Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project

Quarterly Report for the Period

April 1, 2011 through June 30, 2011

Submitted to

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

Ms. Kathleen Aisling
US 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

August 30, 2011

I. Introduction

On October 1, 2003, the US 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). This quarterly report has been prepared pursuant to the requirements of the project and is being submitted to the US District Court, the US Environmental Protection Agency (EPA), and the Texas Commission on Environmental Quality (TCEQ).

II. Project Progress Report

The focus of work during the quarter ending June 30, 2011 has been directed to the following activities.

A. Operations and Maintenance Phase of the Project

A detailed description of the data analyses for this quarter appears in Appendix A, pages 6 through 24, and a summary of these analyses appears in this section.

The Project consists of a network of seven (7) 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, below. Table 1, page 3, 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

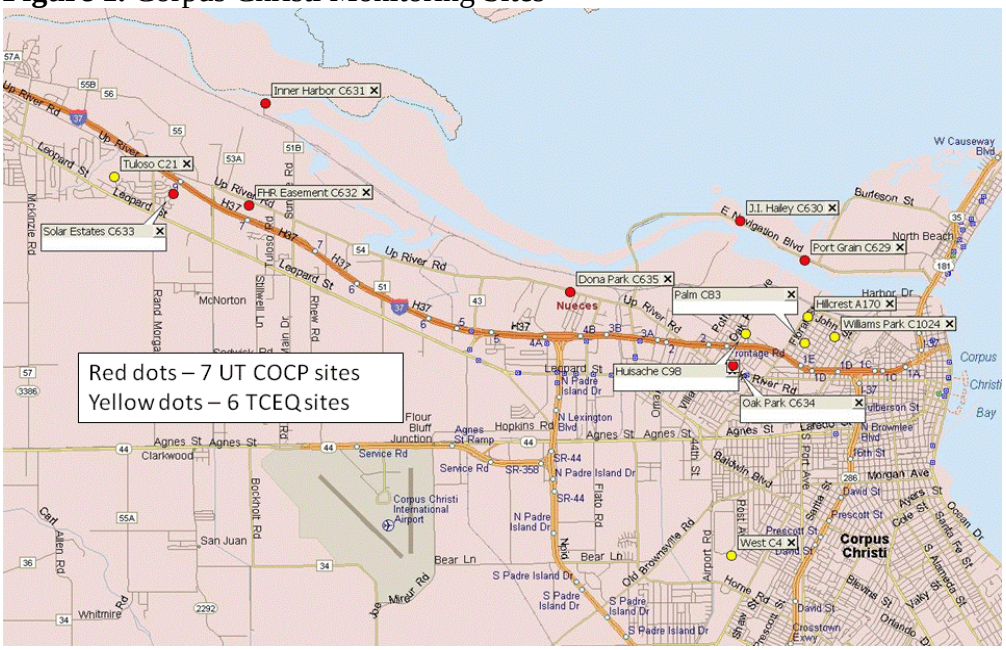


Table 1. Schedule of Air Monitoring Sites, Locations and Major Instrumentation

TCEQ CAMS Nos.	Description of Site Location	Monitoring Equipment				
		Auto GC	TNMHC(T) & Canister(C)	H2S & SO2	Met Station	Camera
634	Oak Park Recreation Center	Yes	T		Yes	
629	Grain Elevator @ Port of Corpus Christi		T&C	Yes	Yes	
630	J. I. Hailey Site @ Port of Corpus Christi		T&C	Yes	Yes	
635	TCEQ Monitoring Site C199 @ Dona Park		T&C	Yes	Yes	Yes
631	Port of Corpus Christi on West End of CC Inner Harbor		T&C	Yes	Yes	
632	Off Up River Road on Flint Hills Resources Easement		T&C	Yes	Yes	
633	Solar Estates Park at end of Sunshine Road	Yes	T	Yes	Yes	Yes

Legend

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

A discussion of data findings for the quarter appears in Appendix A, pages 6 though 24. Specifically, the appendix contains the following elements:

- **Auto-GC Data Summary –** In examining the second quarter of 2011 hourly auto-GC data from Oak Park, Solar Estates, and TCEQ's Palm sites no measurements were found to have exceeded a short-term air monitoring comparison value (AMCV). Also, the quarterly averages of all species were below their respective long-term AMCVs. A summary appears in Appendix A, pages 6 through 24.

- **Benzene Summary** – Average benzene concentrations have been relatively constant in recent years. The first quarter means from 2006 through 2011 are presented.

- **Dona Park Speciated $PM_{2.5}$ Analysis** – The data from the TCEQ's $PM_{2.5}$ sampler have been studied to see what might be learned about local emission sources that affect the community.

- **Analysis of Sulfur Dioxide Exceedance at J. I. Hailey CAMS 630** – On April 9, 2011, SO_2 concentrations were measured above the level of the E.P.A. standard.

B. 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 seven 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.

3. **Budget Monitoring**
   Budget monitoring during the period has focused on projects costs for Phase II – Sites Operation and Maintenance costs. Financial reports for the quarter are included in Appendix B, pages 25 and 26.

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

III. Financial Report

As required, the following financial summary information is provided. Details supporting this financial summary are included in Appendix B, pages 25and 26.

A. Total Amount of COCP Funds and Other Funds Received Under the Project

The COCP funds received through June 30, 2011 totals $7,563,001.26. This total includes interest earned through June 30, 2011.

B. Detailed List of the Actual Expenditures Paid from COCP Funds

Expenditures of COCP funds during this quarter totaled $257,154.14. The detailed breakdown of the actual expenditures is included in Appendix B, page 26. The activities for which these expenditures were used are detailed in Section II, on page 2 of this report.

C. Total Interest Earned on COCP Funds during the Quarter

The interest earned during this quarter totaled $6,576.34. A report providing detailed calculations of the interest earned on the COCP funds during each month of the quarter is included in Appendix B, pages 25 and 26.

D. Balance as of June 30, 2011, in the COCP Account

The balance in the COCP account, including estimated interest earned totals $984,751.68.

E. Expected Expenditures for the Funds Remaining in the COCP Account

The projected expenditures for the funds remaining totals $984,751.68.

Quarterly Report Distribution List:

U.S. District Court

- Mr. Joseph Jasek, Assistant Deputy Chief USPO
- Mr. James Martinez, Supervising USPO

Texas Commission on Environmental Quality

- Ms. Sharon Blue, Litigation Division – Headquarters
- Mr. Chris Owen, Air Quality Division – Headquarters
- Ms. Susan Clewis, Director – Region 14
- Mr. David Kennebeck, Field Operations – Region 14

Environmental Protection Agency

- Ms. Kathleen Aisling, Environmental Engineer, Air Enforcement Section, Dallas Regional Office

Members of the Advisory Board

APPENDIX A

Data Analysis for Corpus Christi Quarterly Report

April 1, 2011 through June 30, 2011

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 monitoring and analysis of data under the Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project for the period April 1 through June 30, 2011. The monitoring network is shown in Figure 1, page 2, 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 2nd quarter of 2011;
- Information on the trends for benzene concentrations at two auto-GCs in residential areas;
- Results from analysis of data from the TCEQ's speciated $PM_{2.5}$ sampler at Dona Park conducted to see what might be learned about local emission sources that affect the community;
- A presentation of the data from a sulfur dioxide (SO_2) one-hour National Ambient Air Quality Standard (NAAQS) exceedance at JIH C630 on April 9, 2011

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

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

Legend

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 operate at Solar Estates CAMS 633 and Oak Park CAMS 634. 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 all seven UT/CEER sites.

- **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 five sites that do not take continuous hydrocarbon measurements with auto-GCs (CAMS 629, 630, 631, 632, and 635).

- **Air Monitoring Comparison Values (AMCV) –** The TCEQ uses AMCVs in assessing ambient data. Two valuable online documents ("fact sheet" and "AMCV document") that explain AMCVs are at http://www.tceq.state.tx.us/implementation/tox/regmemo/AirMain.html#compare (accessed July 2011). The following text is an excerpt from the TCEQ "fact sheet":

  > 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.

  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 source may contribute to monitored values.

- **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[1]. 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 15 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.

  One species measured by this project and regulated by a NAAQS is sulfur dioxide (SO_2). Effective June 2, 2010, EPA modified the SO_2 NAAQS to include a level of 0.075 ppm,

[1] See http://epa.gov/air/criteria.html accessed April 2011

or 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. The other two existing NAAQS for SO_2 are 0.03 ppm averaged over one year and 0.14 ppm averaged over 24 hours, not to be exceeded in any one year. There is also a secondary SO_2 standard of 0.500 ppm over three hours, not to be exceeded in any one year. The reason that there has been little attention to the SO_2 NAAQS on this project until now is that the State of Texas's standard of 0.400 ppm or 400 ppb over 30 minutes for SO_2 was much more likely to be exceeded than the older NAAQS. With the addition of a new NAAQS for SO_2 in June 2010, however, the situation has changed.

- **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 the 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.
    - 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 hydrocarbons at the three Corpus Christi auto-GC sites – Solar Estates C633, Oak Park C634, and TCEQ's Palm 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 between the TCEQ's Hillcrest and Williams Park sites in Figure 1, page 2, is generally downwind under northerly and westerly winds. In examining aggregated data one observes similar patterns of hydrocarbons at all three sites. Palm has operated for a complete year, so one can begin to draw conclusions from comparisons to the other two sites' data, and at this point its concentration statistics are similar to those at Oak Park and Solar Estates.

Table 3, page 14, summarizes the average data values from the second quarter of 2011. Data in this table are available to TCEQ staff at http://rhone3.tceq.texas.gov/cgi-bin/agc_summary.pl (accessed July 2011). The data summarized in Table 3 have not completed the standard data validation process. Generally, a few changes may occur during the standard validation process. The more detailed summary of the validated data from the first quarter of 2011 appears in Table 4, page 15. There have been some changes in the highest one-hour and highest 24-hour values in Table 4 from what had been reported last quarter using non-validated data at Solar Estates C633 – specifically:

- maximum one-hour benzene value changed from 10 to 2.1 ppbV,
- maximum one-hour cyclohexane value changed from 6.5 to 3.2 ppbV,
- maximum one-hour 1,3-butadiene value changed from 5.1 to 1.3 ppbV,
- maximum one-hour c-2-penene value changed from 0.26 to 0.20 ppbV,
- maximum one-hour toluene value changed from 4.9 to 3.5 ppbV,
- maximum one-hour ethyl-benzene value changed from 0.70 to 0.30 ppbV,
- maximum one-hour o-xylene value changed from 0.71 to 0.63 ppbV,
- maximum one-hour 1,3,5-trimethylbenzene value changed from 0.45 to 0.30 ppbV,
- maximum one-hour 1,2,4-trimethylbenzene value changed from 1.5 to 0.40 ppbV,
- maximum one-hour 1,2,3-trimethylbenzene value changed from 0.34 to 0.20 ppbV.

In most if not all cases in which a 1-hour maximum changed, the corresponding pre-validation 24-hour maximum had been recorded the same day and its value was changed also. The benzene and cyclohexane changes listed above came from problems with the sample on February 22 at 8 CST, as a maintenance procedure (hydrogen cylinder change) was carried out. Other changes can be researched upon request.

There were no changes in the Oak Park C634 data during quality assurance/validation. There were numerous changes in the TCEQ's Palm C83 site's statistics, for which UT does not have an explanation.

Tables 3 and 4 show the averages (arithmetic mean of measured values) for 27 hydrocarbon species for the period of interest, and Table 4 also shows the maximum one-hour values and the maximum 24-hour average concentrations. All concentration values in the tables are in ppbV units. No concentrations or averages of concentrations from the 27 species were greater than TCEQ's air monitoring comparison values (AMCV) during 2010 or 2011 to date. Note that values in the 1st quarter are generally higher than in the 2nd or 3rd quarter, owing in large part to the higher frequency of northerly winds in the winter. The mean data columns in Table 3 for the 2nd quarter data are shown graphically in Figure 2, page 16. Quarterly means are much more robust than the one-hour maximum and 24-hour maximum values.

The rows for ***benzene*** are bold-faced in Tables 3 and 4 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.

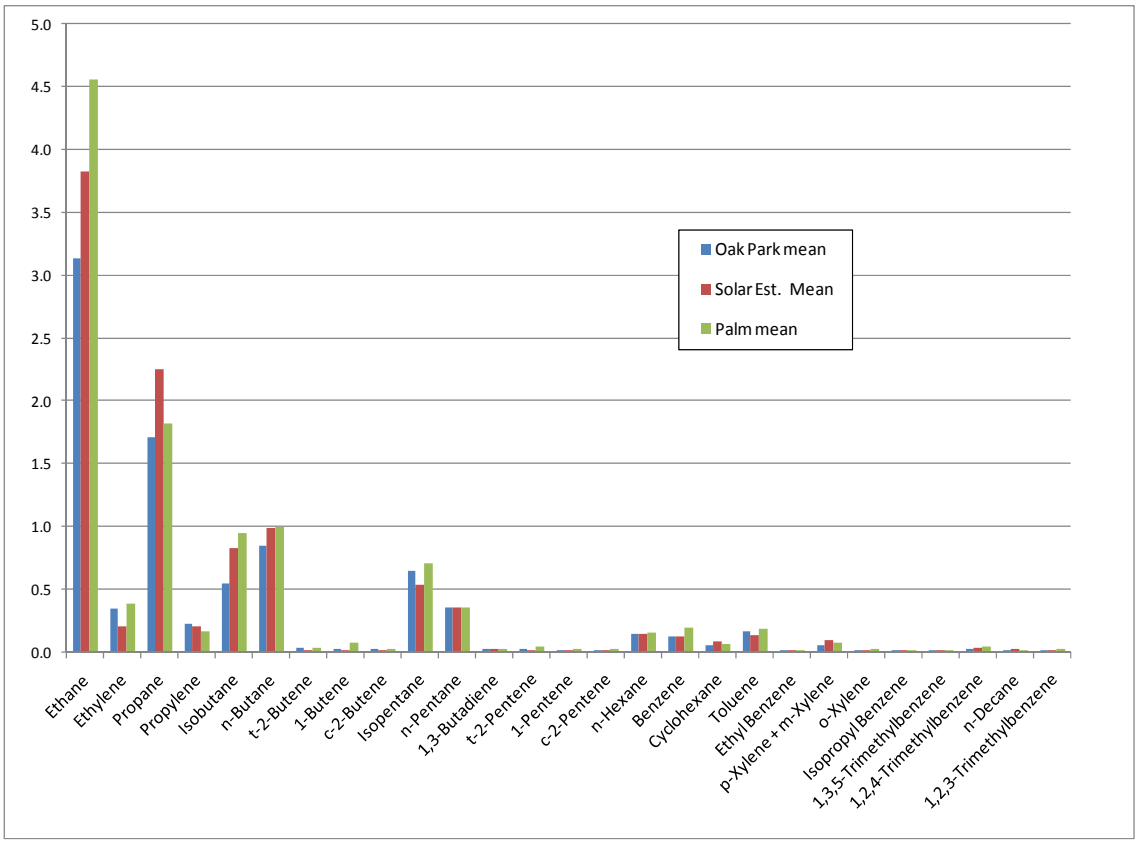
Table 3. Auto-GC mean statistics 2nd quarter 2011

Units ppbV	Oak 2Q11	Solar 2Q11	Palm 2Q11
Species	**Mean**	**Mean**	**Mean**
Ethane	3.13	3.83	4.55
Ethylene	0.35	0.21	0.38
Propane	1.71	2.25	1.81
Propylene	0.22	0.21	0.17
Isobutane	0.54	0.82	0.94
n-Butane	0.85	0.99	1.00
t-2-Butene	0.03	0.02	0.03
1-Butene	0.03	0.01	0.07
c-2-Butene	0.02	0.01	0.02
Isopentane	0.65	0.54	0.71
n-Pentane	0.36	0.36	0.35
1,3-Butadiene	0.02	0.02	0.02
t-2-Pentene	0.02	0.01	0.04
1-Pentene	0.01	0.01	0.02
c-2-Pentene	0.01	0.00	0.02
n-Hexane	0.15	0.15	0.16
Benzene	**0.13**	**0.13**	**0.19**
Cyclohexane	0.06	0.08	0.06
Toluene	0.17	0.13	0.18
Ethyl Benzene	0.02	0.02	0.01
mp -Xylene	0.06	0.09	0.08
o-Xylene	0.02	0.02	0.02
Isopropyl Benzene	0.01	0.01	<0.005
1,3,5-Trimethylbenzene	0.01	0.01	0.01
1,2,4-Trimethylbenzene	0.02	0.03	0.04
n-Decane	0.01	0.02	0.02
1,2,3-Trimethylbenzene	0.01	0.02	0.02

Table 4. Validated Auto-GC statistics 1st quarter 2011

Units ppbV	Oak 1Q11			Solar 1Q11			Palm 1Q11		
Species	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**	**Peak 1hr**	**Peak 24hr**	**Mean**
Ethane	288.06	39.9	8.33	80.20	24.67	8.01	263.21	31.6	9.78
Ethylene	57.11	4.91	0.64	4.61	1.91	0.41	15.56	2.74	0.58
Propane	497.94	55.88	5.99	63.71	13.05	4.83	196.14	21.12	5.80
Propylene	42.04	2.81	0.35	46.77	2.18	0.28	28.4	3.99	0.37
Isobutane	208.26	22.34	1.95	22.73	4.42	1.50	162.38	32.62	3.13
n-Butane	243.29	27.06	2.91	37.56	8.26	2.16	88.88	15.55	3.62
t-2-Butene	3.58	0.39	0.05	0.88	0.19	0.03	76.01	9.99	0.45
1-Butene	3.97	0.44	0.06	2.00	0.23	0.04	69.04	12.73	0.52
c-2-Butene	2.66	0.33	0.06	0.66	0.16	0.02	53.63	8.06	0.33
Isopentane	95.05	11.22	1.63	39.16	3.25	1.00	84.19	9.41	1.93
n-Pentane	71.84	8.59	1.03	29.69	1.85	0.64	74.72	6.86	1.15
1,3-Butadiene	3.24	0.18	0.03	1.30	0.14	0.02	2.27	0.41	0.04
t-2-Pentene	2.00	0.15	0.03	0.61	0.06	0.01	2.24	0.49	0.07
1-Pentene	0.77	0.06	0.02	0.23	0.05	0.01	1.55	0.33	0.04
c-2-Pentene	0.99	0.07	0.01	0.20	0.03	0.00	0.99	0.22	0.04
n-Hexane	34.24	2.86	0.42	4.14	0.77	0.26	31.18	2.91	0.38
Benzene	**10.34**	**1.54**	**0.34**	**2.08**	**0.61**	**0.19**	**10.41**	**1.52**	**0.31**
Cyclohexane	10.16	1.31	0.19	3.19	0.54	0.14	8.49	0.89	0.15
Toluene	11.57	1.74	0.37	3.47	0.64	0.21	4.55	1.08	0.31
Ethyl Benzene	0.66	0.12	0.03	0.30	0.07	0.02	1.01	0.12	0.03
mp -Xylene	2.53	0.37	0.10	7.43	1.27	0.15	4.17	0.50	0.13
o-Xylene	1.12	0.12	0.03	0.63	0.13	0.03	1.44	0.16	0.03
Isopropyl Benzene	1.66	0.33	0.03	0.72	0.13	0.01	0.29	0.05	<0.005
1,3,5-Trimethylbenzene	0.30	0.05	0.01	0.30	0.04	0.01	0.14	0.04	0.01
1,2,4-Trimethylbenzene	0.81	0.12	0.03	0.40	0.09	0.03	0.46	0.23	0.06
n-Decane	0.92	0.12	0.02	0.67	0.12	0.03	0.29	0.07	0.02
1,2,3-Trimethylbenzene	0.32	0.05	0.01	0.20	0.05	0.01	0.22	0.07	0.02

Figure 2. Mean concentrations for 27 hydrocarbon species at three auto-GCs, 2nd quarter 2011



2. Benzene Concentrations in Residential Areas

As has been discussed in past reports, benzene concentrations have been declining at the two auto-GCs operated at Oak Park CAMS 634 and Solar Estates CAMS 633. No benzene values have been measured above the AMCV. A time series with some points annotated by date appears in Figure 3 for Oak Park and in Figure 4 for Solar Estates, on page 17. Note the different y-axis scales for the two sites, as Oak Park does tend to measure higher concentrations than Solar Estates. The highest values measured at each site are noted in Figures 3 and 4. Last quarter it was reported that the second highest benzene value to date at Solar Estates had been measured on February 22, but that value was found to be invalid. The value had been measured during a maintenance procedure (hydrogen cylinder change), so the values of several affected species were flagged. Note that the data from the second quarter 2011 have not been validated yet.

One can observe the seasonal pattern of benzene concentrations at the sites, with higher concentrations tending more toward winter periods. The second quarter of the year tends to have lower concentrations than the first and fourth quarters.

Figure 3. Oak Park hourly benzene 2005 – 2011, ppbV units, individual elevated values noted, no observations greater than the TCEQ's AMCV

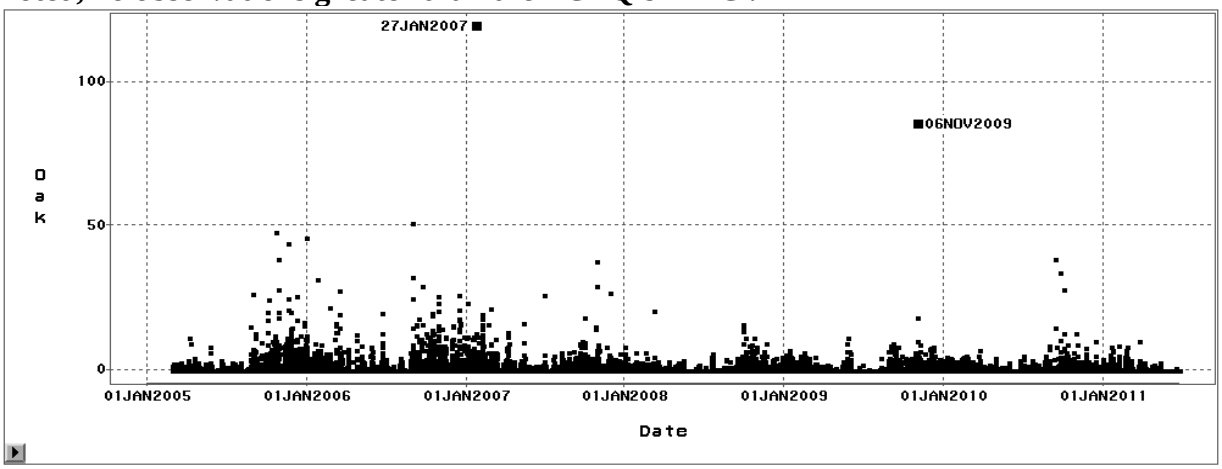


Figure 4. Solar Estates hourly benzene 2005 – 2011, ppbV units, no observations greater than the TCEQ's AMCV

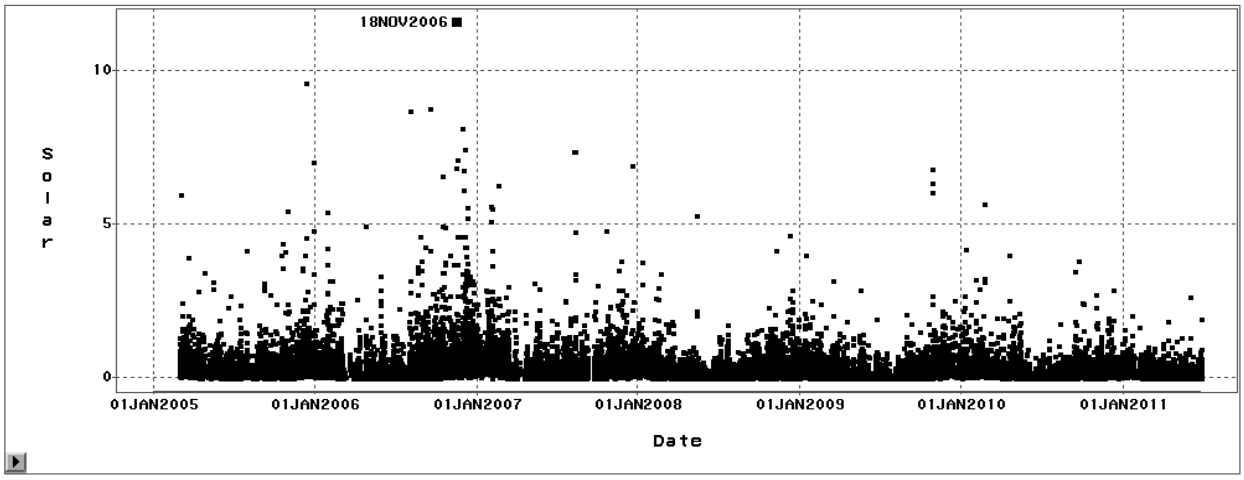
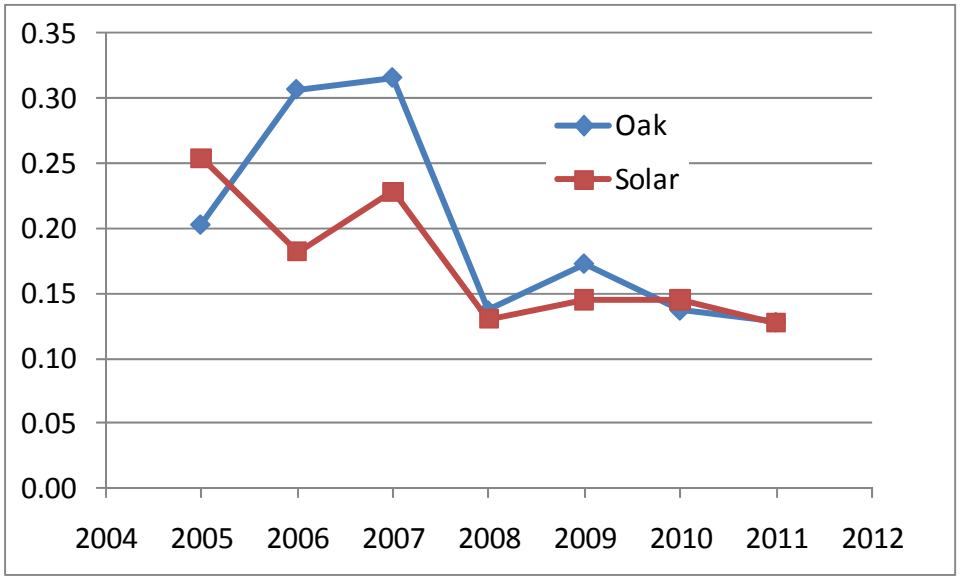


Table 5 on page 18 shows the 2nd quarter summary statistics from the auto-GCs for benzene from 2005 – 2011. The 2nd quarter average benzene concentrations at both sites show relatively little variability since 2008. The 2nd quarter means are graphed in Figure 5 on page 18. The 2nd quarter means from 2008 through 2011 are statistically significantly lower than in the 2nd quarters of the preceding three years.

Table 5. Summary Statistics for Benzene at Oak Park and Solar Estates, 2nd quarter 2005 – 2011, ppbV units

Oak	Year	Num. Obs.	Peak 1-hr	Peak 24-hr	Mean
	2005	1935	11.388	1.276	0.203
	2006	1913	19.986	3.273	0.307
	2007	1956	16.570	3.737	0.316
	2008	1948	3.721	0.790	0.137
	2009	1953	11.681	1.399	0.173
	2010	1935	4.428	1.348	0.137
	2011	1622	3.053	0.856	0.128
Solar	Year	Num. Obs.	Peak 1-hr	Peak 24-hr	Mean
	2005	1619	3.460	0.728	0.254
	2006	1489	4.970	0.840	0.182
	2007	1307	3.142	0.915	0.228
	2008	1781	5.309	0.633	0.130
	2009	1959	2.894	0.481	0.145
	2010	1862	4.022	0.892	0.145
	2011	1815	2.660	0.447	0.127

Figure 5. Mean concentrations of benzene during 2nd quarters by year at Oak Park (blue) and Solar Estates (red), 2005 – 2011, with lower values in 2008 – 2011 compared with 2005 – 2007



3. Fine Particulate Matter ($PM_{2.5}$) at Dona Park

The TCEQ collects particulate matter (PM) samples at the Dona Park C635 site, where UT measures TNMHC, methane, SO_2, and H_2S. The PM collected at this site and several others around the state is composed of particles generally smaller than 2.5 microns (a micron is one millionth of a meter, or 1/25,400 inch). Particulate matter generally smaller than 2.5 microns is referred to as $PM_{2.5}$. $PM_{2.5}$ is usually an aggregation of several different components, which may come from several different sources. In general, it is found that wind-blown dust, aged ammonium sulfate from distant SO_2 sources, and carbonaceous material from various forms of combustion (including motor vehicles) and from atmospheric reactions accounts for most of the mass in $PM_{2.5}$. Traces of other materials such as sea salt entrained in the wind from ocean waves, specific elements emitted from oil combustion, and aged ammonium nitrate from distant urban NOx sources are also found. These examples are not exhaustive. Compliance with the NAAQS for $PM_{2.5}$ is based on the annual averages of total mass combined over three years, and on the statistics of extreme values of daily total mass (the annual 98^{th} percentile) for shorter term exposure. Currently, Corpus Christi is an attainment area for this pollutant. Not all sites collect PM data at the species level, but Dona Park does. From the elemental, the ion (e.g., sulfate and nitrate), and the carbon (e.g., elemental carbon and organic carbon) species masses measured with each sample, some estimates of the sources contributing to the total Dona Park $PM_{2.5}$ mass can be made.

Because of concern about ship emissions that likely affect SO_2 measurements at JIH C630, the TCEQ Dona Park $PM_{2.5}$ data have been examined to see if they contain relevant information about ship emissions. It is more difficult to analyze the relationship between pollutant concentrations and wind direction when the two are measured on different time scales. Wind direction is measured continuously and aggregated into five-minute and one-hour averages. $PM_{2.5}$ is sampled over a 24-hour period onto a sample filter, which is then analyzed in a laboratory for total mass and species composition. By merging all 24 one-hour wind directions for a day with the corresponding single $PM_{2.5}$ composition mix, one can only draw conclusions about upwind sources if all winds were from the same direction. However, pooling data from many days often allows information as to key upwind source areas to emerge. The Dona Park $PM_{2.5}$ species data from 2000 through 2010 were collected from the TCEQ's database, and the species were statistically analyzed with principal component analysis (PCA) to estimate the factors comprising the $PM_{2.5}$ total mass for each sample. Five factors were derived:

- Dust (characterized by silicon and aluminum)
- Sea salt (characterized by sodium and chlorine)
- Ammonium sulfate (characterized by sulfate ion and ammonium ion)
- Motor vehicle (characterized by organic carbon, elemental carbon, and zinc)
- Oil combustion (characterized by vanadium, nickel, and elemental carbon)

The motor vehicle factor is also well-characterized by a significant difference in the weekday averages versus the weekend averages. The ammonium sulfate factor is well-characterized by a significantly higher contribution in the summer (the 2^{nd} and 3^{rd} quarters) than other seasons. Similarly, the sea salt factor is much higher in the spring (the 2^{nd} quarter) than other seasons, and by southeast winds. The dust factor is much higher in the summer (the 3^{rd} quarter), which is largely related to the long-distance transport of dust from North Africa that affect the Gulf Coast each year. The oil combustion factor is higher in the winter (the 1^{st} quarter).

Each of the factors shows some variability with wind direction. The factor identified as "oil combustion" is the one most likely related to ship emissions. Figure 6, on page 20, shows the mean values of the rotated principal component factor scores for "oil combustion" with wind direction. The mean values were calculated using 20-degree wind bins and using the MS Excel "smoothed line" tool to create the resulting graph. The peak direction is to the northeast. This points in the general direction back along the ship channel and to the docks across the ship channel from JIH C630. For comparison purposes, the Dona Park mean SO_2 concentrations as a function of wind direction using 5-degree wind bins is shown in Figure 7, on page 21. SO_2 presents two modes in Figure 7, one to the northeast and one to the northwest. The reader is reminded that westerly winds (around 240 – 300 degrees) in the Corpus Christi area are the least frequent, and average concentrations or average factor scores calculated for westerly wind bins tend to have less reliability and greater variability.

A map of the area around Dona Park with rays drawn to show the general upwind directions associated with the highest factor scores is shown in Figure 8, on page 21. This analysis supports the hypothesis that ship emissions are detectable in the ship channel and perhaps from the docks just south of JIH C630.

Figure 6. Dona Park mean "Oil Combustion" factor scores by 20-degree wind bin, 2000 - 2010

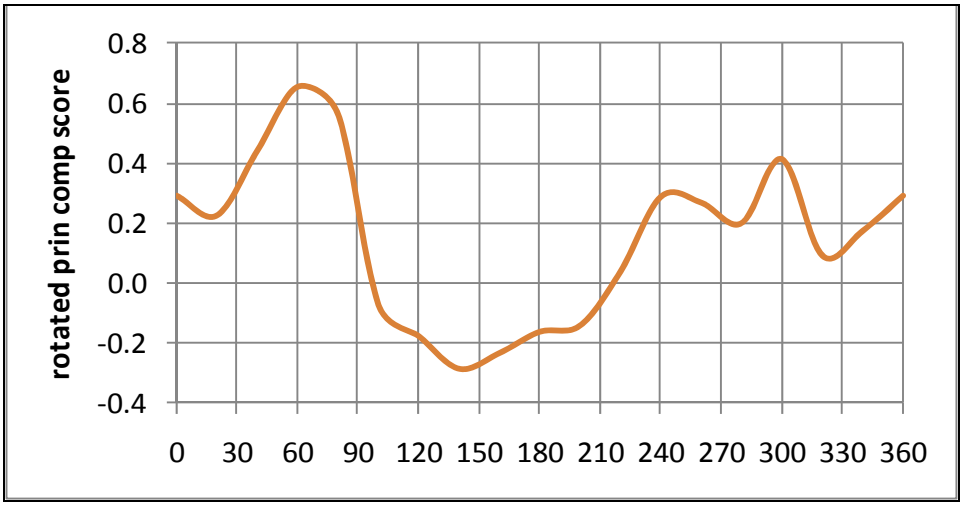


Figure 7. Dona Park mean SO_2 by 5-degree wind bin, 2006 - 2011

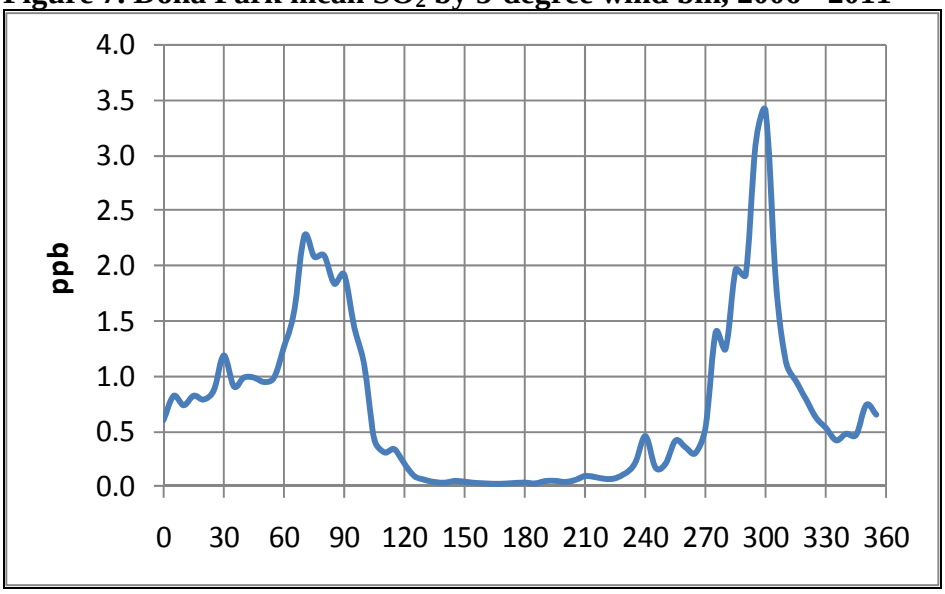
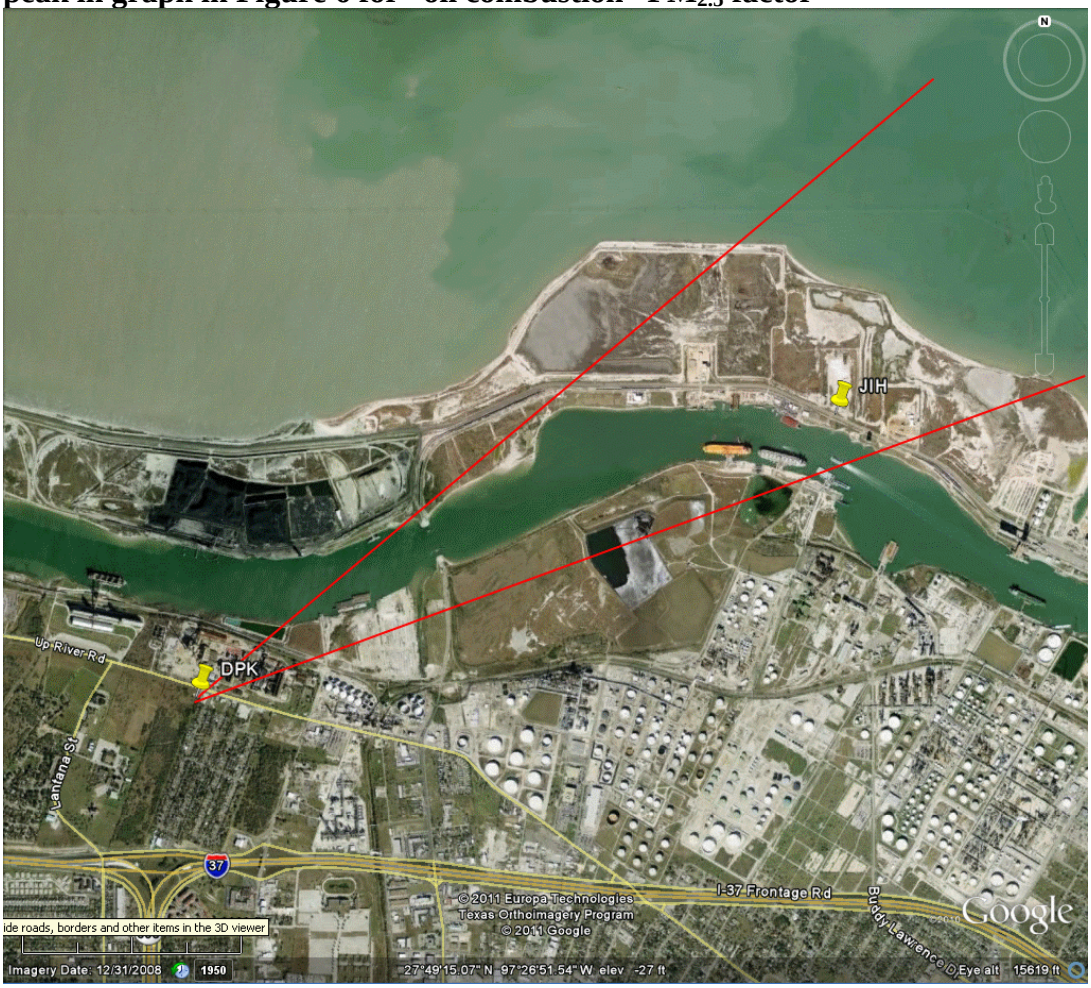


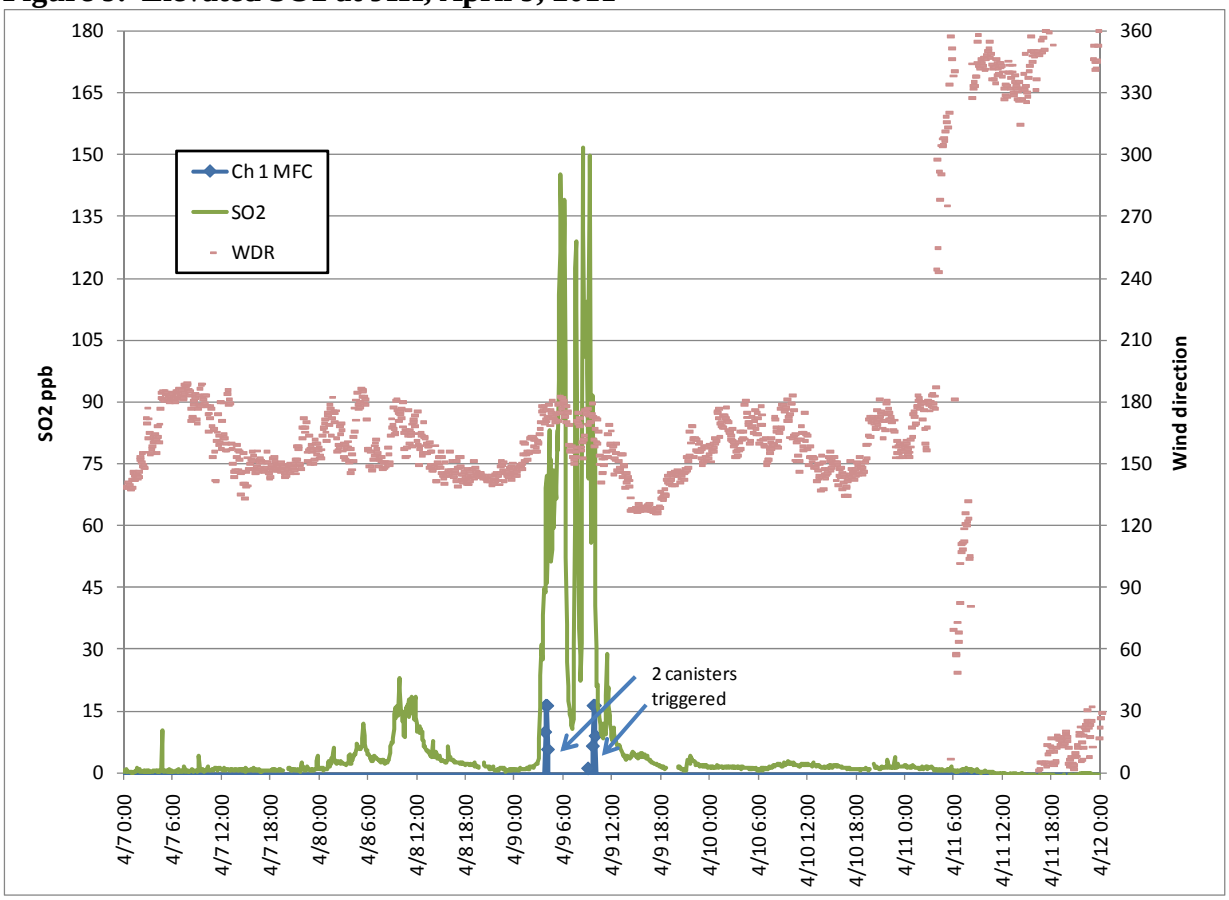
Figure 8. Rays drawn from Dona Park at 50 and 70 degree bearings corresponding to the peak in graph in Figure 6 for "oil combustion" $PM_{2.5}$ factor



4. Sulfur Dioxide at JIH C630

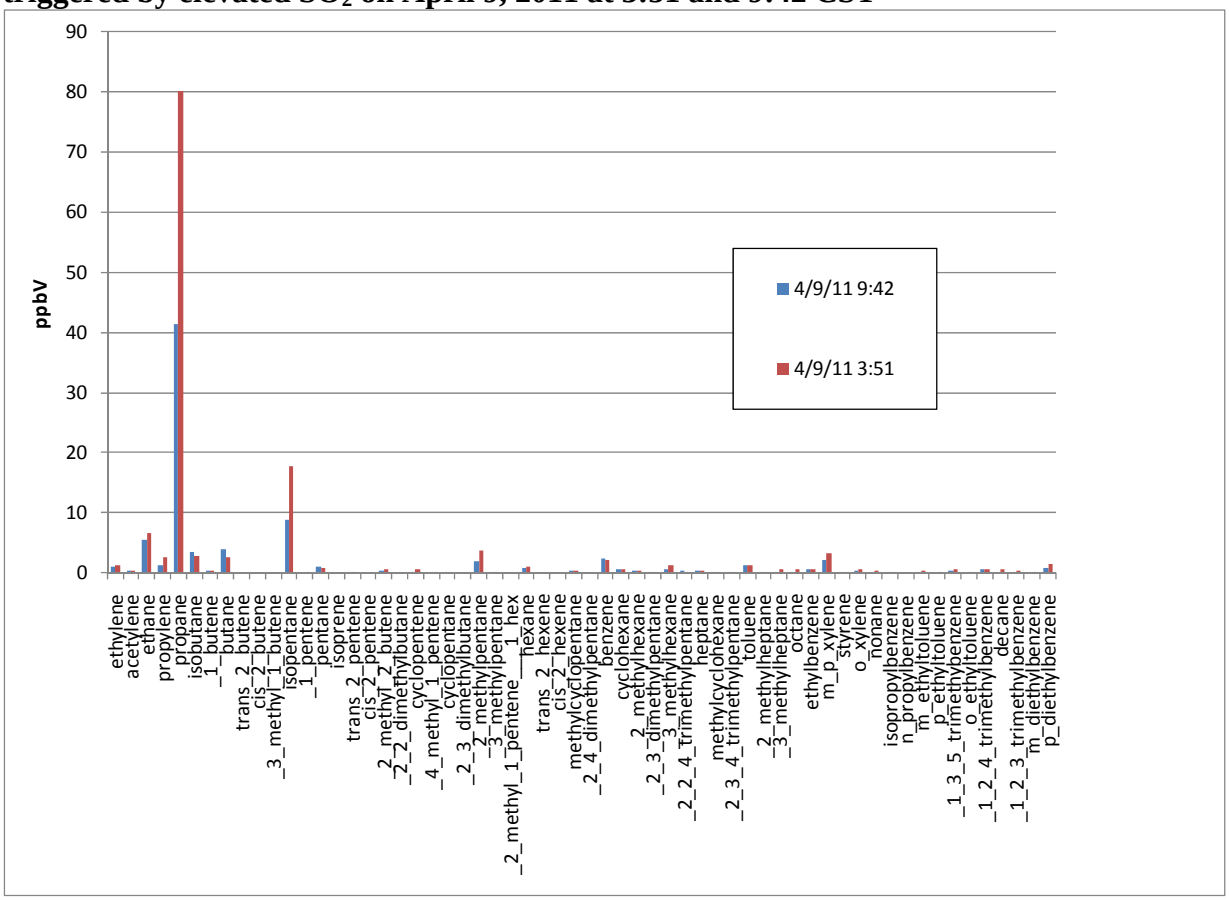
As has been discussed in recent reports, the JIH C630 site measures SO_2 concentrations that do not comply with the EPA's SO_2 NAAQS. One hour concentrations above 75 ppb are considered to be exceedances of the NAAQS. The maximum one hour value for each day at a site is logged, and at the end of the year the 99th percentile daily maximum is selected. This value is averaged with the same statistic from the previous two years, and the resulting average is compared with 75 ppb to determine compliance. If a site collects a full year of data, then the 99th percentile value would be the 4th highest daily maximum for the year. Only one exceedance day occurred in the 2nd quarter of 2011, that being on April 9. The highest one-hour value on that date was 97.8 ppb. The time series of five-minute time resolution data for April 7 through April 11 appears in Figure 9, below.

Figure 9. Elevated SO2 at JIH, April 9, 2011



As Figure 9 indicates, two canister samples were triggered based on SO_2 concentrations topping the 37 ppb (approximately one half the NAAQS level) trigger level for 15 minutes. Data from these canisters' composition detected only propane and isopentane in sizeable amounts. The samples from the two cans have a very similar composition. The data are shown in Figure 10 on page 23.

Figure 10. Concentration of hydrocarbon species in canister samples from JIH C630 triggered by elevated SO_2 on April 9, 2011 at 3:51 and 9:42 CST



At this point there is no working hypothesis that explains the canister composition shown in Figure 10, with only two hydrocarbon species dominating the mix. As more data are collected and analyzed, results will be reported.

Conclusions from the Second Quarter 2011 Data

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

- First quarter benzene concentrations at the auto-GCs and all other auto-GC species of interest remain well below the TCEQ's AMCVs. This quarter had the lowest first quarter means for benzene at both auto-GCs since monitoring began.
- Periodic air pollution events continue to be measured on a routine basis, but values of hydrocarbon or chlorinated hydrocarbon species above the TCEQ AMCV levels were not observed this quarter. One exceedance of the EPA SO_2 NAAQS level was measured this quarter.
- An examination of particulate matter at Dona Park C635 supports the hypothesis that ship emissions are measurable from the ship channel and perhaps from the docks located directly south of the JIH C631 site.

Further analyses will be provided upon request.

APPENDIX B

Financial Report of Expenditures
Financial Report of Interest Earned

Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project

Accounting Report for the Quarter
04/01/2011 - 06/30/2011

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

Total Grant Amount:	$8,761,718.02
Total Interest Earned:	$801,283.24
Total Funds Received:	$7,563,001.26

B. Summary of Expenditures Paid by COCP Funds

		Year 3 Budget	Year 4 Budget	Year 5 Budget	Year 6 Budget	Year 7 Budget	Yrs 1-7 Adjusted Budget	Prior Activity	Current Activity 04/01/11 - 06/30/11	Encumbrances	Remaining Balance 6/30/2011
Salaries-Prof	12	$216,128.63	$160,652.00	$286,279.40	$299,633.00	$318,499.00	$1,184,508.03	($1,163,365.89)	($7,519.28)	($9,162.49)	$4,460.37
Salaries-CEER	15	$19,606.37	$15,636.00	$33,123.00	$30,948.00	$29,880.00	$162,071.37	($143,109.31)	($5,000.36)	($1,591.85)	$12,369.85
Fringe	14	$47,984.00	$38,783.00	$58,333.00	$72,728.00	$76,643.00	$290,643.00	($265,242.98)	($3,053.89)	($3,369.73)	$18,976.40
Communication	42	$0.00	$0.00	$0.00	$0.00	$0.00	$1,400.00	($1,215.00)	($135.00)		$50.00
Other/C-Analysis	47/68	$60,474.00	$73,500.00	-$8,656.40	$73,500.00	$14,219.00	$122,949.60	($118,178.00)	$3,723.00		$8,494.60
Supplies	50	$86,844.00	$33,500.00	$68,676.00	$122,682.00	$72,797.32	$512,298.05	($483,014.94)	($27,464.43)	($2,304.26)	-$485.58
Quality Assurance	51	$0.00	$20,300.00	$8,000.00	$0.00	$7,070.00	$25,640.27	($16,640.00)	$0.00		$9,000.27
Subcontract	62-65	$1,965,693.00	$314,022.00	$296,734.00	$346,289.00	$591,523.00	$3,550,053.00	($3,308,399.01)	($60,911.08)		$180,742.91
Program Income	66*	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	($140,617.19)	($8,555.64)	-$149,172.83
Travel	75	$2,300.00	$2,000.00	$7,719.00	$9,000.00	$6,712.00	$30,191.00	($28,746.33)	($975.44)	($0.01)	$469.22
Equipment	80	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00		$0.00
Indirect Costs	90	$359,655.00	$98,759.00	$112,531.00	$143,217.00	$167,601.70	$881,963.70	($793,163.98)	($15,200.47)		$73,579.25
TOTALS		$2,758,685.00	$757,152.00	$862,739.00	$1,097,997.00	$1,284,945.02	$6,761,718.02	($6,321,095.44)	($257,154.14)	($24,983.98)	$158,484.46

B.1. Summary of Program Income (66) Expenditures

Salaries-Prof	66	$0.00
Salaries-CEER	66	$0.00
Fringe	66	$0.00
Communication	66	$0.00
Other/C-Analysis	66	$0.00
Supplies	66	$72,424.52
Quality Assurance	66	$0.00
Subcontract	66	$68,192.67
Program Income	66	$0.00
Travel	66	$0.00
Equipment	66	$0.00
TOTAL		$140,617.19

C. Interest Earned by COCP Funds as of 06/30/11

Prior Interest Earned:	$794,706.90
Interest Earned This Quarter:	$6,576.34
Total Interest Earned to Date:	$801,283.24

D. Balance of COCP Funds as of 06/30/11

Total Grant Amount:	$8,761,718.02
Total Interest Earned:	$801,283.24
Current Q. Expenses	($257,154.14)
Total Expenditures:	($6,321,095.44)
Remaining Balance:	$994,751.68

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

Accounting Certification