Neighborhood Air Toxics Modeling Project
For
Houston and Corpus Christi
Case # 2:11-MC-00044

Phase 1B
Monitoring Network Extension

Quarterly Report for the Period

April 1, 2016 through June 30, 2016

Submitted to

The Honorable Janis Graham Jack
United States District Court for the Southern District of Texas
Corpus Christi, Texas

Mr. John L. Jones
United States Environmental Protection Agency, Region 6
Dallas, Texas

Ms. Susan Clewis
Texas Commission on Environmental Quality, Region 14
Corpus Christi, Texas

Submitted by

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I. Introduction

On February 1, 2008, the United States District Court entered an Order (D.E. 981, Order (pp.1, 7-11)) regarding unclaimed settlement funds in Lease Oil Antitrust Litigation (No.11) Docket No. MDL No. 1206. The Court requested a detailed project proposal from Dr. David Allen, the Gertz Regents Professor in Chemical Engineering and the Director of the Center for Energy and Environmental Resources at The University of Texas at Austin (UT Austin), regarding the use of $9,643,134.80 in the Settlement Fund. The proposal was for a project titled "Neighborhood Air Toxics Modeling Project for Houston and Corpus Christi" (hereinafter "Air Toxics Project"). The Air Toxics Project was proposed in two stages. In Stage 1, UT Austin was to develop, apply, demonstrate and make publicly available, neighborhood-scale air quality modeling tools for toxic air pollutants in Corpus Christi, Texas (Phase 1A) and extend the operation of the air quality monitoring network in Corpus Christi, Texas (Phase 1B). The ambient monitoring results from Stage 1, Phase 1B were to be used in synergy with the neighborhood-scale models (Phase 1A) to improve the understanding of emissions and the spatial distribution of air toxics in the region.

On February 21, 2008, the United States District Court for the Southern District of Texas issued an order to the Clerk of the Court to distribute funds in the amount of $4,586,014.92, plus accrued interest, to UT Austin for the purposes of implementing Stage 1 of the Air Toxics Project as described in the detailed proposal submitted to the Court by UT Austin on February 15, 2008 (D.E. 998).

Under the Order to Distribute Funds in MDL No. 1206, on March 3, 2008, at the direction of the Settlement Administrator, $4,602,598.66 was disbursed to UT Austin for Stage 1 of the Project. This amount includes the interest accrued prior to distribution from the MDL No. 1206 Settlement Fund.

In Stage 2, subject to the availability of funds, it was planned that UT Austin would extend the modeling to the Houston, Texas ship channel region, develop a mobile monitoring station that could be deployed in Corpus Christi and in other regions of Texas and/or further extend the operating life of the existing stationary network in the same or a modified spatial configuration. Based on the decision of the U.S. Court of Appeals for the 5th Circuit on June 27, 2011, UT Austin will not be receiving the Stage 2 funding at any point in the future. Further, work on the modeling portion of Stage 1 (Phase 1A) was completed June 30, 2011. Hence, all future progress reports will describe only work on Stage 1, Phase 1B (extending the operation of the air quality monitoring network).

The air quality monitoring network was originally authorized on October 1, 2003, when the United States District Court for the Southern District of Texas issued an order to the Clerk of the Court to distribute funds in the amount of $6,700,000, plus interest accrued, to The University of Texas at Austin (UT Austin) to implement the court ordered condition of probation (COCP) project *Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation* (Project). Those funds have been expended. Funding for the air quality monitoring network originally created for the COCP Project is now provided through Stage 1, Phase 1B of the Air Toxics Project.

This Stage 1, Phase 1B quarterly report has been prepared pursuant to the requirements of the Air Toxics project and is being submitted to the United States District Court, the United States Environmental Protection Agency (EPA), and the Texas Commission on Environmental Quality (TCEQ).

II. Air Toxics Project – Stage 1 - Phase 1B Overview

Phase 1B of the project reserved approximately 65% of the initial Stage 1 project funds, or approximately $3 million, to extend the operation of the Corpus Christi ambient air monitoring network. Under Phase 1B, the project team will use these funds to continue the operation and maintenance of the monitoring network initiated under the Corpus Christi Air Monitoring and Surveillance Camera Project.

III. Air Toxics Project – Stage 1 – Phase 1B Progress Report

The focus of work during the quarter ending June 30, 2016, has been directed to the following activities funded by the Stage 1, Phase 1B extension of the Corpus Christi Air Monitoring network.

A. Operations and Maintenance Phase of the Project

The Project had consisted of a network of six (6) air monitoring stations with air monitoring instruments and surveillance camera equipment. A map showing locations of the COCP Project monitoring sites along with TCEQ sites appears in Figure 1, on page 4. Table 1, on pages 4 and 5, identifies the location and instrumentation found at each of the COCP Project sites. TCEQ sites and some of the sites farther from the COCP area than the TCEQ sites, operated by Texas A&M at Kingsville (TAMUK), provide additional data used in these analyses.

Figure 1. Corpus Christi Monitoring Sites, "X" marks site terminated in 2012

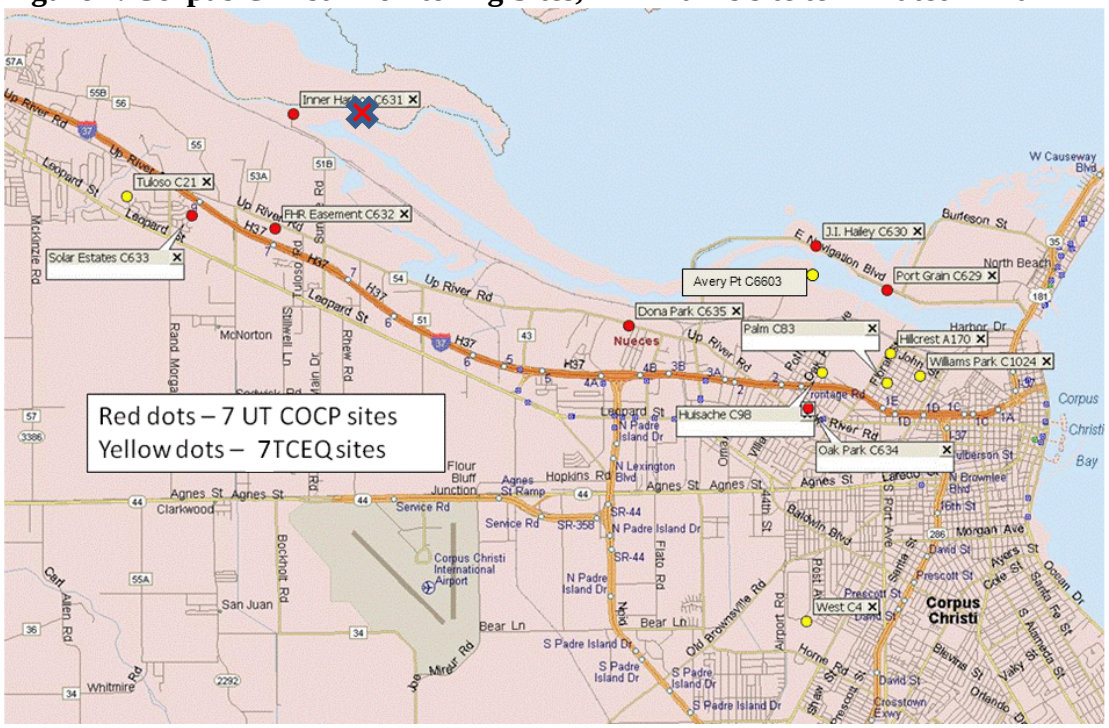

Table 1. Schedule of UT Air Monitoring Sites, Locations and Major Instrumentation

TCEQ CAMS#	Description of Site Location	Monitoring Equipment				
		Auto GC	**TNMHC(T) Canister(C)**	**H_2S & SO_2**	**Met Station**	**Camera**
634	Oak Park Recreation Center (**OAK**)	3/05 to 5/16	C: 12/04 to 2/09 T: 12/04 to 4/12		12/04 to 5/16	
629	Grain Elevator @ Port of Corpus Christi (**CCG**)		T&C: 12/04 to 5/16	12/004 to 5/16	12/04 to 5/16	
630	J. I. Hailey Site @ Port of Corpus Christi (**JIH**)		T&C: 12/04 to 5/16	12/04 to 5/16	12/04 to 5/16	
635	TCEQ Monitoring Site C199 @ Dona Park (**DPK**)		T&C: 12/04 to 5/16	12/04 to date	12/04 to date	1/05 to 5/16
632	Off Up River Road on Flint Hills Resources Easement (**FHR**)		T&C: 12/04 to 5/16	12/04 to 5/16	12/04 to 5/16	
633	Solar Estates Park at end of Sunshine Road (**SOE**)	Mar 2005 to date	C: 12/04 to 2/09 T: 12/04 to 4/12	12/04 to 5/16	12/04 to date	1/05 to 5/16
631	*Port of Corpus Christi on West End of CC Inner Harbor (**WEH**) (site terminated)*		T&C: 12/04 to 5/12	12/04 to 5/12	12/04 to 5/12	

Legend

- CAMS: continuous ambient monitoring station
- Auto GC: automated gas chromatograph
- TNMHC: total non-methane hydrocarbon analyzer (all except CAMS 634 & 633 also have canister hydrocarbon samplers)

Table 1 (Continued)
Legend

- H_2S: hydrogen sulfide analyzer
- SO_2: sulfur dioxide analyzer
- Met Station: meteorology station consisting of measurement instruments for wind speed, wind direction, ambient air temperature and relative humidity
- Camera: surveillance camera

A detailed description of the data analyses and findings for this quarter appears in Appendix A, on pages 9 through 22. Specifically, the appendix contains the following elements:

- **Auto-GC Data Summary** – In examining the validated data for 2016 hourly auto-GC data from Oak Park, Solar Estates, and the TCEQ's Palm site, no individual measurements were found to have exceeded a short-term air monitoring comparison value (AMCV). A summary of data appears on pages 14 through 18.

- **Benzene Summary** – A review of eleven years of data is presented, which appears on pages 19 through 20.

- **SO_2 and H_2S Summary** – A summary of SO_2 and H_2S data collection in 2016 is presented on pages 20 through 21.

Future Quarterly Reports
This will be the last quarterly report that includes an analysis of the data from the Corpus Christi air monitoring sites now that operations funded by this project have ended. A final report documenting the 13 years of project activity, including more than 11 years of data collection and analysis, will be prepared and submitted later this year.

B. Project Management and Planning

Project Management and Planning during this period has focused on the following five (5) major activities.

1. **Air Monitoring Operations**
   Operations and maintenance of the six monitoring sites reporting data via the TCEQ LEADS concluded on May 21, 2016. The data can be accessed and reviewed at the project website (http://www.utexas.edu/research/ceer/ccaqp/).

2. **Communication and Reporting**
   The status of the Project has been communicated through the website, which is operational with portions under continual updating, quarterly and annual reports, and meetings of a Community Advisory Board.

3. **Budget Monitoring**
   Budget monitoring during the period has focused on projects costs for Stage 1, Phase 1B – Sites Operation and Maintenance costs. Financial reports for the quarter are included in Appendix B, on pages 23 through 25.

4. **Other Contributions**
   There were no other contributions made to the project during this quarter.

5. **Decommissioning and Transitioning of Sites**
   The decommissioning schedule established for the project is shown below.

Decommissioning Schedule

May 2016	Discontinue operation of sites and conduct final Quality Assurance Audits
June thru September 2016	Decommission sites and prepare project final report
November 2016	Submit project final report
December 2016	Close out project account

Project personnel began the process of decommissioning four of the project sites (Oak Park – C634, FHR – C632, JI Hailey – C630, and Port Grain – C629) by discontinuing their operations on May 21, 2016, leaving the two remaining sites (Solar Estates – C633 and Dona Park – C635) operational as funding was identified to continue operations of these two sites until May 2017. The cost of operations for Solar Estates and Dona Park was transferred to this new funding source effective May 21, 2016.

After discontinuing operations at Oak Park, FHR, JI Hailey, and Port Grain, final audits were conducted, equipment was disconnected, equipment condition was assessed and equipment was prepared for transit to Austin or stored at the Dona Park or Solar Estates sites for use as spares. The shelters and site improvements made when the sites were established were removed. Work will continue in the next quarter to restore the sites to their original condition and the satisfaction of the property owner.

III. Financial Report

As required, the following financial summary information is provided. Details supporting this financial summary are included in Appendix B, on pages 23 through 25.

A. <u>Total Amount of Air Toxics Project Funds and Other Funds Received Under the Project</u>
   The total amount of Air Toxics Project funds received through June 30, 2016 equals $3,138,592.92. This total includes interest earned through June 30, 2016.

B. Detailed List of the Actual Expenditures Paid from Air Toxics Project Funds Stage 1, Phase 1B through June 30, 2016
Expenditures of Air Toxics Project funds during this quarter totaled $162,509.64. The funds remaining in the Air Toxics account (not spent for Stage 1, Phase 1A) are in a separate account so that separate financial reports can be generated.

C. Total Interest Earned on Air Toxics Project Funds through June 30, 2016
The interest earned during this quarter totaled $250.51. The Air Toxics Project total interest earned through June 30, 2016 equals $393,221,24. A report providing detailed calculations of the interest earned on the Air Toxics Project funds are included in Appendix B, on pages 23 through 25.

D. Balance as of June 30, 2016, in the Air Toxics Project Account
The balance in the Air Toxics Project account, including interest earned totals $196,652.54.

E. Anticipated Expenditures for the Funds Remaining in the Air Toxics Project Account – Stage 1, Phase 1A
There are no additional expenditures anticipated for Stage 1, Phase 1A.

F. Anticipated Expenditures for the Funds Remaining in the Air Toxics Project Account – Stage 1, Phase 1B
All funds remaining after the close of Stage 1, Phase 1A have been allocated to Stage 1, Phase 1B, and the extension of the operation of the Corpus Christi ambient monitoring network, which includes expenditures for decommissioning of the sites and restoration of them to pre-project conditions.

The Stage 1, Phase 1A Neighborhood Air Toxics Modeling Project was originally allocated a budget of $2,277,564. As of June 30, 2011, final expenditures on Phase 1A totaled $1,863,081.22. The remaining funds totaling $414,482.78 were transferred, with the Court's permission, to a new account to allow for easier tracking of the expenses as they are utilized for Stage 1, Phase 1B, the extension of the Corpus Christi Air Monitoring Project.

Quarterly Report Distribution List:

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Members of the Community Advisory Board of the *Corpus Christi Air Monitoring and Surveillance Camera Project*

APPENDIX A

Data Analysis for Corpus Christi Quarterly Report

April 1, 2016 through June 30, 2016

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Data Analysis for Corpus Christi Quarterly Report

This technical report describes results of the monitoring and analysis of data under the Air Toxics Project Stage 1, Phase 1B. The primary focus is on the period April 1 through June 30, 2016. Monitoring operations ended on May 21, 2016. The monitoring network is shown earlier in this report in Figure 1, on page 4, and is described in Table 2, below. This report contains the following elements:

- A summary of Oak Park, Solar Estates, and Palm (TCEQ) auto-GC data for 2016,
- Information on the trends for benzene concentrations at the two project auto-GCs in residential areas, and
- A summary of sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) monitoring.

Table 2. Schedule of air monitoring sites, locations and major instrumentation

TCEQ CAMS#	Description of Site Location	Monitoring Equipment				
		Auto GC	**TNMHC(T) Canister(C)**	**H_2S & SO_2**	**Met Station**	**Camera**
634	Oak Park Recreation Center (**OAK**)	3/05 to 5/16	C: 12/04 to 2/09 T: 12/04 to 4/12		12/04 to 5/16	
629	Grain Elevator @ Port of Corpus Christi (**CCG**)		T&C: 12/04 to 5/16	12/04 to 5/16	12/04 to 5/16	
630	J. I. Hailey Site @ Port of Corpus Christi (**JIH**)		T&C: 12/04 to 5/16	12/04 to 5/16	12/04 to 5/16	
635	TCEQ Monitoring Site C199 @ Dona Park (**DPK**)		T&C: 12/04 to 5/16	12/04 to date	12/04 to date	1/05 to 5/16
632	Off Up River Road on Flint Hills Resources Easement (**FHR**)		T&C: 12/04 to 5/16	12/04 to 5/16	12/04 to 5/16	
633	Solar Estates Park at end of Sunshine Road (**SOE**)	3/05 to date	C: 12/04 to 2/09 T: 12/04 to 4/12	12/04 to 5/16	12/04 to date	1/05 to 5/16
631	*Port of Corpus Christi on West End of CC Inner Harbor (**WEH**) (site terminated)*		T&C: 12/04 to 5/12	12/04 to 5/12	12/04 to 5/12	

Legend

- CAMS: continuous ambient monitoring station
- Auto GC: automated gas chromatograph
- TNMHC: total non-methane hydrocarbon analyzer (all except CAMS 634 & 633 also have canister hydrocarbon samplers)
- H_2S: hydrogen sulfide analyzer
- SO_2: sulfur dioxide analyzer
- Met Station: meteorology station consisting of measurement instruments for wind speed, wind direction, ambient air temperature and relative humidity
- Camera: surveillance camera

Glossary of terms

- **Pollutant concentrations** – Concentrations of most gaseous pollutants are expressed in units denoting their "mixing ratio" in air; i.e., the ratio of the number molecules of the pollutant to the total number of molecules per unit volume of air. Because concentrations for all gases other than molecular oxygen, nitrogen, and argon are very low, the mixing ratios are usually scaled to express a concentration in terms of "parts per million" (ppm) or "parts per billion" (ppb). Sometimes the units are explicitly expressed as ppm-volume (ppmV) or ppb-volume (ppbV) where 1 ppmV indicates that one molecule in one million molecules of ambient air is the compound of interest and 1 ppbV indicates that one molecule in one billion molecules of ambient air is the compound of interest. In general, air pollution standards and health effects screening levels are expressed in ppmV or ppbV units. Because hydrocarbon species may have a chemical reactivity related to the number of carbon atoms in the molecule, mixing ratios for these species are often expressed in ppb-carbon (ppbV times the number of carbon atoms in the molecule), to reflect the ratio of carbon atoms in that species to the total number of molecules in the volume. This is relevant to our measurement of auto-GC species and TNMHC, which are reported in ppbC units. For the purpose of relating hydrocarbons to health effects, this report notes hydrocarbon concentrations in converted ppbV units. However, because TNMHC is a composite of all species with different numbers of carbons, it cannot be converted to ppbV. Pollutant concentration measurements are time-stamped based on the start time of the sample, in Central Standard Time (CST), with sample duration noted.

- **Auto-GC** – The automated gas chromatograph collects a sample for 40 minutes, and then automatically analyzes the sample for a target list of 46 hydrocarbon species. At the outset of this project, a set of 27 species were selected for tracking. These include benzene and 1,3-butadiene, which are air toxics, various species that have relatively low odor thresholds, and a range of gasoline and vehicle exhaust components. Auto-GCs have operated at Solar Estates, CAMS 633, and Oak Park, CAMS 634, since March 2005. In June 2010 TCEQ began operating an auto-GC at Palm, CAMS 83, at 1511 Palm Drive in the Hillcrest neighborhood.

- **Total non-methane hydrocarbons (TNMHC)** – TNMHC represent a large fraction of the total volatile organic compounds released into the air by human and natural processes. TNMHC is an unspeciated total of all hydrocarbons, and individual species must be resolved by other means, such as with canisters or auto-GCs. However, the time resolution of the TNMHC instrument is much shorter than the auto-GC, and results are available much faster than with canisters. TNMHC analyzers operate at the sites that do not take continuous hydrocarbon measurements with auto-GCs (CAMS 629, 630, 632, and 635).

- **Canister** – Electro-polished stainless steel canisters are filled with air samples when an independent sensor detects that *elevated* (see below) levels of hydrocarbons (TNMHC) are present. Samples are taken for 20 minutes to try to capture the chemical make-up of the air. In most cases, the first time on any day that the monitored TNMHC concentration exceeds 2,000 ppbC at a site for a continuous period of 15 minutes or more, the system

will trigger and a sample will be collected. Samples are sent to UT Austin and are analyzed in a lab to resolve some 60 hydrocarbon and 12 chlorinated species. Canister samplers operate at the four active sites that do not take continuous hydrocarbon measurements with auto-GCs (CAMS 629, 630, 632, and 635).

- **Air Monitoring Comparison Values (AMCV) –** The TCEQ uses AMCVs in assessing ambient data. Two valuable online documents ("Fact Sheet" and "Uses of ESLs and AMCVs Document") that explain AMCVs are at http://www.tceq.texas.gov/toxicology/AirToxics.html (accessed July 2016). The following text is an excerpt from the TCEQ "Fact Sheet" document:

  > Effects Screening Levels are chemical-specific air concentrations set to protect human health and welfare. Short-term ESLs are based on data concerning acute health effects, the potential for odors to be a nuisance, and effects on vegetation, while long-term ESLs are based on data concerning chronic health and vegetation effects. Health-based ESLs are set below levels where health effects would occur whereas welfare-based ESLs (odor and vegetation) are set based on effect threshold concentrations. The ESLs are screening levels, **not ambient air standards.** Originally, the same long- and short-term ESLs were used for both air permitting and air monitoring.
  >
  > There are significant differences between performing health effect reviews of air permits using ESLs, and the various forms of ambient air monitoring data. The Toxicology Division is using the term "air monitoring comparison values" (AMCVs) in evaluations of air monitoring data in order to make more meaningful comparisons. "AMCVs" is a collective term and refers to all odor-, vegetative-, and health-based values used in reviewing air monitoring data. Similar to ESLs, AMCVs are chemical-specific air concentrations set to protect human health and welfare. Different terminology is appropriate because air *permitting* and air *monitoring* programs are different.

- **Rationale for Differences between ESLs and AMCVs** – A very specific difference between the permitting program and monitoring program is that permits are applied to one company or facility at a time, whereas monitors may collect data on emissions from several companies or facilities or other source types (e.g., motor vehicles). Thus, the protective ESL for permitting is set lower than the AMCV in anticipation that more than one permitted emission source may contribute to monitored concentrations.

- **National Ambient Air Quality Standards (NAAQS) –** U.S. Environmental Protection Agency (EPA) has established a set of standards for several air pollutions described in the Federal Clean Air Act. NAAQS are defined in terms of *levels* of concentrations and particular *forms*. For example, the NAAQS for particulate matter with size at or less than 2.5 microns ($PM_{2.5}$) has a *level* of 12 micrograms per cubic meter averaged over 24-hours, and a *form* of the annual average based on four quarterly averages, averaged over three years. Individual concentrations measured above the level of the NAAQS are called *exceedances*. The number calculated from a monitoring site's data to compare to the level of the standard is called the site's *design value,* and the highest design value in the area for a year is the regional design value used to assess overall NAAQS compliance. A monitor or a region that does not comply with a NAAQS is said to be *noncompliant.* At some point after a monitor or region has been in noncompliance, the U.S. EPA may

choose to label the region as *nonattainment*. A nonattainment designation triggers requirements under the Federal Clean Air Act for the development of a plan to bring the region back into compliance.

A more detailed description of NAAQS can be found on the EPA's Website at https://www.epa.gov/criteria-air-pollutants/naaqs-table (accessed July 2016).

One species measured by this project and regulated by a NAAQS is sulfur dioxide (SO_2). EPA set the SO_2 NAAQS to include a level of 75 ppb averaged over one hour, with a form of the three-year average of the annual 99th percentiles of the daily maximum one-hour averages. If measurements are taken for a full year at a monitor, then the 99th percentile would be the fourth highest daily one hour maximum. There is also a secondary SO_2 standard of 500 ppb over three hours, not to be exceeded more than once in any one year.

- **Elevated Concentrations** – In the event that measured pollutant concentrations are above a set threshold they are referred to as "elevated concentrations." The values for these thresholds are summarized by pollutant below. As a precursor to reviewing the data, the reader should understand the term "*statistical significance*." In the event that a concentration is higher than one would typically measure over, say, the course of a week, then one might conclude that a specific transient assignable cause may have been a single upwind pollution source, because experience shows the probability of such a measurement occurring under normal operating conditions is small. Such an event may be labeled "statistically significant" at level 0.01, meaning the observed event is rare enough that it is not expected to happen more often than once in 100 trials. This does not necessarily imply the occurrence of a violation of a health-based standard. A discussion of "elevated concentrations" and "statistical significance" by pollutant type follows:

    - For H_2S, any measured concentration greater than the level of the state residential standards, which is 80 ppb over 30 minutes, is considered "elevated." For SO_2, any measured concentration greater than the level of the NAAQS, which is 75 ppb over one hour, is considered "elevated." Note that the concentrations of SO_2 and H_2S need not persist long enough to constitute an exceedance of the standard to be regarded as elevated. In addition, any closely spaced values that are statistically significantly (at 0.01 level) greater than the long-run average concentration for a period of one hour or more will be considered "elevated" because of their unusual appearance, as opposed to possible health consequence. The rationale for doing so is that unusually high concentrations at a monitor may suggest the existence of unmonitored concentrations closer to the source area that are potentially above the state's standards.
    - For TNMHC, any measured concentration greater than the canister triggering threshold of 2,000 ppbC is considered "elevated." Note that the concentrations need not persist long enough to trigger a canister (900 seconds) to be considered elevated.
    - For benzene and other air toxics in canister samples or auto-GC measurements, any concentration above the AMCV is considered "elevated." Note that 20-

minute canister samples and 40-minute auto-GC measurements are both compared with the short-term AMCV.

- Some hydrocarbon species measured in canister samples or by the auto-GC generally appear in the air in very low concentrations close to the method detection level. Similar to the case above with H_2S and SO_2, any values that are statistically significantly (at 0.01 level) greater than the long-run average concentration at a given time or annual quarter will be considered "elevated" because of their unusual appearance, as opposed to possible health consequence. The rationale for doing so is that unusually high concentrations at a monitor may suggest an unusual emission event in the area upwind of the monitoring site.

1. Auto-GC Data Summaries in Residential Areas

In this section, the results of semi-continuous sampling for 27 hydrocarbon species that are assessed in this project at the three Corpus Christi auto-GC sites – UT's Solar Estates, CAMS 633 (C633), UT's Oak Park, CAMS 634 (C634), and TCEQ's Palm, CAMS 83 (C83), – are presented. These three sites are located in residential areas. Solar Estates and Oak Park are generally downwind of industrial emissions under northerly winds. Palm, located near the TCEQ's Hillcrest and Williams Park sites in Figure 1, on page 4, is generally downwind of industries under northerly and westerly winds. In examining the aggregated data, one observes similar patterns of hydrocarbon species concentrations at all three sites.

Table 3, on page 15, lists the data completeness of the two project auto-GCs from January 2014 through the most recent month of data validation (May 2016). When data are missing, the reason is generally owing to quality assurance steps or maintenance procedures. The project regularly exceeds the minimum 75 percent data recovery goal. However, in May 2015 the Oak Park auto-GC suffered significant loss of data, reducing data completeness for the month to 45 percent. Equipment problems were corrected in late May 2015, and monthly data completeness since then has been between 86 and 100 percent.

Table 3. Percent data recovery by month, 2014-2016

Month	Oak Park	Solar Est.	Month	Oak Park	Solar Est.	Month	Oak Park	Solar Est.
Jan-14	97	96	Jan-15	93	100	Jan-16	97	100
Feb-14	99	100	Feb-15	96	100	Feb-16	100	100
Mar-14	93	97	Mar-15	98	100	Mar-16	88	97
Apr-14	98	100	Apr-15	88	97	Apr-16	99	82
May-14	95	98	May-15	45**	99	May-16	96	99
Jun-14	100	84*	Jun-15	100	100			
Jul-14	80*	100	Jul-15	100	85*			
Aug-14	96	99	Aug-15	99	98			
Sep-14	99	100	Sep-15	87*	99			
Oct-14	98	98	Oct-15	86	99			
Nov-14	99	99	Nov-15	98	100			
Dec-14	98	100	Dec-15	94	100			
Average 2014	**96**	**98**	**Average 2015**	**90**	**98**	**Average 2016**	**96**	**96**

* Months with planned/routine preventive maintenance
** Significant data loss owing to equipment malfunction

Table 4, on page 16, summarizes the statistics (maximum and average (mean) values) on fully validated data from the 1st quarter of 2016. Data in this table are available to TCEQ staff at http://rhone.tceq.texas.gov/cgi-bin/agc_summary.pl (accessed July 2016). Table 5, on page 17, summarizes the statistics (maximum and average (mean) values) on fully validated data from the 2nd quarter of 2016. The rows for ***benzene*** are bold-faced in Tables 4 and 5 owing to the concern that the concentrations for this species tend to be closer to the AMCV than are concentrations of other species. The benzene short-term AMCV is 180 ppbV and the benzene long-term AMCV is 1.4 ppbV. There were no valid measurements of n-hexane from the TCEQ's Palm site in the 1st quarter.

All concentration values in Tables 4 and 5 are in ppbV units. No individual concentrations or averages of concentrations from the 27 species were greater than TCEQ's air monitoring comparison values (AMCV).

The mean concentration data columns in Table 4 are shown graphically in Figure 2, on page 18, to allow a visual comparison of the average concentrations from the 1st quarter of 2016 across the three sites. In Figure 3, on page 18, the mean concentrations from the 2nd quarter of 2016 through May 21 from Table 5 are shown graphically. For both graphs in Figures 2 and 3, the y-axes are the same to facilitate making comparisons between quarters.

Table 4. Validated auto-GC statistics, 1st quarter 2016

Units ppbV	Oak 1Q16			Solar 1Q16			Palm 1Q16		
Species	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**
Ethane	156	35.41	7.07	116.35	51.68	10.28	113.694	57.687	9.998
Ethylene	14.432	2.569	0.31	4.158	1.12	0.348	21.718	2.682	0.473
Propane	181.59	32.99	5.7	76.478	34.33	6.085	1,040.34	71.593	6.351
Propylene	7.443	1.121	0.27	31.727	1.802	0.245	17.848	2.031	0.265
Isobutane	56.752	7.649	2.03	18.915	6.879	1.626	108.625	11.071	2.223
n-Butane	97.951	16.12	3.78	32.611	14.89	2.901	361.031	28.499	4.336
t-2-Butene	0.995	0.27	0.07	2.587	0.201	0.027	4.736	0.764	0.104
1-Butene	1.378	0.231	0.06	2.136	0.186	0.024	3.746	0.328	0.1
c-2-Butene	0.711	0.242	0.07	2.087	0.182	0.033	5.503	0.505	0.089
Isopentane	69.32	9.243	1.82	17.977	4.615	1.184	270.415	19.7	1.963
n-Pentane	28.532	6.303	1.3	9.869	4.291	0.907	20.641	6.084	1.079
1,3-Butadiene	0.523	0.083	0.03	3.88	0.465	0.024	2.681	0.155	0.031
t-2-Pentene	0.606	0.12	0.03	0.625	0.053	0.008	2.03	0.391	0.07
1-Pentene	0.352	0.094	0.02	0.299	0.034	0.005	0.996	0.192	0.036
c-2-Pentene	0.261	0.062	0.02	0.314	0.025	0.003	1.084	0.18	0.032
n-Hexane	115.54	25.76	0.91	3.19	1.232	0.308	*	*	*
Benzene	**6.221**	**1.237**	**0.3**	**1.164**	**0.439**	**0.136**	**9.189**	**1.051**	**0.236**
Cyclohexane	8.94	1.567	0.34	1.523	0.409	0.12	6.949	0.706	0.148
Toluene	7.514	1.639	0.37	1.66	0.485	0.15	10.099	1.243	0.294
Ethyl Benzene	1.662	0.178	0.05	0.908	0.076	0.015	0.561	0.148	0.028
m&p -Xylene	7.135	0.663	0.16	4.316	0.552	0.125	2.051	0.639	0.136
o-Xylene	1.917	0.175	0.05	1.291	0.095	0.015	0.794	0.193	0.043
Isopropyl Benzene	1.724	0.216	0.03	1.433	0.12	0.01	0.691	0.223	0.011
1,3,5-Tri-methylbenzene	0.665	0.149	0.02	0.13	0.032	0.004	0.422	0.101	0.016
1,2,4-Tri-methylbenzene	1.041	0.167	0.04	0.201	0.051	0.009	1.114	0.241	0.039
n-Decane	2.019	0.299	0.03	0.424	0.069	0.016	0.579	0.136	0.026
1,2,3-Tri-methylbenzene	0.58	0.081	0.02	0.113	0.025	0.001	0.292	0.069	0.015

*No valid measurements this quarter.

Table 5. Partially-validated auto-GC mean statistics, 2nd quarter 2016 (through May 21)

Units ppbV	Oak 2Q16			Solar 2Q16			Palm 2Q16		
Species	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**
Ethane	59.406	9.469	3.58	40.229	12.95	5.674	49.071	14.491	4.613
Ethylene	27.432	2.126	0.25	2.251	0.625	0.228	31.356	2.187	0.305
Propane	87.255	9.676	2.43	20.726	7.042	3.223	40.796	8.702	2.236
Propylene	16.379	1.284	0.19	4.45	0.517	0.167	4.784	0.812	0.117
Isobutane	210.4	29.45	1.57	15.919	2.367	1.058	16.744	3.914	0.833
n-Butane	97.333	7.408	1.73	16.956	4.186	1.708	48.131	6.875	1.416
t-2-Butene	7.477	0.797	0.09	0.224	0.046	0.019	2.872	0.333	0.05
1-Butene	4.95	0.349	0.05	0.223	0.039	0.019	3.281	0.364	0.062
c-2-Butene	6.634	0.855	0.08	0.361	0.054	0.022	3.484	0.425	0.045
Isopentane	53.981	8.6	1.27	60.919	4.187	1.102	42.166	6.146	0.92
n-Pentane	44.439	4.347	0.77	57.441	3.711	0.83	24.249	3.845	0.554
1,3-Butadiene	2.808	0.17	0.02	0.309	0.045	0.012	2.412	0.154	0.014
t-2-Pentene	3.614	0.602	0.04	0.181	0.023	0.007	2.605	0.282	0.029
1-Pentene	2.416	0.418	0.03	0.127	0.018	0.005	2.561	0.28	0.017
c-2-Pentene	1.499	0.253	0.02	0.087	0.011	0.003	1.324	0.137	0.011
n-Hexane	41.248	3.233	0.32	4.435	0.992	0.273	9.927	1.149	0.26
Benzene	**5.587**	**0.653**	**0.18**	**3.85**	**0.368**	**0.117**	**2.382**	**0.439**	**0.1**
Cyclohexane	11.132	1.25	0.23	0.809	0.199	0.09	1.922	0.351	0.06
Toluene	5.161	0.752	0.22	2.075	0.295	0.141	2.599	0.496	0.142
Ethyl Benzene	0.93	0.127	0.03	0.547	0.056	0.015	0.331	0.055	0.011
m&p -Xylene	3.227	0.412	0.09	1.546	0.268	0.082	1.531	0.32	0.076
o-Xylene	1.131	0.139	0.03	0.22	0.049	0.014	0.477	0.085	0.023
Isopropyl Benzene	0.833	0.087	0.02	0.604	0.075	0.008	0.091	0.023	0.002
1,3,5-Tri-methylbenzene	0.42	0.054	0.01	0.143	0.017	0.003	0.206	0.033	0.008
1,2,4-Tri-methylbenzene	0.88	0.111	0.03	0.106	0.03	0.008	0.422	0.074	0.022
n-Decane	0.518	0.057	0.01	0.323	0.057	0.015	0.334	0.052	0.013
1,2,3-Tri-methylbenzene	0.293	0.04	0.01	0.082	0.018	0.002	0.135	0.037	0.015

Figure 2. Mean concentration from Table 4 for the 1st quarter of 2016 at three auto-GCs

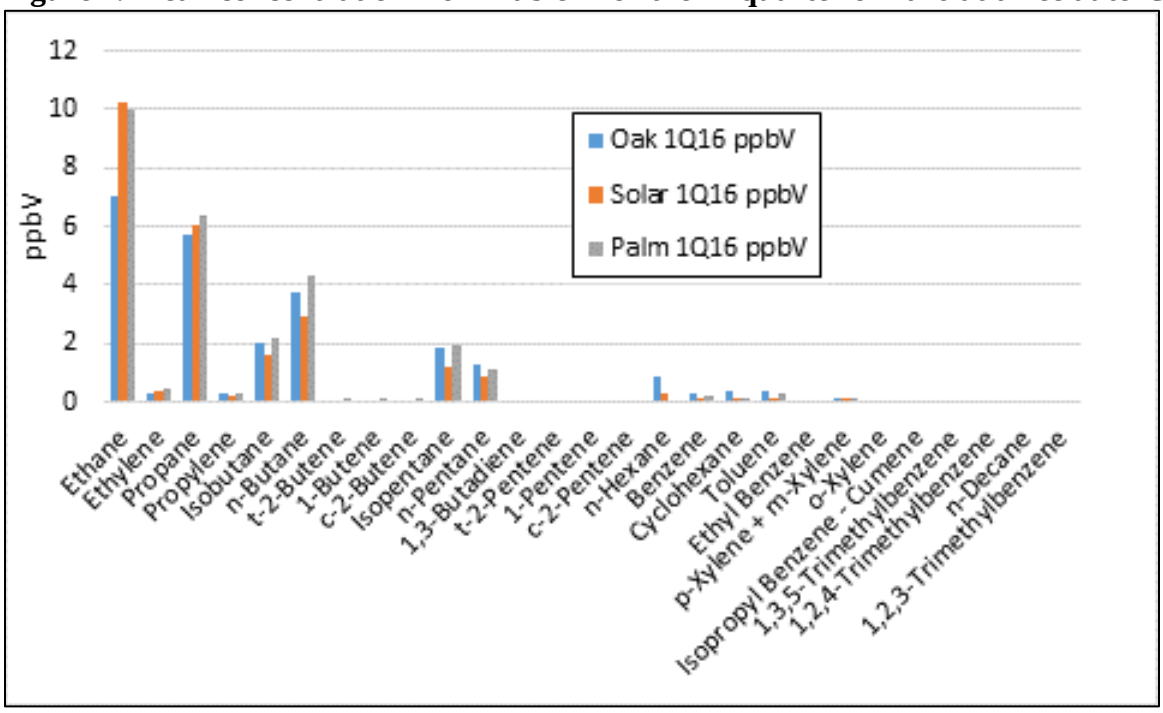
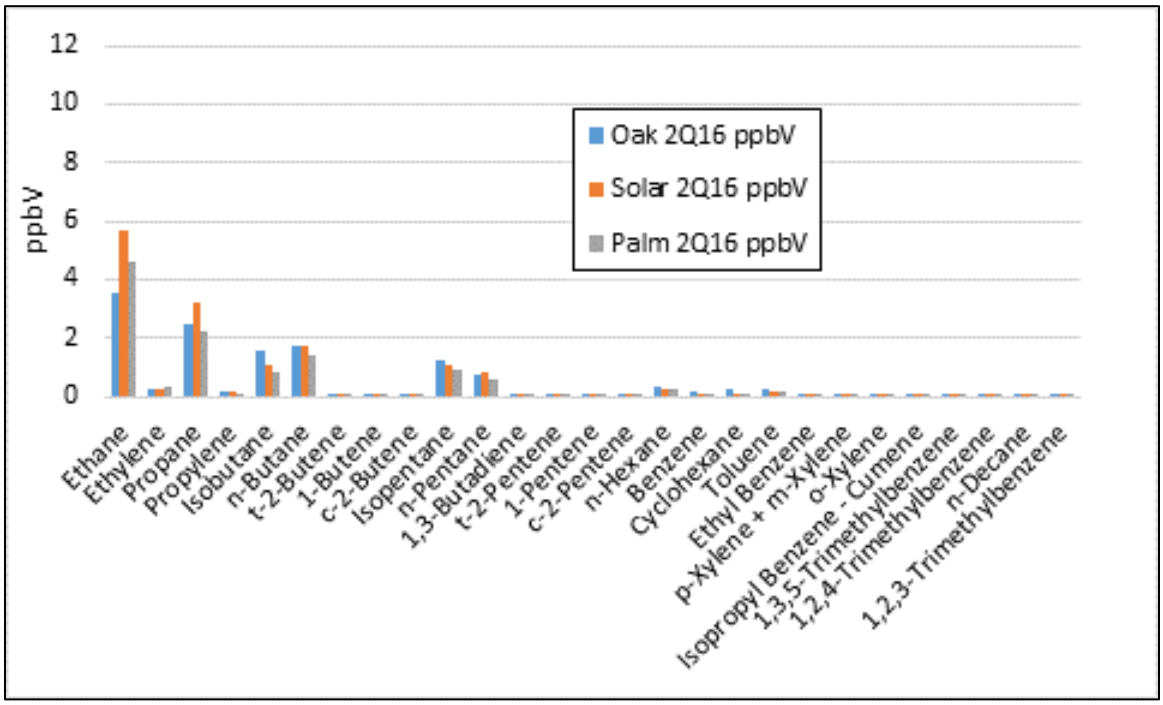


Figure 3. Mean concentration from Table 5 for the 2nd quarter of 2016 (through May 21) at three auto-GCs



2. Benzene Concentrations in Residential Areas

As has been discussed in past reports, benzene concentrations in recent years are lower than in the first three years of operation at the two auto-GCs operated at Oak Park, C634, and Solar Estates, C633. Also, in recent years (2008 through 2016), concentration averages have generally shown relatively little variation compared to earlier years. No individual one-hour benzene values have been measured above the AMCV since the beginning of monitoring.

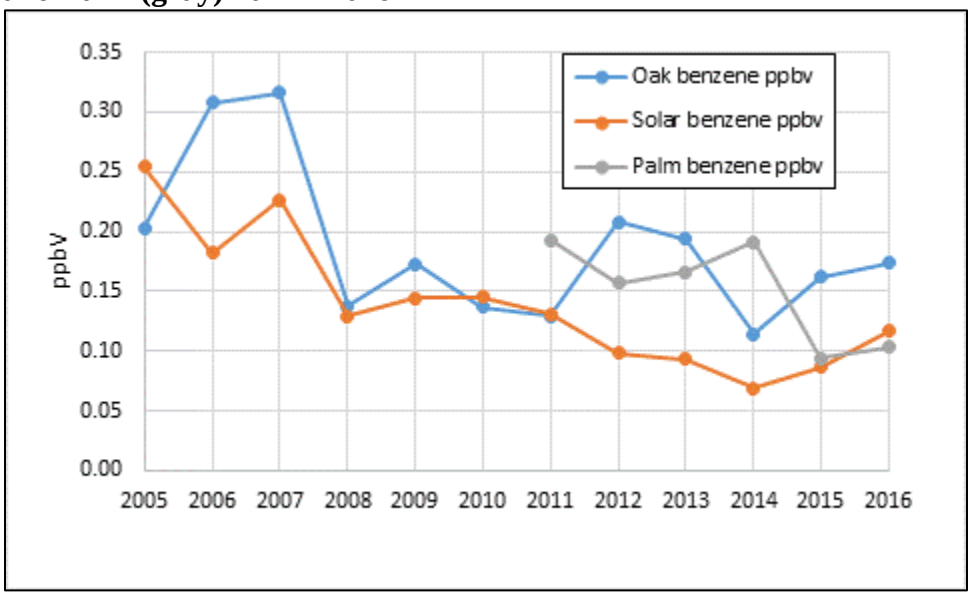
Table 6, below, shows the 2nd quarter average concentrations from the two project auto-GCs for benzene from 2005 through 2016 (through May 21), and for the TCEQ Palm site since 2011.

The second-quarter means are graphed in Figure 4, on page 20. The means for TCEQ's Palm site are shown for 2011 through 2016 only.

Table 6. Mean statistics for Benzene at Oak Park and Solar Estates, 2nd quarter 2005 – 2016, Palm 2011 – 2016, ppbV units

year	Oak Park	Solar Estates	TCEQ Palm
2005 (March only)	0.20	0.25	
2006	0.31	0.18	
2007	0.32	0.23	
2008	0.14	0.13	
2009	0.17	0.14	
2010	0.14	0.15	
2011	0.13	0.13	0.19
2012	0.21	0.10	0.16
2013	0.19	0.09	0.17
2014	0.11	0.07	0.19
2015	0.16	0.09	0.09
2016 (51 days only)	0.17	0.12	0.10

Figure 4. Mean concentrations of benzene, ppbV units, during 2nd quarters of each year (2016 only through May 21) at Oak Park (blue) and Solar Estates (orange), 2005 – 2016 and Palm (gray) 2011 – 2016



3. Sulfur Dioxide and Hydrogen Sulfide Measurements at Corpus Christi Monitors

As was mentioned earlier in this report, SO_2 ambient concentrations are regulated by the National Ambient Air Quality Standards (NAAQS) established in 2010. EPA set the SO_2 NAAQS to include a level of 75 ppb averaged over one hour, with a form of the three-year average of the annual 99th percentiles of the daily maximum one-hour averages. If measurements are taken for a full year at a monitor, then the 99th percentile would be the fourth highest daily one hour maximum. Individual hourly concentrations measured above the SO_2 75 ppb level of the NAAQS are called *exceedances*. The average of the three years 99th percentile daily maxima at a monitoring site is that site's *design value*. There is also a secondary SO_2 standard of 500 ppb over three hours, not to be exceeded more than once in any one year; however, concentrations this high have not been measured by TCEQ or UT monitors. The TCEQ also has a shorter 30-minute rolling average net ground level standard of 400 ppb that may not be added by an individual emission source on top of a background concentration. Concentrations this high have not been measured by TCEQ or UT monitors in Corpus Christi.

The maximum one-hour values measured at each project site for SO_2 and H_2S in the second-quarter of 2016 through May 21 are shown in Table 7, on page 21, with the bottom row listing the standards: EPA NAAQS for SO_2, TCEQ 30-minute standard for H_2S.

Table 7. Maximum one-hour SO_2 and H_2S, ppb units, at project sites and three TCEQ sites, second-quarter 2016 (through May 21)

Site	SO_2	H_2S
West C4	2.3	
Tuloso C21	2.2	
Huisache C98	2.0	4.3
Port Grain C629	3.5	5.3
J.I. Hailey C630	1.1	38.4
Flint Hills C632	4.7	4.0
Solar Estates C633	2.3	2.8
Dona Park C635	2.7	4.3
Standards	**75.0**	**80.0***

* H_2S standard is for 30-minutes

Over time, regulatory efforts have reduced the amount of sulfur in fuels, leading to reduced SO_2 in ambient air. Recent reports on this project have shown that the reductions in sulfur content in fuel used in ships in the Corpus Christi ship channel have led to reduced concentrations measured at specific monitors. Sulfur reductions have also been made in diesel fuel used by some motor vehicles and in the coal used in some power plants. Currently, all Nueces County SO_2 monitors are in compliance with the NAAQS.

Hydrogen sulfide (H_2S) is not a NAAQS-regulated pollutant, but can be odorous and toxic. It is regulated by the TCEQ 30-minute rolling average net ground level standard of 80 ppb that may not be added by an individual emission source on top of a background concentration. Elevated measured 30-minute average concentrations in the proximity of 80 ppb in Texas are very rare, with the exception being one monitoring site in El Paso. There have been no 80 ppb 30-minute exceedances in Corpus Christi since April 2012.

Overnight on April 6, 2016, to the early morning of April 7, elevated H_2S was measured at the JIH CAMS 630 site. Winds were very light, averaging less than 2 miles per hour generally from the south. The maximum 30-min average during this period was 54 ppb, which is below the TCEQ's 80 ppb 30-min. standard. The maximum one hour average was 38.4 ppb at 23:00 CST on April 6, which was the maximum over this reporting period and is shown in Table 7. At the nearby Port Grain CAMS 629 site, concentrations were lower than at JIH, but still above normal background concentrations with a peak one-hour average of 3.6 ppb at 2:00 CST on April 7. Back trajectories run from both sites are inconclusive, as the light and variable wind speeds introduce large uncertainty in estimating an upwind path for the air parcels reaching either JIH or Port Grain during the night.

Conclusions from the Second Quarter 2016 (through May 21) Data

In this quarter's report, several findings have been made:

- To date, concentrations at the auto-GCs remained well below the TCEQ's AMCVs for all species tracked for this project.
- Trends in quarterly average benzene concentrations remain relatively flat.

- No exceedances of the EPA SO_2 NAAQS level were measured this quarter at UT sites or at TCEQ sites. All sites are maintaining NAAQS compliance.
- Periodic air pollution events continue to be measured on a routine basis.

Further analyses will be provided upon request.

APPENDIX B

Financial Report of Expenditures
Financial Report of Interest Earned

Neighborhood Air Toxics Modeling Project for Houston and Corpus Christi - Phase 1B

Accounting Report for the Quarter
4/1/16 - 6/30/16

A. Total Amount of Air Toxics Funds and Other Funds Received Under This Proposal

Total Grant Amount:	$2,745,371.68
Total Interest Earned:	$393,221.24
Total Funds Received:	**$3,138,592.92**

B. Summary of Expenditures Paid by Air Toxics Funds

		Yr 1 Budget	Year 2 Budget	Year 3 Budget	Year 4 Budget	Adjustments Prior Quarter	Adjustments This Quarter	Adjusted Budget	Prior Activity	Current Activity 4/1/16 - 6/30/16	Encumbrances	Remaining Balance 4/1/16 - 6/30/16
Salaries-Prof	12	$111,654.00	$183,063.49	$31,566.18	$31,566.18	$28,706.24	$0.00	$354,989.91	($354,989.91)	$5,479.95	($4,573.69)	$906.26
Fringe	14	$24,563.88	$40,273.97	$11,051.05	$11,051.05	$27,283.01	$0.00	$103,171.91	($109,833.48)	($12,842.02)	($6,575.85)	-$26,079.44
Salaries-CEER	15	$0.00	$0.00	$10,538.09	$0.00	$72,390.44	$0.00	$82,928.53	($79,129.74)	($3,761.44)	$0.00	$37.35
Salary Holding	16	$133,401.93	$0.00	$0.00	$0.00	($133,401.93)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Quality Assurance	41	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Cell Phone Allowance	42	$0.00	$300.00	$360.00	$360.00	$750.00	$0.00	$1,410.00	($1,260.00)	($90.00)	$0.00	$60.00
SEP Reserve	43	$10,800.00	$0.00	$0.00	$0.00	($10,800.00)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Contingency	47	$0.00	$0.00	$5,000.00	$5,000.00	($1,393.34)	$0.00	$3,606.66	($3,196.75)	$0.00	$0.00	$409.91
Monthly M&O	50	$0.00	$0.00	$20,908.45	$20,908.45	$48,073.57	($34.49)	$68,947.53	($68,274.78)	($459.80)	$0.00	$212.95
Equipment & Spare Parts	51	$0.00	$32,584.00	$17,539.29	$17,539.29	$244.21	$0.00	$50,367.50	($50,367.50)	$0.00	$0.00	$0.00
Telephone SWB-DSL/RR	52	$0.00	$8,454.00	$8,707.47	$8,707.47	$12,162.20	$0.00	$29,323.67	($29,323.67)	$0.00	$0.00	$0.00
Electric	53	$0.00	$22,438.00	$23,086.69	$23,086.69	$25,094.93	$0.00	$70,619.62	($70,619.62)	$0.00	$0.00	$0.00
Gases	54	$0.00	$10,811.00	$10,676.72	$10,676.72	$9,959.67	$0.00	$31,447.39	($31,447.39)	$0.00	$0.00	$0.00
Other Costs	55	$0.00	$0.00	$260,000.00	$260,000.00	($260,000.00)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Consultant Services - Holding	60	$80,000.00	$0.00	$0.00	$0.00	($80,000.00)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Consultant Services - ORSAT/TMSI	61-62	$0.00	$194,750.38	$466,081.72	$466,081.72	$756,922.60	$0.00	$1,417,754.70	($1,399,566.76)	($9,600.00)	$0.00	$8,587.94
Program Income Expenses	66	$0.00	$0.00	$0.00	$0.00		$0.00	$0.00	($62,415.53)	($138,045.34)	($55,808.43)	-$256,269.30
Analytical	68	$0.00	$27,839.39	$6,458.00	$6,458.00	$89,059.61	$0.00	$123,357.00	($115,257.00)	$0.00	$0.00	$8,100.00
Travel	75	$0.00	$3,000.00	$1,000.62	$1,000.62	$1,620.20	$34.49	$5,655.31	($5,655.31)	$0.00	$0.00	$0.00
Equipment	80	$0.00	$0.00	$0.00	$0.00	$43,700.00	$0.00	$43,700.00	($43,700.00)	$0.00	$0.00	$0.00
Indirect Costs	90	$54,062.97	$78,527.13	$130,946.14	$130,946.14	$94,555.71	$0.00	$358,091.95	($354,393.30)	($3,190.99)	$0.00	$507.66
TOTALS		**$414,482.78**	**$602,041.36**	**$1,003,920.42**	**$993,382.33**	**$724,927.12**	**$0.00**	**$2,745,371.68**	**($2,779,430.74)**	**($162,509.64)**	**($66,957.97)**	**($263,526.67)**

C. Interest Earned by Air Toxics Funds as of 4/1/16 - 6/30/16

Prior Interest Earned:	$392,970.73
Interest Earned This Quarter:	$250.51
Total Interest Earned to Date:	**$393,221.24**

D. Balance of Air Toxics Funds as of 4/1/16 - 6/30/16

Total Grant Amount:	$2,745,371.68
Total Interest Earned:	$393,221.24
Total Expenditures:	($2,941,940.38)
Remaining Balance:	**$196,652.54**

I certify that the numbers are accurate
and reflect acutal expenditures
for the quarter

Accounting Certification
26-7700-99

Neighborhood Air Toxics Modeling Project for Houston and Corpus Christi - Stage 1 Phase 1A

Accounting Report for the Quarter
4/1/16 - 6/30/16

A. Total Amount of Air Toxics Funds and Other Funds Received Under This Proposal

Total Grant Amount:	$1,863,081.22
Total Interest Earned:	$344,222.10
Interest Transferred to Phase 1B	($344,222.10)
Total Funds Received:	**$1,863,081.22**

B. Summary of Expenditures Paid by Air Toxics Funds

		Yr 1 and Yr2 Budget	Year 3 Budget	Adjustments Prior Quarter	Adjustments This Quarter	Adjusted Budget	Prior Activity	Current Activity 4/1/16 - 6/30/16	Encumbrances	Remaining Balance 4/1/16 - 6/30/16
Salaries-Prof	**12**	$616,882.00	$228,508.00	($95,903.26)	$0.00	$749,486.74	($749,486.74)	$0.00	$0.00	$0.00
Salaries-CEER	**15**	$66,780.00	$24,045.00	($11,435.81)	$0.00	$79,389.19	($79,389.19)	$0.00	$0.00	$0.00
Fringe	**14**	$149,185.00	$55,852.00	($22,669.10)	$0.00	$182,367.90	($182,367.90)	$0.00	$0.00	$0.00
Supplies	**50**	$61,991.00	-$5,831.00	($21,633.36)	$0.00	$34,526.64	($34,526.64)	$0.00	$0.00	$0.00
Contingency	**51**	$6,746.00	$27,805.00	($34,551.00)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Consultants	**60**	$22,500.00	$2,500.00	($25,000.00)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Subcontracts	**61-63**	$600,000.00	$0.00	($54,943.78)	$0.00	$545,056.22	($545,056.22)	$0.00	$0.00	$0.00
Modeling/Computer Svs	**67**	$46,500.00	$12,500.00	($59,000.00)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Computation Center	**68**	$0.00	$1,800.00	$0.00	$0.00	$1,800.00	($1,800.00)	$0.00	$0.00	$0.00
Tuition	**71**	$17,727.00	$0.00	($125.00)	$0.00	$17,602.00	($17,602.00)	$0.00	$0.00	$0.00
Travel	**75**	$15,000.00	$5,000.00	($17,403.03)	$0.00	$2,596.97	($2,596.97)	$0.00	$0.00	$0.00
Equipment	**80**	$17,500.00	$7,500.00	($17,755.00)	$0.00	$7,245.00	($7,245.00)	$0.00	$0.00	$0.00
Indirect Costs	**90**	$243,122.00	$53,952.00	($54,063.44)	$0.00	$243,010.56	($243,010.56)	$0.00	$0.00	$0.00
TOTALS		**$1,863,933.00**	**$413,631.00**	**($414,482.78)**	**$0.00**	**$1,863,081.22**	**($1,863,081.22)**	**$0.00**	**$0.00**	**$0.00**

C. Interest Earned by COCP Funds as of 4/1/16 - 6/30/16

Prior Interest Earned:	$344,222.10
Interest Earned This Quarter:	$0.00
Interest Transferred to Phase 1B	-$344,222.10
Total Interest Earned to Date:	**$0.00**

D. Balance of COCP Funds as of 4/1/16 - 6/30/16

Total Grant Amount:	$1,863,081.22
Total Interest Earned:	$0.00
Total Expenditures:	($1,863,081.22)
Remaining Balance:	**$0.00**

I certify that the numbers are accurate
and reflect acutal expenditures
for the quarter

Accounting Certification
26-7696-41