AIR QUALITY RESEARCH PROGRAM

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

Annual Report
May 15, 2023-Aug. 31, 2023

Submitted to

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PREPARED IN COOPERATION WITH THE TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

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Texas Air Quality Research Program

Final Report

May 15, 2023-August 31, 2023

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

The AQRP efforts were focused primarily on maintaining project management communications with subaward Principal Investigators (PI), audits of project Financial Status Reports (FSR), internal UT account audits, monthly UT FSR preparation, Project Management Monthly Technical Report (MTR) reviews and discussions, AQRP website upgrades, and close-out of subaward contracts and the internal UT account for the 2022-2023 biennium. The Research Projects section reports project subaward status and summary details of progress made to date.

Project details are posted on the AQRP website (https://aqrp.ceer.utexas.edu/research/projects). Summary details of awarded projects are listed in Appendix A.

Projects submitted Final Reports by August 31, 2023. Details are in the Research Projects section of this report. Project MTRs through August 2023 and final reports are posted on the AQRP website (https://aqrp.ceer.utexas.edu/research/projects).

Due to unplanned delays with subaward invoicing from subawards, the UT subaward accounts could not be closed out until December 2023, further delaying the submission of this Final Report. The TCEQ Project Manager was kept apprised of the delays and estimated time of completion.

The AQRP website redesign project was completed and went live. However, data migration resulted in missing files and inactive hyperlinks. The AQRP Program Manager is committing time in the 2024-2025 Biennium to conduct a detailed review every site page, link, and file to ensure archival data will be appropriately available to the public. The new AQRP website is located at https://aqrp.ceer.utexas.edu/.

The Financial Status Report section of this report includes current accounting through the biennium close-out.

Throughout the reporting period, the AQRP Program Manager communicated regularly with the TCEQ Project Manager regarding program deadlines, deliverables, program updates, submission of monthly FSRs, and provided any additional information as requested by the TCEQ.

The AQRP 2023 Workshop was held August 31, 2023, from 9:00 AM CT to 4:00 PM CT at the J. J. Pickle Research Campus, hosted by the Center for Energy and Environmental Resources (10100 Burnet Road, Building EME (#133), Austin, TX 78758). Recording of the workshop and Project presentations can be found at https://aqrp.ceer.utexas.edu/workshops.

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).

The current AQRP contract was executed for the 2022-2023 biennium and funding of $750,000 per year was awarded. The 2023-2025 biennium amendment funding is awarded at $750,000 per year.

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 http://aqrp.ceer.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 (http://aqrp.ceer.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 steps 8 and 9.

Research Projects

FY 2022-2023 Projects

Project 22-003 (Atmospheric and Environmental Research, Inc.)

Title: Evaluating the Ability of Statistical and Photochemical Models to Capture the Impacts of Biomass Burning Smoke on Urban Air Quality in Texas	**STATUS: ENDED** (08/22/2022 – 08/31/2023)
	Funded Amount: $161,388 **Remaining Balance:** $933.18
PI: Matthew Alvarado	**AQRP Project Manager**: Elena McDonald-Buller
	TCEQ Project Liaison: Chola Regmi

Abstract: Understanding the impact of domestic fire smoke on urban air quality (AQ) requires understanding (i) the chemistry of the smoke before it reaches the city and (ii) the changes in the urban production rate of ozone (O_3) and particulate matter ($PM_{2.5}$) caused by the smoke. The relative importance of these two pathways on the air quality impacts of domestic fire smoke is not well understood and it is unclear which processes should be targeted to reduce the overall uncertainty.

In addition, three-dimensional (3D) photochemical models like the Comprehensive Air Quality Model with Extensions (CAMx) can have trouble representing the near-source chemistry of the smoke plume and the impact of smoke mixing with urban pollution due to a combination of low spatial resolution near fires and incorrect representation of the chemistry of smoke-specific volatile organic compounds (VOCs). These limitations in physical approaches have led to the development of a variety of statistical approaches to estimate the impact of biomass burning on urban AQ. However, little work has been done to compare the statistical and 3D photochemical approaches or to identify priorities for further development of both approaches. Thus, the United State Environmental Protection Agency (US EPA) and United States (US) Forest Service organized assessment of smoke research needs noted this was a key priority for future smoke chemistry research. A statistical analysis of the impacts of domestic fire emission on urban air quality in Texas and a statistical evaluation of the ability of the CAMx model to simulate these impacts would greatly help TCEQ air quality managers understand the impacts of domestic fires on Texas air quality and human health.

Thus, the objectives of this project are to:

(1) Use generalized additive models (GAMs) driven with satellite and surface observations to examine the impact of fires on background and total O_3 and $PM_{2.5}$ in Texas urban areas.

(2) Examine the ability of CAMx photochemical model to simulate these fire impacts by applying similar statistical methods to the CAMx results.

(3) Use any statistically significant differences found to prioritize different approaches to improve the ability of CAMx to simulate the impacts of domestic fires on air quality.

This project will examine the impact of fires on urban AQ in Texas using statistical modeling. Two urban areas will be examined: Houston-Galveston-Brazoria (HGB) and El Paso. Background O_3 and $PM_{2.5}$ concentrations will be estimated using the lowest value observed at sites near the border of the area of interest, as TCEQ has done in the past (e.g., Berlin et al., 2013). Analyzing the impacts of fires on background and urban sites separately will allow examination of the change in O_3 and $PM_{2.5}$ due to the mixing of smoke with urban pollution separately from the impact of smoke before it mixes with urban pollution. The same statistical methods will be applied to both the real-world surface observations and CAMx-simulated surface observations to determine if the impact of fires on urban air quality as simulated in CAMx is statistically equivalent to the impacts seen in the real-world data. Statistically significant differences will be examined to determine avenues for improving the handling of smoke and urban air chemistry in the photochemical models.

Project Update:
Research completed August 31, 2023. Final Report can be viewed directly at https://aqrp.ceer.utexas.edu/images/Reports%20PDF/22-023FinalRpt.pdf.

Project 22-006 (Aerodyne Research, Inc. (ARI) (Primary), Baylor University (Collaborator))

Title: Hydrogen Cyanide for Improved Identification of Fire Plumes in the $(BC)^2$ Network	**STATUS: ENDED** (08/22/2022 – 08/31/2023)
PI: Tara Yacovitch (ARI) **Co-PI:** Rebecca Sheesley (Baylor) **Co-PI**: Sascha Usenko (Baylor)	**Funded Amount**: $108,480 **Remaining Balance:** $4,369.39 (ARI: $51,255; Baylor: $57,225) **AQRP Project Manager**: Vincent Torres **TCEQ Project Liaison**: Erik Gribbin

Abstract: Wildfire incidents in the US have and will continue to increase with a changing climate. Smoke can impact the local air quality in Texas from both local/in-state fires and transported emissions from other parts of the US and from Mexico. The 2020 Black and Brown Carbon $(BC)^2$ study demonstrated how wavelength-dependent aerosol optical properties could be used to track the influence of biomass burning. The $(BC)^2$ network operated in El Paso, Houston, and Galveston in 2020-21 and is being expanded to include Dallas-Fort Worth (DFW) in 2022 and 2023. Hydrogen cyanide (HCN) is a small nitrogen-containing molecule produced in significant quantities from biomass burning, and in limited quantities from vehicle combustion. The goal of this project is to improve smoke plume characterization with the addition of HCN to the $(BC)^2$ smoke monitoring network. This goal explicitly addresses the AQRP's 2022-2023 research priorities, notably "Domestic Fire Emissions" including transported emissions from wildfires (domestic, international) and their impacts on exceptional events in Texas. Performing this monitoring at a Dallas-Fort Worth site ties in with the AQRP's 2022-2023 research priority "Changing Emission Patterns in Texas", which includes additional research along the Interstate-35. This project will deploy a laser-based instrument to measure HCN at a new $(BC)^2$ network site in Dallas-Fort Worth. The work is laid out as 3 tasks: 1) Design measurement campaign; 2) Execute field campaigns; and 3) Data Analysis.

Project Update:
Research completed August 31, 2023. Final Report can be viewed directly at https://www.aqrp.ceer.utexas.edu/edocman/projects/22-006FinalRpt.pdf.

Project 22-008 (University of Houston (Primary), St. Edward's University (Collaborator))

Title: Modeling analysis of TRACER-AQ and over-water Measurements to improve prediction of on-land and offshore ozone	**STATUS: ENDED** (08/22/2022 – 08/31/2023)
PI: Yuxuan Wang (UH)	**Funded Amount**: $181,724 **Remaining Balance:** $698.33
Co-PI: James Flynn (UH)	(UH: $175,621; St. Edward's: $6,103)
Co-PI: Paul Walter (St. Ed's)	**AQRP Project Manager**: Elena McDonald-Buller
	TCEQ Project Liaison: Barry Exum

Abstract: The Tracking Aerosol Convection ExpeRiment-Air Quality (TRACER-AQ) study, including the Galveston Offshore Ozone Observations (GO3) field campaign, provided unprecedentedly rich observations of ozone air pollution covering both offshore and onshore locations that are needed to validate current air quality models. During the TRACER-AQ period (July – October 2021), there were six multi-day ozone episodes, resulting in over 20 days during which at least one land-based site or ship-based measurement had Maximum Daily 8-hour Average (MDA8) ozone concentrations exceeding the current National Ambient Air Quality Standard (NAAQS) of 70 ppbv. The project team's preliminary analysis of TRACER-AQ observations has revealed definitive gaps in the Weather Research and Forecasting (WRF) model and WRF-driven photochemical models in replicating the observations. This AQRP project will address these issues via continued efforts of model-observation comparisons and photochemical model intercomparisons using three models driven by the same high-resolution WRF meteorology and emissions (CAMx, WRF-GC, and WRF-Chem). The activities are designed to focus on the following primary science questions:

1. Which configurations and simulation settings of WRF most accurately replicate the extensive meteorological data collected as part of TRACER-AQ?
2. How well do coupled mesoscale meteorological and photochemical grid modeling of coastal/maritime boundary layers replicate observations?
3. How well do photochemical grid models predict over-water concentrations and formation rates of ozone?
4. What are the spatial distributions of ozone and ozone precursors during TRACER-AQ on days with on-land monitors recording exceedances of the NAAQS and how well does the photochemical model predict such distributions?
5. Which emission source categories affect ozone formation over Galveston Bay and the Gulf of Mexico?

The project specifically targets the AQRP Priority Research Area FY2022-2023: *TRACER-AQ and over-water measurements*. The project will lead to improvements in meteorological and photochemical models to better simulate on-land and offshore ozone in the Houston-Galveston-Brazoria (HGB). The model intercomparison will characterize the strengths and weaknesses of the regulatory model, CAMx, in the context of other air quality models. The modeling interpretation of

TRACER-AQ observations will better understand offshore O_3 formation and transport and their effects on high ozone episodes on land that directly relate to ozone exceedances.

Project Update:
Research completed August 31, 2023. Final Report can be viewed directly at https://aqrp.ceer.utexas.edu/images/Reports%20PDF/22-008FinalRpt.pdf.

Project 22-010 (Aerodyne Research, Inc.)

Title: Dallas Field Study (DFS); Ozone Precursors, Local Sources and Remote Transport Including Biomass Burning **PI**: Edward Fortner	**STATUS: ENDED** (08/22/2022-08/31/2023) **Funded Amount**: $228,418 **Remaining Balance:** $162.21 **AQRP Project Manager**: Vincent Torres **TCEQ Project Liaison**: David Westenbarger

Abstract: The Dallas Fort Worth (DFW) Metropolitan area is the most populous metropolitan area (MSA) in the state of Texas and the fourth most populous MSA in the country. It is also experiencing a high rate of growth and is located along the Interstate 35 (I-35) corridor an area which the AQRP 2022-2023 research priority "Changing Emission Patterns in Texas" addresses as a research focus. The Aerodyne Mobile Laboratory (AML) will conduct measurements in the Spring of 2023 in the DFW area. This project's first objective is to conduct measurements of point sources in the DFW metropolitan area characterizing the volatile organic compounds (VOC) signature of these sources. This will lead to a better understanding of the VOC component of regional ozone production and an improved assessment of optimum strategies for ozone reduction in the DFW area.

The second goal of this project is to determine the influence of biomass burning impacted airmasses on the DFW metropolitan area. We will conduct measurements upwind and downwind of the DFW when biomass burning impacted airmasses enter the DFW area and determine the impact of these airmasses relative to typical ambient airmasses transiting the DFW area. We will also characterize any wildfires regionally by conducting measurements of the biomass burning plume, better characterizing the evolvement of the plume over time. This goal addresses the AQRP 2022-2023 research priority of "Domestic Fire Emissions".

Project Update:
Research completed August 31, 2023. Final Report can be viewed directly at https://aqrp.ceer.utexas.edu/images/Reports%20PDF/22-010FinalRpt.pdf.

Project 22-019 (University of Houston)

Title: Refining Ammonia emission using inverse modeling and satellite observations over Texas and the Gulf of Mexico and investigating its effect on fine particulate matter **PI**: Yunsoo Choi	**STATUS: ENDED** (08/22/2022 – 08/31/2023) **Funded Amount**: $131,366 **Remaining Balance:** $10,094.08 **AQRP Project Manager**: Elena McDonald-Buller **TCEQ Project Liaison**: Khalid Al-Wali

Abstract: The overall goal of this project is to conduct an inverse modeling study over the State of Texas and the Gulf of Mexico using Community Multiscale Air Quality (CMAQ) models integrated with ammonia (NH_3) remote sensing data from the Cross-track Infrared Sounder (CrIS) for 2019. Objectives of this project are 1) updating the emissions inventory over Texas and the Gulf of Mexico; 2) investigating the contribution of the updated NH_3 emissions on fine particulate matter ($PM_{2.5}$) concentrations; and 3) analyzing the effect of adjusted NH_3 emissions on atmospheric chemistry. In this inverse modeling study, we will use CrIS satellite observations to adjust National Emissions Inventory (NEI) NH_3 emissions, which are highly uncertain owing to a lack of NH_3 observations and therefore more likely to result in errors in the calculated bottom-up NH_3 emissions. To proceed with the emission adjustment approach, we will apply the iterative Finite Difference Mass Balance (iFDMB) inverse modeling technique to revise the NEI NH_3 emissions with respect to CrIS observations. Since running iFDMB is computationally expensive and requires numerous iterations, the employment of a reduced complexity CMAQ model (RCCM) for simulations can reduce the burden of computations while maintaining the accuracy of predictions. We will conduct the iFDMB by implementing a RCCM to simulate NH_3 concentrations over the regions of interest. Following this project, we will develop adjustment factors for modifying NH_3 emissions until they reach an optimum state in which NH_3 concentrations are the closest to the CrIS observations. After updating the emissions inventory, we will investigate the consequent impacts of the adjusted NH_3 emissions on the behaviors of such atmospheric constituents as the concentrations of $PM_{2.5}$ and inorganic $PM_{2.5}$ species.

Project Update:
Research completed August 31, 2023. Final Report can be viewed directly at https://aqrp.ceer.utexas.edu/images/Reports%20PDF/22-019FinalRpt.pdf.

Project 22-020 (Texas A&M University)

Title: Quantifying the Emissions and Spatial/Temporal Distributions of Consumer Volatile Chemical Products (VCPs) in the Greater Houston Area	**STATUS: ENDED** (08/22/2022 – 08/31/2023)
	Funded Amount: $160,182 **Remaining Balance:** $13.14
PI: Yue Zhang **Co-PI**: Qi Ying	**AQRP Project Manager**: Elena McDonald-Buller
	TCEQ Project Liaison: Bob Gifford

Abstract: Air pollution is the fifth largest cause of death in the world. Volatile organic compounds (VOCs) can also undergo chemical reactions with atmospheric oxidants to form major atmospheric pollutants, such as photochemical ozone (O_3) and particulate matter (PM). With this changing emission profile of carbonaceous compounds in urban areas, volatile chemical products (VCPs) have become one of the most significant sources of anthropogenic VOCs. VCPs typically consist of organic species from consumer products and business activities, including cleaning agents, printing inks, personal care products, pesticides, and coatings. In the populated urban regions, such as New York City, where O_3 formation is VOC-limited, VCPs account for more than half of the 20-ppb maximum daily average 8-h (MDA8) O_3 attributed to anthropogenic VOCs. As the fourth largest city in the US, with more than 7 million people in the surrounding areas, Houston has no reported ambient measurements of the VCP to our knowledge, highlighting the urgent need to update the VCP emission inventory in the Greater Houston Area validated by ambient measurements with detailed spatial and temporal resolution. Our primary hypothesis is that the VCPs in the Greater Houston Area account for a significant portion of the total VOC emission and have important implications on the regional ozone concentrations that were previously not captured by the emission inventory and models. To address this hypothesis, our primary goal is to use existing field measurement data to provide temporal, spatial, and seasonal information of the VCPs in the Greater Houston Area and use a high spatial resolution regional chemical transport model with a detailed photochemical mechanism to further improve the VCP emission inventory and understand the impacts of VCP on air quality, including ozone.

Project Update:
Research completed August 31, 2023. Final Report can be viewed directly at https://aqrp.ceer.utexas.edu/images/Reports%20PDF/22-020FinalRpt.pdf.

Project 22-023 (The George Washington University (Primary), Ramboll (Collaborator))

Title: Source-sector NOx emissions analysis with sub-kilometer scale airborne observations in Houston during TRACER-AQ	**STATUS: ENDED** (08/22/2022 – 08/31/2023)
	Funded Amount: $248,146.60 **Remaining Balance:** $82.26
PI: Daniel Goldberg (GWU) **Co-PI**: Greg Yarwood (Ramboll)	(GWU: $103,425; Ramboll: $144,721.60)
	AQRP Project Manager: Elena McDonald-Buller
	TCEQ Project Liaison: Sushil Gautam

Abstract: Nitrogen oxide (NO_X) emissions are a critical participant in ozone formation. Many North American cities already have NO_X-limited ozone formation during the warm season (Jin et al., 2020; Jung et al., 2022), and the remaining cities should have primarily NO_X-limited conditions in the coming years (Koplitz et al., 2021). Further reducing ozone production rates within cities will therefore require improved quantification of NO_X emissions. One major limitation of our current observing network is the inability to accurately quantify NO_X emissions on a sector-by-sector basis in a timely fashion, with the exception of continuous emissions monitoring systems (CEMS) on electricity generating units. Many non-road sources of NO_X emissions, such as industrial or construction emissions, have large uncertainties (Zawacki et al., 2018).

In this project we will use fine spatial resolution nitrogen dioxide (NO_2) information (250 × 560 m^2) from the Geostationary Coastal and air pollution events Airborne Simulator (GCAS) instrument (Janz et al., 2019; Nowlan et al., 2018), available during the September 2021 NASA/TCEQ Tracking Aerosol Convection ExpeRiment – Air Quality (TRACER-AQ) field campaign, to better understand the fine-scale structure of NO_X emissions in the Houston metropolitan area including a sector-by-sector analysis.

Complementing the airborne observations, the Comprehensive Air Quality Model with Extensions (CAMx) will be run with a fine spatial resolution (444 × 444 m^2) using the 2019 TCEQ emissions inventory. The model output will then be compared to data from the GCAS and the Tropospheric Monitoring Instrument (TROPOMI) in order to identify gaps in our understanding of NO_X emissions. We will compare/contrast NO_2 concentrations near large CEMS and non-CEMS point sources, major highways, large population centers, airports, railyards, and commercial marine vessels to determine whether the magnitude of the NO_X emissions agree between the inventory and observations. We will also use GCAS observations to estimate NO_X emissions directly from individual point sources or quasi-points sources (e.g., airports, petrochemical complexes, etc.). To maximize the value of the airborne measurements, we will use a Generalized Additive Model (GAM) to estimate the contributions from different NO_X emission sectors that best matches the airborne retrievals.

This work maps to at least four Research Priority Areas of the Texas Air Quality Research Program (AQRP), as shown in the Table 22-023-1 below. This project will combine aircraft and satellite observations with high resolution models, to provide actionable information about TCEQ's 2019 Emissions Inventory for NO_X. These results will provide a new perspective for aiding in decision-making for improving ozone air quality in the region.

Project Update:
Research completed August 31, 2023. Final Report can be viewed directly at https://aqrp.ceer.utexas.edu/images/Reports%20PDF/22-023FinalRpt.pdf.

FINANCIAL STATUS REPORT

The Air Quality Research Program (AQRP) contract was awarded for FY 22-23 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. Table 1 details the FY 22-23 Administration budget.

Dr. David Allen, Principal Investigator and AQRP Director, is responsible for the overall administration of the AQRP. RoseAnna Goewey, AQRP Program and Grant Manager, coordinates all aspects of program management. Randy George, AQRP Information Technology (IT) Manager, assists the Director and Program Manager with all website development updates, data storage, and handling of all other IT related issues. Nohemi Cazares, Senior Administrative Associate, performs required accounts payable services to ensure timely reimbursement payments to subaward entities.

The University of Texas at Austin's federally negotiated fringe rates can be viewed in detail at https://research.utexas.edu/wp-content/uploads/sites/5/2022/06/FY23_Fringe_Benefit_Rates_063022.pdf.

At the close of the 2022-2023 biennium, residual Administration budget amounted to $22,757.19. Approval to Carry Forward these funds into Biennium 2023-2025 is approved. All funds will be used in the Administrative budget category for future website hosting fees and Texas Advanced Computing Center (TACC) data storage fees required for research project data archival.

Table 1: Administration Budget FY 22-23 (final expenses at close-out)

Budget Category	FY22 Budget	FY23 Budget	Total Budget	Expenses*	Remaining Balance
Personnel/Salary	$36,795.32	$60,374.11	$97,169.43	$82,068.52	$15,100.91
Fringe Benefits	$11,369.72	$18,112.29	$29,482.01	$24,951.77	$4,530.24
Supplies	$702.37	$12,995.91	$13,698.28	$12,015.67	$1,682.61
Total Direct Costs	$48,867.41	$91,482.31	$140,349.72	$119,035.96	$21,313.76
Authorized Indirect Costs *(10% of Salaries and Wages)*	$3,679.54	$5,970.75	$9,650.29	$8,206.85	$1,443.44
Total Costs	**$52,546.95**	**$97,453.06**	**$150,000.01**	**$127,242.81**	**$22,757.20**

ITAC

ITAC expenditure consists of member travel expenses for the 2023 Workshop only. Residual ITAC funds are approved for Carry Forward into the 2024-2025 Biennium, in the amount of $10,850. Carry Forward funds will be used in the 2024-2025 within the Contractual budget category, specifically allocated for Research Projects Subaward Agreements.

Table 2: ITAC Budget FY 22-23 (final expenses at close-out)

Budget Category	FY22 Budget	FY23 Budget	Total Budget	Expenses*	Remaining Balance
Travel	$0.00	$10,000.00	$10,000.00	$400.00	$9,600.00
Supplies	$0.00	$1,250.00	$1,250.00	$0.00	$1,250.00
Total Direct Costs	$0.00	$11,250.00	$11,250.00	$400.00	$10,850.00
Authorized Indirect Costs *(10% of Salaries and Wages)*	$0.00	$0.00	$0.00	$0.00	$0.00
Total Costs	**$0.00**	**$11,250.00**	**$11,250.00**	**$400.00**	**$10,850.00**

Project Management

Table 3 details the FY 22-23 Project Management Budget. Project Management expenses consisted of Project Manager salaries, fringes, supplies, and associated Indirect Costs. Residual Project Management funds are approved for Carry Forward into the 2024-2025 Biennium, in the amount of $5,422.10. Carry Forward funds will be used in the 2024-2025 within the Contractual budget category, specifically allocated for Research Projects Subaward Agreements.

Table 3: Project Management Budget FY 22-23 (final expenses at close-out)

Budget Category	FY22 Budget	FY23 Budget	Total Budget	Expenses*	Remaining Balance
Personnel/Salary	$4,545.67	$79,343.61	$83,889.28	$80,646.72	$3,242.56
Fringe Benefits	$1,400.47	$24,336.31	$25,736.78	$24,230.78	$1,506.00
Supplies	$108.78	$921.22	$1,030.00	$680.71	$349.29
Total Direct Costs	$6,054.92	$104,601.14	$110,656.06	$105,558.21	$5,097.85
Authorized Indirect Costs *(10% of Salaries and Wages)*	$454.57	$7,934.36	$8,388.93	$8,064.68	$324.25
Total Costs	**$6,509.49**	**$112,535.50**	**$119,044.99**	**$113,622.89**	**$5,422.10**

RESEARCH PROJECTS

All research projects have Subaward Agreements fully executed. Table 4 shows the FY 22-23 Research Project budgets and expenditures actually incurred on the UT account as of May 31, 2023. The FY 22-23 budget allocates $1,222,500.00 for research projects.

Residual Research Projects funds are approved for Carry Forward into the 2024-2025 Biennium, in the amount of $16,352.99. Carry Forward funds will be used in the 2024-2025 within the Contractual budget category, specifically allocated for Research Projects Subaward Agreements.

Total Carry Forward approved for the 2024-2025 Research Projects Subaward Agreements total is $32,625.09. This is a combination of 2022-2023 residuals from the ITAC, Project Management, and Research Projects budgets.

Table 4: FY 22-23 Contractual/Research Project Budget

FY 22 Contractual Funding		**$611,250.00**		
FY 22 Total Contractual Funding		**$611,250.00**		
Project Number	**Institution**	**Amount Awarded**	**Cumulative Expenditures**	**Remaining Balance**
22-003	Atmospheric and Environmental Research, Inc	$161,388.00	$0.00	$161,388.00
22-006	Aerodyne Research, Inc. (ARI)	$51,255.00	$0.00	$51,255.00
22-006	Baylor University	$57,225.00	$0.00	$57,225.00
22-008	University of Houston	$175,621.00	$0.00	$175,621.00
22-008	St. Edward's University	$6,103.00	$0.00	$6,103.00
22-010	Aerodyne Research, Inc.	$228,418.00	$0.00	$228,418.00
22-019	University of Houston	$131,366.00	$0.00	$131,366.00
22-020	Texas A&M University	$160,182.00	$0.00	$160,182.00
22-023	The George Washington University	$103,425.00	$0.00	$103,425.00
22-023	Ramboll	$144,721.60	$0.00	$144,721.60
FY 22 Total Contractual Funding Awarded		$1,219,704.60		
FY 22 Contractual Funds Expended (Init. Projects)			$0.00	
FY 22 Contractual Funds Remaining to be Spent				$611,250.00
FY 22 Contractual Funding Carry-Forward		**$611,250.00**		
FY 23 Contractual Funding		**$611,250.00**		
FY 23 Total Contractual Funding		**$1,218.705.00**		
Project Number	**Institution**	**Amount Awarded**	**Cumulative Expenditures**	**Remaining Balance**
22-003	Atmospheric and Environmental Research, Inc	$161,388.00	$160,454.82	$933.18
22-006	Aerodyne Research, Inc. (ARI)	$59,255.00	$58,934.30	$320.70
22-006	Baylor University	$49,225.00	$45,176.31	$4,048.69
22-008	University of Houston	$175,621.00	$174,922.67	$698.33
22-008	St. Edward's University	$6,103.00	$6,103.00	$0.00
22-010	Aerodyne Research, Inc.	$228,418.00	$228,255.79	$162.21
22-019	University of Houston	$131,366.00	$121,271.92	$10,094.08
22-020	Texas A&M University	$160,182.00	$160,168.86	$13.14
22-023	The George Washington University	$103,425.00	$103,419.88	$5.12
22-023	Ramboll	$144,722.00	$144,644.46	$77.54
FY 23 Total Contractual Funding Awarded		$1,219,705.00		
FY 23 Contractual Funds Expended (Init. Projects)			$1,203,352.01	
FY 23 Contractual Funds Remaining to be Spent				$16,352.99
Total Contractual Funding		**$1,219,705.00**		
Total Contractual Funding PENDING AWARD		**$1,219,705.00**		
Total Contractual Funding Remaining to be Awarded		**$0.00**		
Total Contractual Funds Expended to Date			**$1,203,352.01**	
Total Contractual Funds Remaining to be Spent				**$16,352.99**

APPENDIX A. CONTRACTUAL RESEARCH PROJECTS APPROVED FOR FUNDING (BIENNIUM 2022-2023)

Proj. Nbr.	Project Title	Research Priority Area	PI, *Collab. PI*	Co-PI, *Collab. Co-PI*	Primary Institution, *Collab. Institution*	Institution Budget	Total Project Budget	Residual Funds	AQRP Project Manager	TCEQ Liaison, Backup Liaison
22-003	Evaluating the Ability of Statistical and Photochemical Models to Capture the Impacts of Biomass Burning Smoke on Urban Air Quality in Texas	Domestic fire emissions	Matthew Alvarado	n/a	Atmospheric and Environmental Research, Inc (AER)	$161,388	$161,388	$933.18	Elena McDonald-Buller	Chola Regmi, Thuy Phi
22-006	Hydrogen Cyanide for Improved Identification of Fire Plumes in the $(BC)^2$ Network	Domestic fire emissions	Tara Yacovitch *Rebecca Sheesley*	n/a *Sascha Usenko*	Aerodyne Research, Inc. *Baylor University*	$51,255 *$57,225*	$108,480	$320.70 *$4,048.69*	Vincent Torres	Erik Gribbin, August Kaiser
22-008	Modeling analysis of TRACER-AQ and over-water Measurements to improve prediction of on-land and offshore ozone	TRACER-AQ and over-water measurements	Yuxuan Wang *Paul Walter*	James Flynn *n/a*	University of Houston *St. Edward's University*	$175,621 *$6,103*	$181,724	$698.33 *$0.00*	Elena McDonald-Buller	Barry Exum, Miranda Kosty
22-010	Dallas Field Study (DFS); Ozone Precursors, Local Sources and Remote Transport Including Biomass Burning	Changing emission patterns in Texas	Edward Fortner	n/a	Aerodyne Research, Inc.	$228,418	$228,418	$162.21	Vincent Torres	David Westenbarger, Cara Scalpone
22-019	Refining Ammonia emission using inverse modeling and satellite observations over Texas and the Gulf of Mexico and investigating its effect on fine particulate matter	Improve emission inventories	Yunsoo Choi	n/a	University of Houston	$131,366	$131,366	$10,094.08	Elena McDonald-Buller	Khalid Al-Wali, Shay Guerin
22-020	Quantifying the Emissions and Spatial/Temporal Distributions of Consumer Volatile Chemical Products (VCPs) in the Greater Houston Area	Improve emission inventories	Yue Zhang	Qi Ying	Texas A&M University	$160,182	$160,182	$13.14	Elena McDonald-Buller	Bob Gifford, Michael Ege
22-023	Source-sector NOx emissions analysis with sub-kilometer scale airborne observations in Houston during TRACER-AQ	TRACER-AQ and over-water measurements	Daniel Goldberg *Greg Yarwood*	n/a *n/a*	The George Washington University *Ramboll*	$103,425 *$144,721.60*	$248,146.60	$5.12 *$77.54*	Elena McDonald-Buller	Sushil Gautam, Lam Nguyen