AIR QUALITY RESEARCH PROGRAM

Texas Commission on Environmental Quality
Contract Number 582-22-20017
Awarded to The University of Texas at Austin

Quarterly Report
December 1, 2024 – February 28, 2025

Submitted to

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Texas Air Quality Research Program

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OVERVIEW

The goals of the State of Texas Air Quality Research Program (AQRP) are:

(i) to support scientific research related to Texas air quality, in the areas of emissions inventory development, atmospheric chemistry, meteorology, and air quality modeling,

(ii) to integrate AQRP research with the work of other organizations, and

(iii) to communicate the results of AQRP research to air quality decision-makers and stakeholders.

PROGRAM ACTIVITIES FOR THE QUARTER

During this reporting period, AQRP focused on finalizing subawards to awardee institutions, collecting Monthly Technical Reports (MTR), and ensuring all Subawardees' contractual and technical questions were addressed and resolved in a timely manner.

By January 2025, all subaward contracts were fully executed. Appendix A provides details of all awarded projects.

During the subaward contracting phase, MTRs were not contractually required, but some teams submitted MTRs voluntarily as a courtesy. Most current MTR content is included in the Research Project section of this report. AQRP Project Managers and TCEQ Liaisons reviewed all submitted MTRs, providing comments and feedback as needed.

As part of the AQRP Subaward Agreement requirements, prior biennium project publications citing AQRP-funded research were reviewed by AQRP Project Managers and TCEQ Liaisons.

The Financial Status Report (FSR) section includes accounting data through February 2025.

Throughout the period, the AQRP Program Manager maintained regular communication with the TCEQ Project Manager to discuss deadlines, deliverables, program updates, and the submission of monthly FSRs, and provided additional information as requested.

BACKGROUND

Section 387.010 of House Bill (HB) 1796 (81st Legislative Session), directs the Texas Commission on Environmental Quality (TCEQ) to establish the Texas Air Quality Research Program (AQRP). The University of Texas at Austin (UT) was selected by the TCEQ to administer the program. A contract for the administration of the AQRP was established between the TCEQ and UT. Consistent with the provisions in HB 1796, up to 10% of the available funding is to be used for program administration; the remainder (90%) of the available funding is to be used for research projects, individual project management activities, and meeting expenses associated with an Independent Technical Advisory Committee (ITAC).

A new AQRP contract was executed for the 2024-2025 biennium and funding of $750,000 per year was awarded.

RESEARCH PROJECT CYCLE

The Research Program is implemented through a nine-step cycle each biennium. The steps in the cycle are described from project concept generation to final project evaluation for a single project cycle.

1) The project cycle is initiated by developing (in year 1) or updating (in subsequent years) the research priorities. The Air Quality Research Program (AQRP) Director, in consultation with the Independent Technical Advisory Committee (ITAC), the Advisory Council (the Council) and the Texas Commission on Environmental Quality (TCEQ), develop research priorities; the research priorities are released along with a Request for Proposals (RFP).
2) Project proposals relevant to the research priorities are solicited. The RFP will be found at https://aqrp.ceesa.utexas.edu/ once released.
3) The ITAC performs a scientific and technical evaluation of the proposals.
4) The project proposals and ITAC recommendations are forwarded to the TCEQ. The TCEQ evaluates the project recommendations from the ITAC and comments on the relevancy of the projects to the State of Texas's air quality research needs.
5) The recommendations from the ITAC and the TCEQ are presented to the Council and the Council selects the proposals to be funded.
6) All Investigators are notified of the status of their proposals, either intent to fund, not funded, or contingent (not funded at this time, but being held for possible reconsideration if funding becomes available).
7) Intent to fund projects are assigned an AQRP Project Manager at UT Austin and a Project Liaison at TCEQ. The AQRP Project Manager is responsible for ensuring that project objectives are achieved in a timely manner and that effective communication is maintained among investigators involved in multi-institution projects. The AQRP Project Manager has responsibility for documenting progress toward project measures of success for each project. The AQRP Project Manager works with the researchers, and the TCEQ, to create an approved work plan for the project.

   The AQRP Project Manager also works with the researchers, TCEQ, and the Program's Quality Assurance officer to develop an approved Quality Assurance Project Plan (QAPP) and Work Plan for each project. Subaward Agreements are issued. The AQRP Project Manager reviews monthly, quarterly, annual, and final reports from the researchers and works with the researchers to address deficiencies.
8) The AQRP Director and the AQRP Project Manager for each project describe progress on the project in the ITAC and Council meetings dedicated to on-going project review.
9) The project findings are communicated through multiple mechanisms. Final reports are posted to the AQRP web site (https://aqrp.ceesa.utexas.edu/); research briefings are developed for the public and air quality decision makers; and a bi-annual research conference/data workshop is held.

During this period, the AQRP performed step 7.

Research Projects
FY 2024-2025 Projects

Project 24-003 (University of Houston)

Title: Improving Emission Rates Estimates of Commercial Marine Vessels	**Status:** ACTIVE 08/12/2024 – 08/31/2025
PI: James Flynn (University of Houston)	**Funded Amount:** $242,048
Co-PI: Christian Lindhjem (Ramboll)	**AQRP Project Manager:** Vincent Torres
Co-PI: Jerker Samuelsson (FluxSense)	**TCEQ Project Liaison:** Cody McClain

Abstract: The Texas Commission on Environmental Quality (TCEQ) relies on emission inventories to shape the State Implementation Plan (SIP), crucial for managing air pollutants such as nitrogen oxides (NO_X) and ozone (O_3). Recognizing the significance of reliable data, the team of the University of Houston (UH) and Ramboll proposed this research project to address the research priority identified by the Air Quality Research Program (AQRP) to improve emission inventories for commercial marine vessels (CMV).

CMV emissions, particularly NO_X, constitute a substantial portion of coastal NO_X emissions. In the Houston-Galveston-Brazoria nonattainment area, CMVs accounted for approximately 18% of NO_X emissions in 2019, with a continued significant contribution expected for years to come. Among different vessel categories, smaller commercial vessels, notably towboats, were responsible for about 42% of CMV NO_X emissions in Texas in 2019 (TCEQ, 2023). Towboat and tugboat emissions have greater uncertainty than other CMV categories due to the lack of information on engines and the uncertainties of engine loads and operating parameters. This project aims to improve our understanding of commercial marine exhaust emissions, focusing on NO_X, volatile organic compounds (VOC), $PM_{2.5}$, and hydrocarbon speciation. The emphasis on smaller vessels will improve our ability to intercept their exhaust plumes.

Employing the instrumented UH research boat, our approach involves sampling emission plumes from vessels downwind of busy shipping lanes in Galveston Bay. Plumes will be identified by elevated levels of carbon dioxide (CO_2), NO_X, and other compounds. The research team expects to sample plumes from hundreds of towboats to meaningfully constrain the emission inventory. Leveraging real-time Automatic Identification System (AIS) transponder data, which reports vessel identification, position, speed, and draft, enhances our ability to connect measured plumes to individual vessels and ascertain engine information.

Emissions rates, derived from the field measurement data, will be compared with EPA expected values for each of the sampled and identified vessel engines. Multiple encounters with the same vessel over the sampling period will provide insights into emission variability. The analysis results have the potential to enhance the accuracy of the commercial marine emission inventory and

speciated VOC reactivity. Such improvement can be integrated into various modeling frameworks, including those utilized for SIP modeling that support air quality planning efforts.

Project update:

- FluxSense personnel and instruments arrive in early February. The initial setup of the instrument was made at the University of Houston (UH) warehouse.
- UH finalized instrumentation and network setup.
- UH was trained in how to operate FluxSense's Mobile extractive Differential Optical Absorption Spectroscopy (MeDOAS) and Mobile extractive Fourier Transform Infra-Red (MeFTIR) instruments.
- Received canisters from Desert Research Institute (DRI).
- Deployed the UH boat on February 14, 2025. Final UH and FluxSense instruments installations were made once the boat was in the water.
- The boat will be housed at the Bayland Marina in Baytown during the campaign.
- Began collecting data both stationary and non-stationary while at the marina and in Galveston Bay.

Non-stationary days in February: 2/17/2025, 2/24/2025, and 2/26/2025.

Image 24-003-1: University of Houston research deployment boat

Preliminary analysis: None.

Data collected: Field data collected. To be reported in future reports.

Problems/issues encountered and proposed solutions: No major problem encountered.

Goals and anticipated issues for succeeding reporting period: Continue to sample during favorable conditions.

Detailed analysis of the progress of the project to date: To be reported in subsequent reports.

Project 24-004 (Ramboll)

Title: Evaluating Updates to CAMx and NOx Emission Inventories Using TEMPO Measurements over Texas	**Status:** ACTIVE 08/12/2024 – 08/31/2025 **Funded Amount:** $229,691 **AQRP Project Manager:** Elena McDonald-Buller
PI: Jeremiah Johnson (Ramboll)	**TCEQ Project Liaison:** Robert Kierstead

Abstract: Nitrogen oxide (NO_x) emissions are critical to ozone formation in Texas and consequently accurate NO_x emission inventories are essential to air quality planning using the Comprehensive Air Quality Model with Extensions (CAMx). Previous work by our team showed that highly resolved (sub 1 km) NO_2 column measurements by the National Aeronautics and Space Administration (NASA) Geostationary Coastal and Air Pollution Events (GEO-CAPE) Airborne Simulator (GCAS) aircraft can constrain the CAMx NO_x emission inventory for Houston with source-category specificity. In this project, research team will evaluate whether NO_2 column measurements by the new NASA Tropospheric Emissions: Monitoring of Pollution (TEMPO) satellite can constrain CAMx NO_x emission inventories as successfully as the GCAS aircraft. At the same time, research team will investigate how improving the CAMx NO_x chemistry (i.e., particle nitrate photolysis), NO_2 vertical distribution and soil NO_x emission inventory influence CAMx agreement with measured NO_2 columns. This project will determine how the new Tropospheric Emissions: Monitoring of Pollution (TEMPO) satellite can be used for NO_x emission inventory evaluation. Lessons learned and techniques developed for this project could be applied to other areas in the United States.

Project update:

Task 1: Texas 4 km CAMx baseline simulation for NO_2 and Ozone

Completed development of natural (biogenic, lightning NO_x, sea salt and wind-blown dust) emissions and continued development of aircraft cruise emissions. Started configuring Comprehensive Air Quality Model with Extensions (CAMx) source apportionment run script. Prepared Continuous Air Monitoring Stations (CAMS) ozone and nitrogen dioxide (NO_2) air quality measurements for model performance evaluation.

Task 2: Create TEMPO NO_2 Diurnal Profiles and Compare to Diurnal NOx Emission Maps

Started processing Tropospheric Emissions: Monitoring of Pollution (TEMPO) NO_2 columns in preparation for comparison to nitrogen oxides (NO_x) emission maps under Task 2 and CAMx NO_2 columns under Task 3.

Task 3: Comparison of NO_2 Columns between CAMx and TEMPO

Task 3 has not yet been initiated.

Task 4: CAMx Updates and Testing

Task 4 has not yet been initiated.

Task 5: Estimating NO_x Emissions by Sector and by Time of Day using CAMx Source Apportionment and TEMPO Retrievals
Task 5 has not yet been initiated.

Task 6: Project Management and Reporting
Submitted Monthly Technical Report for January 2025.

Preliminary analysis: To be reported in subsequent reports.

Data collected: None to report.

Problems/issues encountered and proposed solutions: Subaward delivered later than anticipated, preventing distribution of subcontracts to project collaborators. Principal Investigator will adjust task schedules if needed after subcontracts have been delivered.

Goals and anticipated issues for succeeding reporting period: Complete development of CAMx modeling platform for the entire modeling period in Aug-Sep 2023, including completion of all emissions processing. Start basecase 3-D CAMx simulation with NO_2 source apportionment and begin model performance evaluation and CAMx model updates. Continue processing TEMPO NO_2 columns and process CAMx diurnal NOx emissions as part of Task 2.

Detailed analysis of the progress of the project to date: None to report.

Project 24-007 (University of Houston)

Title: Texarkana Intensive Campaign	**Status:** ACTIVE 08/12/2024 – 08/31/2025
PI: James Flynn (University of Houston)	**Funded Amount:** $309,703
Co-PI: Sascha Usenko (Baylor University)	**AQRP Project Manager:** Vincent Torres
Co-PI: Edward Fortner (Aerodyne Research Inc.)	**TCEQ Project Liaison:** Chola Regmi

Abstract: The Texarkana Texas (TX)-Arkansas (AR) metropolitan area has recently become an area of concern due to elevated fine Particulate Matter ($PM_{2.5}$) aerosol loadings. The area is forested and contains a few large paper mills which are one potential source of the PM. These paper mills are located in Texas, Arkansas, and Louisiana. There are other possible industrial sources of $PM_{2.5}$ and it is possible that the $PM_{2.5}$ is being advected into the area from sources well outside of the area. The upcoming changes to regulatorily acceptable $PM_{2.5}$ levels necessitate a better understanding of the cause of these enhanced $PM_{2.5}$ levels in the Texarkana area. A comprehensive study of the particle and gas phase chemical species associated with these $PM_{2.5}$ exceedance episodes will assist in interpreting the source of these air masses.

A three-week field deployment in Texarkana, TX during the February-March 2025 time period to examine the sources of high $PM_{2.5}$ loadings in the Texarkana area will be conducted. This study will obtain information regarding the chemical species present in these high loading events in both particle and gas phase. This information will better inform policymakers with respect to the health hazards associated with these higher aerosol loading events.

Objectives for this study include:

1. Characterize selected $PM_{2.5}$ and Volatile Organic Compound (VOC) point sources in the Texarkana area.
2. Evaluate background $PM_{2.5}$ conditions in the vicinity, including upwind of the Texarkana TX-AR metropolitan area. Given the location of the metropolitan area this will likely involve measuring areas outside of the state of Texas but would not emphasize detailed emission factors for out-of-state sources.
3. Any highly local effects which might be present and impacting the measurement of $PM_{2.5}$ at the Texarkana New Boston Station (C1031) will be examined.

The University of Houston, Baylor University, and Aerodyne are nationally recognized for their experience in development and deployment of mobile air quality labs. These customizable, comprehensive, and dynamic platforms provide on-the-go monitoring and analysis of aerosol, VOCs, trace gas, boundary layer height and meteorological parameters. Texarkana's air quality is impacted by local sources, photochemical processing and transport from multiple regions. This complexity can be overcome with the deployment of mobile air quality laboratories which have

several advantages in study areas such as Texarkana. These advantages include real-time monitoring, flexibility in sampling location and time, response to plumes or events (e.g., potential aerosol or precursor plumes), source characterization (e.g., upwind vs downwind), repeat measurements, and accessibility in complex environments.

Project update:

- Successfully conducted the measuring campaign for Texarkana during the month of February.
- Deployed MAQL3 on February 6, 2025. Mobile Air Quality Lab (MAQL3) first went to Baylor University (BU) to integrate the Aerosol Mass Spectrometer (AMS). MAQL3 then headed to Texarkana and arrived on 2/10/2025 at the RV park.
- Calibrations and regular maintenance were conducted during stationary sampling days.
- A Handix Portable Optical Particle Spectrometer (POPS) optical particle scanner was mounted to the Aerodyne Smaller Mobile Laboratory (minAML) https://aerodyne.com/aerodyne-mobile-laboratory/ while a second POPS was mounted inside MAQL3, connected to the aerosol sample inlet. The POPS units on the minAML and MAQL3 allowed both mobile labs to have a similar measurement to aid in plume identification. It also provided an opportunity for intercomparison between a POPS mounted outside with a very short sample inlet and the POPS mounted inside the mobile lab with a longer sample inlet.
- MAQL3 conducted a total of 13 days of mobile sampling during February, not including the day of arrival.
- Measurements were made under a variety of wind conditions but southerly winds that were hoped to be seen were relatively rare. On February 26, southerly winds were forecast to begin in the very early hours of the morning. To take advantage of the opportunity, the MAQL3 and minAML teams started mobile sampling around 5 a.m. Measurements were made upwind and downwind of a papermill to the south of Texarkana. Plumes were intercepted multiple times including at the TCEQ PM monitoring site in downtown Texarkana. Later in the morning winds shifted to southwesterly. Plumes were intercepted multiple times to the southeast of Texarkana.

Preliminary analysis:

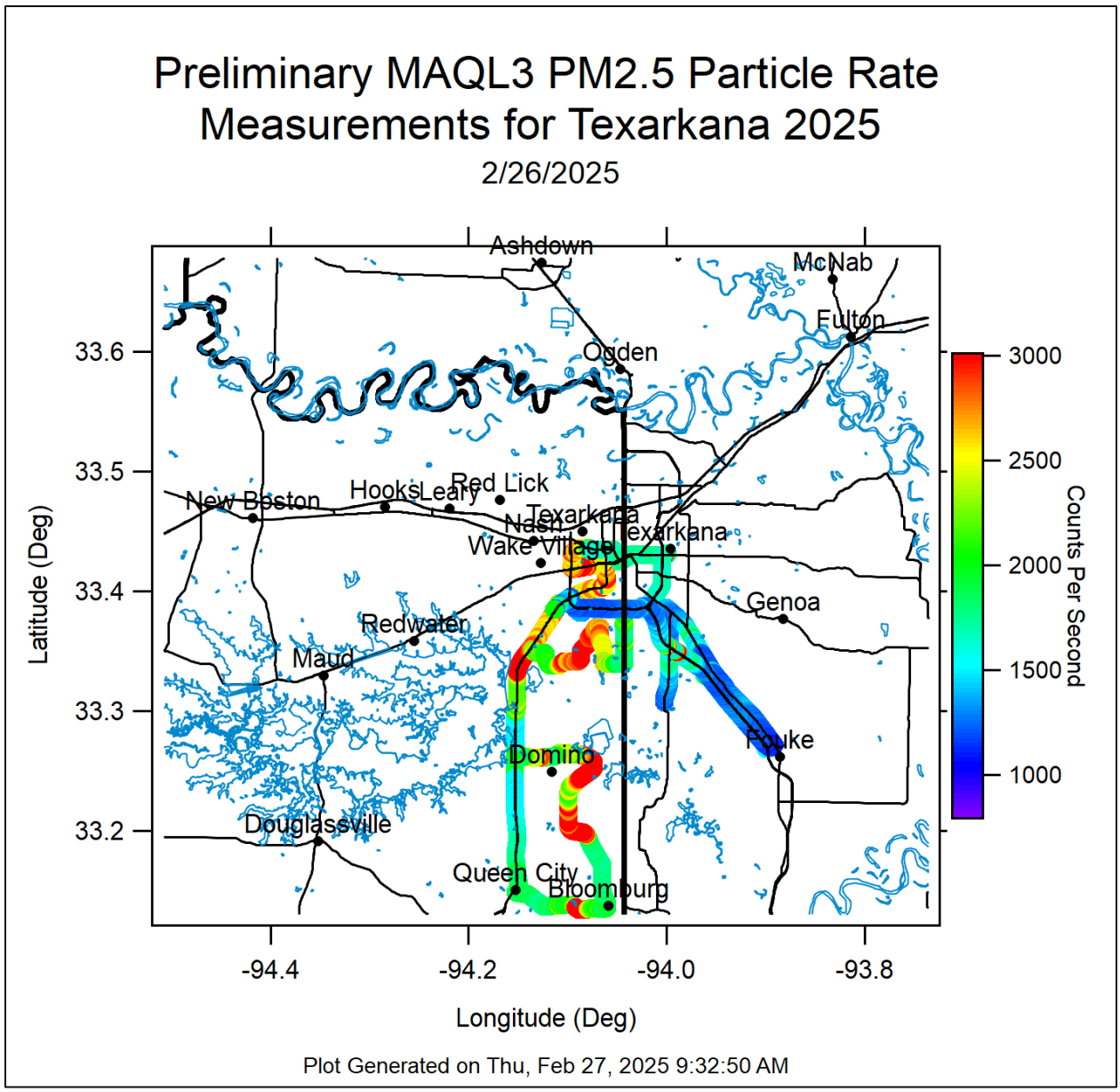

Figure 24-007-1: Preliminary MAQL3 $PM_{2.5}$ Particle Rate Measurement for Texarkana 2025.

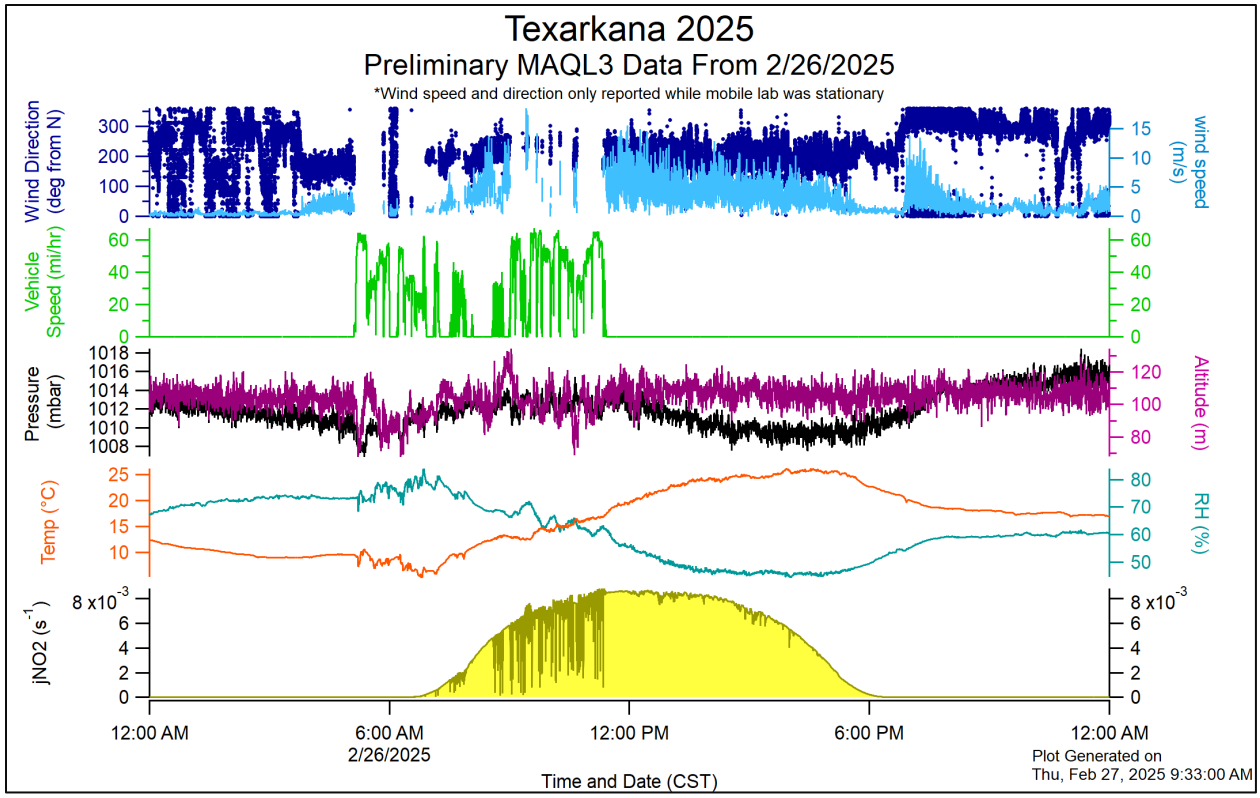

Figure 24-007-2: Texarkana 2025-Preliminary MAQL3 Data from 2/26/2025

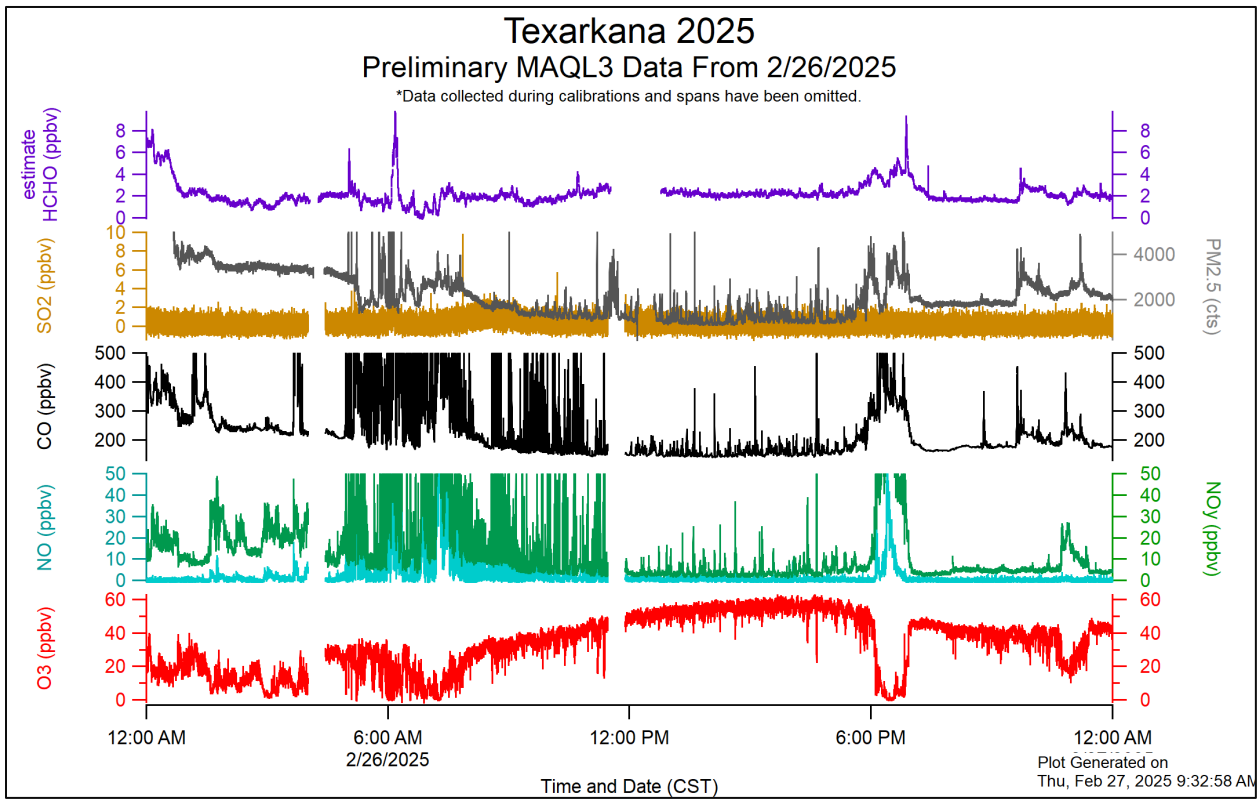

Figure 24-007-3: Texarkana 2025-Preliminary MAQL3 Data from 2/26/2025

Data collected: Raw data has been collected and will be processed into final data.

Problems/issues encountered and proposed solutions: The formaldehyde instrument did not respond to calibration gas after regular maintenance was performed on 2/11. Changing to a different chemical solution batch solved the problem. It was determined that one of the batches taken for the campaign had gone bad. The UH team delivered a new batch of solutions to the mobile lab team mid-campaign to ensure there was enough to get through the end of the campaign.

Goals and anticipated issues for succeeding reporting period: Complete the last two days of sampling at the beginning of March. Perform final calibrations, offload the Baylor University's AMS instrument, and begin final data processing.

Detailed analysis of the progress of the project to date: None to report.

Project 24-021 (University of Houston)

Title: Improving WRF representation of coastal, marine, and residual boundary layers and quantifying the effects on ozone prediction	**Status:** ACTIVE 08/12/2024 – 08/31/2025 **Funded Amount:** $186,978 **AQRP Project Manager:** Elena McDonald-Buller
PI: Yuxuan Wang	**TCEQ Project Liaison:** Gabriel Lee

Abstract: This AQRP project continues our efforts of modeling the 2021-2023 offshore field campaign data in the Houston-Galveston-Brazoria (HGB) area, with a focus on the evaluation and improvement of the meteorological model representation of coastal, marine, and residual boundary layers. The models to be investigated are the Weather Research and Forecasting (WRF) and Comprehensive Air Quality Model with Extensions (CAMx), the state's regulatory photochemical model. The field campaigns include the Tracking Aerosol Convection ExpeRiment-Air Quality (TRACER-AQ) studies during July – October 2021 (TAQ1) and April – October 2022 (TAQ2) and the 2023 Mobile and Offshore Air Quality Monitoring Project during May-Oct 2023. They collected unprecedently rich observations of meteorological factors and atmospheric composition including planetary boundary layer (PBL) and ozone (O_3) over diverse offshore locations, such as the Houston Ship Channel, Galveston Bay, and the Gulf of Mexico. Utilizing these observations to evaluate and improve models, the project will focus on the following primary science questions:

How well does mesoscale meteorological and photochemical grid modeling replicate coastal/maritime boundary layers observations from the 2021-2023 offshore observations?

How sensitive is WRF prediction of coastal/maritime boundary layers to model parameters? To what extent do the 2021-2023 offshore observations constrain those parameters?

How will the simulation of residual layer ozone be improved by explicitly parameterizing the entrainment of free tropospheric ozone into the residual layer?

What are the effects of improved PBL and residual layer (RL) simulation on offshore ozone prediction and source attribution in CAMx?

Perturbed physics ensembles (PPEs) will be conducted to the WRF model to explore parameter uncertainties and identify parameter combinations that yield simulations most consistent with observations. As boundary layer dynamics are crucial for the diffusion, accumulation, and deposition of ozone and its precursors, the project will improve our predictability of ozone in the HGB and better understand the sources of high offshore O_3 that may relate to ozone exceedances.

The project specifically targets the AQRP Priority Research Priorities FY2024-2025: Photochemical air quality models concerning model improvements to WRF PBL schemes, and TRACER-AQ and over-water measurements concerning additional analyses of those campaign data.

Project update:

Task 4:

- Selected the days for the Weather Research and Forecasting (WRF) model perturbation.
- Compiled a list of the physics parameters and their expected perturbation values.
- Performed more than 200+ simulations and compared with the base run.
- Identified the optimal physics parameters and schemes.
- Working on Task 4 report.

Preliminary analysis:

Research team performed the perturbed runs for major physics parameters and schemes for the selected days to identify the parameters which can optimize the WRF planetary boundary layer height (PBLH). The WRF simulation is conducted by perturbing each parameter to its minimum, maximum, and mid-values. Table 24-021-1 lists the cases and the values perturbed for the WRF run.

Simulation Name	Perturbations
PBL_base	None
PBLH1	B1 = 36, B2 = 22.5
PBLH2	B1= 30, B2 = 18.5
PBLH3	$\alpha 1 = 0.27$
PBLH4	$\alpha 1 = 0.50$
PBLH5	C3 = 0.50
PBLH6	C3 = 0.42
PBLH7	Pr = 2
PBLH8	Pr = 1.37

Table 24-021-1: Summary of WRF simulation cases highlighting the perturbed parameter and their values for each run.

The research team compared the output of the multiple perturbed runs with the base run and observations over Galveston Bay using the frequency distribution curve, as shown in Figure 24-021-1a for September 09, 2021, as a representative day. The frequency distributions for perturbation simulations PBLH5 and PBLH4 are closer to observations compared to other runs, and PBLH5 is verified as being the best simulation based on hourly box plot (Figure 24-021-1c). The box plot shows that the daytime PBLH for each hour is higher in the perturbed run (PBLH5) than the base run and appears to be close to the observations. PBLH5 is related to the closure constant

C3 which is sensitive to boundary layer evolution and vertical mixing. The values of C3 = 0.5 generally refer to the evolution of convective boundary layer.

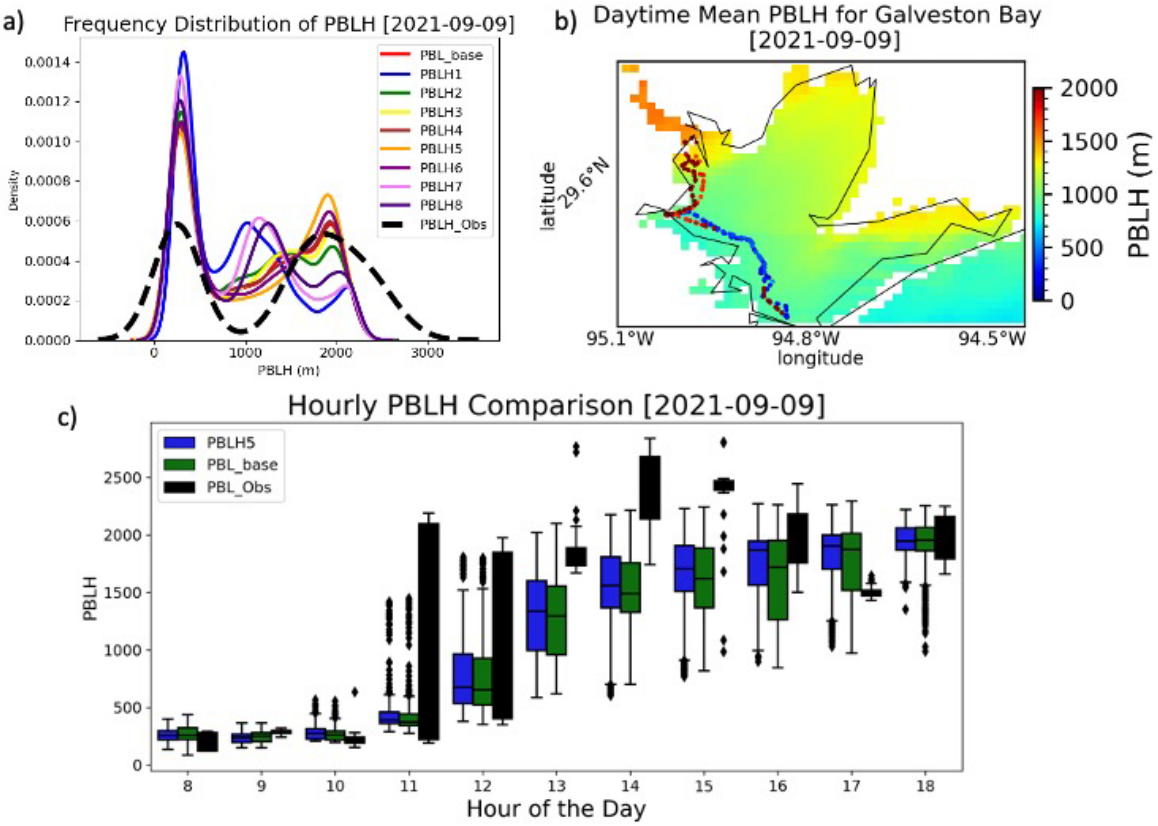

Figure 24-021-1: a) The frequency distribution of daytime (08-18:00 CDT) PBLH over Galveston Bay b) Model daytime mean PBLH along with the boat observations overlaid (denoted by dots) c) Box plot of Hourly PBLH for Observations, Base run and PBLH5.

The research team also compared the spatial distribution of daytime (08:00-18:00 CDT) mean PBLH for the entire domain from the better-performing perturbed run (PBLH5) with the base run, as shown in Figures 24-021-2a and 24-021-2b, respectively. The difference between the perturbed and base runs (Figure 24-021-2c) shows that the increase in daytime mean PBLH is observed over the water up to 200 m as a result of the perturbation. It is important to note that the PBLH over the land has not been significantly impacted by the perturbation. Detailed analysis of the perturbation simulations will be described in the Task 4 Report, which is due March 15, 2025.

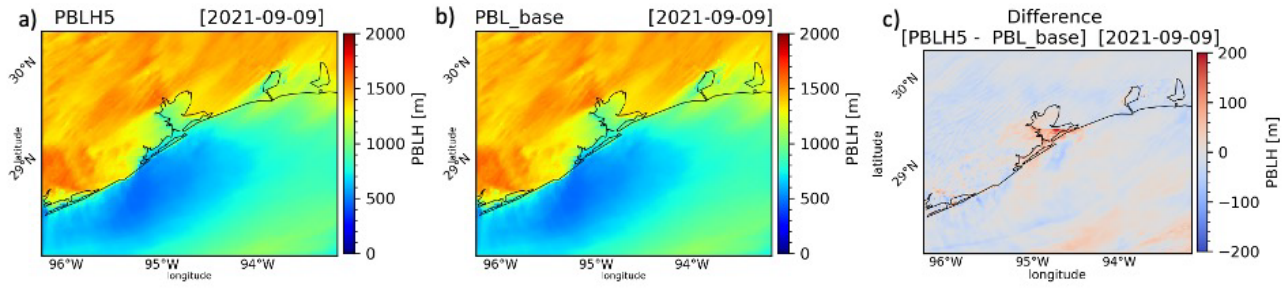

Figure 24-021-2: Daytime (08:00-18:00 CDT) mean PBL for a) perturbed run b) base run c) differences between perturbed and base run.

Data collected: None to report.

Problems/issues encountered and proposed solutions: None to report.

Goals and anticipated issues for succeeding reporting period: Continue with Task 4. Analyze the results for all the selected days. Submit Task 4 Report. No issues to report.

Detailed analysis of the progress of the project to date: None to Report.

Project 24-024 (The University of Texas at Austin)

Title: Novel Observations of Quantified Source Apportionment of Ozone, Particulate Matter and Contributing Precursors in the El Paso Area	**Status:** ACTIVE 08/12/2024 – 08/31/2025 **Funded Amount:** $280,810 **AQRP Project Manager:** Vincent Torres
PI: Pawel Misztal (UT Austin)	**TCEQ Project Liaison:** Celinda Vallejo-Rodriguez

Abstract: The United States Environmental Protection Agency recently lowered the annual National Ambient Air Quality Standard (NAAQS) for fine particulate matter or particulate matter small than 2.5 μm in diameter ($PM_{2.5}$) from 12 to 9 μg m^{-3}. This new annual standard brings the El Paso region to near non-attainment for $PM_{2.5}$, underlining the importance of understanding the composition and sources of $PM_{2.5}$ and O_3 in El Paso.

An improved understanding of El Paso organic aerosol and ozone is therefore essential and will directly benefit the Texas Commission on Environmental Quality (TCEQ) in guiding how to manage El Paso's air quality.

Project 24-024 will focus on improving our understanding of the contributions of volatile organic compounds (VOC) to formation of secondary organic aerosol (SOA). This work will contribute with spatiotemporal observations of SOA composition and its gas-phase organic precursors, measured by a comprehensive suite of state-of-the-science instrumentation deployed in the University of Texas electric mobile laboratory. Work will include analysis of recently collected data in El Paso, conducting novel comprehensive mobile and stationary measurements in El Paso region, and air quality modeling by the Comprehensive Air-quality Model with extensions (CAMx).

The proposed work is highly relevant to the TCEQ AQRP priority research areas and will contribute to knowledge about the sources contributing to high PM, O_3 and VOC (e.g. toluene) episodes in this region.

Project update:

Task 2b: Activities during February included the following:

- An annual three dimensional Comprehensive Air Quality Model with Extensions (3-D CAMx) simulation based on the U.S. Environmental Protection Agency's (EPA's) Office of Air Quality Planning and Standards (OAQPS) 2022 modeling platform (https://registry.opendata.aws/epa-2022-modeling-platform/) was completed. This simulation required nearly one month of computational time at the Texas Advanced Computing Center (TACC). Boundary and initial conditions for the El Paso-Juarez were extracted for the El Paso-Juarez 12-km domain shown in Figure 24-024-1.
- All gridded emissions in binary format, meteorological fields, geographic data, ozone column, and photolysis rates from the EPA modeling platform were "windowed" to match

the El Paso-Juarez 12-km domain. The research team note that EPA by-sector emissions files were provided in Community Multiscale Air Quality (CMAQ) Network Common Data Form (NetCDF) format. Dr. Kimura streamlined the cmaq2camx tool to convert these files to the CAMx NetCDF format which were then "windowed" to the extent of the 12-km El Paso-Juarez domain.

- Flexi-nests for the 4-km and 1-km domains (Figure 24-024-1) were defined in the CAMx configuration.
- Emissions for three categories, fertilizer, biogenics, and fugitive dust, were regridded from the EPA 2022 modeling platform for the El Paso-Juarez 4-km and 1-km nested domains. These emission files were converted from CMAQ to CAMx NetCDF files.
- Emissions for all other gridded source categories previously processed via spatial surrogates for the El Paso 4-km and 1-km nested domains were also converted from CMAQ to CAMx NetCDF format. No changes were required for point source emissions within the El Paso-Juarez domain.

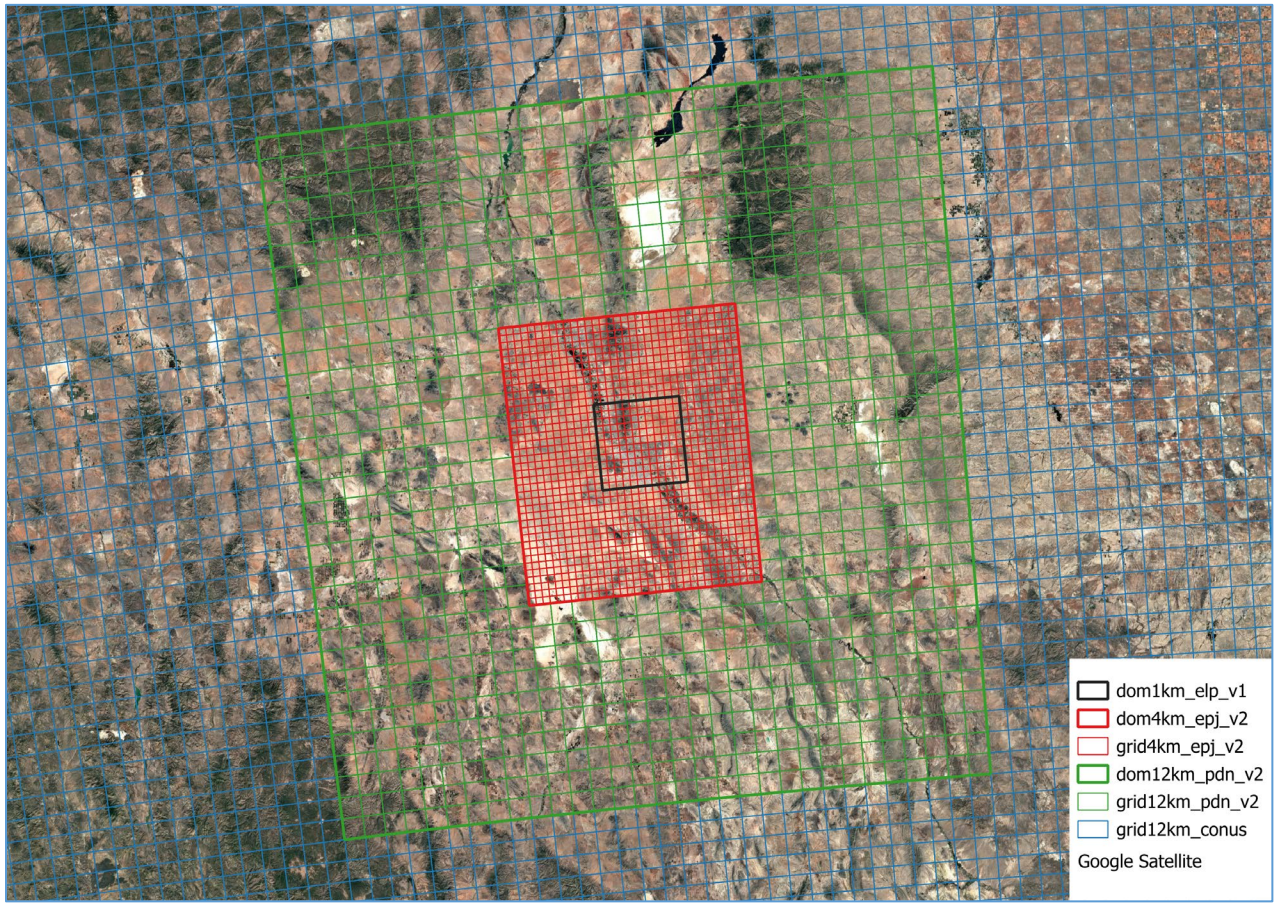

Figure 24-024-1: 12-km West Texas domain (green) with 4-km nested domain (red) and 1-km El Paso-Juarez innermost domain (black). The 12-km West Texas domain was windowed from the existing 12-km Continental United States (CONUS) grid of the EPA OAQPS 2022 modeling platform (blue).

Task 3: Activities in February continued focusing on large data processing and among others included:

Pre-processing of the entire Vocus-PTR-TOF (Vocus Proton-Transfer-Reaction Time-of-Flight Mass Spectrometer) dataset using PTRwid routine (Holzinger, 2015). To maximize efficiency, the raw Hierarchical Data Format version 5 (HDF5) data from the Vocus were uploaded to the Box and synchronized on the 128 GB workstation with Interactive Data Language (IDL).

- The PTRwid routine yielded 1525 ions in the unified mass list. The mass defect plot (Figure 24-024-2) shows the richness of chemical space, with homologous series of alkanes, carbonyls, acids, hydroxyacids, aromatics, and nitrogen containing compounds.
- As a second step, postprocessing using Matlab routine is currently ongoing. The number of volatile organic compound (VOC) ions will be reduced by removing primary ions, water clusters and compounds below abundance threshold to exclude ions close to detection limit (<900 parts per quadrillion (ppq); 10^{-15}). The mass assignment presented in Figure 24-024-2 was automated using Matlab program to yield the closest-match formula with the measured exact monoisotopic protonated mass. Further work will verify and complement these assignments which, except for a few representatives, lack compounds containing silicon, sulfur, halogenated compounds, and other exotic compounds which need to be manually (or semi-manually) complemented.

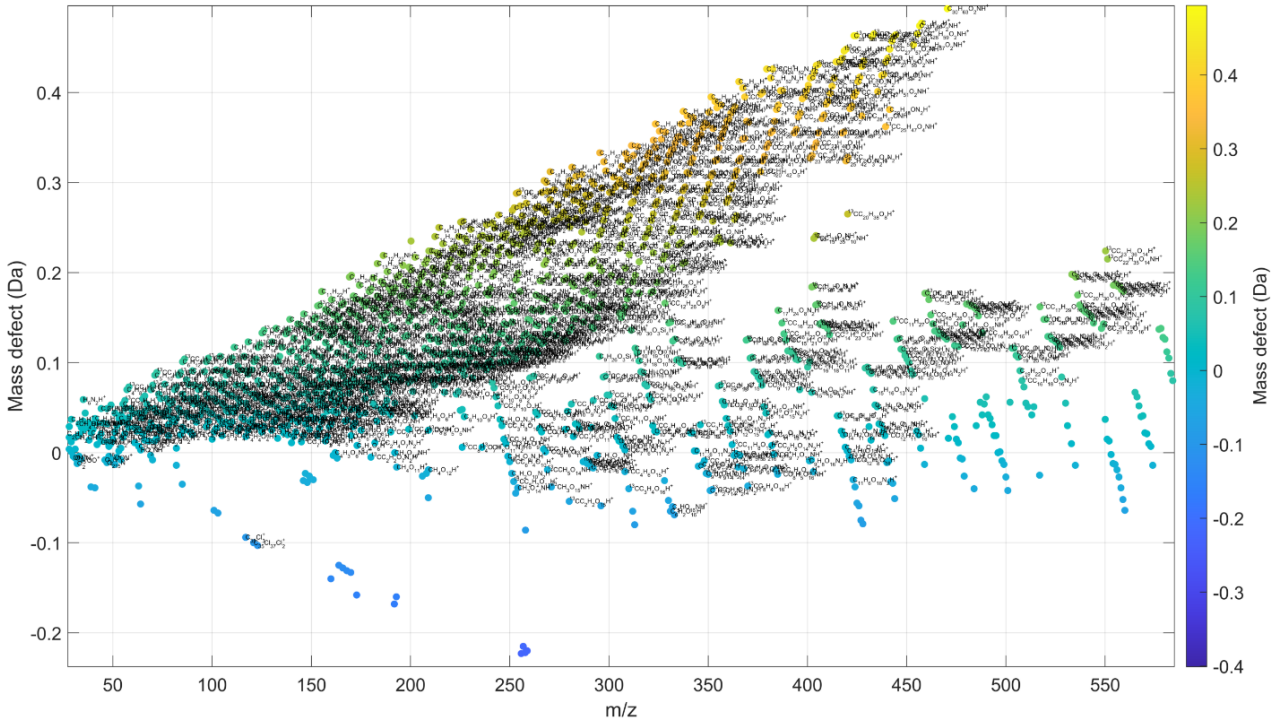

Figure 24-024-2. Mass defect plot for the unified mass list with more than 1500 ions detected in the El Paso Winter Campaign (the identified formulas are preliminary).

- Preliminary findings reveal hotspots for different gas and particle-phase pollutants from various source types and industries. For example, ethylene oxide enhancements were encountered downwind of sterilization facilities in the area, as well as elevated aromatics levels near a local refinery. Traffic emissions, mostly from diesel engines, contributed to sudden, significant spikes in organic aerosol levels near major roads (not shown due to ongoing data analysis). Figure 24-024-3 shows the time series of non-refractory particulate

matter with a diameter of 1 micron or smaller (NR-PM_1) (measured by the high resolution aerosol mass spectrometer (HR-AMS)) when the van was driving near a house fire in El Paso, Texas.

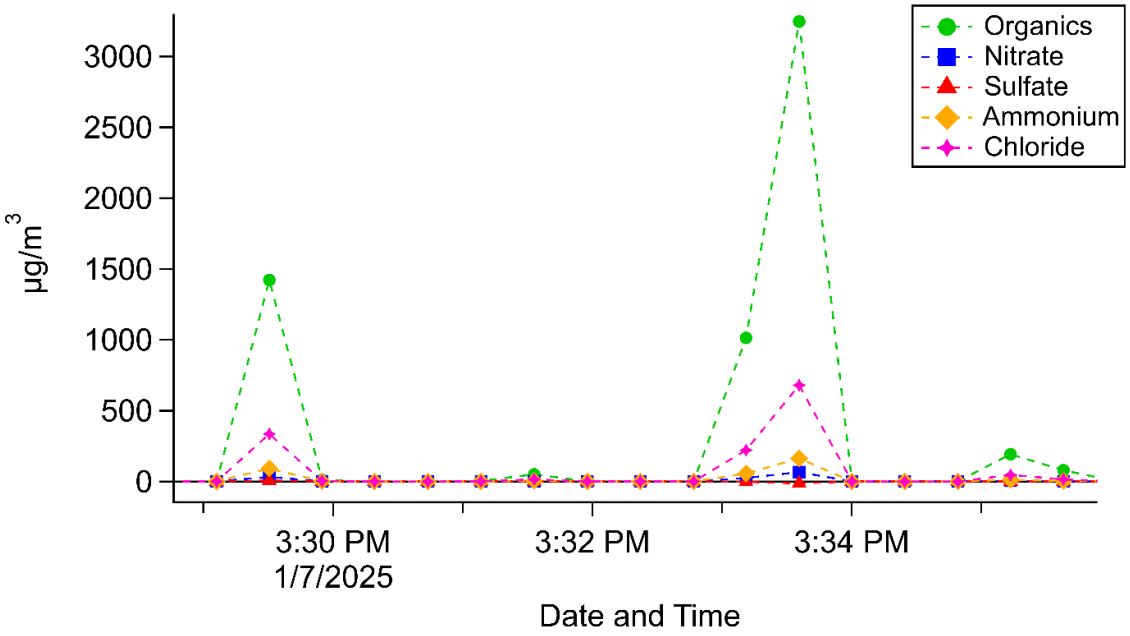

Figure 24-024-3: Timeseries of NR-PM_1 near a house fire, 1/7/2025

At around 3:29 pm, the van made its initial entry into the fire plume, where we see the immediate elevation of organic aerosols to almost 1500 µg/m^3. Between 3:30 pm and 3:32 pm, the driving team then decided to circle around the plume, attempting to get closer to the house fire. Around 3:33 pm, the mobile van made its second entry into the smoke plume, where we see NR-PM_1 organics increased to above 3000 µg/m^3. Additionally, in both plume capture periods, we saw elevation of chloride aerosols up to around 500 µg/m^3. These plumes were coinciding with plumes observed by the Vocus (preview data shown in previous MTR). The data analysis for this project is ongoing and will focus on source markers and combined VOC and particulate matter (PM) source apportionment.

- Mobile data from the QuantAQ Modulair-Gas monitor were also analyzed and the preliminary maps with observed carbon monoxide and $PM_{2.5}$ are shown in Figure 24-024-4. The largest enhancements in $PM_{2.5}$ were often correlated with carbon monoxide (CO) enhancements indicating the combustion processes are likely responsible for much of primary $PM_{2.5}$ in the region. Prominent hotspots were observed along the US – Mexico border, near active burning and other combustion sources such as cooking and motor vehicles. Further multivariate analysis using VOCs and speciated PM_1 will quantitatively apportion the primary and secondary particles along with VOC precursors.

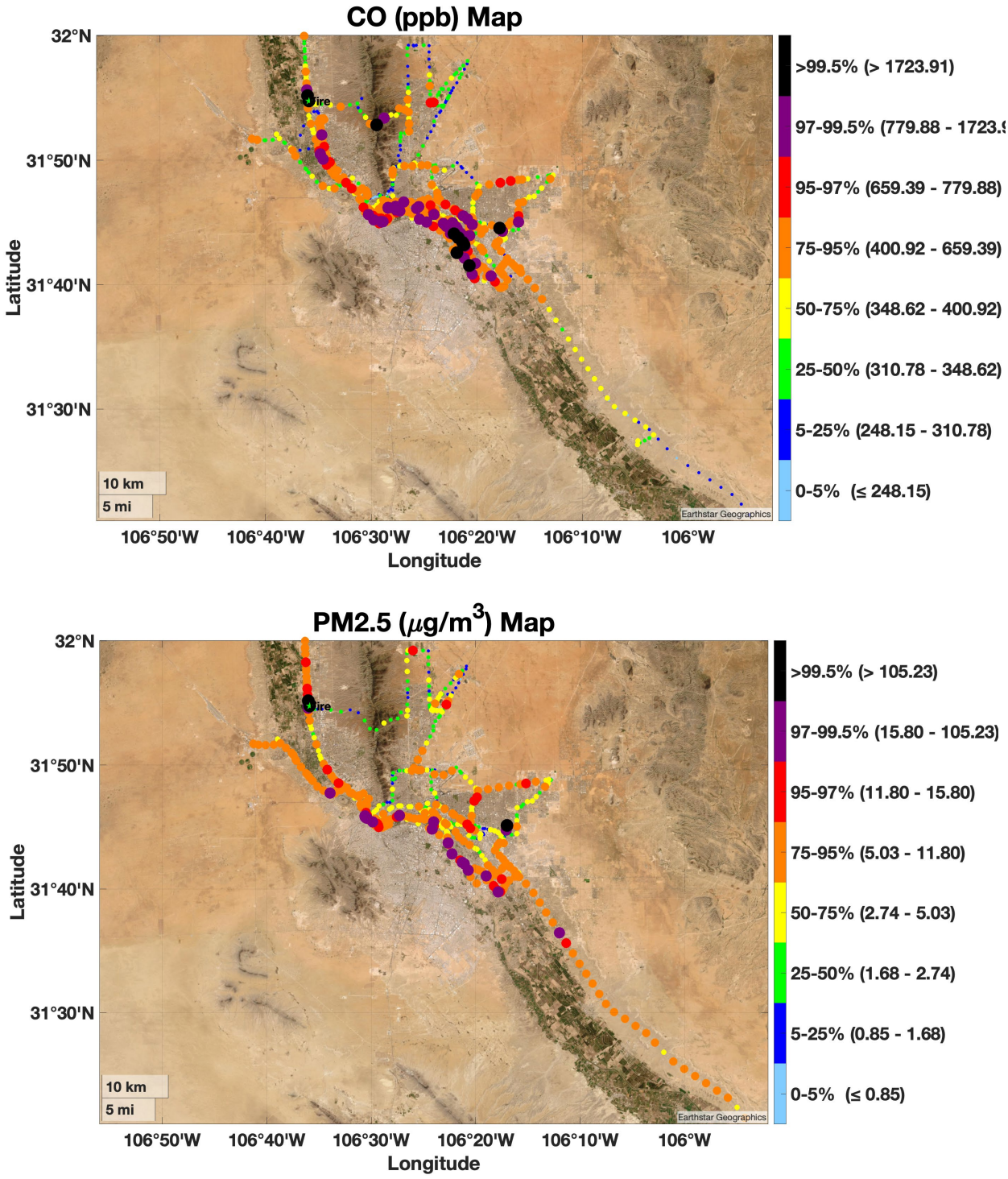

Figure 24-024-4. Preliminary maps for example tracers measured by QuantAQ, carbon monoxide (top panel) and $PM_{2.5}$ (bottom panel). The color scale corresponds to percentile ranges (with absolute value ranges in parentheses).

Preliminary analysis: Preliminary analysis completed; more details to report in subsequent report.

Data collected: None to report.

Problems/issues encountered and proposed solutions: None to report.

Goals and anticipated issues for succeeding reporting period: The modeling team expects that the El Paso-Juarez CAMx basecase simulation should be completed. Quality assurance assessments and comparisons with ambient measurements in the region should be initiated.

The observation team expects more preliminary data to be included in the next MTR.

The quality control of compound identification, calibrations and source apportionments will be conducted and the progress included in the next MTR. Further efforts are focused on the integrated analysis of VOC and PM data in the context of inventories and modeling data. The modeling results have been a useful reference and further observation-modeling integrations are planned.

The UTEP site is now fully connected and powered. The second intensive field campaign in El Paso is currently tentatively planned for the second half of May.

Detailed analysis of the progress of the project to date: Progress proceeding as planned. More details in the subsequent report.

Independent Technical Advisory Committee

The Air Quality Research Program (AQRP) funding is to be used primarily for research projects, and one of three groups responsible for selecting the projects is the Independent Technical Advisory Committee (ITAC). The ITAC is composed of between 9 and 15 individuals with scientific expertise relevant to the AQRP. The ITAC is charged with recommending technical approaches, establishing research priorities, and reviewing, commenting, and advising on all projects to ensure that the projects facilitate air quality improvement in Texas. Members of the ITAC consist of the Texas Commission on Environmental Quality (TCEQ) Air Quality Deputy Director (or designee), and representatives with air quality expertise from research institutions with extensive expertise in air quality research in Texas. The members of the ITAC are listed in Table 1. The members of the ITAC are drawn from Texas universities active in air quality research, national laboratories that have participated in air quality studies in Texas, and institutions that have expertise not available in Texas and that have participated in air quality studies in Texas.

The ITAC membership is intentionally drawn from air quality researchers who have experience in Texas. These researchers and their colleagues will likely have interest in responding to the requests for research proposals issued by the AQRP. This raises potential confidentiality and conflict of interest issues, and the contract between TCEQ and the University of Texas at Austin requires that the AQRP maintain and implement an appropriate written policy on conflict of interest. Specifically, for the ITAC, all members are required to certify:

> *Confidentiality:* As a member of Independent Technical Advisory Committee (ITAC), I understand that I will have access to proposals submitted to the Air Quality Research Program (AQRP). Subject to any legal requirements, I agree to keep the information in these proposals confidential until the selection process is completed and it is appropriate to release information to the public. I understand that there may be certain information that comes to me in my role as a member of ITAC that retains its confidential nature even after the process is concluded. I also understand that I will review said proposals and may have access to the reviews made by other ITAC members. I agree to keep these reviews and the identity of the reviewers confidential until such time as this information is released to the public. (NOTE: For the reviews and reviewers, this information may never be released.)
>
> *Conflict of Interest:* As a member of ITAC, I agree that I will not evaluate, comment on, or vote on proposals in which I or my home institution is involved, including but not limited to, any financial interest, or in which I have another form of conflict of interest. I understand that ITAC members with conflicts of interest must leave the meeting room or the conference line when a proposal with which they have a conflict is discussed, voted on or otherwise being considered. I understand that I must recuse myself from participating in or attempting to influence at any time the ITAC's or the AQRP Council's consideration or decision concerning such proposals. I agree to bring any issues concerning a possible conflict of interest to the attention of the Director of the AQRP or the TCEQ Air Quality Deputy Director. If there is a question of interpretation regarding whether a conflict of interest exists, I agree that the decision regarding whether a conflict of interest exists will be made by the Director of the Air Quality Research Program or the TCEQ Air Quality Deputy Director.

All members of the ITAC agree to abide by these conflicts of interest and confidentiality provisions prior to participating in the review of proposals. Table 1 contains the 2024-2025 Biennium ITAC members.

Table 1. Independent Technical Advisory Committee Members

Name	Title	Institution
David Allen	Professor and Director, AQRP	The University of Texas at Austin
Doug Boyer	Technical Specialist	TCEQ, Office of Air Director
Brad Pierce	Director, Space Science and Engineering Center	Univ. of Wisconsin-Madison
Don Collins	Professor	University of California, Riverside
Joost de Gouw	Research Physicist, Cooperative Institute for Research in Environmental Sciences (CIRES) Senior Scientist and Fellow	National Oceanic and Atmospheric Administration (NOAA), University of Colorado Boulder
James Nolan	Technical Specialist	TCEQ, Office of Air Director
Lea Hildebrandt Ruiz	Associate Professor	The University of Texas at Austin
Rebecca Sheesley	Associate Professor	Baylor University
William Vizuete	Professor	University of North Carolina
Yuxuan Wang	Associate Professor of Atmospheric Chemistry	University of Houston
Greg Yarwood	Principal	Ramboll
Renyi Zhang	Distinguished Professor of Atmospheric Sciences, Harold J. Haynes Chair in Geosciences	Texas A&M University

TCEQ Relevancy Review

The Texas Commission on Environmental Quality (TCEQ) reviews proposals for relevancy to the State's air quality research needs. TCEQ approval is required for a project to receive funding from the Program.

Advisory Council

The final group responsible for selecting Air Quality Research Program (AQRP) research projects is the Advisory Council (the Council). The Council consists of between 7 and 11 members. Two Council members with relevant scientific expertise are nominated by the Texas Commission on Environmental Quality (TCEQ). As defined in the AQRP contract, up to four members of the Council can be county judges from the Houston-Galveston-Brazoria (HGB) and Dallas-Fort Worth (DFW) non-attainment counties. Additional members should have a general background in air quality and business practices, and can include elected officials, business community representatives, environmental group representatives, and members of the general public. The Council's responsibilities are to attend meetings with TCEQ Management and the AQRP to understand the statewide project goals for the funding period, to select for funding the projects reviewed by the Independent Technical Advisory Committee (ITAC) and ranked by the TCEQ, and to assist with the presentation of project final results at locations throughout the state. Table 2 contains the 2024-2025 Biennium Advisory Council Members.

Table 2. Advisory Council Members

NAME	TITLE	INSTITUTION
Dan Baker	Senior Partner	Environmental Reaction Engineering Experts (E REX)
Beata Czader	Air Modeling Team Leader	TCEQ
Andrew De Candis	Clean Cities & Clean Vehicles and H-GAC Cities Co-Director	Houston-Galveston Area Council (H-GAC)
Lyle Hufstetler	Clean Cities Coordinator	Alamo Area Council of Governments (AACOG)
Chris Klaus	Senior Program Manager	North Central Texas Council of Governments (NCTCOG)
Lindley Anderson	Senior Technical Specialist	TCEQ Air Quality Division
Chris Rabideau	Senior Technical Specialist	Chevron
Cyrus Reed	Conservation Director	Sierra Club

FINANCIAL STATUS REPORT

The Air Quality Research Program (AQRP) contract was awarded for FY 24-25 for $750,000 per year. Funds were distributed across several different reporting categories as required under the contract with TCEQ. The reporting categories are listed below in detail.

Program Administration: Limited to 10% of the overall funding per fiscal year. This category includes all staffing, materials and supplies, and equipment needed to administer the overall AQRP. It also includes the costs for the Council meetings.

ITAC: These funds are to cover the costs, largely travel expenses, for the Independent Technical Advisory Committee (ITAC) meetings.

Project Management: Limited to 8.5% of the funds allocated for Contractual budget category. Each research project is assigned a Project Manager to ensure that project objectives are achieved in a timely manner and that effective communication is maintained among investigators in multi-institution projects. These funds are to support the staffing and performance of project management.

Research Projects / Contractual: These are the funds available to support the research projects that are selected for funding.

Program Administration

Program Administration includes salaries and fringe benefits for those overseeing the program, as well as materials and supplies, travel, equipment, and other expenses. This category allows indirect costs in the amount of 10% of salaries and wages.

Dr. David Allen, Principal Investigator and AQRP Director, is responsible for the overall administration of the AQRP. RoseAnna Goewey, AQRP Program Manager, performs program and grant management. Mr. Vincent Torres, AQRP QAPP Manager, reviews and oversees AQRP approval of all project QAPPs.

The University of Texas at Austin's federally negotiated fringe rates for full-time/benefits eligible employees is 27% in the current fiscal year. Rates are estimated to have a 0.5% increase for full/part-time benefits eligible employees in subsequent years. AQRP projects fully expending the Program Administration budget by August 31, 2025.

Table 3: Administration Budget (2024-2025 Biennium)

Budget Category	**FY 23-25 Budget**	**Current Expenditures** February 2025	**Cumulative Expenditures**	**Remaining Balance**
Personnel/Salary	$106,388.68	$1,486.05	$56,973.45	$49,415.23
Fringe Benefits	$29,203.45	$401.23	$14,936.91	$14,266.54
Travel	**$0.00**			
Supplies	$26,526.19	$38.10	$8,092.16	$18,434.03
Equipment	**$0.00**			

Other	$0.00			
Contractual	$0.00			
Total Direct Costs	**$162,118.32**	**$1,925.38**	**$80,002.52**	**$82,115.80**
Authorized Indirect Costs *(10% x Personnel/Salary)*	$10,638.87	$148.61	$5,698.35	$4,940.52
Total Costs	**$172,757.19**	**$2,073.99**	**$85,700.87**	**$87,056.32**

ITAC

Table 4 details the 2024-2025 Biennium ITAC budget. Through November 2024, ITAC travel for members to attend meetings is accrued. Additional ITAC travel expenses are expected in August 2025 for members to attend the biannual workshop hosted at UT Austin.

Table 4: ITAC Budget (2024-2025 Biennium)

Budget Category	**FY 23-25 Budget**	**Current Expenditures** February 2025	**Cumulative Expenditures**	**Remaining Balance**
Personnel/Salary	$0.00			
Fringe Benefits	**$0.00**			
Travel	**$10,000.00**	**$0.00**	**$945.97**	**$9,054.03**
Supplies	$1,250.00	$0.00	$0.00	$1,250.00
Equipment	$0.00			
Other	$0.00			
Contractual	$0.00			
Total Direct Costs	**$11,250.00**	**$0.00**	**$945.97**	**$10,304.03**
Authorized Indirect Costs *(10% x Personnel/Salary)*	$0.00	$0.00	$0.00	$0.00
Total Costs	**$11,250.00**	**$0.00**	**$945.97**	**$10,304.03**

Project Management

Table 5 details the 2024-2025 Biennium Project Management Budget. Expenses include Project Manager salaries, fringes, required supplies, and associated Indirect Costs. AQRP projects fully expending the Project Management budget by August 31, 2025.

Table 5: Project Management Budget (2024-2025 Biennium)

Budget Category	**FY 23-25 Budget**	**Current Expenditures** February 2025	**Cumulative Expenditures**	**Remaining Balance**
Personnel/Salary	$76,000.00	$571.41	$44,820.56	$31,179.44
Fringe Benefits	$20,862.00	$154.28	$11,811.82	$9,050.18

Travel	$0.00			$0.00	
Supplies	**$8,038.00**	**$0.00**	**$5,735.58**	**$2,302.42**	
Equipment	$0.00			$0.00	
Other	**$3,750.00**	**$0.00**	**$0.00**	**$3,750.00**	
Contractual	$0.00				$0.00
Total Direct Costs	**$108,650.00**	**$725.69**	**$62,367.96**		**$46,282.04**
Authorized Indirect Costs *(10% x Personnel/Salary)*	$7,600.00	$57.14	$4,481.06		$3,118.94
Total Costs	**$116,250.00**	**$782.83**	**$66,849.02**		**$49,400.98**

Research Projects

Due to contracting delays, research Subawardees were contracted, but invoices will not be submitted until subsequent quarters. Table 6 shows the 2024-2025 Biennium Research Project budget. The budget allocates $1,255,125.09 for research projects. The budget includes carry forward from the prior biennium. At the time of this report's subaward contracts have not invoiced against the AQRP funding. Project 24-024 at The University of Texas was able to utilize funding due to internal financial processes at the University.

Table 6: 2024-2025 Biennium Research Project Budget

2024-2025 Biennium Total Contractual Funding		**$1,222,500.00**		
FY 22-23 Contractual Carry Forward		**$32,625.09**		
TOTAL CONTRACTUAL BUDGET		**$1,255,125.09**		
Project Number	**Institution (PI)**	**Amount Awarded**	**Cumulative Expenditures**	**Remaining Balance**
24-003	*University of Houston (Flynn)*	$159,221.00	$0.00	$159,221.00
24-003	*Ramboll (Lindhjem)*	$47,827.00	$0.00	$47,827.00
24-003	*Fluxsens (Samuelsson)*	$35,000.00	$0.00	$35,000.00
24-004	*Ramboll (Johnson)*	$229,691.00	$0.00	$229,691.00
24-007	*University of Houston (Flynn)*	$144,233.00	$0.00	$144,233.00
24-007	*Baylor University (Usenko)*	$88,951.00	$0.00	$88,951.00
24-007	*Aerodyne (Fortner)*	$76,519.00	$0.00	$76,519.00
24-021	*University of Houston (Wang)*	$186,978.00	$0.00	$186,978.00
24-024	*The University of Texas at Austin (Misztal)*	$280,810.00	$52,876.71	$227,933.29
FY 24 Total Contractual Funding Awarded		$1,249,230.00		
FY 24 Contractual Funds Expended			$52,876.71	
FY Contractual Funds Remaining to be Spent				$1,202,248.38
Total Contractual Funding		**$1,255,125.09**		
Total Contractual Funding Awarded		**$1,249,230.00**		
Total Contractual Funding Contingency		**$5,895.09**		
Total Contractual Funds Expended to Date			**$52,876.71**	
Total Contractual Funds Remaining to be Spent				**$1,202,248.38**

APPENDIX A. CONTRACTUAL RESEARCH PROJECTS APPROVED FOR FUNDING (BIENNIUM 2024-2025)

Project #	Project Title	Research Priority	*Primary Institution*: PI	*Collab. Institution*: Co-PI(s)	Total Budget	AQRP Project Manager	TCEQ Liaison
24-003	Improving Emission Rates Estimates of Commercial Marine Vessels	Improve emission inventories	*University of Houston*: Flynn	*Ramboll*: Lindhjem, *FluxSens*: Samuelsson	$242,048	Vincent Torres	Cody McClain
24-004	Evaluating Updates to CAMx and NOx Emission Inventories using TEMPO Measurements over Texas	Photochemical air quality models	*Ramboll*: Jeremiah Johnson	n/a	$229,691	Elena McDonald-Buller	Robert Kierstead
24-007	Texarkana Intensive Campaign	Development of an ozone and $PM_{2.5}$ field study in El Paso	*University of Houston*: James Flynn	*Baylor University*: Usenko; *Aerodyne Research, Inc.*: Fortner	$309,703	Vincent Torres	Chola Regmi
24-021	Improving WRF representation of coastal, marine, and residual boundary layers and quantifying the effects on ozone prediction	Photochemical air quality models	*University of Houston*: Yuxuan Wang	n/a	$186,978	Elena McDonald-Buller	Gabriel Lee
24-024	Novel Observations and Quantified Source Apportionment of Ozone, Particulate Matter and Contributing Precursors in the El Paso Area	Development of an ozone and $PM_{2.5}$ field study in El Paso	*The University of Texas at Austin*: Pawel Misztal	n/a	$280,810	Vincent Torres	Celinda Vallejo-Rodriguez