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, 2015 through June 30, 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

David Allen, Ph.D.
Principal Investigator
Center for Energy and Environmental Resources
The University of Texas at Austin
10100 Burnet Road, Bldg 133 (R7100)
Austin, TX 78758
512/475-7842
allen@che.utexas.edu

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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, 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

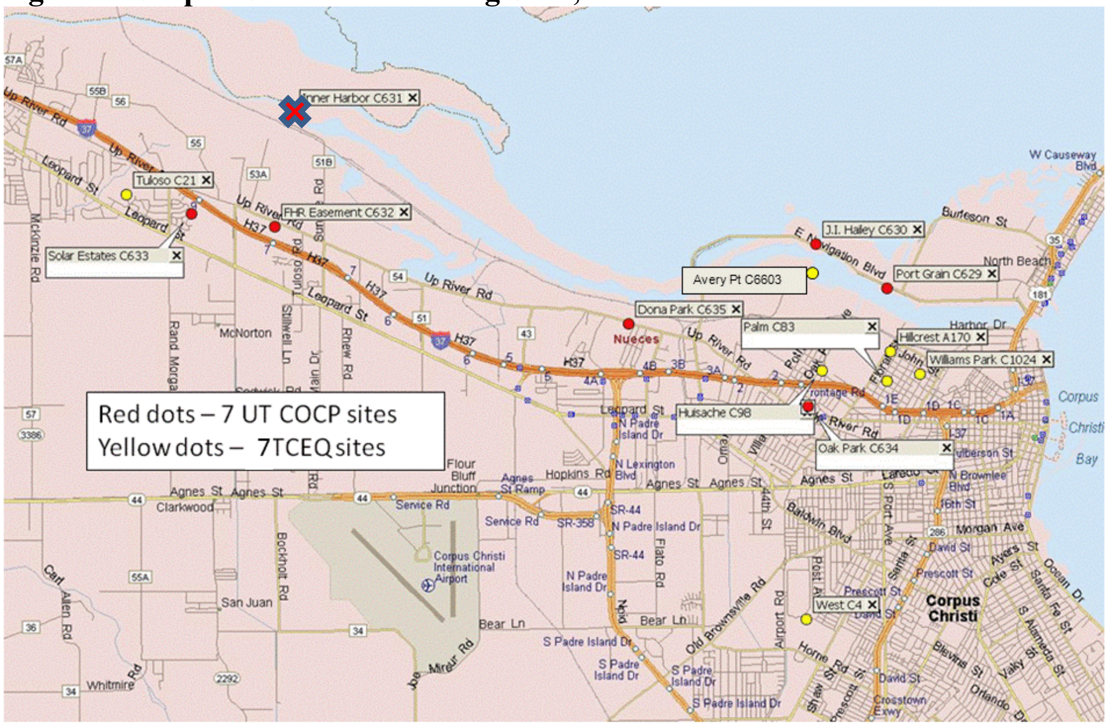

Table 1. Schedule of Air Monitoring Sites, Locations and Major Instrumentation

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 9 through 38. Specifically, the appendix contains the following elements:

- **Auto-GC Data Summary –** Both the first and second quarter auto-GC data for the two project sites have been validated. In examining the validated first and second quarters of 2015 hourly auto-GC data from Oak Park, Solar Estates, and the validated first quarter of 2015 data at 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 22. 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.

- **Benzene Summary –** A review of more than ten years of data is presented, with a focus on overall trends since 2005 and the second quarter average concentrations from 2005 through 2015, which appears on pages 23 through 27.

- **SO_2 and H_2S Summary –** A summary of SO_2 and H_2S data collection in the year to date is presented on pages 28 through 32.

- **TNMHC and Methane at the J. I. Hailey CAMS 630 site** - A discussion of a recent episode of elevated TNMHC at JIH CAMS 630 on April 29 & 30, 2015 is presented on pages 33 through 37.

B. Scheduled Meetings of the Volunteer Advisory Board

The Corpus Christi Project Advisory Board met on April 16, 2015. The meeting notes from that Advisory Board Meeting are found in Appendix B, pages 39 through 42.

C. Project Management and Planning

Project Management and Planning during this period has focused on the following four (4) 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 C, pages 43 through 45.

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 C, pages 43 through 45.

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 June 30, 2015 equals $3,137,649.31. This total includes interest earned through June 30, 2015.

B. Detailed List of the Actual Expenditures Paid from Air Toxics Project Funds Stage 1, Phase 1B through June 30, 2015
Expenditures of Air Toxics Project funds during this quarter totaled $239,890.43. 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, 2015
The interest earned during this quarter totaled $217.79. The Air Toxics Project total interest earned through June 30, 2015 equals $392,277.63. A report providing detailed calculations of the interest earned on the Air Toxics Project funds is included in Appendix C, pages 43 through 45.

D. Balance as of June 30, 2015, in the Air Toxics Project Account
The balance in the Air Toxics Project account, including interest earned totals $991,938.66.

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.

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

April 1, 2015 through June 30, 2015

The University of Texas at Austin
Center for Energy & Environmental Resources
Contact: Dave Sullivan, Ph.D.
sullivan231@mail.utexas.edu
(512) 471-7805 office
(512) 914-4710 cell

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, 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 first and second quarters of 2015;
- Information on the trends for benzene concentrations at the two project auto-GCs in residential areas, now with eleven years of second quarter data, and at the TCEQ's Palm auto-GC, with five years of second quarter data (since 2011);
- A summary of sulfur dioxide (SO_2) and hydrogen sulfide (H_2S) monitoring; and
- A discussion of a recent episode of elevated TNMHC and methane at JIH CAMS 630 on April 29 and 30, 2015.

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 (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. 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 2000 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 2015). 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://www.epa.gov/air/criteria.html (accessed July 2015).

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 2000 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.

- o 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 15, lists the data completeness from the two project auto-GCs from January 2013 through the most recent month of data validation (June 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. Overall for the second quarter, the data completeness at Oak Park auto-GC was 78 percent, which surpasses the allowable minimum goal of 75 percent. The specific problem at Oak Park is described in a May 15 report from UT’s contractor for the site operation:

> *We have had a lot of issues with the Oak Park site this week. It has an oven sensor failure on the thermal desorber that we have failed to resolve. It is possible it is a board level failure as well as a broken thermocouple. We are working to resolve this issue but it serves as a reminder that this equipment (Oak Park and Solar Estates) is getting old. The equipment was purchased in 2004 so it is now over 10 years old. Once we determine what parts need to be replaced I will let you know.*

The problems were corrected in late May, and data completeness for the month of June rose to 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			
Aug-13	87	98	Aug-14	96	99			
Sep-13	82	99	Sep-14	99	100			
Oct-13	99	99	Oct-14	98	98			
Nov-13	91	100	Nov-14	99	99			
Dec-13	99	99	Dec-14	98	100			
Average 2013	**93**	**99**	**Average 2014**	**96**	**98**	**Average 2015**	**87**	**99**

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

Table 4, on page 17, summarizes the statistics (maximum and average values) on fully validated data from the first quarter of 2015. Data in this table are available to TCEQ staff at http://rhone3.tceq.texas.gov/cgi-bin/agc_summary.pl (accessed July 2015). Table 5, on page 18, summarizes the statistics (maximum and average values) on the validated UT data and partially validated TCEQ Palm data from the second quarter of 2015. Note that with unvalidated data there is a chance that some summary statistics may change after validation is complete.

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.

As noted above, Tables 4 and 5 contain some statistics for 27 hydrocarbon species for the periods of interest. All concentration values in the tables 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 average data columns in Table 4 and Table 5 are shown graphically in Figures 2 and 3, respectively, on page 19. Figures 2 and 3 are plotted on the same y-axis scale, so they can be compared directly. For species measured consistently above their respective method detection limits at the Corpus Christi auto-GCs, mean concentrations are generally lower in the second and third quarters of the year, and higher in the first and fourth quarters of the year. More frequent maritime southerly flow in the spring and summer is a contributor 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 fallwinter fourth and first quarters. As can be observed by comparing Figures 2 and 3, average concentrations for the most prominent species were higher in the first quarter of 2015 compared with the second quarter 2015 at all three Corpus Christi sites.

Figure 4, on page 20, shows the average concentrations from the second quarter of 2014 for the purpose of making a rough comparison with the second quarter of 2015 in Figure 4. One observes considerable similarity in the year-to-year second quarter comparison.

Table 4. Validated auto-GC statistics, 1st quarter 2015

Units ppbV	Oak 1Q15			Solar 1Q15			Palm 1Q15		
Species	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**
Ethane	117.987	41.103	17.343	146.987	42.240	17.234	146.403	47.610	18.485
Ethylene	56.333	7.944	1.031	13.475	2.112	0.759	43.950	5.327	0.988
Propane	152.648	33.210	11.197	91.963	29.294	10.616	188.550	31.428	11.684
Propylene	18.284	1.965	0.482	4.254	0.866	0.283	6.236	1.121	0.418
Isobutane	41.080	8.771	3.341	29.843	7.674	2.648	60.810	9.479	3.744
n-Butane	88.088	14.940	5.863	49.944	13.831	4.838	124.618	21.160	6.817
t-2-Butene	3.108	0.380	0.095	2.283	0.127	0.047	8.781	0.836	0.132
1-Butene	2.666	0.227	0.063	2.746	0.126	0.033	2.475	0.508	0.118
c-2-Butene	2.791	0.297	0.060	3.238	0.156	0.046	3.845	0.448	0.114
Isopentane	86.993	9.576	2.548	18.644	4.832	1.700	42.163	8.754	2.672
n-Pentane	28.067	5.238	1.952	13.498	3.825	1.269	36.264	6.377	1.806
1,3-Butadiene	0.488	0.109	0.034	0.729	0.035	0.009	0.528	0.099	0.037
t-2-Pentene	7.245	0.559	0.076	1.381	0.063	0.007	3.619	0.359	0.075
1-Pentene	2.188	0.208	0.038	1.218	0.055	0.006	1.686	0.195	0.040
c-2-Pentene	1.506	0.145	0.028	1.693	0.077	0.003	1.781	0.170	0.036
n-Hexane	18.359	2.669	0.718	5.864	1.270	0.489	10.516	1.692	0.636
Benzene	**8.160**	**2.559**	**0.555**	**5.770**	**0.454**	**0.200**	**12.053**	**1.278**	**0.345**
Cyclohexane	5.326	0.796	0.269	2.830	0.436	0.175	2.847	0.680	0.212
Toluene	6.030	1.213	0.506	3.711	0.608	0.230	7.325	0.873	0.344
Ethyl Benzene	0.857	0.143	0.044	0.731	0.054	0.020	0.611	0.114	0.035
m&p -Xylene	2.774	0.530	0.146	16.465	2.038	0.188	3.041	0.660	0.199
o-Xylene	1.098	0.163	0.054	0.709	0.083	0.022	0.869	0.160	0.059
Isopropyl Benzene	0.967	0.198	0.023	1.192	0.309	0.011	2.250	0.384	0.012
1,3,5-Tri-methylbenzene	0.446	0.072	0.023	0.453	0.035	0.008	0.259	0.060	0.019
1,2,4-Tri-methylbenzene	0.674	0.144	0.043	0.695	0.054	0.022	0.409	0.110	0.043
n-Decane	0.657	0.148	0.036	0.859	0.111	0.028	0.322	0.085	0.032
1,2,3-Tri-methylbenzene	0.326	0.082	0.021	0.360	0.018	0.002	0.117	0.038	0.008

Table 5. Auto-GC mean statistics, 2nd quarter 2015 (UT validated, Palm partially validated)

Units ppbV	Oak 2Q15			Solar 2Q15			Palm 2Q15		
Species	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**
Ethane	71.208	20.648	4.135	146.498	16.723	4.522	59.763	18.070	3.847
Ethylene	47.934	4.645	0.466	7.202	0.939	0.245	34.389	3.101	0.386
Propane	509.797	39.317	2.566	39.282	8.301	2.302	76.735	9.556	1.756
Propylene	6.302	0.926	0.174	3.060	0.764	0.099	4.726	0.760	0.150
Isobutane	20.959	5.713	0.852	15.244	2.672	0.753	32.842	2.938	0.685
n-Butane	30.915	10.729	1.296	56.891	7.894	1.197	78.119	6.223	1.147
t-2-Butene	0.780	0.223	0.046	0.872	0.125	0.027	0.786	0.251	0.041
1-Butene	0.499	0.152	0.031	0.755	0.081	0.012	0.720	0.223	0.048
c-2-Butene	0.781	0.182	0.030	0.758	0.085	0.008	0.729	0.222	0.030
Isopentane	23.054	8.096	0.937	43.460	4.615	0.651	22.552	3.443	0.735
n-Pentane	15.585	5.703	0.580	16.277	1.630	0.403	18.268	1.860	0.399
1,3-Butadiene	0.280	0.036	0.012	5.024	0.655	0.011	0.268	0.047	0.019
t-2-Pentene	1.756	0.353	0.050	3.832	0.175	0.005	0.742	0.162	0.035
1-Pentene	0.981	0.183	0.023	1.534	0.072	0.003	0.391	0.095	0.019
c-2-Pentene	0.834	0.147	0.016	1.954	0.089	0.002	0.363	0.089	0.015
n-Hexane	5.621	1.919	0.245	7.663	0.863	0.189	7.617	1.089	0.197
Benzene	**2.784**	**1.196**	**0.162**	**7.092**	**1.041**	**0.086**	**2.415**	**0.847**	**0.094**
Cyclohexane	1.355	0.497	0.074	1.077	0.224	0.073	5.425	0.871	0.057
Toluene	16.970	3.988	0.256	5.662	0.873	0.119	3.158	0.790	0.171
Ethyl Benzene	0.308	0.083	0.025	0.486	0.052	0.011	0.267	0.079	0.011
m&p -Xylene	1.449	0.333	0.090	4.268	0.657	0.089	1.247	0.396	0.089
o-Xylene	0.400	0.112	0.032	0.741	0.076	0.013	0.393	0.106	0.027
Isopropyl Benzene	0.433	0.210	0.009	0.634	0.059	0.005	0.958	0.216	0.006
1,3,5-Tri-methylbenzene	0.191	0.078	0.014	0.393	0.047	0.004	0.162	0.033	0.007
1,2,4-Tri-methylbenzene	0.696	0.231	0.042	3.679	0.481	0.016	0.256	0.065	0.022
n-Decane	0.325	0.185	0.027	0.982	0.109	0.014	0.323	0.044	0.011
1,2,3-Tri-methylbenzene	0.216	0.125	0.018	0.210	0.030	0.007	0.587	0.081	0.017

Figure 2. Mean ppbV, 27 species at 3 auto-GCs, 1st quarter 2015 (validated data)

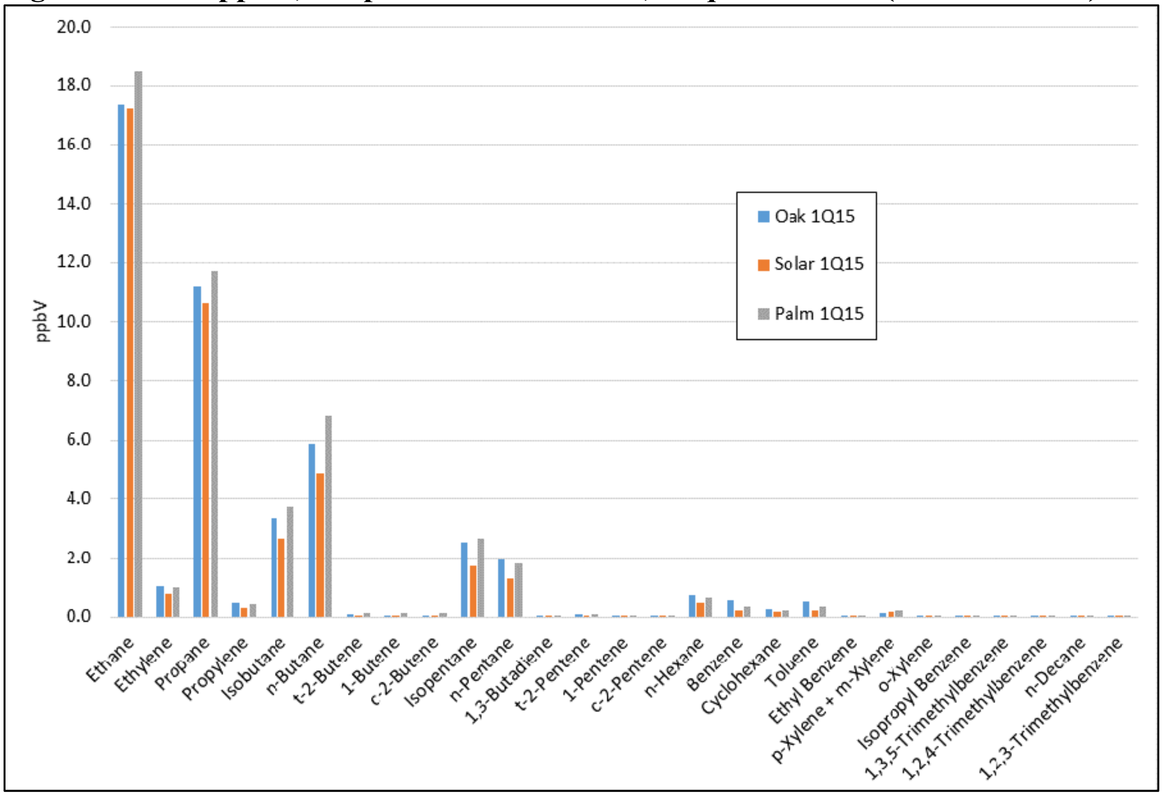


Figure 3. Mean ppbV, 27 species at 3 auto-GCs, 2nd quarter 2015 (Palm partially validated)

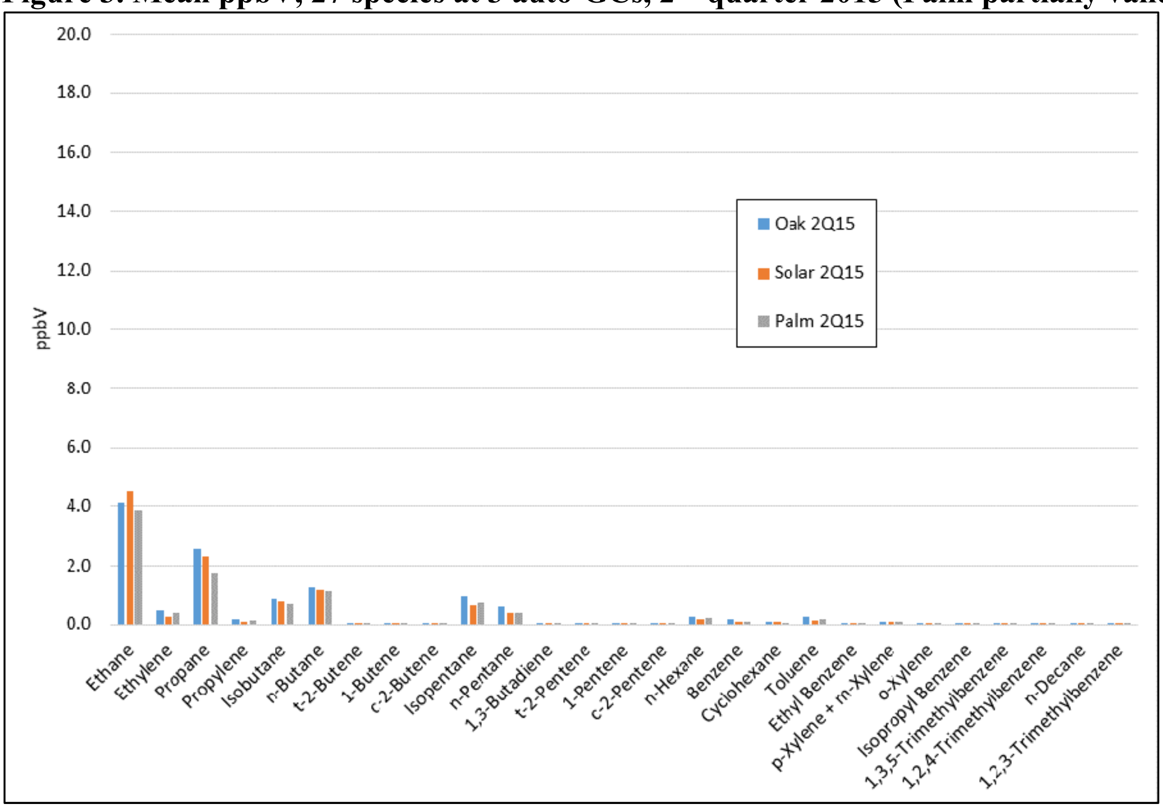
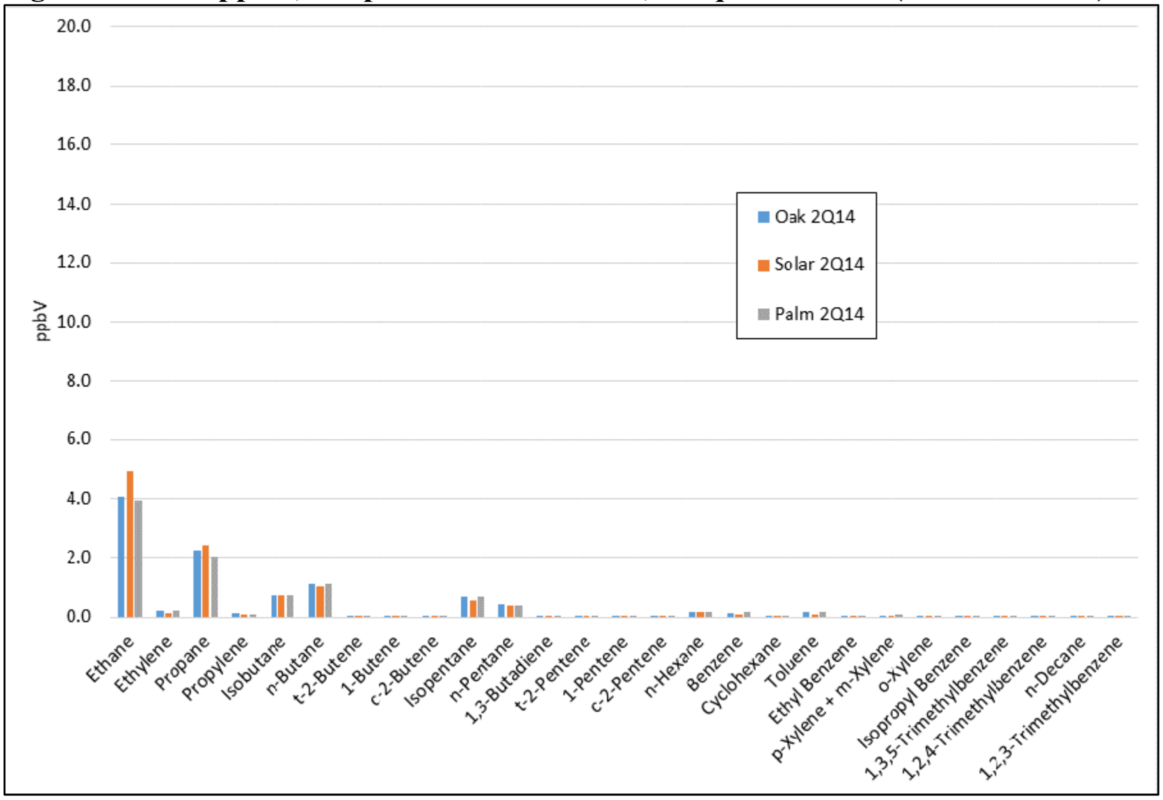


Figure 4. Mean ppbV, 27 species at 3 auto-GCs, 2nd quarter 2014 (validated data)



As was reported in the recent quarterly reports and annual reports, the annual and quarterly mean concentrations from Solar Estates and Oak Park are higher over the last four years under northerly winds for ethane and propane and some other *light alkane*[1] species than in the preceding three years. For the second quarter of 2015, the overall trend is for higher concentrations over 2012 – 2015 for ethane at Solar Estates and for several alkane species at Oak Park. Second quarter results do not display as strong a trend signal as the first quarter results because of higher frequency of southerly winds in the spring. A preliminary hypothesis is that increased natural gas and oil extraction or processing emissions are possible assignable causes for the higher mean concentrations. Figure 5, on page 21, shows graphical summaries of the mean concentrations for the second quarters of the years 2005 through 2015 for Solar Estates for ethane and propane, two species found in natural gas, and two butane isomers and two pentane isomers, which may be in natural gas and in other fuel products. Figure 6, on page 21, shows a similar second quarter graph for the Oak Park site, and Figure 7, on page 22, shows a similar second quarter graph for the TCEQ Palm site, beginning in 2011. To illustrate the effect of the change of seasons has on the trends, Figure 8, on page 22, shows the trends from the first quarters of 2006 – 2015 for ethane and propane for the Solar Estates and Oak Park sites.

[1] Alkanes are a class of hydrocarbons that are fully saturated (single carbon-hydrogen and carbon-carbon bonding). The light-weight alkanes discussed here have between two and five carbon atoms.

Figure 5. Mean concentrations of ethane, propane, butane isomers, and pentane isomers during second quarters of each year at Solar Estates

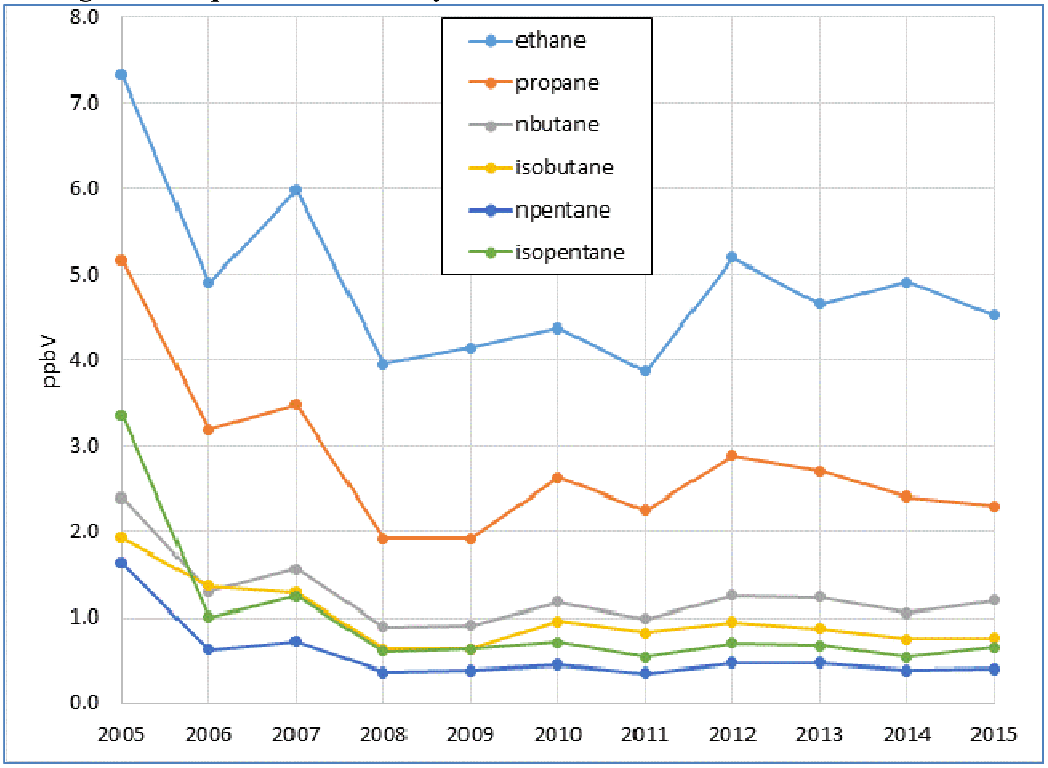


Figure 6. Mean concentrations of ethane, propane, butane isomers, and pentane isomers during second quarters of each year at Oak Park

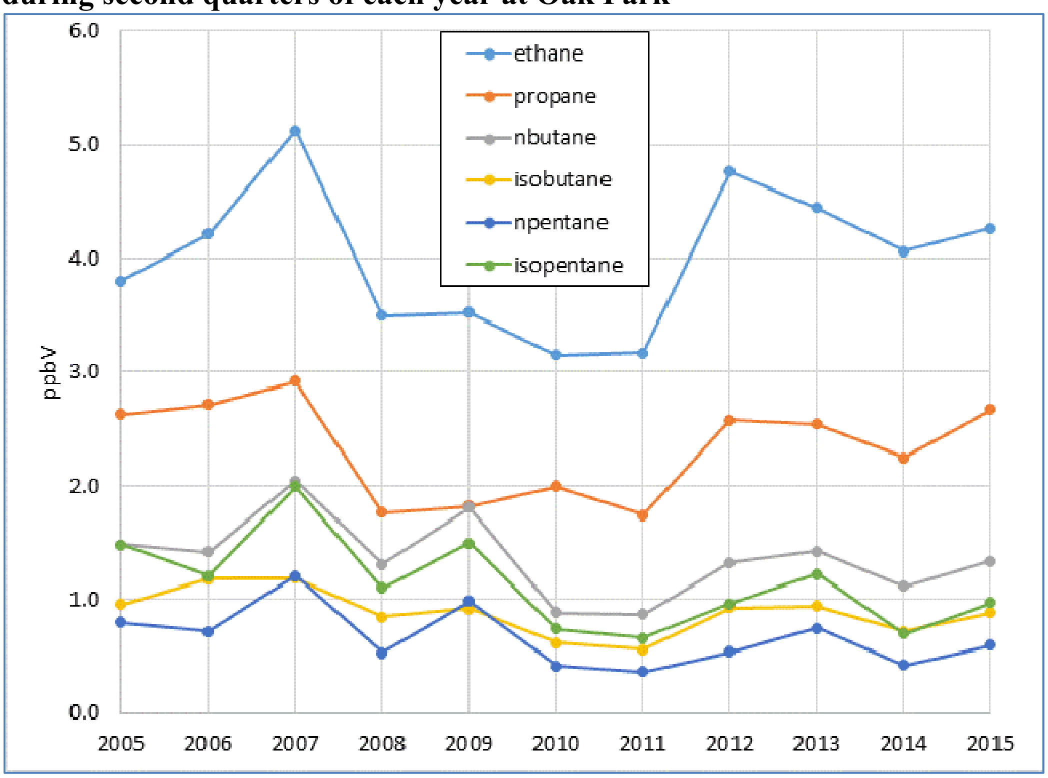


Figure 7. Mean concentrations of ethane, propane, butane isomers, and pentane isomers during second quarters of each year at TCEQ's Palm site since 2011

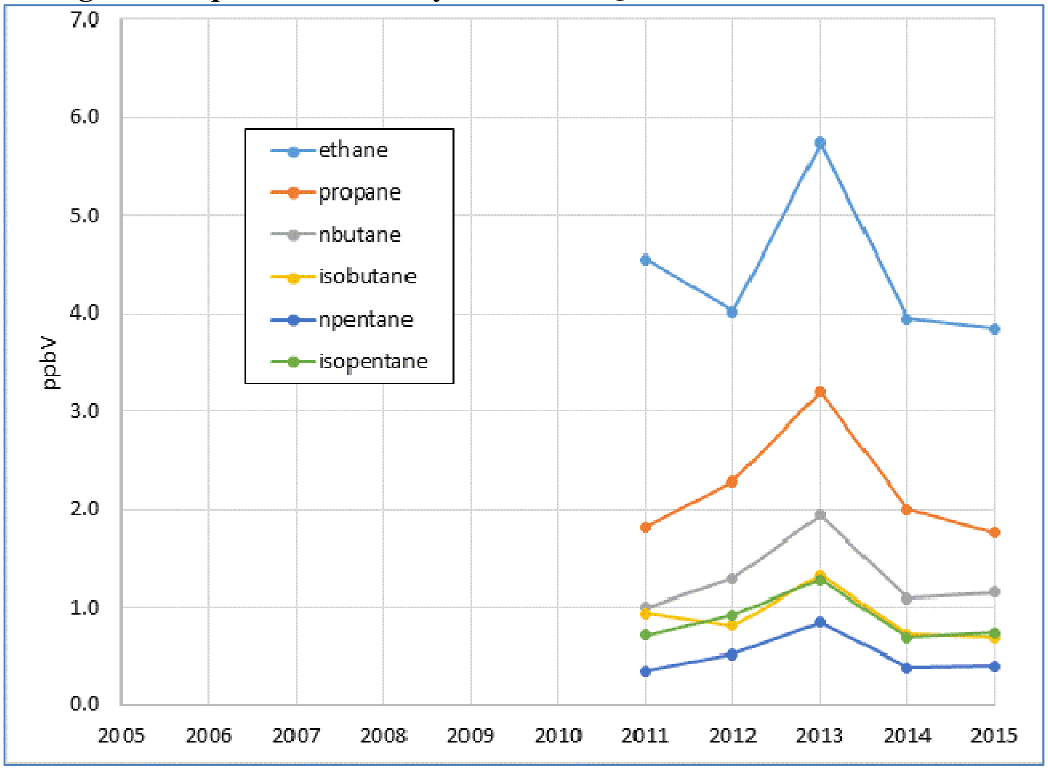


Figure 8. Mean concentrations of ethane and propane during first quarters of each year since 2016 (2005 was incomplete)

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. A time series for Oak Park hourly benzene in ppbV units from March 1, 2005 through March 31, 2015 with two points annotated by date appears in Figure 9, below. The two points from 6:00 a.m. CST Saturday, January 27, 2007, and 4:00 a.m. CST Friday, November 6, 2009, measured under northerly winds, are identified as statistical outliers in that they are unusually high given the balance of the data. The same graph is reproduced without the two outlier points in Figure 10, on page 24. The time series for Solar Estates appears in Figure 11, on page 24, with the highest value to date from October 3, 2014 labeled, having been measured under northeasterly winds. Note the different y-axis scales for the two sites, as Oak Park does tend to measure higher benzene concentrations than Solar Estates. Figure 12, on page 25, shows the time series for the TCEQ Palm C83 auto-GC, operating since 2010, with apparent outliers on January 30, 2012 and May 13, 2014 indicated, both measured under northerly winds.

Figure 9. Oak Park hourly benzene March 1, 2005 – March 31, 2015, ppbV units, individual elevated values noted, no observations greater than the TCEQ's AMCV

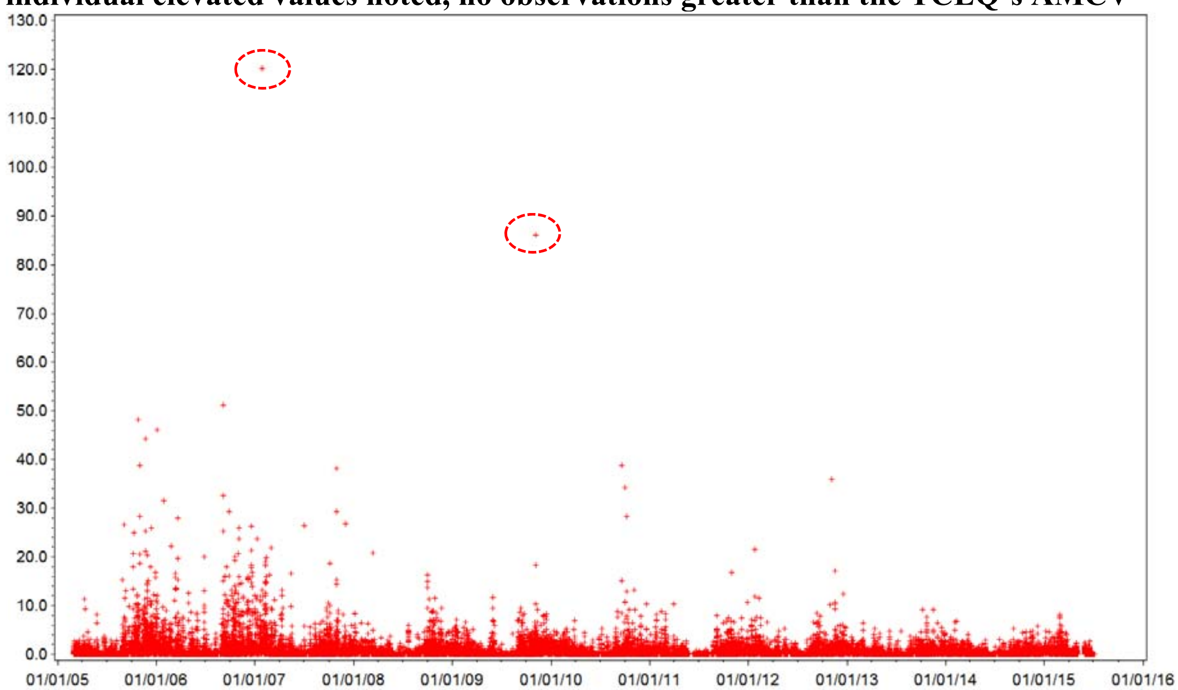


Figure 10. Oak Park hourly benzene March 1, 2005 – June 30, 2015, ppbV units, two outliers from January 27, 2007 and November 6, 2009 removed

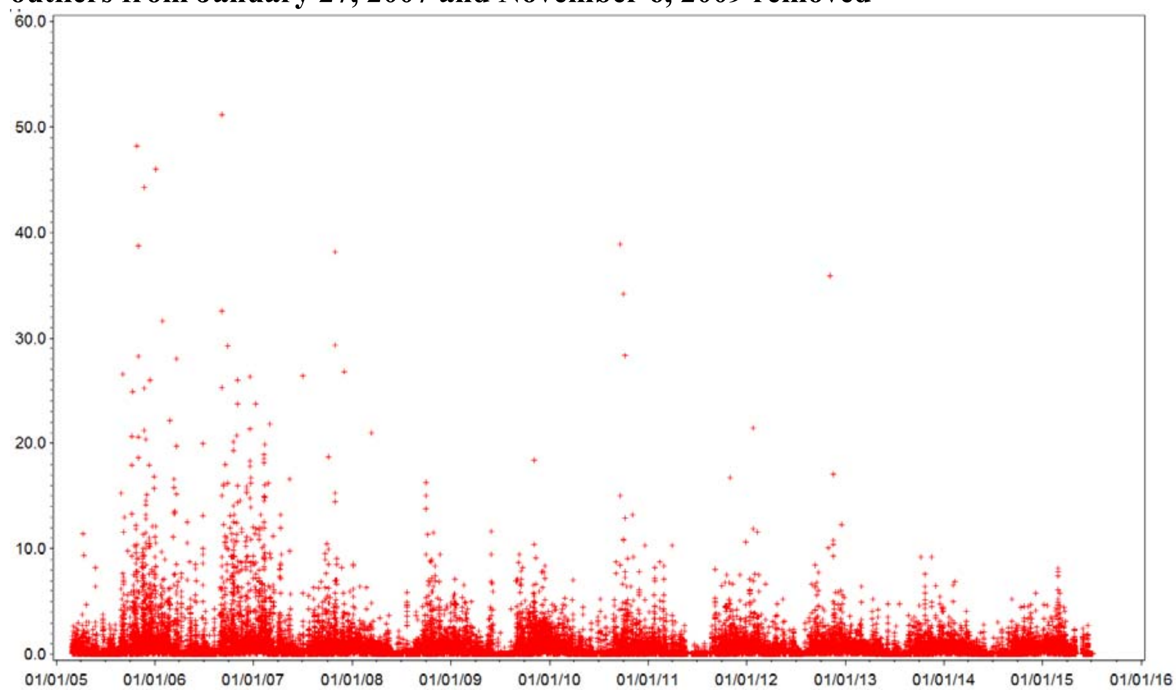


Figure 11. Solar Estates hourly benzene Mar. 2005 – June 30, 2015, ppbV units, maximum concentration noted, no observations greater than the TCEQ's AMCV

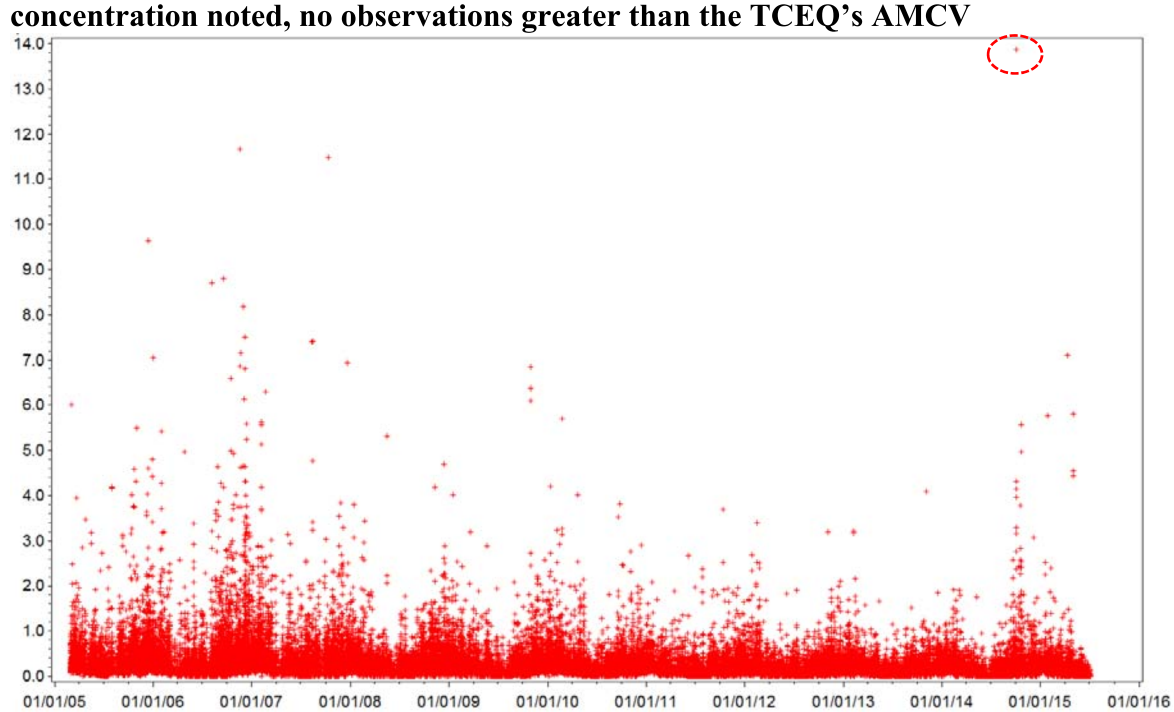


Figure 12. TCEQ Palm hourly benzene June 1, 2010 – June 30, 2015, ppbV units, individual highest concentrations noted, no observations greater than the TCEQ's AMCV

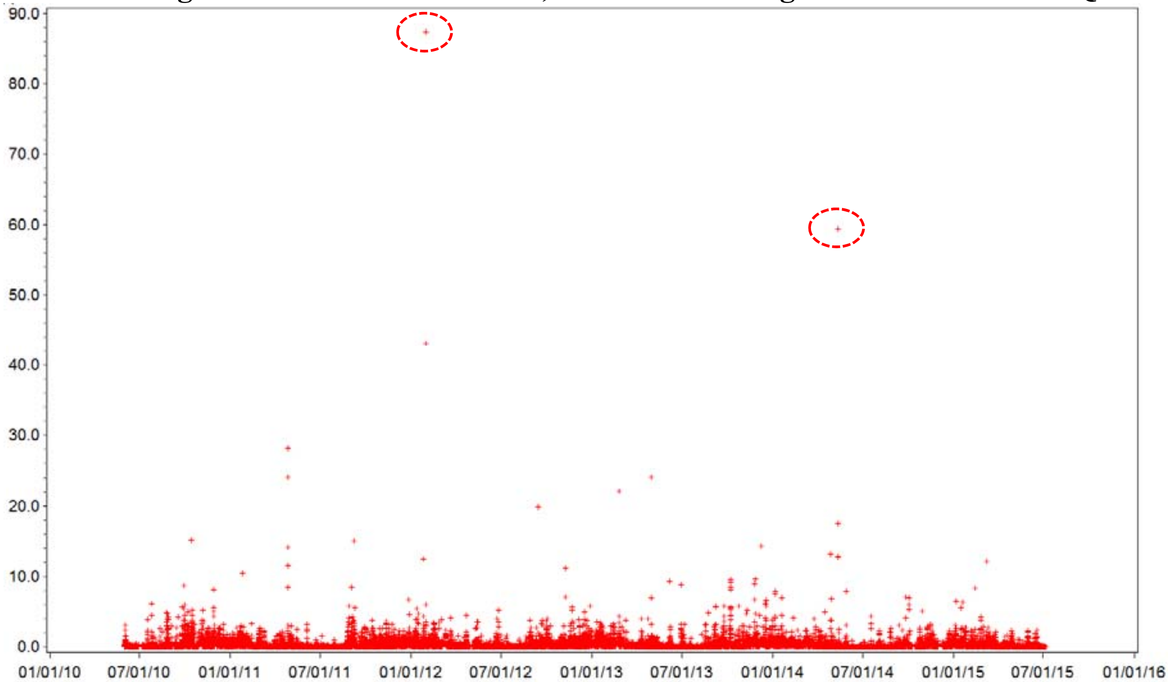


Table 6, below, shows the second quarter average concentrations from the two project auto-GCs for benzene from 2005 through 2015, and for the TCEQ Palm site since 2011. The project now has eleven years of complete second quarter data. The second quarter means are graphed in Figure 13, on page 26. The means for TCEQ's Palm site are shown for 2011 through 2015 only. The second quarter averages at UT sites from 2008 through 2015 are statistically significantly lower than in the first quarters of the project's first three years, and this finding is similar to findings for other quarters in recent reports on this project.

Table 6. Mean statistics for Benzene at Oak Park and Solar Estates, 2nd quarter 2005 – 2015, Palm 2011 – 2015, ppbV units

year	Oak Park	Solar Estates	Palm
2005	0.203	0.254	
2006	0.308	0.182	
2007	0.316	0.227	
2008	0.137	0.130	
2009	0.173	0.145	
2010	0.137	0.145	
2011	0.129	0.131	0.193
2012	0.208	0.098	0.157
2013	0.193	0.093	0.166
2014	0.114	0.069	0.191
2015	0.167	0.086	0.094

Figure 14, on page 27, shows the monthly means for the three sites since each started operation. This figure shows the strong seasonal effects, the early downward trend and subsequent flattening out in the trends at Oak Park and Solar Estates. Note that in Figure 14 each up/down grid line corresponds to a January.

Figure 13. Mean concentrations of benzene, ppbV units, during fourth quarters of each year at Oak Park (blue) and Solar Estates (orange), 2005 – 2014 and Palm (gray) 2010 – 2014

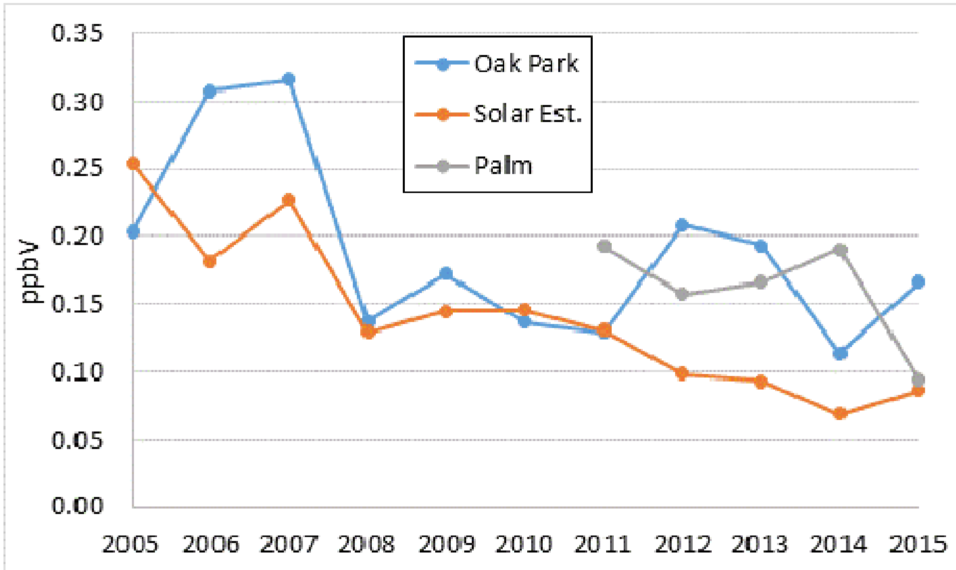
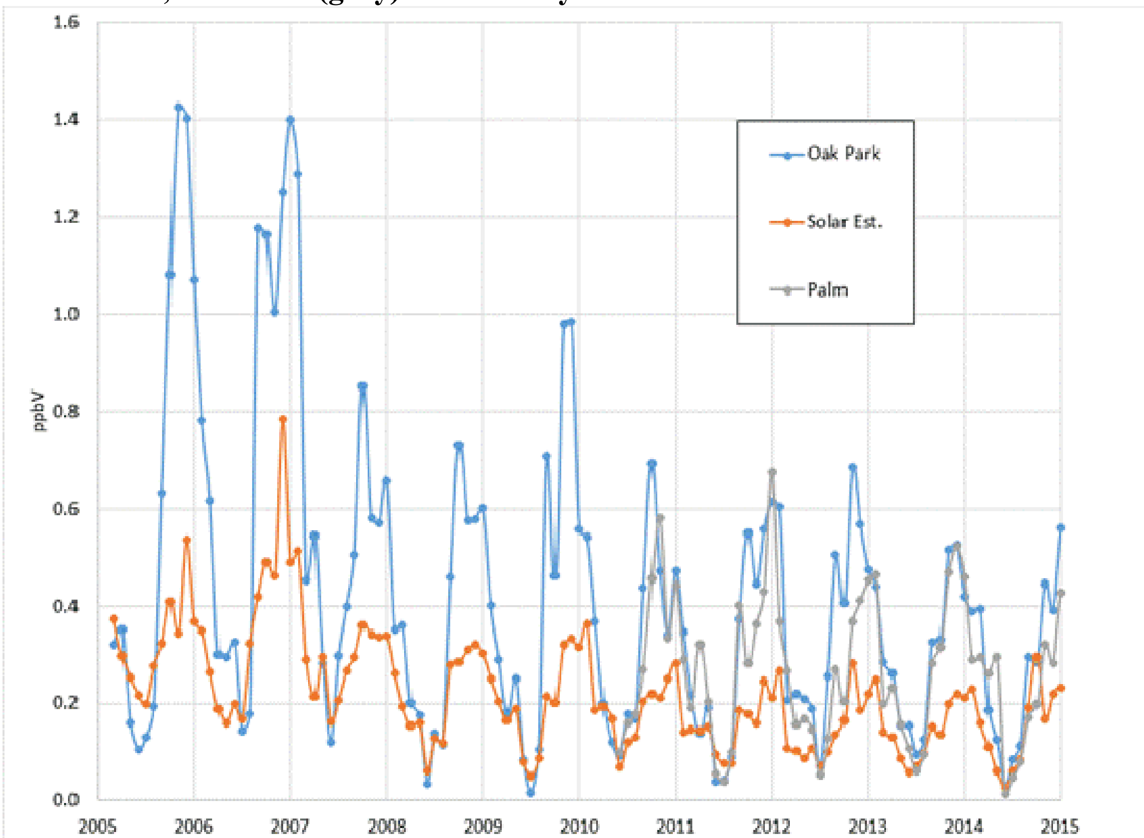


Figure 14. Mean concentrations of benzene by month of each year at Oak Park (blue) and Solar Estates (orange), 2005 – mid 2015 with lower values in 2008 – 2015 compared with 2005 – 2007, and Palm (gray) 2010 – early 2015



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.

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.

The maximum one-hour values measured at each project site for SO_2 and H_2S in the second 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, second quarter 2015

Site	SO_2	H_2S
West C4	1.1	
Tuloso C21	8.4	
Huisache C98	4.3	6.8
Port Grain C629	4.1	8.7
J.I. Hailey C630	9.5	8.2
Flint Hills C632	1.9	4.1
Solar Estates C633	1.7	5.8
Standards	**75.0**	**80.0***

* H_2S standard is for 30-minutes

From the 2005 start of monitoring at J. I. Hailey (JIH) C630, the data from the site had shown noncompliance with the 2010 SO_2 NAAQS up through the three year period ending in 2012. Beginning with the three year period ending in 2013, the JIH C630 SO_2 concentrations show compliance with the NAAQS. However, there are still occasional short-term elevated concentrations measured at the site. Figure 15, below, shows the time series for 5-minute SO_2 measurements in the second quarter of 2015 at the site. Some points representing measurements on days with the highest individual concentrations are labeled. April 13 was the date with the highest 5-minute value at 104 ppb, within a one–hour average of 9 ppb. The maximum 5-minute value on May 2 was 76 ppb within the 9.5 ppb one-hour average that was the maximum one-hour value this quarter. The time series for SO_2 on April 13 for JIH C630 and the nearby Port Grain C629 appears in Figure 16, on page 30. One observes that most measurements are very close to 0.0, the natural background concentration of SO_2. JIH C630 has five observations significantly greater than 0.0 and Port Grain C629 has one value at 14 ppb at 13:45 CST. Figure 17, on page 30, shows an aerial with back trajectory traces generated by the UT Corpus Christi Trajectory Tool for 9:50 CST and 14:05 CST (the two highest concentration observations) from C630 and one trace from C629 for the 13:45 CST observation. In the report last quarter a case study was presented in which back trajectories from the two sites intersected, suggesting a common source affecting the two monitoring sites. In this case, the trajectories do not converge, and it is very possible that two different sources affected the two sites on this day. It is also very possible that the source affecting JIH C630 was relatively close based on the divergence in the two trajectories upwind in Figure 17.

Figure 15. Five-minute SO_2 data JIH CAMS 630 second quarter (4/1 to 6/30) 2015

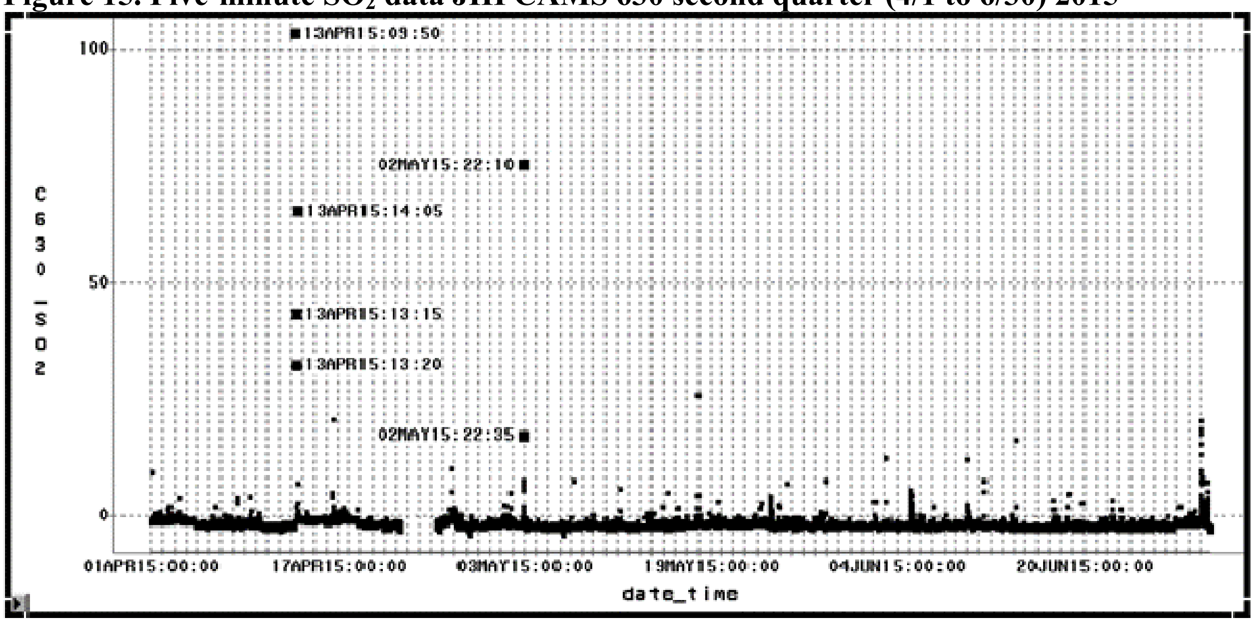


Figure 16. Five-minute SO_2 data April 13 for JIH C630 and Port Grain C629

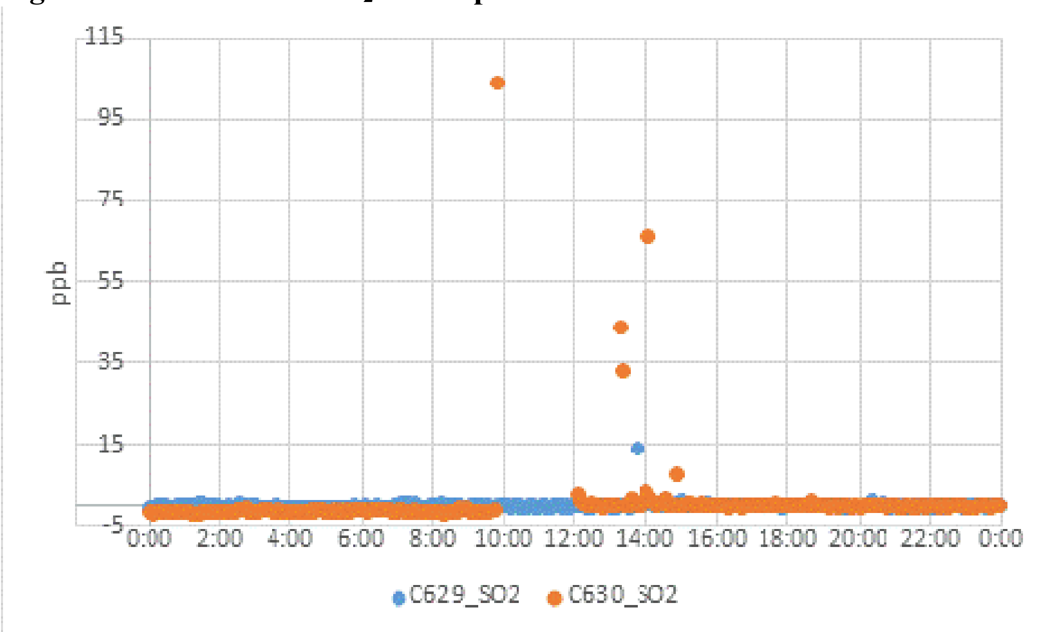


Figure 17. Google Earth Pro aerial with back trajectories starting 9:50 and 14:05 CST at JIH C630 and 13:45 CST Port Grain C629

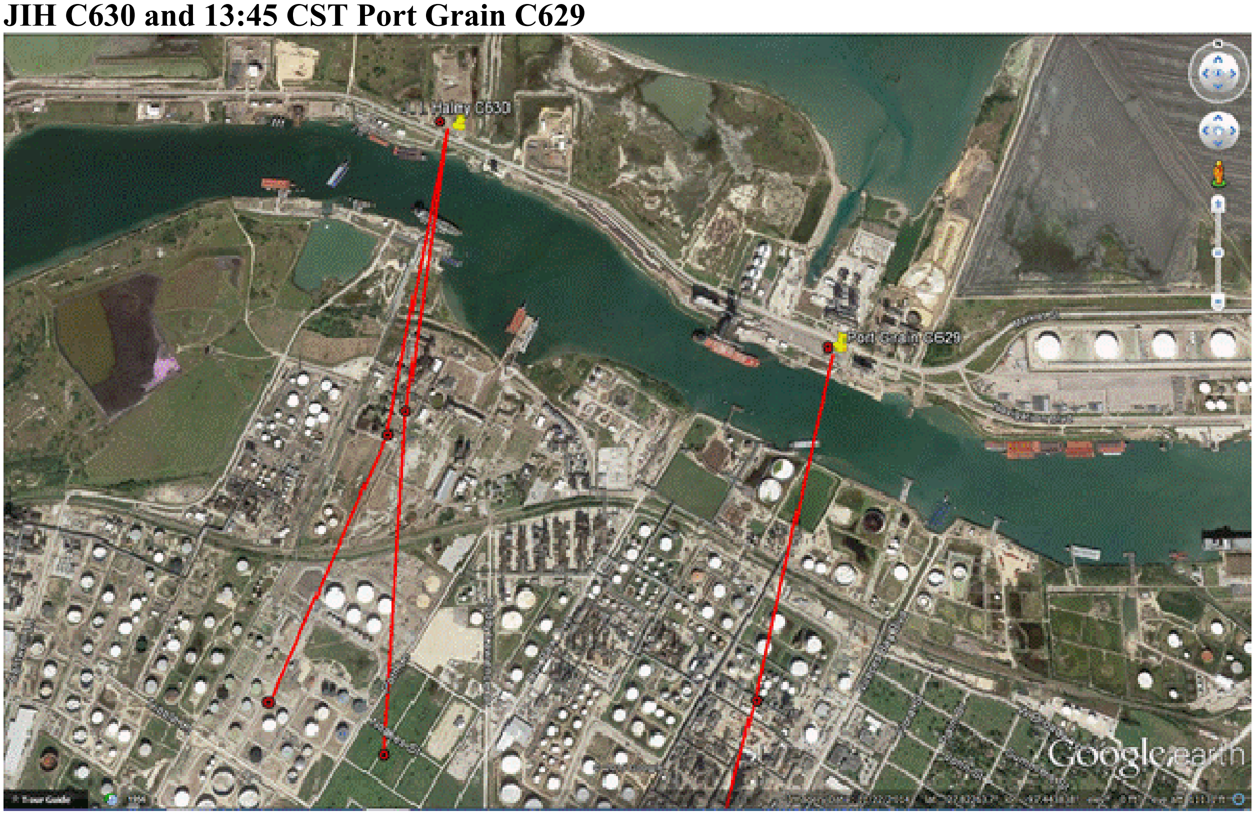
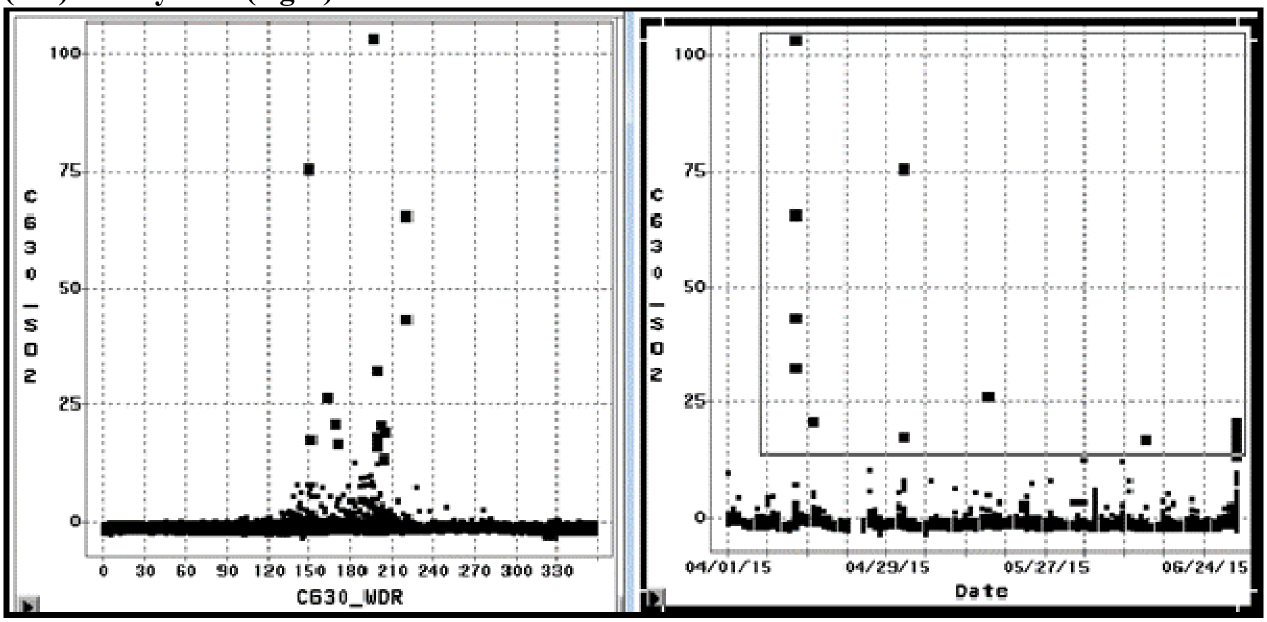


Figure 18, below, shows the JIH C630 five-minute SO_2 data for the second quarter by coincident wind direction on the left, and another, compressed version of the time series from the earlier Figure 15 on the right. This combination of graphs shows that the elevated SO_2 concentrations were all associated with southerly winds, but also were distributed over several different days.

Figure 18. CAMS 630 second quarter five-minute SO_2 data by coincident wind direction (left) and by date (right)

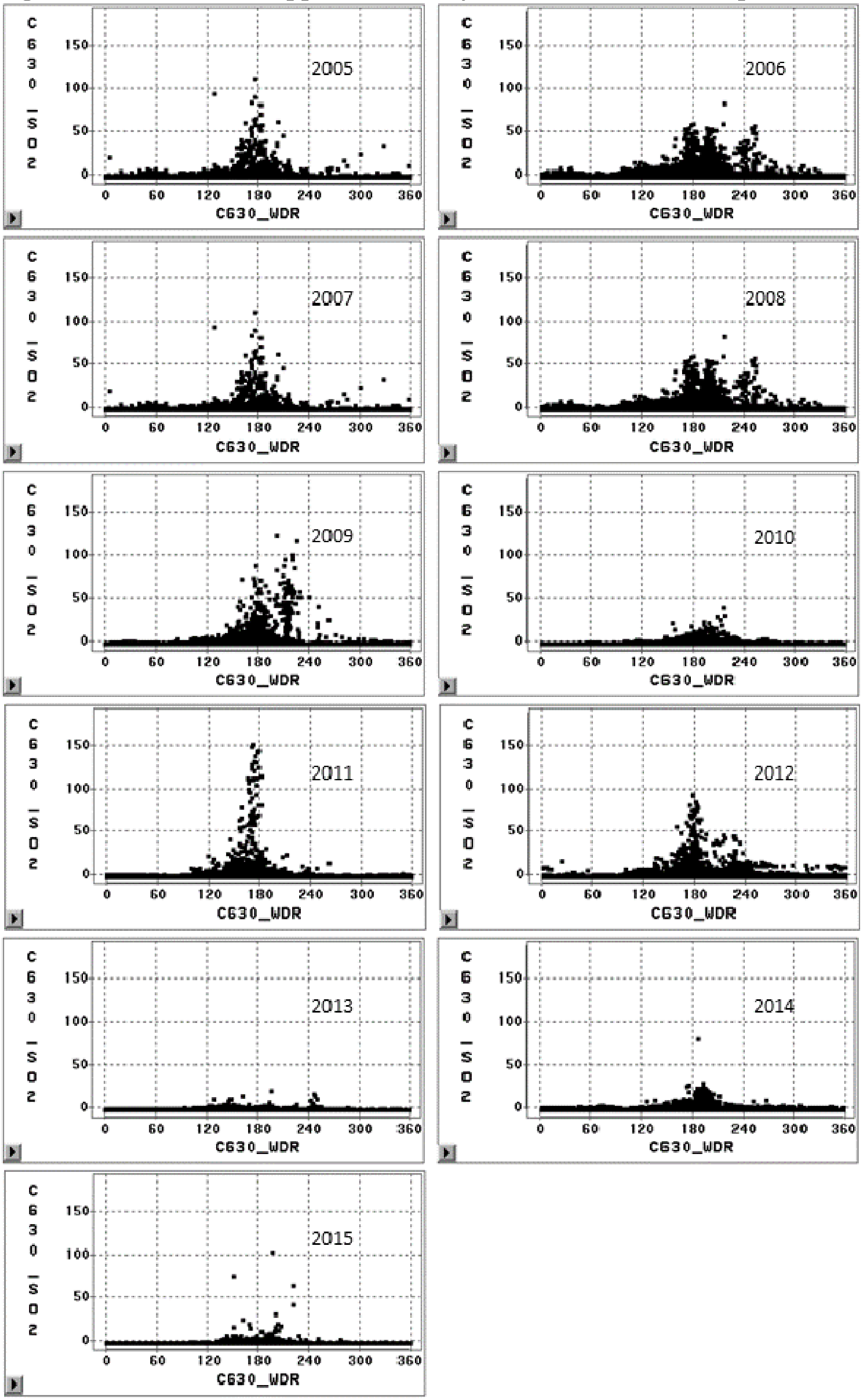


In order to assess SO_2 concentration trends at JIH C630, Figure 19, on page 32, combines 11 graphs of SO_2 five-minute ppb concentrations by wind direction for each year of operation, 2005 through partial 2015. All graphs are on the same scales. Figure 19 shows a marked reduction in concentrations from 2012 to 2013. However, there appear to be more SO_2 observations above the 0.0 background level in 2014 and 2015 than in 2013. Table 8, below, summarizes the count and percentage of 5-minute observations greater than or equal to 7.5 ppb (10 percent of the level of the NAAQS). Interestingly, although the magnitude of the highest concentrations of SO_2 was lower in 2014 than in earlier years, the frequency of values at or above the 7.5 ppb threshold selected in this assessment was higher than in 2010 and comparable to 2005.

Table 8. Second quarter by year, JIH C630 count, percentage of 5-minute $SO_2 \geq 7.5$ ppb

year	N >= 7.5 ppb	n obs	PCT	year	N >= 7.5 ppb	n obs	PCT
2005	221	24,597	0.90%	2011	368	24,756	1.49%
2006	719	23,549	3.05%	2012	458	25,101	1.82%
2007	477	25,330	1.88%	2013	12	25,150	0.05%
2008	798	25,233	3.16%	2014	201	24,600	0.82%
2009	374	25,339	1.48%	2015	34	24,496	0.14%
2010	68	25,037	0.27%				

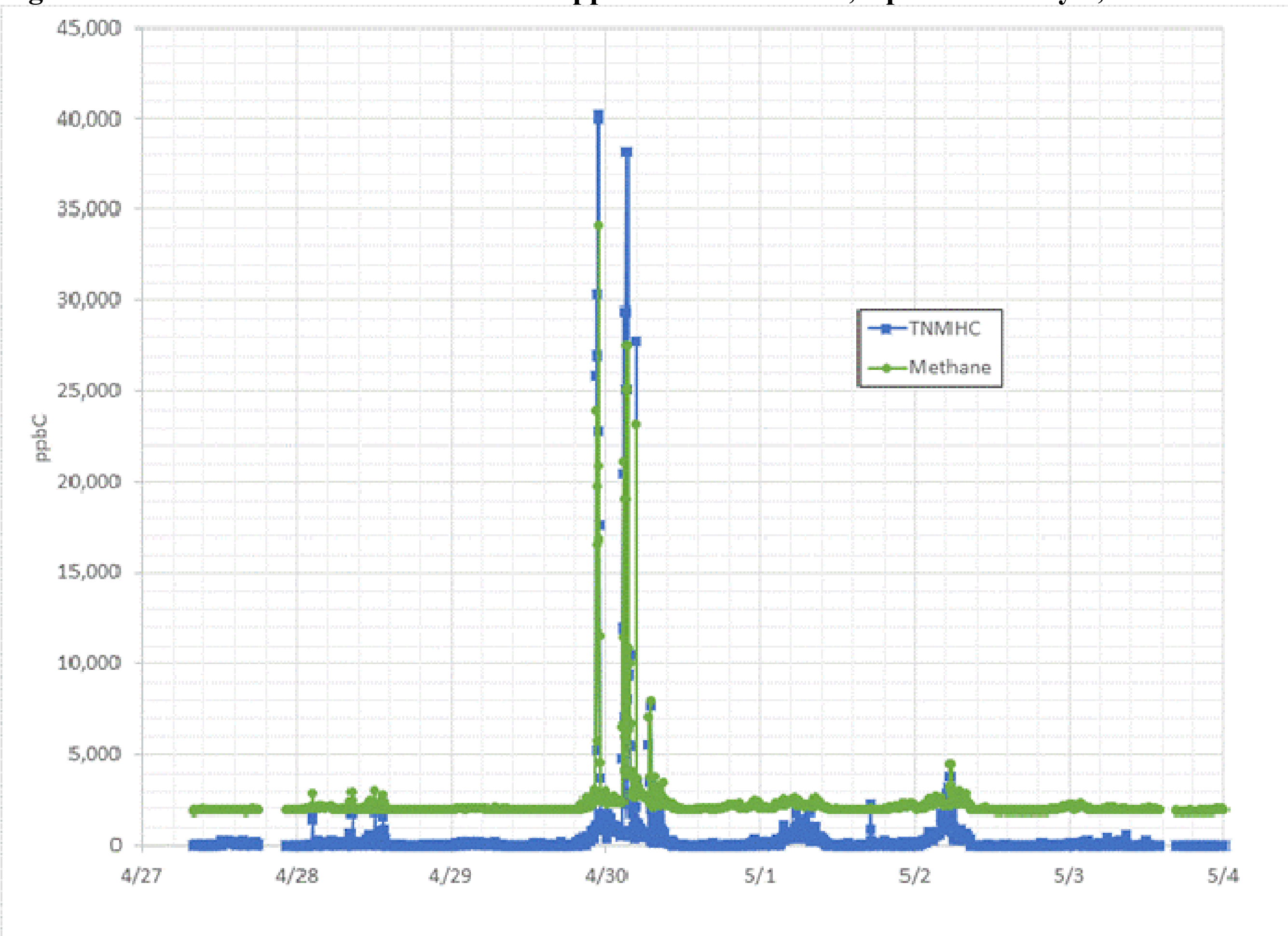
Figure 19. JIH C630 SO_2 ppb 5-minute by wind direction, 2005 – partial 2015



4. Recent episode of elevated TNMHC at J. I. Hailey CAMS 630 on April 29 & 30, 2015

On the overnight from April 29 – 30, 2015 at J. I. Hailey CAMS 630, TNMHC 5-minute values in the range of 40,000 ppbC were recorded. Winds were very light (~2.5 mph) from approximately 300 degrees (northwest). These were the highest recorded 5-minute values at JIH since Nov. 2008, and the one hour value 4/29/2015, 22 CST was 16,280 ppbC, one of the highest measurements to date. Coincident with the elevated TNMHC was elevated methane at 12,685 ppbC at 22 CST. A few hours later, at 3 CST the one-hour TNMHC was 9,618 ppbC and methane was 9,434 ppbC. The time series for the 5-minute TNMHC and methane data from JIH C630 from April 27 to May 4 appears in Figure 20, below.

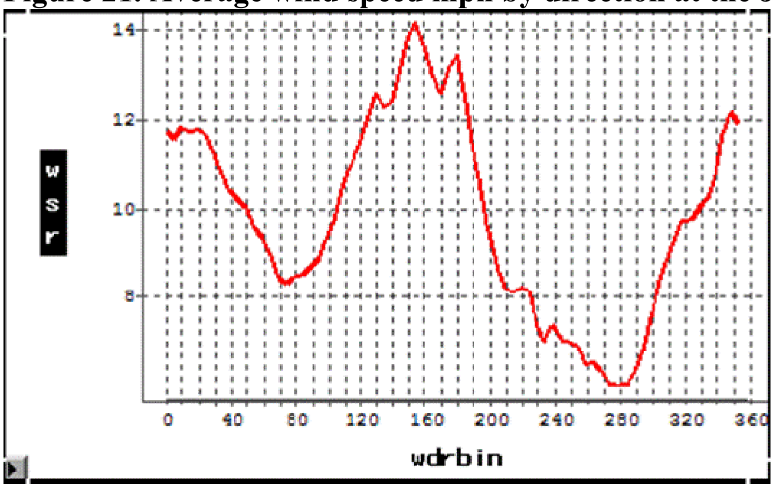
Figure 20. TNMHC and methane 5-minute ppbC data JIH C630, April 27 to May 4, 2015



These elevated concentrations prompted an examination of historical data at JIH C630. Dr. Sullivan collaborated with Mr. John Jolly at the TCEQ's Office of Air Quality to compare measured concentrations, wind speed and direction measurements, and observed land use changes near the JIH C630 site.

Earlier in this report in the section dealing with SO_2, graphs were presented (Figure 18, on page 31, and Figure 19, on page 32) showing individual concentration measurements of SO_2 by coincident wind direction. In that section there was no discussion of wind speed. Doing so adds a level of complexity to the analysis, and Dr. Sullivan and Mr. Jolly did so in their recent collaboration. The relationship between wind speed and pollutant concentrations is that in general, all else held equal, under high speeds a pollutant is diluted and dispersed in the surrounding air, lowering resultant concentrations and under low speeds may accumulate and thus produce higher measured concentrations. This provided a possible explanation of the high concentrations measured on April 29 – 30. The mean wind speed at JIH C630 is 11.4 miles per hour (mph), but from 22:25 CST to 23:05 CST April 29 when TNMHC averaged 23,649 ppbC wind speeds were between 1.9 and 2.7 mph. A short time later on April 30 from 2:40 CST to 3:45 CST, the TNMHC average 12,896 with slightly higher wind speed between 3.4 and 5.7 mph. In general, average wind speed varies by wind direction. In the Corpus Christi area, westerly winds tend to be slowest, implying that, all else held equal, the concentrations under westerly winds would be highest. Figure 21, below, shows the average wind speed by direction at the JIH C630 site.

Figure 21. Average wind speed mph by direction at the JIH C630 site 2005 – partial 2015



Because both TNMHC and methane were elevated on the overnight of April 29 – 30, both parameters were included in this analysis. Methane exists in the air owing to natural geologic processes and to human activity. As one can notice in Figure 20, on the preceding page, that while the TNMHC concentration is close to 0.0 much of the time, the methane concentration is close to 2,000 ppbC. Actually a rough estimate for the current methane "background" concentration in the northern hemisphere is 1,800 ppbC.[2] This background concentration can also be shown to vary with the season in Corpus Christi, with higher concentrations in winter months and lower concentrations in summer months. Over ten and a half years of operation, the JIH C630 site monthly median averages 1,996 ppbC methane in December and 1792 ppbC in July – a 200 ppbC or about a 10 percent change within the year. In order to take this into account, a new variable called "methane-excess" was created by subtracting bottom 10th percentile (p-tile) methane concentration from every methane measurement. The bottom 10th p-

[2] See, for example, Seinfeld, J.H. and S. N. Pandis, Atmospheric Chemistry and Physics, 2nd Ed., Wiley & Sons, 2006, or see http://www.esrl.noaa.gov/gmd/obop/mlo/programs/esrl/methane/methane.html (accessed July 2015)

tile was selected to reduce the number of negative methane-excess values that would result from using the median.

In looking at the aggregated data from JIH C630, wind speed has a negative correlation with TNMHC of -0.13 and a negative correlation of -0.30 with methane-excess, both of which are statistically significant. To account for the wind speed effect, both the TNMHC and methane-excess data were adjusted by multiplying each measurement by the coincident wind speed and normalizing the result by dividing the product by the average wind speed at the site, 11 mph. After doing so the correlations converge to near 0.0: 0.0001 for adjusted-TNMHC and 0.005 for adjusted-methane-excess.

During the early years of the project, TNMHC concentrations above 10,000 ppbC were cropped at 10,000 ppbC. Thus, the mean value for TNMHC is biased low because of the exclusion of values above 10,000 in some years and not others. An alternative to comparing the mean concentration between years or across different wind directions is to look at the frequency of values above some threshold – say, the 95th percentile value – by counting observations above the threshold and dividing by the total number of observations by year or by wind direction. Over 10 and one half years, the 95th percentile value for the adjusted-TNMHC is 368 ppbC and for adjusted-excess-methane is 387 ppbC. The frequency of observations by wind direction or by time period above the 95th p-tile is referred to as the conditional probability function (CPF).

Figure 22, on page 36, shows a series of 11 graphs of the conditional probability of a value above 95th p-tile by 5-degree wind bins by calendar year. All 11 graphs use the same x and y–axis scales. Conclusions are

- For 2005 – 2012, the key direction for TNMHC varies from southerly to westerly.
- For 2013 – 2014 and for Jan. – July 2015, the maxima CPF are 300 – 315 degrees, with strong directionality and close alignment of peak adjusted-TNMHC and adjusted-methane-excess.

As a last step in their analysis, Sullivan and Jolly looked at a collection of aerial photos from Google Earth Pro. Two images appear in Figure 23, on page 37, showing land use changes to the northwest of JIH C630 between November 2011 and November 2014. It appears that an oil and gas facility was installed northwest at approximately a 300 degree angle and 0.35 miles from JIH C630 between late 2011 and late 2014.

Figure 22. Graphs of conditional probability (CPF) of adj-TNMHC or adj-methane-excess value above 95th p-tile by 5-degree wind bins by calendar year 2005 – 2015

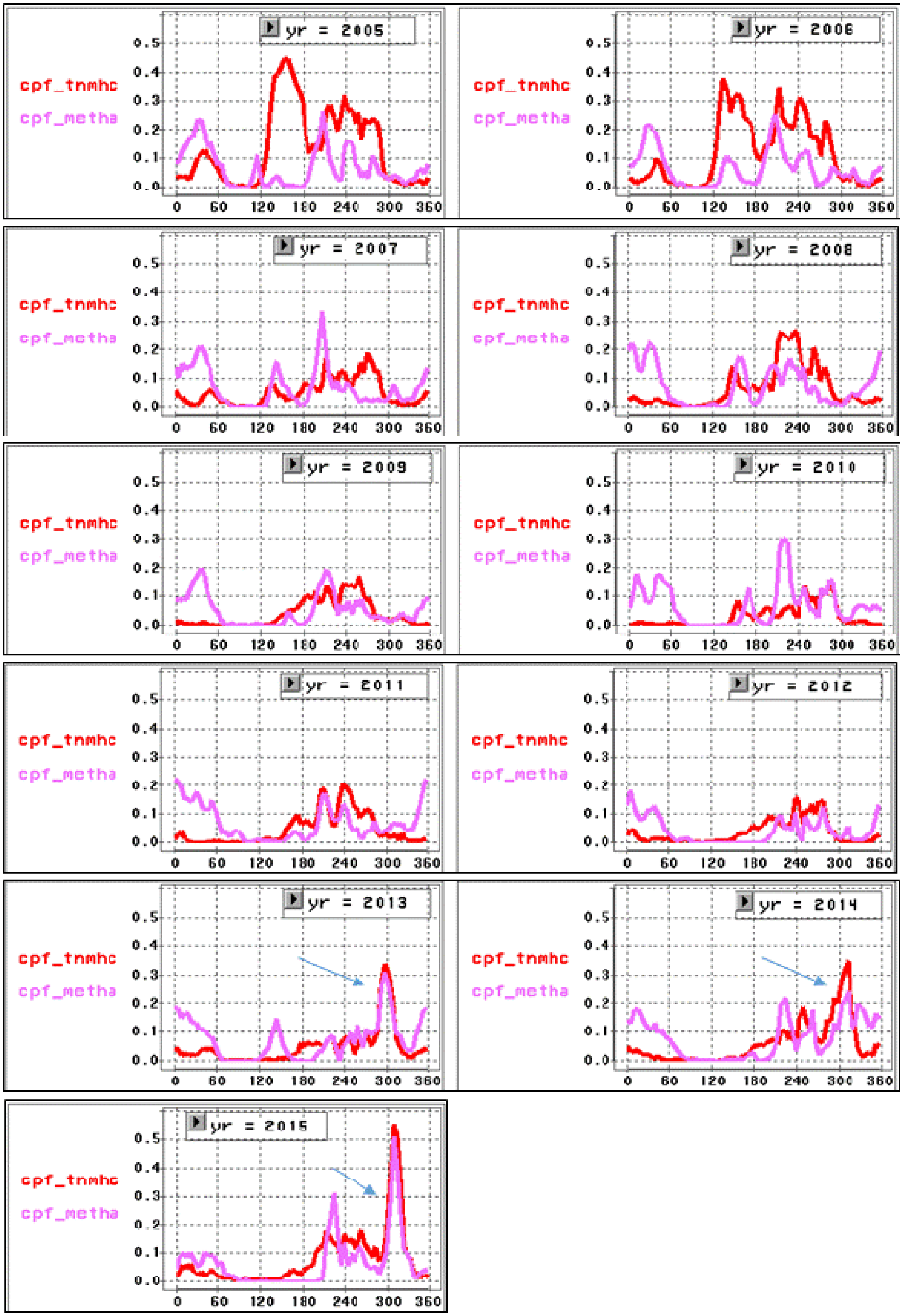


Figure 23. Top: aerial form Google Earth Pro dates November 2011; bottom: November 2014. Ray from JIH CAMS 630 at 307 degrees

Conclusions from the Second 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. Trends in quarterly average benzene concentrations remain relatively flat. Mean concentrations for several light alkane hydrocarbon species, possibly associated with natural gas, have increased in the past four years under northerly winds.
- 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 study was shown for elevated short-term SO_2 for which the hourly average remained below the level of the NAAQS.
- A potentially new source has been identified for gas leaks near JIH C630.
- Periodic air pollution events continue to be measured on a routine basis.

Further analyses will be provided upon request.

APPENDIX B

April 16, 2015
Advisory Board Meeting Notes

ADVISORY BOARD MEETING

Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project

Texas A&M University - Corpus Christi

Room 2010, NRC Building

12:00 pm – 2:00 pm

April 16, 2015

Advisory Board Members Present:

Ms. Gretchen Arnold	Corpus Christi Advocate
Dr. Glen Kost	Public Health Awareness
Ms. Joyce Jarmon	Corpus Christi Community Council

Guest Present:

Ms. Lois Huff	Sierra Club Coastal Bend Group

Ex-Officio Members of the Board Present:

Mr. Chris Owen	TCEQ – Region 14 via teleconference call
Mr. Kelly Ruble	TCEQ – Region 14

Project Personnel Present:

Mr. Vincent Torres	The University of Texas at Austin
Dr. Dave Sullivan	The University of Texas at Austin
Ms. Terri Mulvey	The University of Texas at Austin

I. Call to Order and Welcome

Mr. Vincent Torres called the meeting to order at 12:00 pm. Ms. Lois Huff, current chair of the Sierra Club Coastal Bend Group, joined the meeting at the invitation of Ms. Joyce Jarmon. Mr. Torres welcomed Ms. Huff.

II. Funding for Operations

A. Financial Status of Project and Decommissioning

Mr. Torres gave an update on the financial status of the remaining funds. Barring any unforeseen circumstances, as of 9/30/2014, the project had approximately 15 months of funding (exclusive of decommissioning expenses) and could operate the network through December 2015, possibly into January 2016.

The proposed schedule will follow this timeline: January 2016 – Discontinue operation of all sites and conduct final QA audits; February thru May 2016 – Decommission all sites;

prepare final project report and June 2016 – Submit final project report and close out project account.

Mr. Torres has a listed a sample of decommissioning preparation by items and condition of each item. Ms. Lois Huff, inquired where does the property go after the project ends? Mr. Torres responded as the items would be used as either back up or as a spare.

B. Proposal for Continued Auto-GC Sites(s) Monitoring

Dr. Dave Sullivan gave an update on the proposals seeking funding for continuing operations of the auto-GC site(s) after the project funding is exhausted. He reported that UT Austin is proposing continuing one or two auto-GC sites, and is seeking funding for this purpose. The auto-GC sites proposal would be to keep the residential area sites: Oak Park, Solar Estates and possibly Dona Park; replace old equipment at continuing sites; add SO_2 and H_2S instruments to the continuing auto-GC sites; and make software improvements to the auto-GC sites.

Dr. Sullivan listed possible stakeholders as: Federal Court, City of Corpus Christi District 1, Nueces County Precinct 1, Port Industries and others such as possible community groups. He also suggested the Advisory Board members may wish to contact city and/or county officials about the importance of the network and its scheduled ending date.

Ms. Joyce Jarmon mentioned that a long time close friend of Sissy Farenthold, Mr. Jackson Pope, indicated he wanted to use his influence to help the Advisory Board and the Project with our financial quest. She will forward Mr. Pope's contact information to Dr. Sullivan. Once he has received Mr. Pope's information, Dr. Sullivan will contact Mr. Pope to see if he can help with identifying continuation funding for the Project. **ACTION ITEM**

Dr. Glen Kost mentioned there was possibly a new plant by Lindale which was a concern by the Long Term Health Board. Mr. Kelly Ruble replied that South Cross Gas Fractions Facility is currently in the process of obtaining an application for permit. The TCEQ Permitting Group is located in Austin. He will check on the status of the permitting. **ACTION ITEM**

III. Project Overview and Status

A. Phase II – Site Operation and Maintenance

Dr. Dave Sullivan gave an update on and analysis of monitoring data collected by the Project for the past 10 years.

Dr. Sullivan mentioned that there was a declining trend in most species at the auto-GC sites, including benzene. However, he reported that there was an increasing trend in several alkane species. There was good news about SO_2 in Corpus Christi. New regulations on emissions from ships took effect June 1, 2012 and appear to have been effective. SO_2 emissions now appear to be in compliance with the latest SO_2 standard of 75 ppb.

Dr. Sullivan reported there were a total of 27 canisters taken in 2014. He also reported that there was good agreement between the canister data and the TNMHC instrument measurements. There were 6 canister samples collected at the CCGrain site, which is located on the north side in an industrial area. There were 5 canisters collected at the Dona Park site, which is in a residential area. Some of the samples collected were on 7/12, 7/15, 7/16, and 10/15/14 all during the early morning with south wind. The samples were predominately propane. There were 16 canister samples collected at the JIHailey site, which is across the ship channel and in an industrial area. The 27 canisters from 2014 contained several alkane species: ethane, propane, butane, isobutene, isopentane, and pentane. Alkane species are found in the exhaust from motor vehicles and in natural gas.

Dr. Sullivan reported that the significant downward trend in benzene at the Oak Park and Solar Estates sites has now flattened out. He noted that there was a strong seasonal pattern, which resulted in higher benzene concentrations in winter months. The wind directions associated with peak mean concentrations point back to the refineries.

Dr. Sullivan reported sulfur species (SO_2 and H_2S) monitoring is a very important part of the monitoring network. In June 2, 2010 new rules were adopted for stricter EPA standards (NAAQS). The JI Hailey site did not comply with new NAAQS rules in 2012. However, the new stricter emission rules may have had a positive effect, and the site is now in compliance. All the sites are now showing a downward trend in concentrations. However, occasional elevated SO_2 values are measured.

IV. Follow up to Old Business/Action Items

V. Advisory Board

Mr. Torres suggested the weeks of November 12 or November 17, 2015 as possible meeting dates for the next Advisory Board meeting.

VI. Other Issues

VII. Adjourn

The meeting adjourned at 1:45pm

APPENDIX C

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
4/1/15 - 6/30/15

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

Total Grant Amount:	$2,745,371.68
Total Interest Earned:	$392,277.63
Total Funds Received:	**$3,137,649.31**

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 4/1/15 - 6/30/15	Encumbrances	Remaining Balance 4/1/15 - 6/30/15
Salaries-Prof	12	$111,654.00	$183,063.49	$31,566.18	$31,566.18	$98,233.06	$0.00	$424,516.73	($227,973.18)	($42,146.25)	($13,735.37)	$140,661.93
Fringe	14	$24,563.88	$40,273.97	$11,051.05	$11,051.05	$34,155.63	$0.00	$110,044.53	($66,250.53)	($12,600.56)	($3,292.22)	$27,901.22
Salaries-CEER	15	$0.00	$0.00	$10,538.09	$0.00	$55,713.31	$0.00	$66,251.40	($53,666.54)	($9,861.30)	$0.00	$2,723.56
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	$0.00	$1,155.00	($900.00)	($90.00)	$0.00	$165.00
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)	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
Monthly M&O	50	$0.00	$0.00	$20,908.45	$20,908.45	$42,472.49	$0.00	$63,380.94	($55,614.34)	($3,263.40)	($2,956.40)	$1,546.80
Equipment & Spare Parts	51	$0.00	$32,584.00	$17,539.29	$17,539.29	($3,858.00)	$0.00	$46,265.29	($38,259.23)	($7,145.50)	$0.00	$860.56
Telephone SWB-DSL/RR	52	$0.00	$8,454.00	$8,707.47	$8,707.47	$10,391.56	$0.00	$27,553.03	($21,834.73)	($2,037.16)	$0.00	$3,681.14
Electric	53	$0.00	$22,438.00	$23,086.69	$23,086.69	$20,257.77	$0.00	$65,782.46	($54,393.10)	($4,550.68)	$0.00	$6,838.68
Gases	54	$0.00	$10,811.00	$10,676.72	$10,676.72	$13,457.71	$0.00	$34,945.43	($26,555.79)	($1,164.75)	($1,604.96)	$5,619.93
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	$0.00	$1,389,670.92	($987,279.20)	($98,232.35)	$0.00	$304,159.37
Analytical	68	$0.00	$27,839.39	$6,458.00	$6,458.00	$72,883.61	$0.00	$107,181.00	($76,979.00)	($27,102.00)	$0.00	$3,100.00
Travel	75	$0.00	$3,000.00	$1,000.62	$1,000.62	$2,832.38	$0.00	$6,833.00	($3,829.32)	($406.42)	($0.01)	$2,597.25
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	($248,585.26)	($31,290.06)	$0.00	$78,216.63
TOTALS		**$414,482.78**	**$602,041.36**	**$1,003,920.42**	**$993,382.33**	**$724,927.12**	**$0.00**	**$2,745,371.68**	**($1,905,820.22)**	**($239,890.43)**	**($21,588.96)**	**$578,072.07**

C. Interest Earned by Air Toxics Funds as of 4/1/15 - 6/30/15

Prior Interest Earned:	$392,059.84
Interest Earned This Quarter:	$217.79
Total Interest Earned to Date:	$392,277.63

D. Balance of Air Toxics Funds as of 4/1/15 - 6/30/15

Total Grant Amount:	$2,745,371.68
Total Interest Earned:	$392,277.63
Total Expenditures:	($2,145,710.65)
Remaining Balance:	**$991,938.66**

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

Accounting Certification
26-7700-99

8/3/2015

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

Accounting Report for the Quarter
4/1/15 - 6/30/15

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 4/1/15 - 6/30/15	Encumbrances	Remaining Balance 4/1/15 - 6/30/15
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 4/1/15 - 6/30/15

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 4/1/15 - 6/30/15

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

8/3/2015