

## **STATEMENT OF WORK**

**CITY OF CORPUS CHRISTI (Performing Party/Grantee)**

**CONTRACT (GRANT) NUMBER: 582-20-11981**

**STATEMENT OF WORK ACTIVITIES NO: 832001S**

**SUBGRANTEES TO BE USED UNDER THIS CONTRACT:  
TEXAS A&M UNIVERSITY- CORPUS CHRISTI**

### **Rider 7 – Statement of Work**

#### **TIME LINE**

The activities shall begin upon issuance of this executed Statement of Work and must be completed no later than December 31, 2025.

**TOTAL AMOUNT OF THIS STATEMENT OF WORK ACTIVITIES: \$424,212**

The total amount to be reimbursed by TCEQ for activities performed under this Statement of Work shall not exceed the amount shown above unless the amount is changed by an amendment.

#### **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 86<sup>th</sup> 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<sub>x</sub> concentrations will be measured at all three current sites. This includes increasing the spatial resolution of NO<sub>x</sub> measurements with the purchase and deployment of (2)

additional NO<sub>x</sub> 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<sub>x</sub> emissions and the reduction evaluation depends on NO<sub>x</sub> monitoring. Up until our recent monitoring efforts, NO<sub>x</sub> monitors were not present in the region.

NO<sub>x</sub> 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<sub>x</sub> 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<sub>x</sub> 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<sub>x</sub>. Due to this nonlinear chemistry between precursors and product, determining whether ozone formation in an air shed is "NO<sub>x</sub> or VOC limited" (i.e., sensitive to increases in NO<sub>x</sub> or VOC levels) has proven difficult. NO<sub>x</sub> data from this year's monitoring campaign, suggest the Corpus Christi airshed is NO<sub>x</sub> limited but continuous NO<sub>x</sub> monitoring is necessary to determine if the airshed is in a "NO<sub>x</sub> or VOC limited" regime. The NO<sub>x</sub> data provided by this task along with currently available VOC data will help determine if stakeholders should focus resources on future NO<sub>x</sub> 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 \$11,583):** 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, \$12,000 per year):** Replacement parts, wireless subscriptions, calibration gases, flow calibrator, shipping to manufacturer if needed.

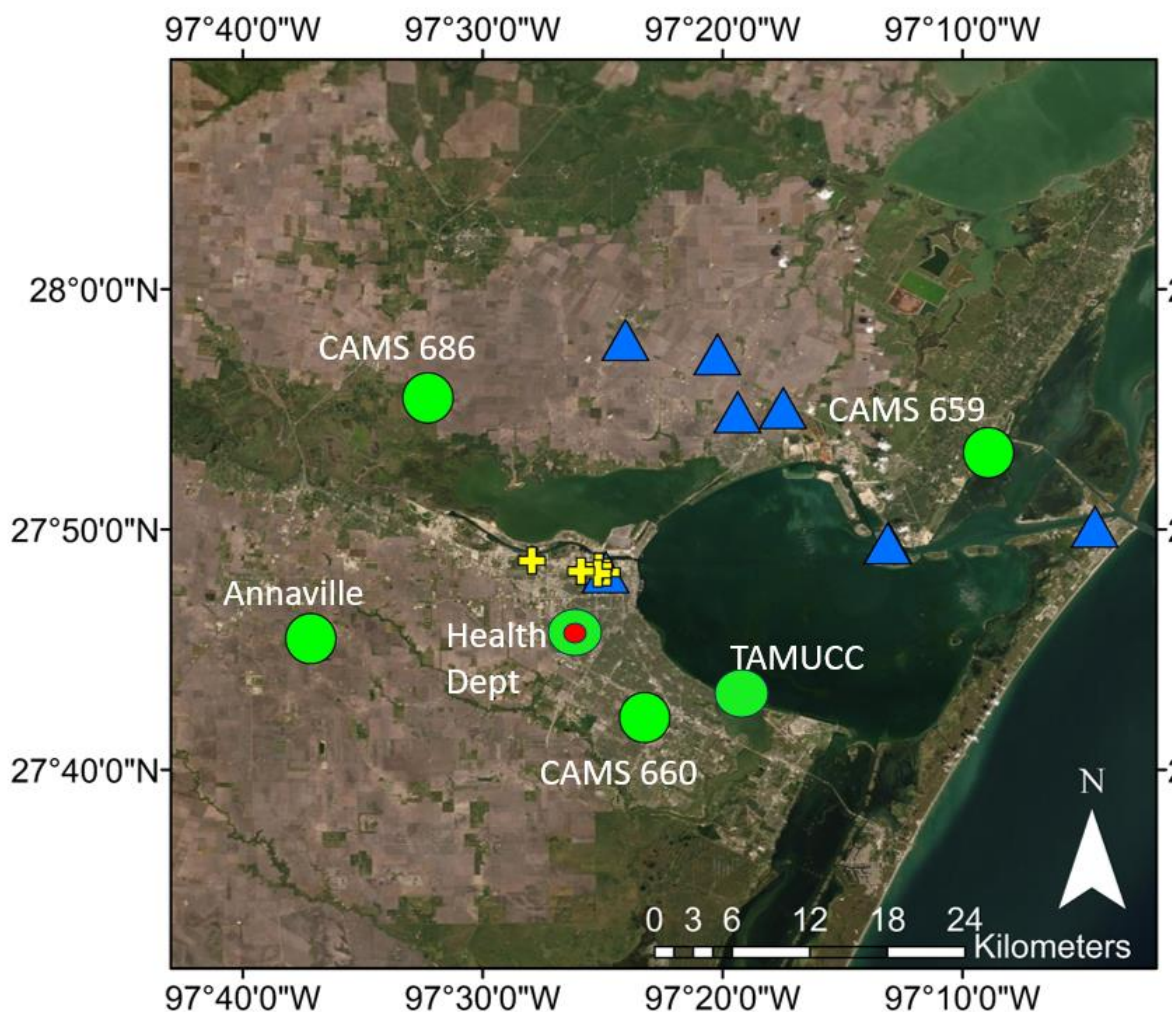
**Laptop and rugged laptop (\$5,500):** Regular laptop for instrument calibration and reporting in lab. Rugged field laptop for field instrumentation maintenance, calibration and data collection.

**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 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 <sub>x</sub> 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, <sup>†</sup> Teledyne API N500 NO <sub>x</sub> 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 <sup>†</sup> Teledyne N500 at company for fix under warranty
Odem site (CAMS 686)	Teledyne API T400 ozone analyzer, <sup>†</sup> Teledyne API N500 NO <sub>x</sub> 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 <sup>†</sup> Teledyne N500 at company for fix under warranty
Annaville site	Teledyne API T400 ozone analyzer, Ecotech NO <sub>x</sub> 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 <sub>x</sub> 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 circle 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<sub>x</sub> 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
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**Aluminum plate shelter (\$19,900):** The same Ambilab air conditioned aluminum plate enclosure installed at the other air monitoring sites.

**NO<sub>x</sub> analyzers (Total \$20,000):** Ecotech Sirinus NO<sub>x</sub> 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 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<sub>3</sub>, NO, NO<sub>x</sub>, NO<sub>y</sub>, CO, SO<sub>2</sub>, HCHO, CH<sub>4</sub>, unspciated sum of reactive alkenes, bulk and specific VOCs via AROMA-VOC, 3-wavelength PM<sub>2.5</sub> scattering and absorption, PM<sub>2.5</sub> size distribution (0.13-2.5 µm), ceilometer, jNO<sub>2</sub>, 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**

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

#### **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 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**

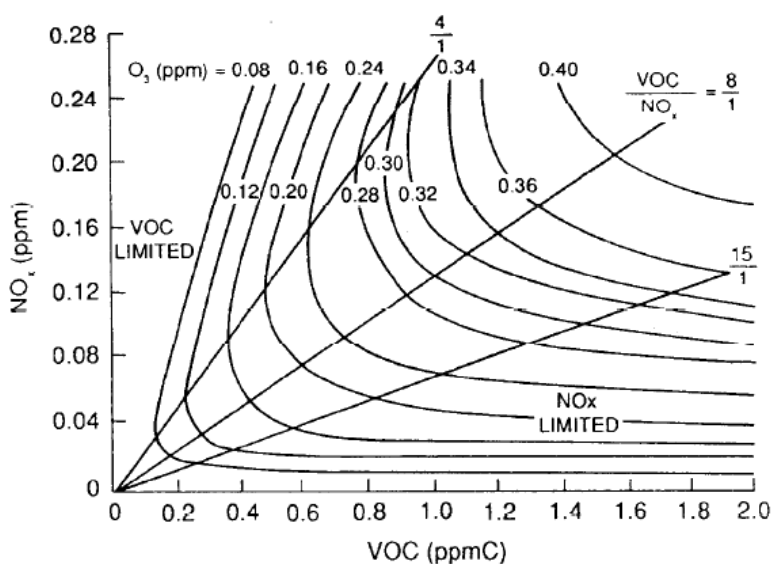
**Task 1 Total Deliverable Cost \$280,341.00**

**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<sub>x</sub> 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, PM<sub>2.5</sub>, 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<sub>x</sub> at all five sites and VOC (CAMS1024) concentration data in order to determine NO<sub>x</sub> 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<sub>x</sub>. Isopleths can be used to determine if an airshed is VOC or NO<sub>x</sub> 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 30 <sup>th</sup> of December, March, June, & September
Final analysis report	December 2025

**Task 2 costs are included under Task 1.**

### Task 3: Soil biogenic NO<sub>x</sub> flux characterization

A primary purpose of Rider 7 funds is to enhance ozone precursor emission inventory accuracy. While stationary NO<sub>x</sub> sources and vehicle emissions are relatively straightforward to measure, complexity arises with sources such as biogenic emissions. SNO<sub>x</sub>, 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<sub>x</sub> (SNO<sub>x</sub>) emissions. For instance, Oikawa et al., 2015 found that the numerical models when compared to direct chamber flux studies can underestimate SNO<sub>x</sub> 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<sub>x</sub> 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<sub>x</sub> 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<sub>x</sub> 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<sub>x</sub> emissions can be reduced to stay in attainment.

### **Deliverables and Dates Task 3**

<b>Deliverables Task 3</b>	<b>Date</b>
Monthly soil NO <sub>x</sub> measurements	Monthly for duration one continuous year of the project
Model NO <sub>x</sub> 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<sub>x</sub> 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<sub>x</sub> flux

**Small trailer (Total \$10,000):** A small portable air-conditioned trailer is need to run the real-time NO<sub>x</sub> analyzers in the field to make the flux measurements. Truck rental covered in Task 1 travel.

**Task 3 Total 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**

<b>Task 4 Deliverables</b>	<b>Date</b>
Air quality presentations	TBD

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

#### **TASK 1 to 4 COVERED UNDER CONTRACTUAL COSTS**

#### **Task 5 - Project Management Activities (Program Administration)**

The Performing Party shall perform all support necessary to ensure all grant requirements are met and the activities are completed in a timely manner. This may include, but is not limited to, providing general and fiscal supervision for grant activities, administering sub-contracts, submitting reports and invoices. The Performing Party shall summarize its activities in quarterly progress reports and quarterly financial status reports described below. City of Corpus Christi staff monitoring activities will charge no more than 10% salary and fringe benefits under this Task. The progress report and quarterly invoices shall document, the accomplishments, expenditures, and milestones achieved during the prior ninety (90) days. Specifically, the quarterly progress report shall:

- I. Summarize all activities performed with respect to each task and subtask of this statement of work for the previous quarter;
2. Establish performance goals for each task and subtask for the quarter in which the report is delivered;
3. Compare accomplishments on every task and subtask to performance goals established the previous quarter;
4. Summarize any reasons why performance goals were not met, when applicable; and
5. Provide a preliminary estimate of costs by task and subtask for the reporting period.

“The grant recipients shall channel the funds to those projects most useful for the State Implementation Plan (SIP).”

#### **Deliverables and Dates Task 5:**

Quarterly progress reports (QPR) and Financial Status Reports (FSR) will be emailed to TCEQ summarizing project active and status of each relevant deliverable including cost incurred during the quarter.

<b>Deliverable Task 5</b>	<b>Deliverable Date</b>
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Task 5: Project Management Activities	
Deliverable 5.1: Quarterly progress and Financial Status Reports	Reports and Financial Status reports Quarterly Progress Reports indicated in the Grant; 30th of December, March, June and September
Deliverable 5.2: Contract Communications will be available between both parties	All reasonable times during communication will be available the performance of work and at between both parties least one month after the contract is completed. A minimum of 30 days before public meetings / events, or major task activities or development.

**Task 5 Total Costs (\$42,421)**

<b>TASK 1 to 5 Budget Breakdown</b>	
<b>Task 1 Budget</b>	<b>280,341</b>
<b>Task 2 Budget</b>	<b>0</b>
<b>Task 3 Budget</b>	<b>22,000</b>
<b>Task 4 Budget</b>	<b>0</b>
<b>TAMUCC Indirect Cost</b>	<b>79,450</b>
<b>TAMUCC Total Budget</b>	<b>381,791</b>
<b>City Total (10%)(Task 5 Budget)</b>	<b>42,421</b>
<b>Total Budget</b>	<b>424,212</b>

**Budget.** Authorized budgeted expenditures for work performed are as follows:

Budget Category	Total Cost for Work to be Performed	Portion that is Administrative Costs (must be 10% or less of Total)
<b>Salary / Wages</b>	\$42,421	\$42,421
<b>Fringe Benefits</b>		
<b>Travel</b>		
<b>Supplies</b>		
<b>Equipment</b>		
<b>Contractual</b>	\$381,791	\$0
<b>Construction</b>		
<b>Other</b>		
<b>Indirect Costs</b>		
Total	\$424,212	\$42,421

**Performing Party/Grantee:**

**City of Corpus Christi**

**By (Authorized Signature)**

\_\_\_\_\_  
Dr. Fauzia Khan

\_\_\_\_\_  
Date

**References**

Oikawa, P.Y., Ge, C., Wang, J., Eberwein, J.R., Liang, L.L., Allsman, L.A., Grantz, D.A. and Jenerette, G.D., 2015. Unusually high soil nitrogen oxide emissions influence air quality in a high-temperature agricultural region. *Nature communications*, 6(1), p.8753.

Romer, P.S., Duffey, K.C., Wooldridge, P.J., Edgerton, E., Baumann, K., Feiner, P.A., Miller, D.O., Brune, W.H., Koss, A.R., De Gouw, J.A. and Misztal, P.K., 2018. Effects of temperature-dependent NO<sub>x</sub> emissions on continental ozone production. *Atmospheric Chemistry and Physics*, 18(4), pp.2601-2614.

Sha, T., Ma, X., Zhang, H., Janecek, N., Wang, Y., Wang, Y., Castro García, L., Jenerette, G.D. and Wang, J., 2021. Impacts of Soil NO<sub>x</sub> Emission on O<sub>3</sub> Air Quality in Rural California. *Environmental science & technology*, 55(10), pp.7113-7122.