AMENDMENT NO. 2

TO THE

TEXAS A & M UNIVERSITY - CORPUS CHRISTI

AND

THE CITY OF CORPUS CHRISTI

This amends the Interlocal Cooperation Agreement between the CITY OF CORPUS CHRISTI (City) and the TEXAS A&M UNIVERSITY - CORPUS CHRISTI (TAMU-CC), authorized by the Corpus Christi City Council by Resolution No.032230 on September 29, 2020 ("the Agreement"), incorporated by reference and attached.

WHEREAS, the parties desire to amend the Agreement under authority of Section 15, which provides that the representatives who were authorized to sign this agreement are authorized to execute minor amendments to this agreement, such as changes in deadlines and minor changes in budget and scope of work;

NOW, THEREFORE, the parties hereto agree to amend the Agreement as follows:

1. AMENDMENT TO SECTION **2.** Section 2 of the Agreement is amended as follows:

   2. STATEMENT OF WORK. The Work Plan is amended to incorporate additional Tasks to the Statement if Work as outlined in Exhibit A.

2. AMENDMENT TO SECTION **4.** Section 4 of the Agreement is amended as follows:

   4. PERIOD OF PERFORMANCE. The program shall be conducted from the execution date of the contract through December 31, 2025.

3. AMENDMENT TO SECTION 5. Section 5 of the Agreement is amended as follows:

   5. PRICE AND PAYMENT. As compensation for the performance of the agreement, the City agrees to reimburse TAMU-CC up to $953,01830 for expenses authorized under the Grant.

      a. This agreement is funded exclusively from funds made available to the City by the Grant. The City's obligation is limited by the provisions of the Grant. The City is not liable to make payment to TAMU-CC, if funding is not available from TCEQ through the Grant. Payments may not exceed $953,018.30 for expenses authorized under the Grant.

4. MAXIMUM AUTHORIZED REIMBURSEMENT. The City agrees to increase the Maximum Authorized Reimbursement shown on the Contract Signature Page by an additional $387,791.00 The original Maximum Authorized Reimbursement, the

amount of the increase, and the amended Maximum Authorized Reimbursement are as follows:

Original Maximum Authorized Reimbursement	$150,499.58
Amendment #1	$420,727.72
Amendment #2	$381,791.00
Revised Maximum Authorized Reimbursement	$953,018.30

All other terms and conditions of the Agreement remain unchanged.

IN WITNESS WHEREOF, the parties have caused this agreement to be executed by their authorized representative.

TEXAS A&M UNIVERSITY- CORPUS CHRISTI

BY: _____
Kimberly Hawkenson, CRA, Director
Office of Sponsored Research Administration

CITY OF CORPUS CHRISTI

BY: _____
Steve Viera
Assistant City Manager

ATTEST

BY:_____
Rebecca Huerta
City Secretary

APPROVED AS TO LEGAL FORM:

_____
Buck Brice
Deputy City Attorney

GRANT ACTIVITIES

The Performing Party will implement all grant activities in order to monitor ozone and inventorying emissions, as required in Rider 7, Texas Commission on Environmental Quality, Article VI of the General Appropriations Act of the 86th Legislature.

Task 1 (Monitoring of Pollution Levels)

1.1: A Category III QAPP for the Ambient Air Quality Monitoring Activities

Deliverable 1.1: A Category III QAPP for the Ambient Air Quality Monitoring Activities delivered to the TCEQ in Microsoft Office Word

Deliverable Date 1.1: Draft QAPP within 30 calendar days after Task 1.2 is approved. The QAPP must be accepted by the TCEQ prior to the start of technical activities.

Deliverable Cost 1.1: Included in personnel costs.

Task 1.2: Ambient Air Monitoring Network

Project Task 1.2 will be to continue to monitor ambient ozone concentrations at the five city air monitoring sites. Relative humidity, temperature, and wind speed/direction will also be measured at each site and NO_x concentrations will be measured at all three current sites. This includes increasing the spatial resolution of NO_x measurements with the purchase and deployment of (2) additional NO_x analyzers. The monthly data will be available to the public by hosting summary data figures on the Coastal Bend Air Quality Partnership's website (cbairquality.org). This task will directly support air monitoring requirements outlined in the State Implementation Plan (SIP) and demonstrate NAAQS compliance. For instance, CAIR SIP consists of reducing NO_x emissions and the reduction evaluation depends on NO_x monitoring. Up until our recent monitoring efforts, NO_x monitors were not present in the region.

NO_x and VOCs are primary ozone precursors but the relationship between these precursors and ozone formation is not linear. Despite these direct impacts on ozone formation, the Corpus Christi airshed did not have a NO_x monitoring station until we developed one this year. It does however have five centrally located VOC monitoring stations (1 AutoGC, 1 TNMOC, 4 canister). Depending on atmospheric conditions, ozone formation can be almost exclusively controlled by NO_x and mostly independent of VOCs. However, there are also conditions where ozone formation can increase with VOC concentrations while not increasing or even decreasing with increasing NO_x. Due to this nonlinear chemistry between precursors and product, determining whether ozone formation in an air shed is "NO_x or VOC limited" (i.e., sensitive to increases in NO_x or VOC levels) has proven difficult. NO_x data from this year's monitoring campaign, suggest the Corpus Christi airshed is NO_x limited but continuous NO_x monitoring is necessary to determine if the airshed is in a "NO_x or VOC limited" regime. The NO_x data provided by this task along with currently available VOC data will help determine if stakeholders should focus resources on future NO_x or VOC controls to mitigate ozone increases.

Deliverables and Dates 1.2

Deliverables 1.2	Date
Ambient monitoring data collected at monitoring sites delivered to TCEQ's LEADS	Continuous April 2024 – Nov 2025
Reports to the City and Data to TCEQ	Monthly Apr 2024 – Dec 2025

Salary and Fringe (Total $104,668, $55,750 year 1, 48,918 year 2): (PI 1 months year 1 and 1 months year 2, 1 PhD student 12 months year 1 and 9 months year 2, Undergraduate student 560 hours both years).

Tuition (Total $18,190, $10,176 year 1, $8,014 year 2): Tuition for one graduate student over the 2-year period.

Travel (Total $12,583): PI and student travel to sites for calibration, maintenance, data recover, passive sampler deployment and collection. Vehicle/truck rental for instrument maintenance and flux measurements. Travel to conference/meetings to disseminate Corpus air quality data/issues and be exposed to new air pollution technologies. Includes $1000 in conference fees.

Maintenance Costs (Total $21,000): Replacement parts, wireless subscriptions, calibration gases, flow calibrator, shipping to manufacturer if needed.

Laptop and rugged laptop ($5,500): Regular laptop for instrument calibration and reporting in lab. Rugged field laptop for field instrumentation maintenance, calibration and data collection.

Outside Calibration and Audits (**Total $25,000**): An outside company (AECOM) will provide calibration and audit services as an additional quality control and assurance check of the monitoring equipment. This will occur quarterly.

Total Direct Deliverable Costs for Task 1.2: $185,941 (Includes Salary, Fringe and Tuition Costs for personnel that also cover personnel for Tasks 1 through 4)

Table 1: Ambient Air Monitoring Sites to be Operated by the Performing Party

Location	Instrumentation	Instrumentation status
Holly Road site (CAMS 660)	Teledyne API T400 ozone analyzer, Teledyne API N500 NO_x analyzer, RX3004-00-01 RX3000 Cellular Data Logger with 10 Inputs, SOLAR-5W - 5W Solar Panel, S-THB-M002 - Temperature/RH Smart Sensor, S-WSB-M003 - Wind Speed Smart Sensor, S-WDA-M003 - Wind Direction Smart Sensor	Working
Aransas Pass site (CAMS 659)	Teledyne API T400 ozone analyzer, ǂTeledyne API N500 NO_x analyzer, RX3004-00-01 RX3000 Cellular Data Logger with 10 Inputs, SOLAR-5W - 5W Solar Panel, S-THB-M002 - Temperature/RH Smart Sensor, S-WSB-M003 - Wind Speed Smart Sensor, S-WDA-M003 - Wind Direction Smart Sensor	Working ǂTeledyne N500 at company for fix under warranty
Odem site (CAMS 686)	Teledyne API T400 ozone analyzer, ǂTeledyne API N500 NO_x analyzer, RX3004-00-01 RX3000 Cellular Data Logger with 10 Inputs, SOLAR-5W - 5W Solar Panel, S-THB-M002 - Temperature/RH Smart Sensor, S-WSB-M003 - Wind Speed Smart Sensor, S-WDA-M003 - Wind Direction Smart Sensor	Working ǂTeledyne N500 at company for fix under warranty

Annaville site	Teledyne API T400 ozone analyzer, Ecotech NO_x Sirinus analyzer, RX3004-00-01 RX3000 Cellular Data Logger with 10 Inputs, SOLAR-5W - 5W Solar Panel, S-THB-M002 - Temperature/RH Smart Sensor, S-WSB-M003 - Wind Speed Smart Sensor, S-WDA-M003 - Wind Direction Smart Sensor	Working
TAMUCC campus site	*Teledyne API T400 ozone analyzer, Ecotech NO_x Sirinus analyzer, *RX3004-00-01 RX3000 Cellular Data Logger with 10 Inputs, *SOLAR-5W - 5W Solar Panel, *S-THB-M002 - Temperature/RH Smart Sensor, S-WSB-M003 - Wind Speed Smart Sensor, *S-WDA-M003 - Wind Direction Smart Sensor	*Currently being developed
Health Department site	Will be developed in task 1.3	Will be developed in task 1.3

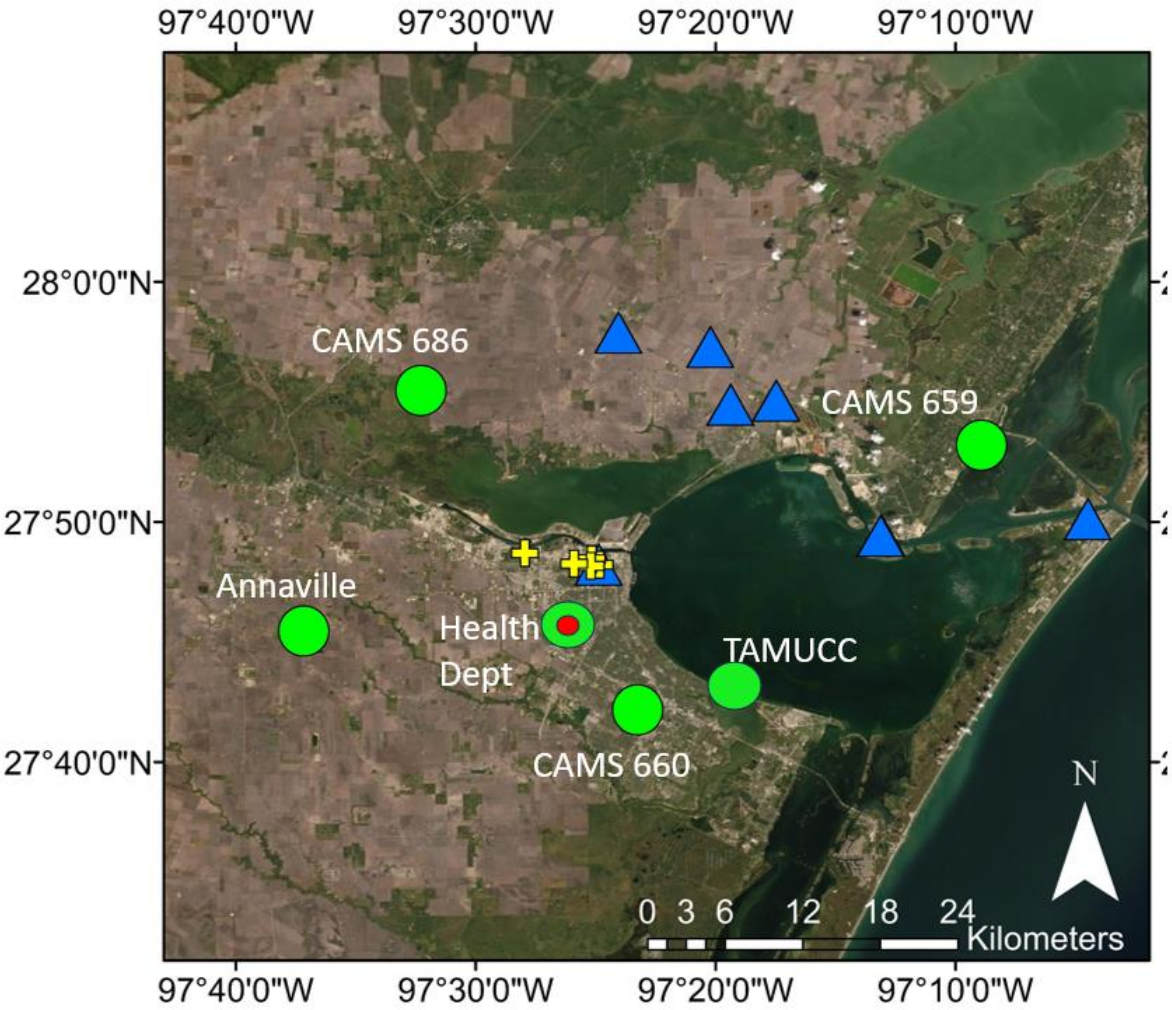

Figure 1. Green circles are current sites and the green cirle with red dot is proposed Health Department site. For reference to other air quality sites, yellow crosses are TCEQ sites and blue triangles are low-cost citizen science sites operated by IOBCWA and CAPE.

Task 1.3: Create New Air Monitoring Site at City Health Department

The goal of task 1.3 will be to establish an air quality site on the grounds of the City of Corpus Christi Health Department. This will include the installation of an aluminum plate shelter and deployment of meteorological instrumentation, an ozone analyzer and a NO_x analyzer. This additional monitoring site will directly support air monitoring requirements outlined in the State Implementation Plan (SIP) and demonstrate NAAQS compliance.

Deliverables and Dates 1.3

Deliverables 1.3	Date
Ordering of air monitoring site shelter and instrumentation	March 2023
Lab quality check of instrumentation and field deployment	June 2023

Aluminum plate shelter ($19,900): The same Ambilab air conditioned aluminum plate enclosure installed at the other air monitoring sites.

NO_x analyzers (Total $20,000): Ecotech Sirinus NO_x analyzer to be deployed at new site

Ozone analyzer ($15,000): Teledyne API T400 Ozone analyzer to be deployed at new site.

Meteorological Instrumentation ($2,500): RX3004-00-01 RX3000 Cellular Data Logger with 10 Inputs, SOLAR-5W - 5W Solar Panel, S-THB-M002 - Temperature/RH Smart Sensor, S-WSB-M003 - Wind Speed Smart Sensor, S-WDA-M003 - Wind Direction Smart Sensor

Total Direct Deliverable Costs for Task 1.3 ($57,400)

Task 1.4. University of Houston Mobile Air Monitoring Campaign Corpus Christi Airshed

A University of Houston team lead by Dr. Jimmy Flynn will perform mobile air monitoring in the Corpus Christi airshed over a four-day period in early November. The campaign will be focused on determining ozone and ozone precursor levels in areas of the airshed not currently covered by stationary monitoring with specific attention to the growing industrial footprint and shipping lanes. The mobile monitoring will tentatively cover urban areas along the full perimeter of Corpus Christi Bay (i.e. from Port Aransas moving south and looping around the bay to Aransas Pass). Specific measurements will include O_3, NO, NO_x, NO_y, CO, SO_2, HCHO, CH_4, unspeciated sum of reactive alkenes, bulk and specific VOCs via AROMA-VOC, 3-wavelength $PM_{2.5}$ scattering and absorption, $PM_{2.5}$ size distribution (0.13-2.5 μm), ceilometer, jNO_2, T/P/RH/WS/WD, GPS, total sky camera. In addition, while not performing mobile measurements, stationary measurements directly adjacent to the Gulf of Mexico will allow characterization of the chemical composition of air being transported into Corpus Christi from the Gulf. The campaign will also allow for comparison to similar data provided by a previous similar air monitoring project, AQRP 20-003: Characterization of Corpus Christi and San Antonio Air Quality During the 2020 Ozone Season and the mobile monitoring done as part of 2022-2023 Rider 7 funding. The primary deliverable

will be the data measured during the stationary and mobile campaigns. This additional monitoring will directly support air monitoring requirements outlined in the State Implementation Plan (SIP) and demonstrate NAAQS compliance.

Deliverables and Dates 1.4

Deliverables 14	**Date**
QAPP/Mobile campaign planning	Summer 2025
Mobile/Stationary measurements	Fall 2025
Data report	November/December 2025

Direct Deliverable Cost 1.4 (This amended task cost will be encumbered by task 1.2 funds)

The University of Houston provides mobile and stationary monitoring at ~$9,000 per day or $36,000 for the full four-day campaign. Scheduled payment breakdown will be as follows:

QAPP/Planning 60%
Monitoring 20%
Data 20%

Total Direct Deliverable Costs for Task 1.4: $36,000

Deliverable Summary Task 1
Deliverables and Dates:

- **QAPP for Stationary Monitoring Network: April 2024**
- **Air Monitoring and data delivered to TCEQ: Continuous May 2024 to Nov 2025**
- **Develop Health Department Air Monitoring Site: June 2023**
- **Monthly/Final Report: First week of each month and December 2025**
- **QAPP for Mobile Air Monitoring Campaign: Summer 2025**
- **Mobile Air Monitoring Campaign: Fall 2025**
- **Mobile Air Monitoring Data Delivery: December 2025**

Task 1 Total Direct Deliverable Cost $280,341.00

Task 2: Detailed Analysis of Ambient Monitoring

Task 2 will report atmospheric conditions and chemical precursor concentrations associated with high or standard exceeding ozone measurements in the Corpus Christi airshed. Atmospheric conditions (i.e., wind direction, wind speed, relative humidity, temperature) will be obtained directly at each site while precursor data (i.e., NO_x and VOC) will be obtained from the nearest monitoring site. The report will be developed through the below investigations and analyses: task will support the State Implementation Plan by demonstrating NAAQS compliance and reporting conditions that may lead to nonattainment.

- Evaluate wind speeds, wind directions, relative humidity and temperature associated with background and high ozone events to determine the local conditions and sources associated with high/low ozone levels
- Determine diurnal and seasonal trends associated with background and high ozone levels
- Determine 24-hour air mass back trajectories using NOAA HYSPLIT software to determine source

regions likely to affect local area ozone.

- Perform weekday vs. weekend analysis to evaluate the potential effectiveness of reduced levels of local industrial and mobile source activity

- Address additional relevant questions listed in Section 11.1.1 of EPA's ozone modeling guidance document, *Guidance on the Use of Models and Other Analyses to Demonstrating Attainment of Air Quality goals for Ozone, PM2.5, and Regional Haze*.

- Investigate ozone and precursor trends and determine the annual frequency of high ozone days

- Create ozone isopleth (Figure 3) by plotting ozone concentrations vs. NO_x at all five sites and VOC (CAMS1024) concentration data in order to determine NO_x vs. VOC limited scenarios in the Corpus Christi airshed.

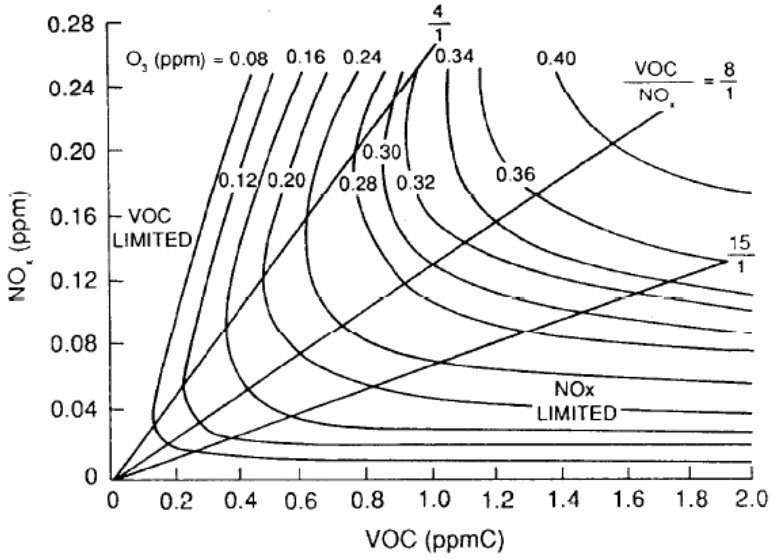

Figure 2. General isopleth depicting the relationship between ozone concentrations and its precursors, VOC, and NO_x. Isopleths can be used to determine if an airshed is VOC or NO_x limited in relation to potential for increased ozone levels (NRC 1991).

Deliverables and Dates 2.

Deliverables Task 2	**Date**
Preliminary analysis and updates with quarterly reports	Quarterly by the 30th of December, March, June, & September
Final analysis report	December 2025

Task 2 costs are included under Task 1.

Task 3: Soil biogenic NO_x flux characterization

A primary purpose of Rider 7 funds is to enhance ozone precursor emission inventory accuracy. While stationary NO_x sources and vehicle emissions are relatively straightforward to measure, complexity arises with sources such as biogenic emissions. SNO_x, a byproduct of denitrification and nitrification in soils, is influenced by various factors such as soil moisture, soil/air temperature, soil type, and available nitrogen. This emission can spike significantly following fertilization and rain events, leading to ozone formation and exacerbating air quality challenges (Romer et al., 2018; Tong et al., 2021). Current numerical models, particularly the widely used Model of Emissions of Gases and Aerosols from Nature (MEGAN), tend to underestimate soil biogenic NO_x (SNO_x) emissions. For instance, Oikawa et al., 2015 found that the numerical models when compared to direct chamber flux studies can underestimate SNO_x by a factor of ten. The limitations of these models underscore the need for direct flux measurements from diverse land types under varying soil temperature and moisture conditions.

To address this gap in understanding, we propose a comprehensive approach in South Texas. Over the course of one year, we will conduct monthly SNO_x soil chamber flux measurements across different land use types, including crops, forested areas, flooded vegetation, urban grasses, and bare soil ground. These direct flux measurements will be accompanied by soil temperature, air temperature and soil moisture measurements to serve as valuable inputs to improve the accuracy of numerical models. Furthermore, we will leverage the National Land Cover Database to model SNO_x emissions in Nueces and San Patricio Counties according to land cover type. This integrated approach aims to provide a more robust foundation for emission inventories and, consequently, enhance our ability to develop effective NO_x mitigation strategies. The SIP requires areas of nonattainment to provide emission inventories, and while the region is currently in attainment, this task falls in line with these SIP requirements as a means of understanding where NO_x emissions can be reduced to stay in attainment.

Deliverables and Dates Task 3

Deliverables Task 3	**Date**
Monthly soil NO_x measurements	Monthly for duration one continuous year of the project
Model NO_x flux in airshed according to land use type	In final report 12/2025

Soil moisture and temperature probes ($2000): Soil moisture and temperature are directly related to soil NO_x production and must be monitored for future modeling.

Chamber ($10,000): Automated dynamic soil flux chamber is needed to mimic natural conditions in the field and measure soil NO_x flux

Small trailer (Total $10,000): A small portable air-conditioned trailer is need to run the real-time NO_x analyzers in the field to make the flux measurements. Truck rental covered in Task 1 travel.

Task 3 Total Direct Deliverable Cost: $22,000

Task 4: Dissemination of air quality introduction material and status to city employees and community

Dr. Felix and/or technicians will be available to disseminate air quality introduction material and city air quality status to city employees and community.

Deliverables and Dates Task 4

Task 4 Deliverables	Date
Air quality presentations	TBD

Task 4 costs are included under personnel costs in task 1.

Total Cost Breakdown

TASK 1 to 4 Budget Breakdown	
Task 1 Budget	**280,341**
Task 2 Budget	**0**
Task 3 Budget	**22,000**
Task 4 Budget	**0**
TAMUCC Indirect Cost	**79,450**
TAMUCC Total Budget	**381,791**