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

October 1, 2015 through December 31, 2015

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 December 31, 2015, 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 currently consists 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 Air Monitoring Sites, Locations and Major Instrumentation

TCEQ CAMS#	Description of Site Location	Monitoring Equipment showing month/year of operations				
		Auto-GC	TNMHC (T) / Canister (C)	H_2S & SO_2	Met Station	Camera
634	Oak Park Recreation Center (**OAK**)	3/05 to date	C: 12/04 to 2/09 T: 12/04 to 4/12		12/04 to date	
629	Grain Elevator @ Port of Corpus Christi (**CCG**)		T&C: 12/04 to date	12/04 to date	12/04 to date	
630	J. I. Hailey Site @ Port of Corpus Christi (**JIH**)		T&C: 12/04 to date	12/04 to date	12/04 to date	
635	TCEQ Monitoring Site C199 @ Dona Park (**DPK**)		T&C: 12/04 to date	12/04 to date	12/04 to date	1/05 to date
632	Off Up River Road on Flint Hills Resources Easement (**FHR**)		T&C: 12/04 to date	12/04 to date	12/04 to date	
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 date	12/04 to date	1/05 to date
631	*Port of Corpus Christi on West End of CC Inner Harbor (**WEH**) (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 633 & 634 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, pages 8 through 25. Specifically, the appendix contains the following elements:

- **Auto-GC Data Summary** – In examining the validated third and fourth quarters of 2015 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 13 through 20. In examining all the data over the course of the project, it does appear that for some hydrocarbon species mean concentrations there is a general increase in recent years, although a drop-off was observed in 2015.

- **Benzene Summary** – A review of more than ten years of data is presented, with a focus on overall trends since 2005 and the fourth quarter average concentrations from 2005 through 2015, which appears on pages 21 and 22.

- **SO_2 and H_2S Summary** – A summary of SO_2 and H_2S data collection since the project began up through the fourth quarter of 2015 is presented on pages 23 through 25.

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 is on-going. 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, pages 26 through 28.

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

5. **Planning for Decommissioning and Transitioning of Sites**
   Planning continued and preliminary preparations are being made for decommissioning of the sites, i.e., removal of all site improvements and restoration of the sites to pre-project conditions, once the current funding ends, which is expected to be early 2016. This plan includes contingencies should funding be identified for continuation of any sites or operation of any monitoring equipment. The timeline for decommissioning of any site or monitoring equipment for which continuation funding has not been identified is as follows:

Decommissioning Schedule

January - February 2016	Discontinue operation of sites and conduct final Quality Assurance Audits
February thru May 2016	Decommission sites and prepare project final report
June 2016	Submit project final report and close out project account

III. Financial Report

As required, the following financial summary information is provided. Details supporting this financial summary are included in Appendix B, pages 26 through 28.

A. Total Amount of Air Toxics Project Funds and Other Funds Received Under the Project
   The total amount of Air Toxics Project funds received through December 31, 2015 equals $3,137,992.09. This total includes interest earned through December 31, 2015.

B. Detailed List of the Actual Expenditures Paid from Air Toxics Project Funds Stage 1, Phase 1B through December 31, 2015
   Expenditures of Air Toxics Project funds during this quarter totaled $234,120.55. 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 December 31, 2015
   The interest earned during this quarter totaled $176.55. The Air Toxics Project total interest earned through December 31, 2015 equals $392,620.41. A report providing detailed calculations of the interest earned on the Air Toxics Project funds is included in Appendix B, pages 26 through 28.

D. Balance as of December 31, 2015, in the Air Toxics Project Account
   The balance in the Air Toxics Project account, including interest earned totals $574,889.10.

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 have been 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.

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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

October 1, 2015 through December 31, 2015

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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 October 1 through December 31, 2015. 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 the third and fourth quarters of 2015, and also a discussion of trends;
- Information on the trends for benzene concentrations at the two project auto-GCs in residential areas, now with eleven years of fourth quarter data, and at the TCEQ's Palm auto-GC, with six years of fourth quarter data (since 2010); 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 showing month/year of operations				
		Auto-GC	TNMHC (T) / Canister (C)	H_2S & SO_2	Met Station	Camera
634	Oak Park Recreation Center (**OAK**)	3/05 to date	C: 12/04 to 2/09 T: 12/04 to 4/12		12/04 to date	
629	Grain Elevator @ Port of Corpus Christi (**CCG**)		T&C: 12/04 to date	12/04 to date	12/04 to date	
630	J. I. Hailey Site @ Port of Corpus Christi (**JIH**)		T&C: 12/04 to date	12/04 to date	12/04 to date	
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632	Off Up River Road on Flint Hills Resources Easement (**FHR**)		T&C: 12/04 to date	12/04 to date	12/04 to date	
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 date	12/04 to date	1/05 to date
631	*Port of Corpus Christi on West End of CC Inner Harbor (**WEH**) (terminated)*		T&C: 12/04 to 5/12	12/04 to 5/12	12/04 to 5/12	

Legend

CAMS	continuous ambient monitoring station, generally followed by station identification number
Auto-GC	automated gas chromatograph
TNMHC	total non-methane hydrocarbon analyzer (all except CAMS 633 & 634 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 (pp<u>m</u>V) or ppb-volume (pp<u>b</u>V) 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 January 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 http://www3.epa.gov/ttn/naaqs/criteria.html (accessed January 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 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 14, lists the data completeness from the two project auto-GCs from January 2013 through the most recent month of data validation (December 2015). 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, and data completeness since then has been between 86 and 100 percent.

Table 3. Percent data recovery by month, 2013-2015, validated data only

Month	Oak Park	Solar Est.	Month	Oak Park	Solar Est.	Month	Oak Park	Solar Est.
Jan-13	100	100	Jan-14	97	96	Jan-15	93	100
Feb-13	94	99	Feb-14	99	100	Feb-15	96	100
Mar-13	97	100	Mar-14	93	97	Mar-15	98	100
Apr-13	100	100	Apr-14	98	100	Apr-15	88	97
May-13	99	99	May-14	95	98	May-15	45**	99
Jun-13	75*	91*	Jun-14	100	84*	Jun-15	100	100
Jul-13	98	99	Jul-14	80*	100	Jul-15	100	85*
Aug-13	87	98	Aug-14	96	99	Aug-15	99	98
Sep-13	82	99	Sep-14	99	100	Sep-15	87*	99
Oct-13	99	99	Oct-14	98	98	Oct-15	86	99
Nov-13	91	100	Nov-14	99	99	Nov-15	98	100
Dec-13	99	99	Dec-14	98	100	Dec-15	94	100
Average 2013	**93**	**99**	**Average 2014**	**96**	**98**	**Average 2015**	**90**	**98**

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

Table 4, on page 15, summarizes the statistics (maximum and average (mean) values) on fully validated data from the third quarter of 2015. Data in this table are available to TCEQ staff at http://rhone3.tceq.texas.gov/cgi-bin/agc_summary.pl (accessed January 2016). Table 5, on page 16, summarizes the statistics (maximum and average values) on the fully validated data from the fourth quarter of 2015. 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.

All concentration values in the 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 observed fourth quarter mean values are significantly higher than third quarter mean values at all three sites, which is observed at most auto-GCs that operate in Texas. In Corpus Christi, the area experiences more frequent maritime southerly flow in the spring and summer which contributes to lower concentrations in the spring-summer second and third quarters, while lower wind speeds and more northerly wind directions contribute to higher concentrations in the fall-winter fourth and first quarters.

The mean concentration data columns in Table 4 and Table 5 for the Oak Park site are shown graphically in Figure 2, on page 17, to contrast the summer and fall-winter results. In Figure 3, on page 17, and in Figure 4, on page 18, the mean concentration data columns in Table 4 and Table 5 for the Solar Estates and Palm sites are shown graphically. For all three graphs, the y-axes are the same to facilitate making comparisons between sites.

Table 4. Validated auto-GC statistics, 3rd quarter 2015

Units ppbV	Oak 3Q15			Solar 3Q15			Palm 3Q15		
Species	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**
Ethane	65.651	12.494	3.197	45.844	15.542	4.307	72.899	18.555	4.231
Ethylene	54.446	3.869	0.359	10.659	1.130	0.243	26.283	2.515	0.324
Propane	63.864	11.711	1.738	49.084	8.905	2.139	64.447	10.193	1.980
Propylene	4.669	0.782	0.191	1.167	0.341	0.175	4.066	0.524	0.120
Isobutane	24.591	4.249	0.726	7.854	2.507	0.752	99.713	10.573	0.842
n-Butane	43.298	7.279	1.042	11.813	4.381	1.041	295.297	27.110	1.319
t-2-Butene	0.726	0.101	0.036	0.190	0.047	0.016	3.864	0.370	0.032
1-Butene	1.155	0.113	0.024	0.232	0.048	0.012	1.165	0.155	0.038
c-2-Butene	0.677	0.082	0.021	0.215	0.047	0.011	4.469	0.414	0.021
Isopentane	61.072	6.379	0.874	13.068	2.079	0.703	156.861	14.875	0.920
n-Pentane	39.280	5.359	0.574	7.699	1.604	0.485	56.342	6.021	0.457
1,3-Butadiene	0.283	0.050	0.012	0.443	0.038	0.016	0.162	0.028	0.014
t-2-Pentene	1.767	0.195	0.038	1.090	0.083	0.009	13.986	1.104	0.041
1-Pentene	0.921	0.091	0.017	0.405	0.040	0.006	7.347	0.616	0.022
c-2-Pentene	0.791	0.078	0.012	0.574	0.041	0.003	6.826	0.552	0.018
n-Hexane	26.811	2.469	0.276	3.856	0.599	0.218	10.221	1.466	0.221
Benzene	**18.339**	**1.599**	**0.169**	**1.325**	**0.224**	**0.073**	**5.777**	**0.966**	**0.115**
Cyclohexane	7.275	0.682	0.087	2.637	0.302	0.101	24.902	1.550	0.073
Toluene	6.680	1.047	0.202	2.193	0.414	0.143	4.778	0.917	0.168
Ethyl Benzene	1.146	0.134	0.027	0.733	0.093	0.020	0.621	0.103	0.012
m&p -Xylene	2.367	0.395	0.084	3.434	0.376	0.096	2.482	0.478	0.087
o-Xylene	0.796	0.137	0.029	1.092	0.111	0.021	0.832	0.150	0.024
Isopropyl Benzene	1.566	0.155	0.009	0.434	0.033	0.004	0.684	0.033	0.002
1,3,5-Tri-methylbenzene	0.411	0.073	0.012	0.341	0.031	0.006	0.348	0.061	0.007
1,2,4-Tri-methylbenzene	0.604	0.134	0.032	0.409	0.082	0.021	0.610	0.128	0.023
n-Decane	0.996	0.112	0.018	0.907	0.104	0.019	0.425	0.068	0.010
1,2,3-Tri-methylbenzene	0.204	0.052	0.016	0.264	0.072	0.015	0.157	0.039	0.019

Table 5. Validated auto-GC mean statistics, 4th quarter 2015

Units ppbV	Oak 4Q15			Solar 4Q15			Palm 4Q15		
Species	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**
Ethane	239.107	29.624	8.771	209.141	32.462	10.681	229.209	41.102	12.301
Ethylene	16.941	1.937	0.407	5.444	0.981	0.402	35.392	2.437	0.540
Propane	732.408	41.180	7.545	68.176	19.545	6.072	142.429	29.841	7.252
Propylene	10.419	0.838	0.339	19.427	1.402	0.251	10.421	4.947	0.351
Isobutane	200.445	15.460	3.009	60.609	5.798	1.746	52.738	18.780	2.849
n-Butane	89.580	24.674	4.551	120.555	9.762	2.991	171.965	22.915	5.040
t-2-Butene	1.440	0.318	0.070	2.887	0.159	0.034	3.860	0.624	0.086
1-Butene	1.279	0.217	0.065	1.027	0.094	0.028	3.511	0.463	0.096
c-2-Butene	0.906	0.246	0.053	3.383	0.181	0.049	3.983	0.554	0.071
Isopentane	200.812	12.762	2.550	83.815	4.718	1.375	77.648	10.843	2.368
n-Pentane	233.398	14.181	1.909	20.717	2.562	1.009	29.216	4.943	1.403
1,3-Butadiene	0.869	0.108	0.033	0.355	0.046	0.017	0.590	0.107	0.022
t-2-Pentene	0.893	0.205	0.052	7.234	0.343	0.017	6.263	0.761	0.087
1-Pentene	0.476	0.099	0.028	3.250	0.157	0.009	3.581	0.430	0.053
c-2-Pentene	0.411	0.080	0.021	3.608	0.170	0.008	3.237	0.403	0.044
n-Hexane	60.510	6.878	0.798	10.558	0.928	0.372	11.682	1.964	0.501
Benzene	**16.672**	**2.262**	**0.417**	**1.813**	**0.354**	**0.147**	**5.119**	**1.433**	**0.294**
Cyclohexane	18.900	2.316	0.433	1.707	0.440	0.152	7.266	1.005	0.195
Toluene	34.872	4.197	0.497	2.970	0.552	0.228	4.656	1.517	0.314
Ethyl Benzene	1.598	0.203	0.055	14.745	0.725	0.035	0.532	0.151	0.030
m&p -Xylene	16.411	1.890	0.193	8.921	1.215	0.192	3.211	0.715	0.152
o-Xylene	2.211	0.273	0.058	1.950	0.113	0.031	0.660	0.163	0.047
Isopropyl Benzene	1.281	0.299	0.039	1.122	0.207	0.015	0.981	0.128	0.010
1,3,5-Tri-methylbenzene	2.237	0.248	0.031	0.427	0.054	0.008	0.282	0.077	0.016
1,2,4-Tri-methylbenzene	1.369	0.174	0.056	0.440	0.083	0.024	0.548	0.119	0.041
n-Decane	2.334	0.256	0.043	0.997	0.121	0.026	0.805	0.214	0.026
1,2,3-Tri-methylbenzene	0.366	0.072	0.024	0.146	0.069	0.008	0.231	0.066	0.020

Figure 2. Oak Park average concentrations of 27 species in the 3rd & 4th quarters of 2015

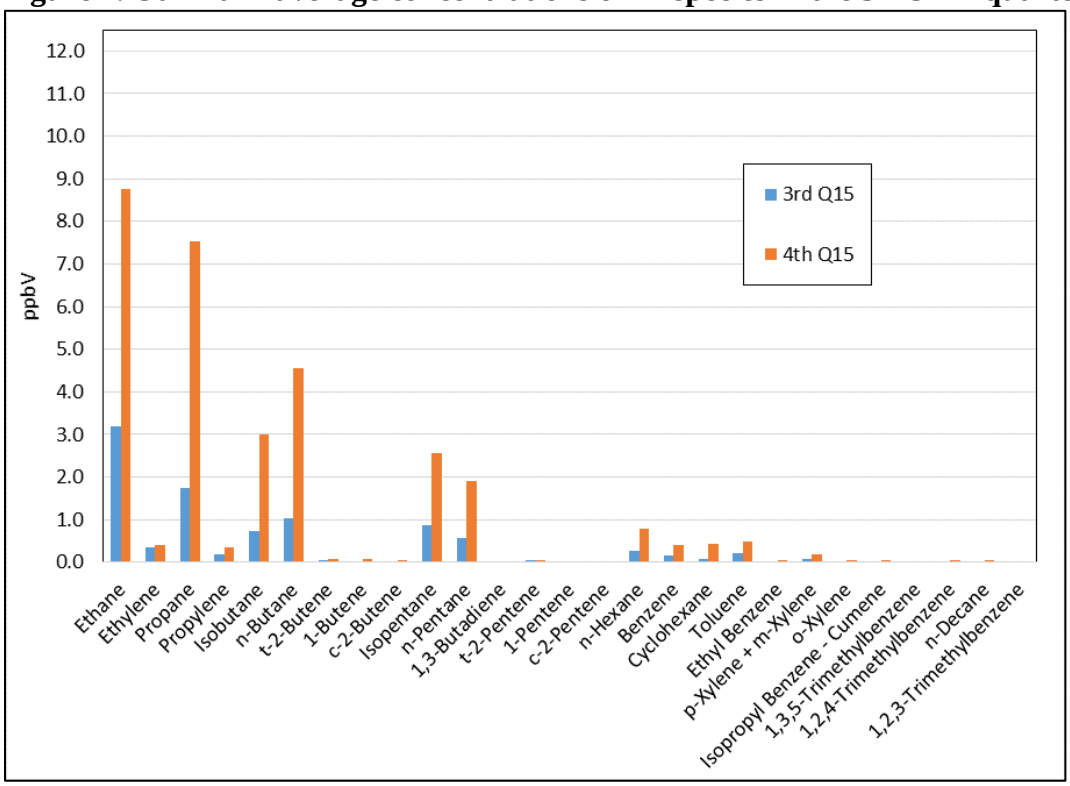


Figure 3. Solar Estates average concentrations of 27 species in the 3rd & 4th quarters of 2015

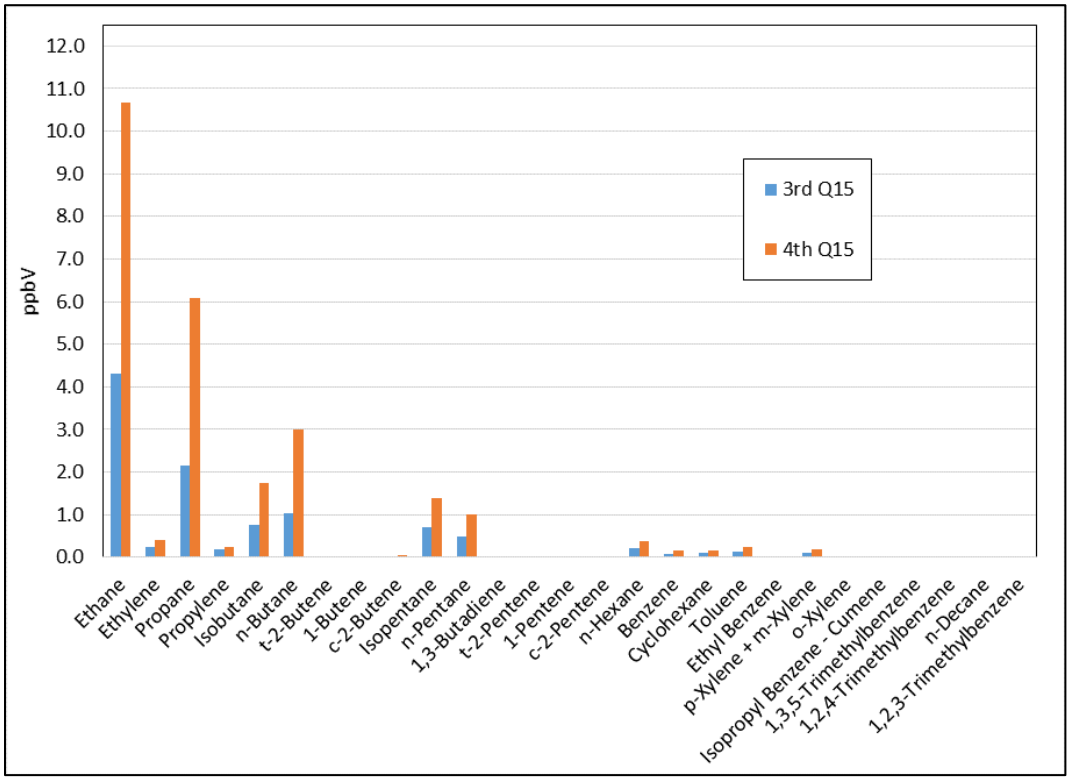
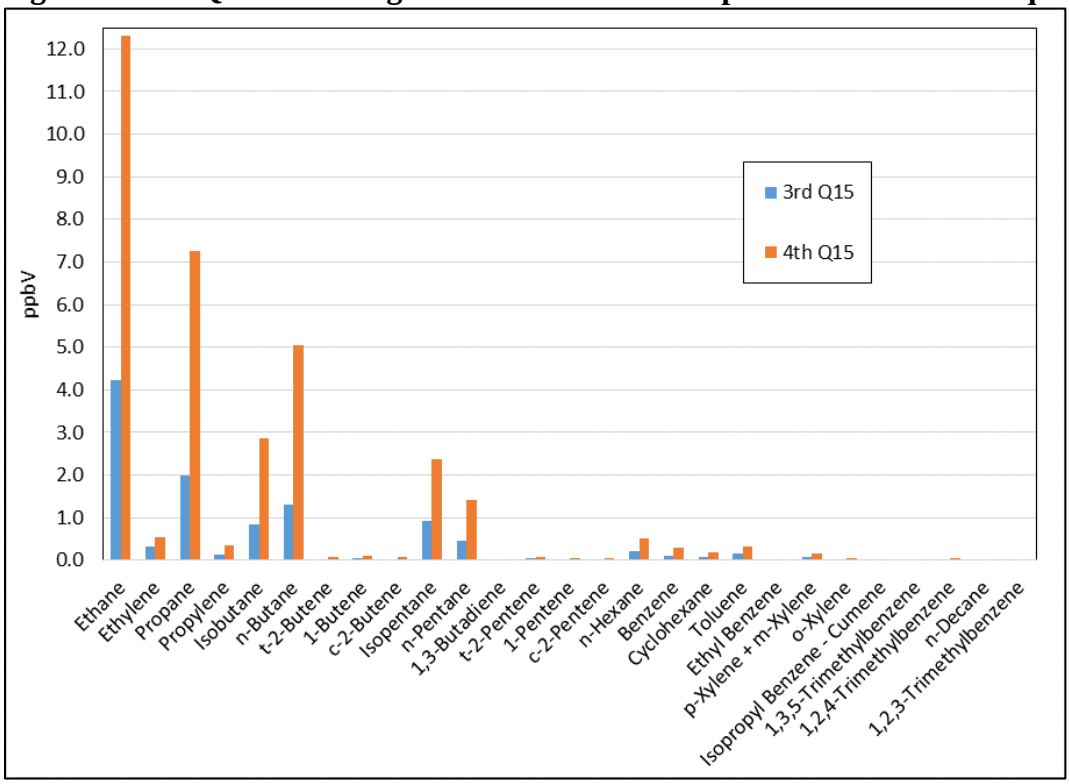


Figure 4. TCEQ Palm average concentrations of 27 species in the 3rd & 4th quarters of 2015



The concentrations of low-molecular weight alkanes (particularly ethane and propane) have been increasing during the third and fourth quarters under northerly winds from 2012 through 2014. Figure 5, on page 19, shows the average concentration of six alkane species at Solar Estates for the fourth quarters of each year since monitoring began in 2005. Six species are shown to illustrate that the recent upward trend tends to drop off from the 4-carbon butanes to the 5-carbon pentanes. The most recent year, 2015, showed a decline in the average concentration for ethane, and in the past two years propane and butanes have decreased. Despite the one year decline in ethane at Solar Estates, the average concentration was the third highest fourth quarter average in 11 years. Figure 6, on page 19, shows the same set of averages for the Oak Park monitor. At Oak Park, the average ethane concentration has dropped off from the maximum value of two years ago in 2013.

Figure 5. Average concentrations for six alkane species at Solar Estates, 4th quarters 2005 – 2015, ppbV units

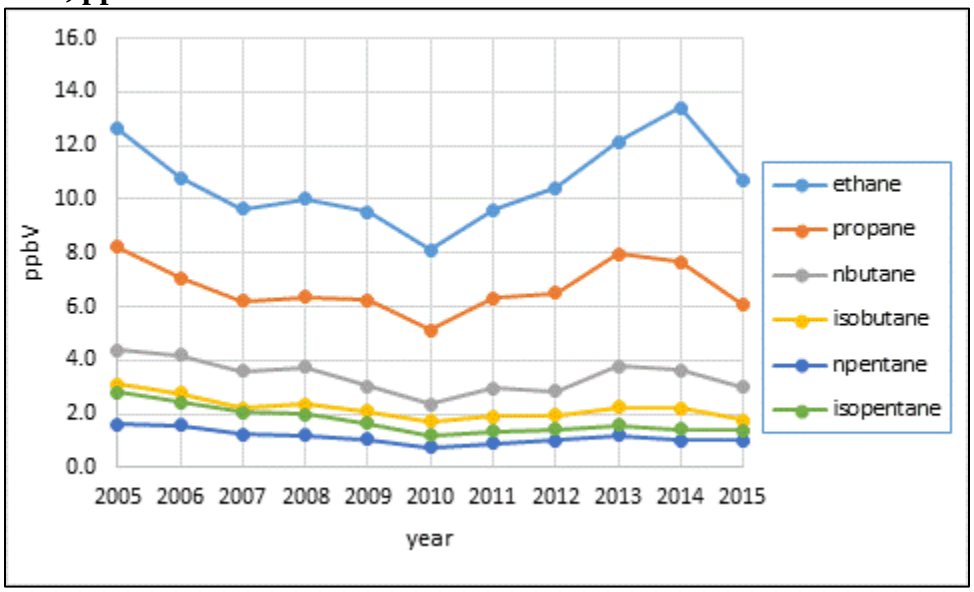
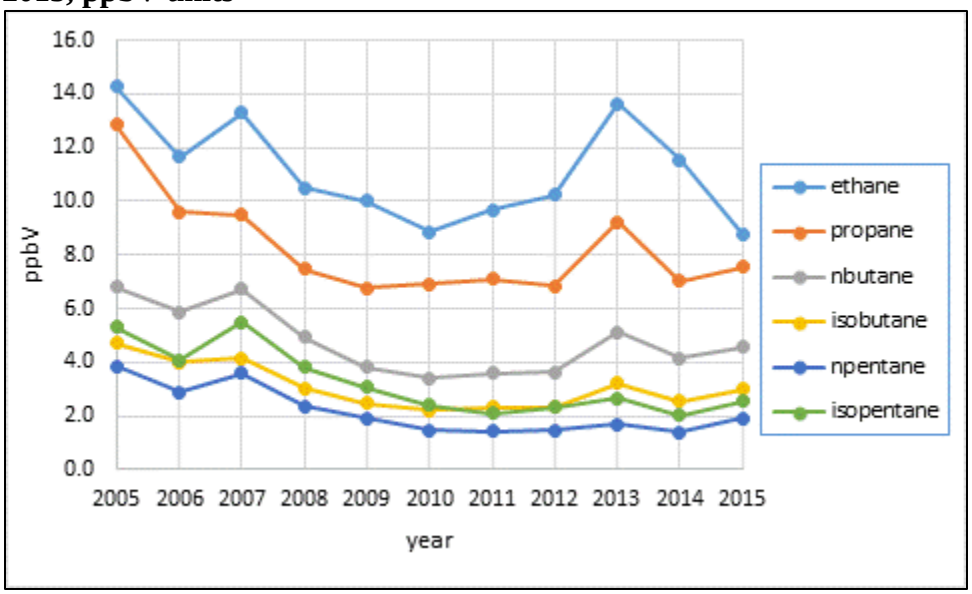


Figure 6. Average concentrations for six alkane species at Oak Park, 4th quarters 2005 – 2015, ppbV units



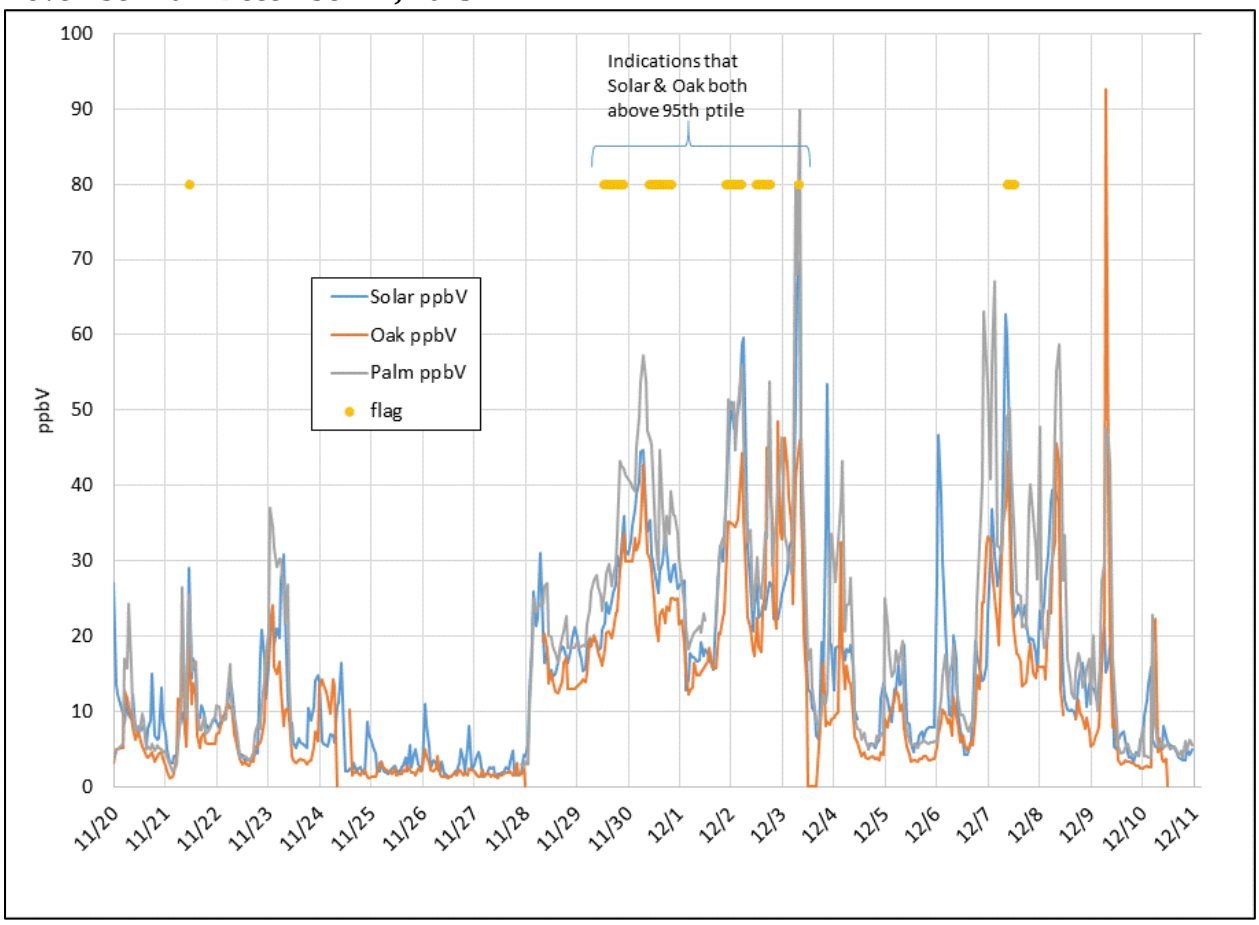
UT is looking into possible explanations for the trends in ethane. One approach has been to examine the behavior of the data at the two project sites relative to each other. Hydrocarbons typically follow a daily pattern of rising over night as the winds calm and temperature inversions hold fresh emissions closer to the ground. Also, fall and winter average concentrations are generally higher than spring and summer mean concentrations owing to weather and the relative location of emissions sources with regard to wind directions. To take the effect of daily and seasonal concentration patterns of concentrations into account, the statistical behavior of the data by hour of the day and by season of the year has been studied. The research hypothesis posed by UT is as follows:

- Hypothesis: If two monitoring sites eight miles apart measure similar concentrations at the same time, and for both sites those concentrations are statistically significantly greater than the mean concentration, then the emission source or sources that produced those concentrations are outside of the local area.

The rationale for this hypothesis is that it is unlikely that two sources, one near each monitor, would be emitting with the same source strength at the same time. In order for two sites to measure similar concentrations from one source area simultaneously, that source area must be far enough away for its plume to have spread out to produce a relatively uniform concentration field.

As an example how concentrations are sometimes simultaneously statistically significantly above the mean, consider the graph in Figure 7, below. During the fourth quarter of 2015, UT selected a period from late November to early December when ethane concentrations above the 95th percentile for each site were simultaneously measured. For completeness, the TCEQ's Palm auto-GC data are included in Figure 7. The graph shows a period over several days with northerly winds during which all three sites measured similar concentrations, with hours during which both the Solar Estates and Oak Park ethane values were at or above the 95th percentile level for the 4th quarter of 2015 indicated by a "flag" variable.

Figure 7. Hourly ethane ppbV concentrations at three Corpus Christ auto-GC sites November 20 – December 11, 2015



2. Benzene Concentrations in Residential Areas

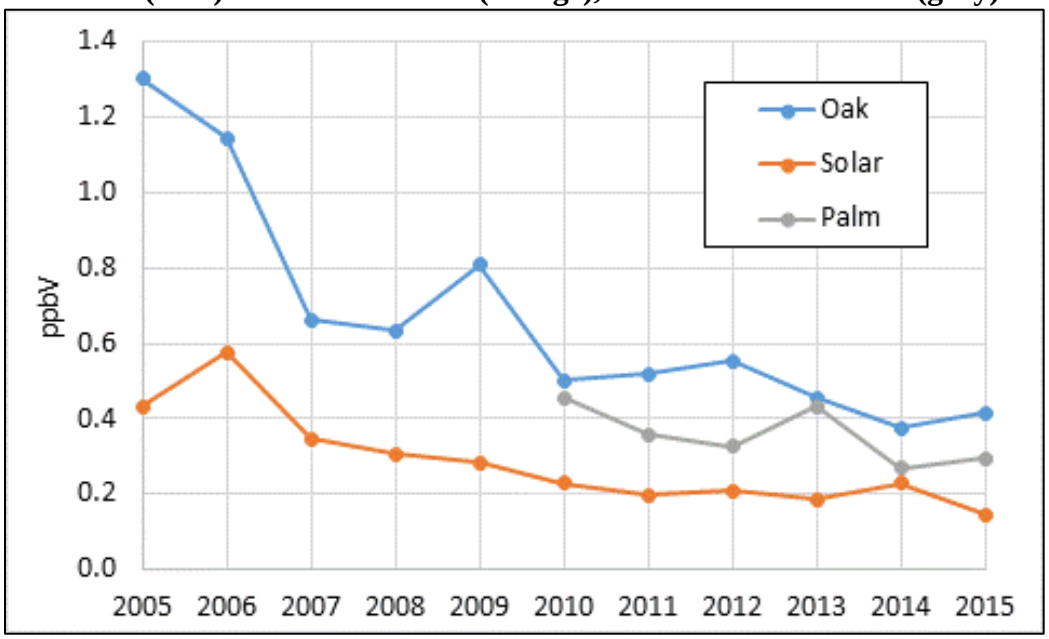
As has been discussed in past reports, benzene concentrations in recent years are lower than in the first three years of operation at the two auto-GCs operated at Oak Park C634 and Solar Estates C633. Also, in recent years (2008 through 2015), concentration averages have generally shown relatively little variation compared to earlier years, unlike the behavior of the light alkane species described earlier in this report. No individual one-hour benzene values have been measured above the AMCV since the beginning of monitoring.

Table 6, on page 22, shows the fourth quarter average concentrations from the two project auto-GCs for benzene from 2005 through 2015, and for the TCEQ Palm site since 2010. The project now has eleven years of complete fourth quarter data. The fourth quarter means are graphed in Figure 8, on page 22. The means for TCEQ's Palm site are shown for 2010 through 2015 only. The fourth quarter averages at UT sites from 2008 through 2015 are statistically significantly lower than in the fourth quarters of the project's first three years, and this finding is similar to findings for other quarters in recent reports on this project. For 2015, the Solar Estates site had the lowest fourth quarter benzene average to date.

Table 6. Mean statistics for Benzene at Oak Park and Solar Estates, 4th quarter 2005 – 2015, Palm 2010 – 2015, ppbV units

year	Oak Park	Solar Estates	Palm
2005	1.302	0.433	
2006	1.144	0.577	
2007	0.663	0.346	
2008	0.633	0.306	
2009	0.808	0.284	
2010	0.502	0.228	0.454
2011	0.520	0.198	0.358
2012	0.552	0.210	0.326
2013	0.455	0.185	0.433
2014	0.374	0.229	0.269
2015	0.416	0.147	0.293

Figure 8. Mean concentrations of benzene, ppbV units, during 4th quarters of each year at Oak Park (blue) and Solar Estates (orange), 2005 – 2015 and Palm (gray) 2010 – 2015



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 fourth quarter of 2015 are shown in Table 7, below, 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, fourth quarter 2015

Site	SO_2	H_2S
West C4	3.5	
Tuloso C21	6.3	
Huisache C98	4.7	11.1
Port Grain C629	0.7	33.9
J.I. Hailey C630	3.4	14.5
Flint Hills C632	10.7	3.9
Solar Estates C633	3.1	2.5
Dona Park C635	4.1	15.7
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 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. However, H_2S sources are detected by the UT and TCEQ monitors in the area. For example, around 4 a.m. CST on November 21, 2015, the Port Grain CAMS 629 site measured H_2S above 50 parts per billion for a sustained period that produced a 41 ppb 30-minute average, and the 33.9 ppb one-hour average in Table 7, on page 23. Winds at the time were from the south. A time series for the 5-minute H_2S and wind direction measurements at the Port Grain CAMS 629 site appears in Figure 9, below. A surface back trajectory from the site at the 4:35 CST start time appears in Figure 10, on page 25. Two other nearby monitoring sites also measured H_2S above normal background levels on November 21, but at lower concentrations and likely from a different emission source.

Figure 9. Nov. 21, 2015 five-minute H_2S and wind direction at Port Grain CAMS 629

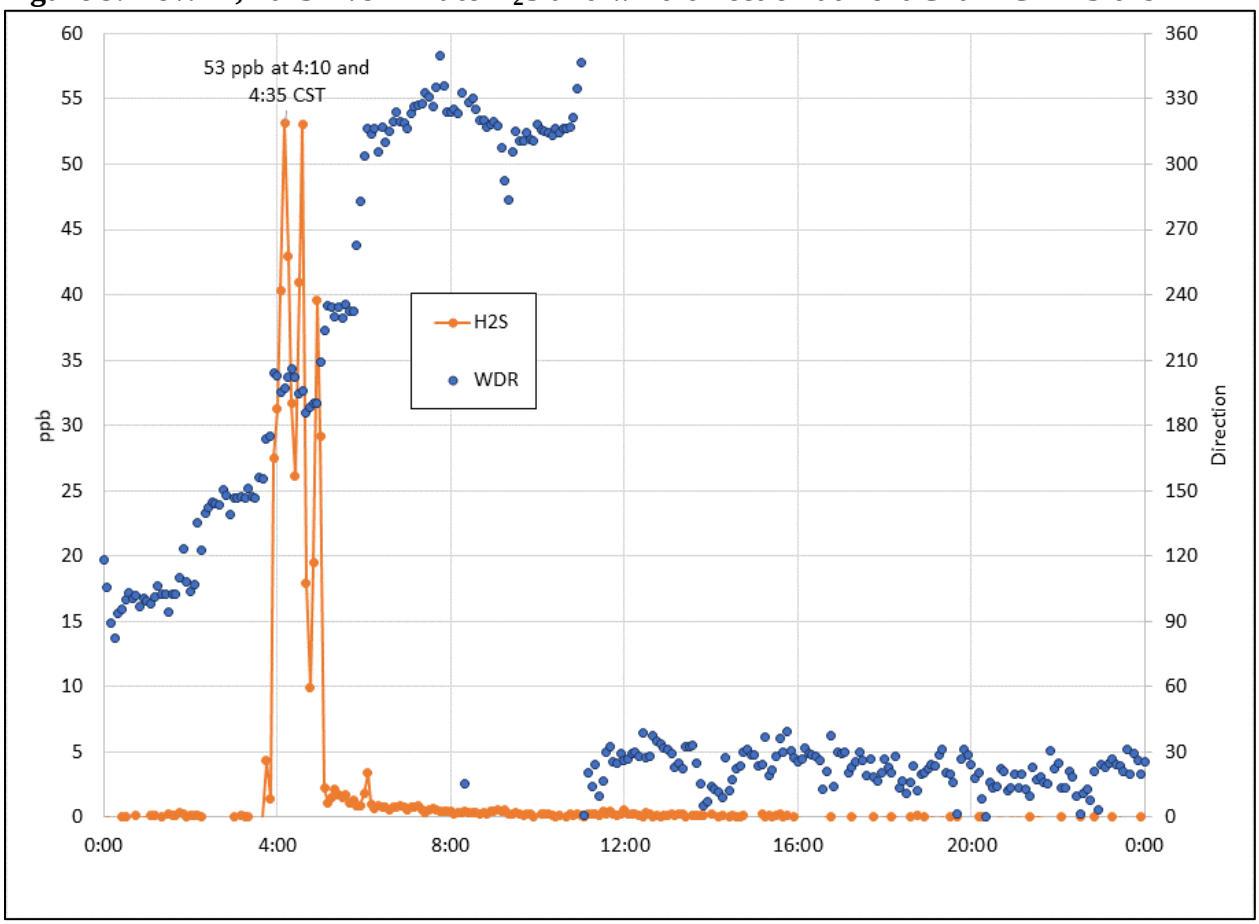
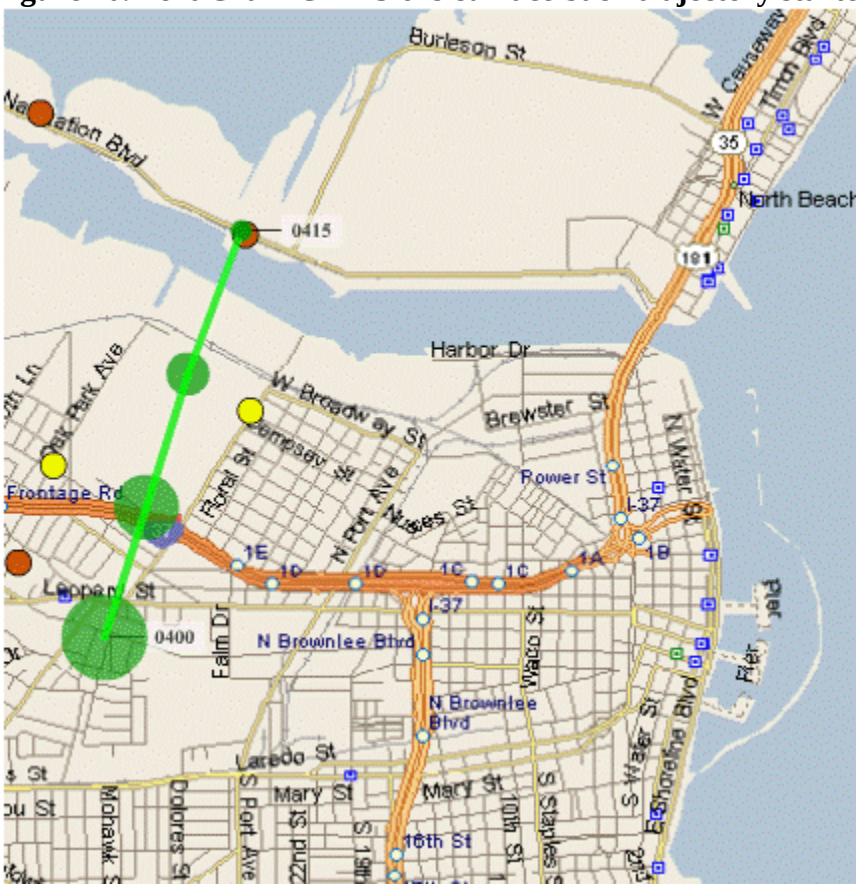


Figure 10. Port Grain CAMS 629 surface back trajectory started at 4:35 CST 11/21/2015



Conclusions from the Fourth Quarter 2015 Data

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

- To date, 2015 concentrations at the auto-GCs remained well below the TCEQ's AMCVs for all species tracked for this project. Mean concentrations for several light alkane hydrocarbon species, possibly associated with natural gas, have increased in the past four years under westerly and northerly winds, but there was a decline in mean concentrations this year's fourth quarter.
- Trends in quarterly average benzene concentrations remain relatively flat. The Solar Estates site had the lowest fourth quarter benzene average concentration measured at the site to date.
- 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. One case of H_2S measured above background levels was investigated.
- 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
10/1/15 - 12/31/15

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

Total Grant Amount:	$2,745,371.68
Total Interest Earned:	$392,620.41
Total Funds Received:	**$3,137,992.09**

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 10/1/15 - 12/31/15	Encumbrances	Remaining Balance 10/1/15 - 12/31/15
Salaries-Prof	12	$111,654.00	$183,063.49	$31,566.18	$31,566.18	$98,233.06	($83,744.54)	$340,772.19	($298,356.45)	($35,386.57)	$0.00	$7,029.17
Fringe	14	$24,563.88	$40,273.97	$11,051.05	$11,051.05	$34,155.63	($15,331.24)	$94,713.29	($85,777.86)	($8,349.12)	$0.00	$586.31
Salaries-CEER	15	$0.00	$0.00	$10,538.09	$0.00	$55,713.31	$3,009.40	$69,260.80	($67,454.08)	($1,806.88)	$0.00	-$0.16
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	$495.00	$15.00	$1,170.00	($1,080.00)	($90.00)	$0.00	$0.00
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	($5,000.00)	$73,109.11	$73,109.11	$0.00	$0.00	$0.00	$73,109.11
Monthly M&O	50	$0.00	$0.00	$20,908.45	$20,908.45	$42,472.49	$19,175.33	$82,556.27	($61,526.46)	($2,642.38)	$0.00	$18,387.43
Equipment & Spare Parts	51	$0.00	$32,584.00	$17,539.29	$17,539.29	($3,858.00)	$3,139.44	$49,404.73	($45,404.73)	($2,155.02)	$0.00	$1,844.98
Telephone SWB-DSL/RR	52	$0.00	$8,454.00	$8,707.47	$8,707.47	$10,391.56	$1,625.15	$29,178.18	($26,060.96)	($2,063.20)	$0.00	$1,054.02
Electric	53	$0.00	$22,438.00	$23,086.69	$23,086.69	$20,257.77	$3,654.14	$69,436.60	($63,956.01)	($4,215.15)	$0.00	$1,265.44
Gases	54	$0.00	$10,811.00	$10,676.72	$10,676.72	$13,457.71	($3,696.27)	$31,249.16	($29,611.21)	($764.33)	$0.00	$873.62
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	$728,838.82	($6,791.49)	$1,382,879.43	($1,194,382.89)	($140,646.70)	$0.00	$47,849.84
Analytical	68	$0.00	$27,839.39	$6,458.00	$6,458.00	$72,883.61	$7,836.00	$115,017.00	($104,081.00)	($4,736.00)	$0.00	$6,200.00
Travel	75	$0.00	$3,000.00	$1,000.62	$1,000.62	$2,832.38	($2,000.03)	$4,832.97	($4,436.54)	($101.65)	$0.00	$294.78
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	($303,154.25)	($31,163.55)	$0.00	$23,774.15
TOTALS		**$414,482.78**	**$602,041.36**	**$1,003,920.42**	**$993,382.33**	**$724,927.12**	**($0.00)**	**$2,745,371.68**	**($2,328,982.44)**	**($234,120.55)**	**$0.00**	**$182,268.69**

C. Interest Earned by Air Toxics Funds as of 10/1/15 - 12/31/15

Prior Interest Earned:	$392,443.86
Interest Earned This Quarter:	$176.55
Total Interest Earned to Date:	$392,620.41

D. Balance of Air Toxics Funds as of 10/1/15 - 12/31/15

Total Grant Amount:	$2,745,371.68
Total Interest Earned:	$392,620.41
Total Expenditures:	($2,563,102.99)
Remaining Balance:	**$574,889.10**

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
10/1/15 - 12/31/15

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 10/1/15 - 12/31/15	Encumbrances	Remaining Balance 10/1/15 - 12/31/15
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 10/1/15 - 12/31/15

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 10/1/15 - 12/31/15

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