Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project
Case Number: 2:11-MC-00044

Annual Progress Report for the Period

October 1, 2011 through September 30, 2012

Submitted to

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

Ms. Kathleen Aisling
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

April 12, 2013

ANNUAL PROGRESS REPORT
TO THE U.S. DISTRICT COURT
FOR THE
CORPUS CHRISTI AIR MONITORING AND SURVEILLANCE CAMERA PROJECT

Activity Summary for the period from
October 1, 2011 through September 30, 2012

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 (University) to implement the court ordered condition of probation (COCP) project *Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation* (Project). This annual report has been prepared pursuant to the requirements of the project proposal and is being submitted to the U.S. District Court, the U.S. Environmental Protection Agency (EPA), and the Texas Commission on Environmental Quality (TCEQ).

A. MONITORING SITES AND EQUIPMENT INSTALLED

The COCP consists of a network of six (6) air monitoring stations as shown in the map below in Figure 1 with air monitoring instruments and surveillance camera equipment as shown in Table 1, on page 3.

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

Table 1. 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**)	Mar 2005 to date	C: Dec 2004 to Feb 2009 T: Dec 2004 to Apr 2012		Dec 2004 to date	
629	Grain Elevator @ Port of Corpus Christi (**CCG**)		T&C: Dec 2004 to date	Dec 2004 to date	Dec 2004 to date	
630	J. I. Hailey Site @ Port of Corpus Christi (**JIH**)		T&C: Dec 2004 to date	Dec 2004 to date	Dec 2004 to date	
635	TCEQ Monitoring Site C199 @ Dona Park (**DPK**)		T&C: Dec 2004 to date	Dec 2004 to date	Dec 2004 to date	Jan 2005 to date
632	Off Up River Road on Flint Hills Resources Easement (**FHR**)		T&C: Dec 2004 to date	Dec 2004 to date	Dec 2004 to date	
633	Solar Estates Park at end of Sunshine Road (**SOE**)	Mar 2005 to date	C: Dec 2004 to Feb 2009 T: Dec 2004 to Apr 2012	Dec 2004 to date	Dec 2004 to date	Jan 2005 to date
631	*Port of Corpus Christi on West End of CC Inner Harbor (**WEH**) (to be relocated)*		T&C: Dec 2004 to May 2012	Dec 2004 to May 2012	Dec 2004 to May 2012	

Legend

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

B. DATA ANALYSIS

As noted in Table 1, page 3, the monitoring network provides measurements of hydrocarbons, sulfur dioxide and hydrogen sulfide. Provided below are brief findings from the monitoring network during FY2012 (October 1, 2011 through September 30, 2012). More details are available in Appendix A, on pages 9 through 35.

Results of Canister Sampling

At five of the six monitoring sites, an ambient air sample may be collected in a canister for subsequent laboratory analysis if a sustained level of elevated concentrations of total nonmethane hydrocarbons has been measured. At one site (JI Hailey, CAMS 630), a canister can also be triggered by elevated sulfur dioxide concentrations. During FY2012, a total of 58 usable canister samples were triggered in the Corpus Christi network. (Occasionally a canister will trigger based on a malfunction or after a wind shift and thus not show concentrations greater than background levels.) At JI Hailey, 25 canisters were triggered with coincident elevated sulfur dioxide. A comparison between JI Hailey canisters sampled coincident with elevated sulfur dioxide and canisters sampled with no coincident elevated SO_2 or hydrocarbons shows minor differences between the two sets. No measured hydrocarbon concentrations were higher than the TCEQ's health reference values.

Summary of Sulfur Species Monitoring

EPA established a new federal standard for sulfur dioxide in 2010. No exceedances of the State of Texas standards for sulfur dioxide and hydrogen sulfide were measured this fiscal year; however, exceedances of the federal sulfur dioxide standard were measured. However, a change brought about by new regulations may have lowered emission rates from one source – ships at dockside in the Ship Channel. At another site, it has been discovered that some unknown chemical may be causing false elevated sulfur dioxide measurements.

Summary of Continuous Hydrocarbon Species Monitoring

No short-term concentrations or long-term average concentrations were measured that were greater than the State of Texas air monitoring comparison values for benzene, 1, 3-butadiene, or any other hydrocarbons this fiscal year. Most species measured have lower annual averages in the most recent four years, compared to the project's first three years.

Trends in Benzene Concentrations in Residential Areas

Because of a high level of concern with benzene, a known carcinogen, this compound is given special attention. An analysis of the benzene data shows concentrations in FY2012 were similar to the four previous years, and significantly lower than in FY 2005 – FY 2007.

C. ADVISORY BOARD

The Advisory Board for the Corpus Christi Air Monitoring and Surveillance Camera Project is a voluntary Board that consists of nine members. The members and their representation on the Board follow:

Ms. Gretchen Arnold	Local Air Quality Issues and Board Spokesperson

Dr. Eugene Billiot	Technical Support to the Board - Instrumentation
Mr. James Bowman	City of Corpus Christi
Dr. William Burgin	Local Public Health - Local Air Quality Issues
Ms. Joyce Jarmon	Community Representation
Dr. Glen Kost	Community Representation
Ms. Pat Suter	Local Advocacy Group
Mr. Christopher Schulz	Community Representation
Mr. Henry Williams	Community Representation

Four meetings of the Advisory Board were held during this year of the Project. All meetings were held on the campus of Texas A&M University in Corpus Christi, Texas. Highlights from these meetings follow:

a. January 10, 2012 Meeting

- Dr. Dave Sullivan, The University of Texas at Austin, gave an update on monitoring data for the 4th calendar quarter ending 12/31/11. A question was raised as towhether the demolition across from Dona Park is affecting the data. Ms. Joyce Jarmon wanted to know the effects of those emissions. Mr. Torres explained that most of the contaminants are probably particulate emissions from the demolition and therefore not measured by any of the instruments on the project. He added that the TCEQ does make particulate measurements at Dona Park. Mr. James Bowman added that a contractor is supposed to be monitoring contaminant emissions from the demolition work.

- In response to a question about the SO_2 measurements in the Port area, Mr. Chris Owen, from the TCEQ, explained that the TCEQ has been following up on the elevated SO_2 measurements and have added a new portable SO_2 monitor along the south side of the port. They will be using data from this monitor to conduct further investigations of elevated SO_2 measurements that are believed to be coming from the combustion of bunker fuel from the ships. He said that the TCEQ, in partnership with the Coast Guard, are obtaining good cooperation from the Port Authority in providing data on ship activity in the Port. It has been determined that the Coast Guard has authority to oversee air quality emissions from the Port area and will be working closely with TCEQ on this enforcement activity. He also pointed out that some rule changes may be forthcoming that will reduce the sulfur content in the fuel used by ships.

b. April 27, 2012 Meeting

- Dr. Dave Sullivan gave an update on and analysis of monitoring data collected by the Project for the past 7 years. The Project has now collected 7 full years of monitoring data.

- In response to a request of the Advisory Board, Dr. Sullivan reported that TCEQ representative Omar Valdez, who is overseeing the testing of emissions from the

demolitions at Dona Park, informed Dr. Sullivan that all of the results have not yet been analyzed. Mr. Valdez offered to make a presentation at a future Advisory Board meeting after the results have been finalized.

- Mr. Torres provided a presentation on the notice of the termination of the Inner Harbor CAMS 631 lease received by University of Texas at Austin. He updated the Advisory Board on discussions with the Port of Corpus Christi Authority (POCCA) representatives that he has been working with.

- Mr. Torres also briefed the Advisory Board on the teleconference with The Honorable Judge Jack on 4/05/12. The Honorable Judge Jack expressed concern with the termination of the lease. She wanted the new lease period to extend as long as the current funding is projected to last, including a renewal term option should new funding be identified. She also did not want the project to incur the cost of moving again, i.e., no termination clause in the lease.

c. June 12, 2012

- Dr. Dave Sullivan gave an update and presentation on options for relocating Inner Harbor CAMS 631. He presented seven site options and the air monitoring objectives each site would be designed to achieve. They were as follows:

Option Site	Objectives
1. Fishing bank	Trends
2. Driscoll property	Maximum concentration; downwind of Valero
3. Tuloso CAMS 21	Human exposure and low cost
4. Academy Park	Human exposure
5. Dunn-Meany	Human exposure
6. Gibson Elem School	Human exposure
7. Mobile Park	Human exposure

- Discussions ensued with the Advisory Board on the pros and cons on the various sites. The Advisory Board recommended that Mr. Torres follow through on the fishing bank site on Port of Corpus Christi property. However, they were skeptical that the Port Authority will allow use of the site for an air monitoring station with the lease terms required by the Court. The next site that the Advisory Board wanted UT to pursue was the property that is owned by the Driscoll Foundation.

d. November 13, 2012 Meeting

- Dr. Dave Sullivan gave an update on and analysis of monitoring data collected by the Project for the past 7 years. The Project has now collected 7.5 to 8 years of monitoring data.

- In response to a request from the Advisory Board at the last meeting, Mr. Torres gave an update on the relocation of the Inner Harbor monitoring site. Mr. Torres presented the findings from the eight site options and their availability as follows:

Site	Owner	Status	Comments
A(1)	Port of Corpus Christi	Eliminated	Not available
A(2)	Port of Corpus Christi	Not recommended at this time	Lease Term & Conditions not acceptable to Court
B	Port of Corpus Christi	Eliminated	Not available
C(1)	Driscoll Foundation	Eliminated	New owners, not available
C(2)	Port of Corpus Christi	Eliminated	Not available
FHR Pad Site	Flint Hills Resources	Eliminated	Lease Terms & Conditions not acceptable to Court
Closed Landfill East Area	City of Corpus Christi	Under consideration	Engineering challenges with with landfill site preparations
Old Gun Range Area	City of Corpus Christi	Under consideration	Farther away than preferred

- Discussions followed with the Advisory Board on the pros and cons of the various sites including 2 additional sites proposed by Ms. Joyce Jarmon and Ms. Gretchen Arnold. Ms. Jarmon also recommended considering the possibility of the Pollywog site. She thought there was plenty of land there that was not being used and might make a suitable site. Ms. Arnold recommended the USDA site that was shown on the PowerPoint presentation slide by Dr. Sullivan also be explored.

- Ms. Arnold agreed with the recommendation to pursue the USDA property and moved that this property be considered. Dr. Kost second the motion. In response, Mr. Torres said the UT Team will investigate the property that is owned by the USDA. If after UT investigates all of the remaining options and the two added at the meeting fail to provide a suitable site, it was recommended by Ms. Arnold to discontinue the search and use the funds to further extend the project life with only the remaining six sites in the network. The goal of the Advisory Board was to have a decision either on a suitable replacement site or extension of the project and not replace the Inner Harbor monitoring site by the time UT sends out the Annual Report to the Court. The Advisory Board agreed that this should be the goal.

- Also in response to a previous request of the Advisory Board, Mr. Torres contacted Mr. Omar Valdez to arrange for a presentation at the Advisory Board meeting on 11/13/12 in regards to the testing of the emissions from the demolitions at Dona Park as reported during the last Advisory Board meeting. Unfortunately Mr. Valdez declined the invitation as he was not able to obtain approval from his management to travel to Corpus Christi to make a presentation at the Advisory Board meeting. UT Staff will try and obtain the data and work on a presentation of the data at a future meeting.

D. PROJECT MANAGEMENT AND PLANNING

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

1. Site Operations and Maintenance and Quality Assurance
   Routine operations, maintenance and quality assurance activities have become the norm at each site. These activities help to maintain high data capture and quality of data.

2. Data Analysis
   The Project now has more than seven years worth of data. The focus of data analysis has been to examine the frequency, level and direction of sources when measurements exceed trigger or warning levels and to analyze data for trends and other patterns indicated in the data collected.

3. Communication
   Information about the status of the Project has been communicated through:
   a. Advisory Board Meetings,
   b. Project Website (website statistics are included in Appendix B, page 37)
   c. Presentations to local community organizations and industry groups,
   d. Quarterly Technical and Financial Reports to the Court and Advisory Board and
   e. Sharing of technical data with the EPA and the Agency for Toxic Substances and Disease Registry.

4. Budget Monitoring
   Budget monitoring during this period has focused on:
   a. Actual project costs for Phase II-Sites Operation and Maintenance,
   b. Administration and oversight costs incurred by the University, and
   c. Budget for future years.
   The Financial Report for the year is included in Appendix C, pages 38 through 42.

5. Other Contributions
   The University of Texas at Austin has been awarded funding for six (6) Supplemental Environmental Projects (SEPs) through the Texas Commission on Environmental Quality since the Project began. These six SEPs total $1,239,379 plus interest earned, which has totaled $ 41,839.06. All of the SEPs are listed in Appendix D, page 44 and 45.

APPENDIX A

Data Analysis for Corpus Christi Annual Report
October 2011 – September 2012

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 Annual Report

This technical report describes recent results of monitoring and analysis of data under the Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project for the period October 1, 2011 through September 30, 2012. The monitoring network is shown in Figure 2, below, and is described in Table 2, on page 11. Note the frequent use of the abbreviation for Continuous Ambient Monitoring Station as "CAMS", or simply as "C", followed by the unique site number, such as "629".

This report contains the following elements:

- Results of canister sampling at five CAMS sites
- Summary of total nonmethane hydrocarbon monitoring at five CAMS sites
- Summary of speciated hydrocarbon monitoring in residential areas at two CAMS sites
    - Trends in benzene concentrations in residential areas
- Summary of sulfur species monitoring at six UT and three TCEQ CAMS sites

Figure 2. Corpus Christi Monitoring Sites, "X" marks terminated CAMS site

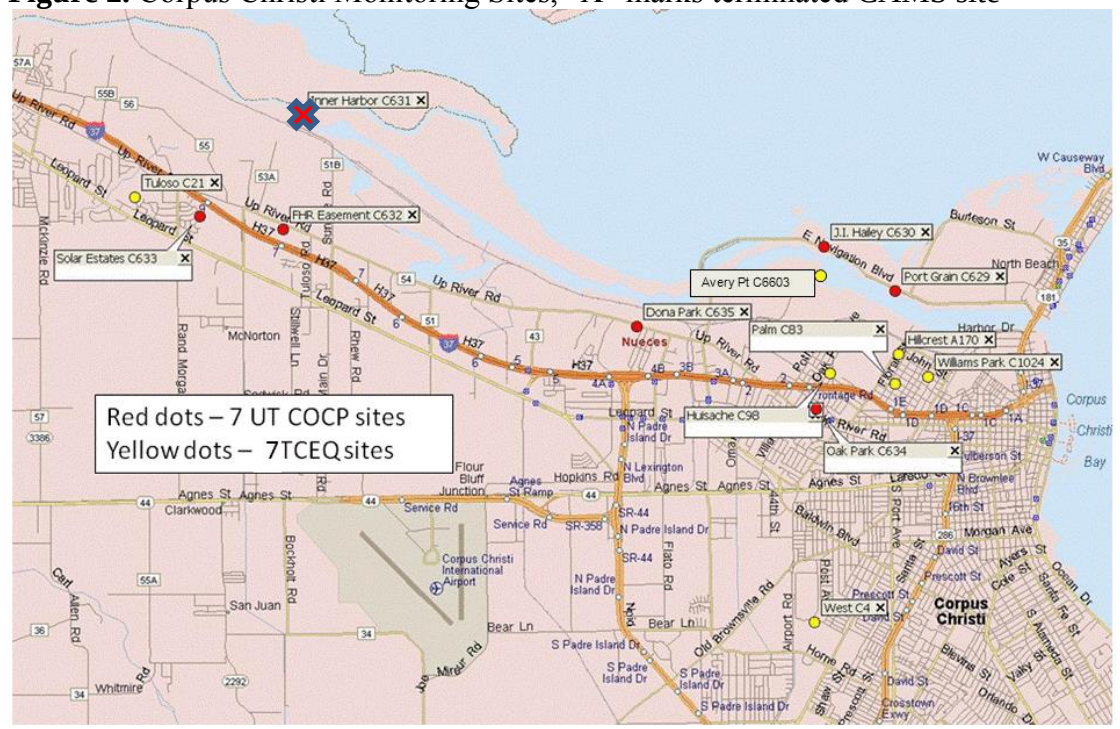


Table 2. Schedule of air monitoring sites, locations and major instrumentation

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**)	Mar 2005 to date	C: Dec 2004 to Feb 2009 T: Dec 2004 to Apr 2012		Dec 2004 to date	
629	Grain Elevator @ Port of Corpus Christi (**CCG**)		T&C: Dec 2004 to date	Dec 2004 to date	Dec 2004 to date	
630	J. I. Hailey Site @ Port of Corpus Christi (**JIH**)		T&C: Dec 2004 to date	Dec 2004 to date	Dec 2004 to date	
635	TCEQ Monitoring Site C199 @ Dona Park (**DPK**)		T&C: Dec 2004 to date	Dec 2004 to date	Dec 2004 to date	Jan 2005 to date
632	Off Up River Road on Flint Hills Resources Easement (**FHR**)		T&C: Dec 2004 to date	Dec 2004 to date	Dec 2004 to date	
633	Solar Estates Park at end of Sunshine Road (**SOE**)	Mar 2005 to date	C: Dec 2004 to Feb 2009 T: Dec 2004 to Apr 2012	Dec 2004 to date	Dec 2004 to date	Jan 2005 to date
631	*Port of Corpus Christi on West End of CC Inner Harbor (**WEH**) (to be relocated)*		T&C: Dec 2004 to May 2012	Dec 2004 to May 2012	Dec 2004 to May 2012	

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 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 "AMCV document") that explain AMCVs are at http://www.tceq.texas.gov/toxicology/AirToxics.html (accessed January 2013). 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.

- **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[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.

  A more detailed description of NAAQS can be found on the TCEQ's Website at http://www.tceq.texas.gov/airquality/monops/naaqs.html (accessed February 2013).

  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, or 75 ppb averaged over one hour, with a form of the three-year average of the annual 99^{th} percentiles of the daily maximum one-hour averages. There is also a secondary SO_2

[1] See http://epa.gov/air/criteria.html accessed February 2013

standard of 0.500 ppm (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 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. Results of Canister Sampling

In FY 2012 a total of 58 usable canister samples were taken. A summary of the maximum benzene concentrations appears in Table 3, below. No measured concentration of any species measured in canister sampling exceeded the TCEQ's AMCV in FY 2012.

Table 3. Summary of canister sample counts and benzene concentrations FY 2012

Sites	Max of benzene ppbV	Number of canister samples	Cans triggered on SO_2
CCG C629	4.88	1	
DPK C635	3.37	11	
FHR C632	22.05	10	
JIH C630	14.04	35	25
WEH C631	8.28	1	

In FY 2011, a new feature had been added to canister sampling at the JIH C630 site. Because of concern about elevated concentrations of SO_2 being measured at the site, canisters may be triggered by SO_2 measurements exceeding 50 ppb. The intent has been to try to characterize what other chemicals may be present in the air coincident with the SO_2, which may help identify the emission source. In FY 2012, 25 canisters were triggered on SO_2 at JIH. The results have been that the hydrocarbon concentrations in the canister samples were relatively low compared to canisters that triggered on TNMHC. The SO_2 triggered canisters had hydrocarbon concentrations that were 23 to 97 percent lower for species averaging at least 0.1 ppbV (38 out of 50 species) with one exception. The exception was isopropylbenzene-cumene, for which the SO_2 triggered canisters were 4 percent higher, which is not statistically significant. The measurement of lower hydrocarbon concentrations is an important finding, as it rules out some possible emissions sources such oil refining, as other species would be expected to be higher than usual. The issue of SO_2 concentrations at Corpus Christi monitoring sites is addressed in Section 4 of this report beginning on page 29, and the concentrations of hydrocarbons in the canisters is discussed below.

All 25 elevated SO_2 canister samples were taken under southerly or southwesterly winds. In April 2012 there were several canisters taken with elevated SO_2 – four each on April 2, 3, and 19 – and four canisters were triggered with neither elevated SO_2 or elevated TNMHC on April 25. These four April 25th canisters were triggered after the end of a short period with elevated SO_2, but were analyzed for the purpose of measuring background air quality blowing across the industrial area and ports. The concentrations of those four canisters were very close to each other, and the results are presented in the graph in Figure 3, on page 16. The 12 canisters collected on April 2, 3, and 19 have their concentrations shown in Figure 4, on page 17. The graph shows that there are varying concentrations in the SO_2-triggered canisters, and that the same species are prevalent in all of the SO_2-triggered canisters. The averages of the concentrations from the four April 25th canisters and the averages of the concentrations from the 12 other April canisters are shown side by side in Figure 5, on page 17. The averages for both sets have approximately the same values for the species propane. This is a hydrocarbon commonly found in urban air from a variety of emissions sources including natural gas leaks. For the majority of other species the elevated SO_2 samples have higher concentrations. Further study

of these and other samples is required to determine whether these differences are statistically significant and whether they can be related to meteorological factors or to upwind activities.

Figure 3. Canister results at JIH C630 for four samples taken coincident with low concentrations of SO_2 and TNMHC, April 25, 2012

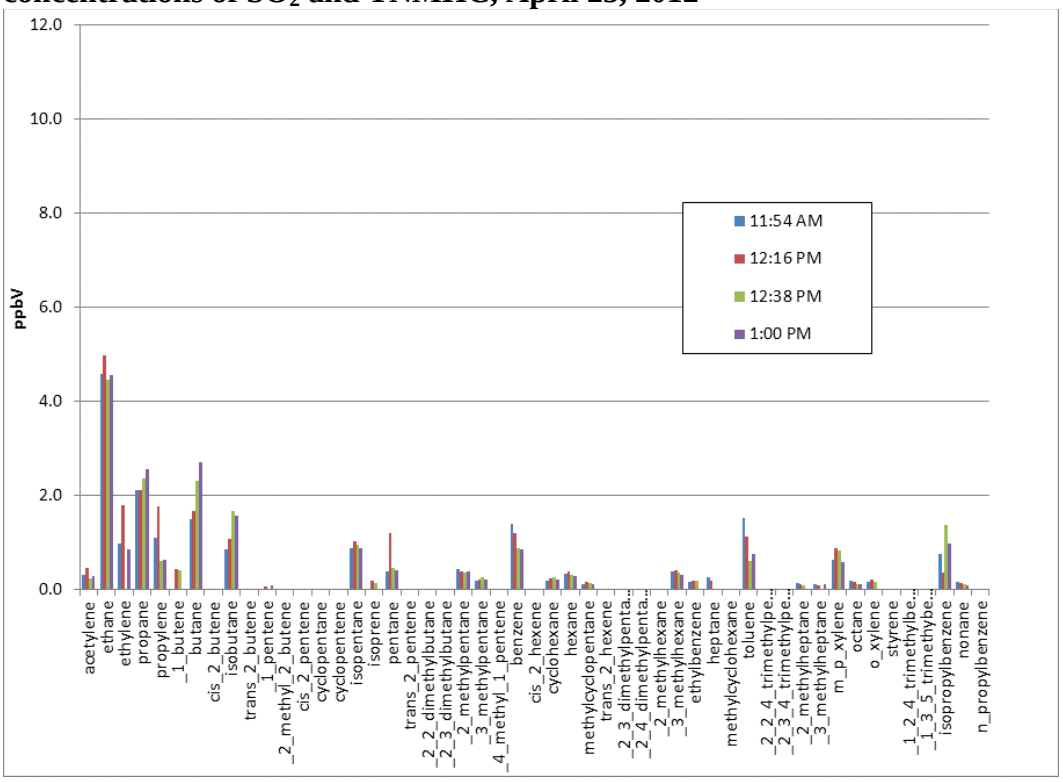


Figure 4. Canister results at JIH C630, 12 samples coincident with elevated SO_2, April 2012

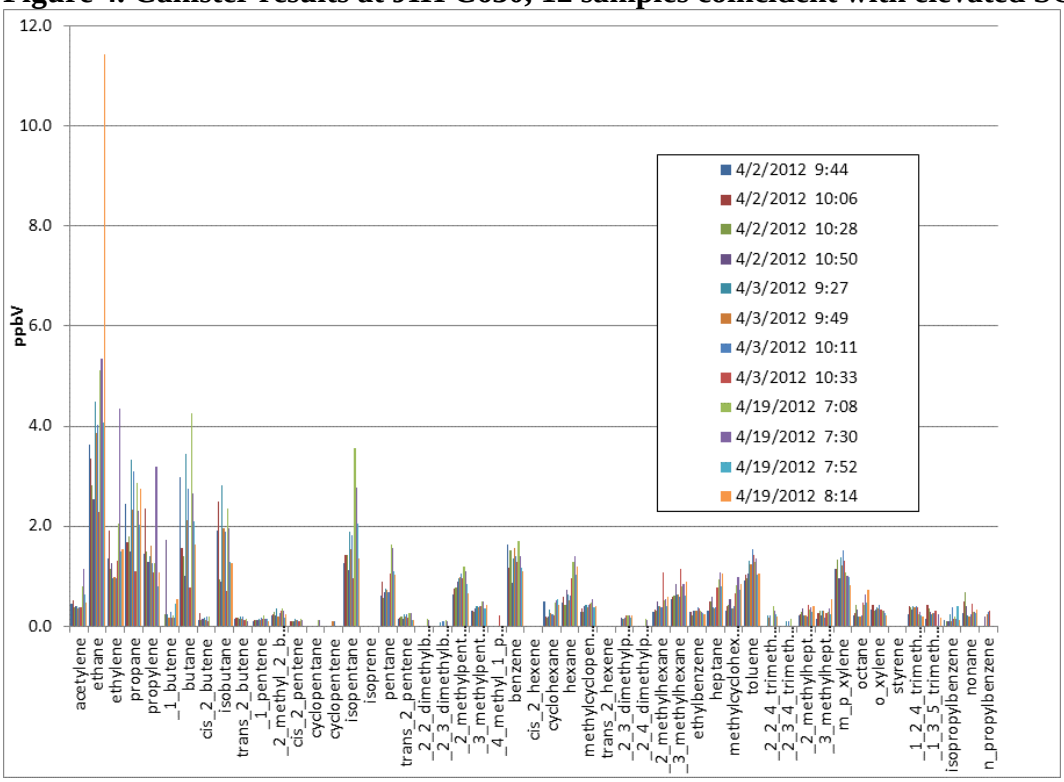
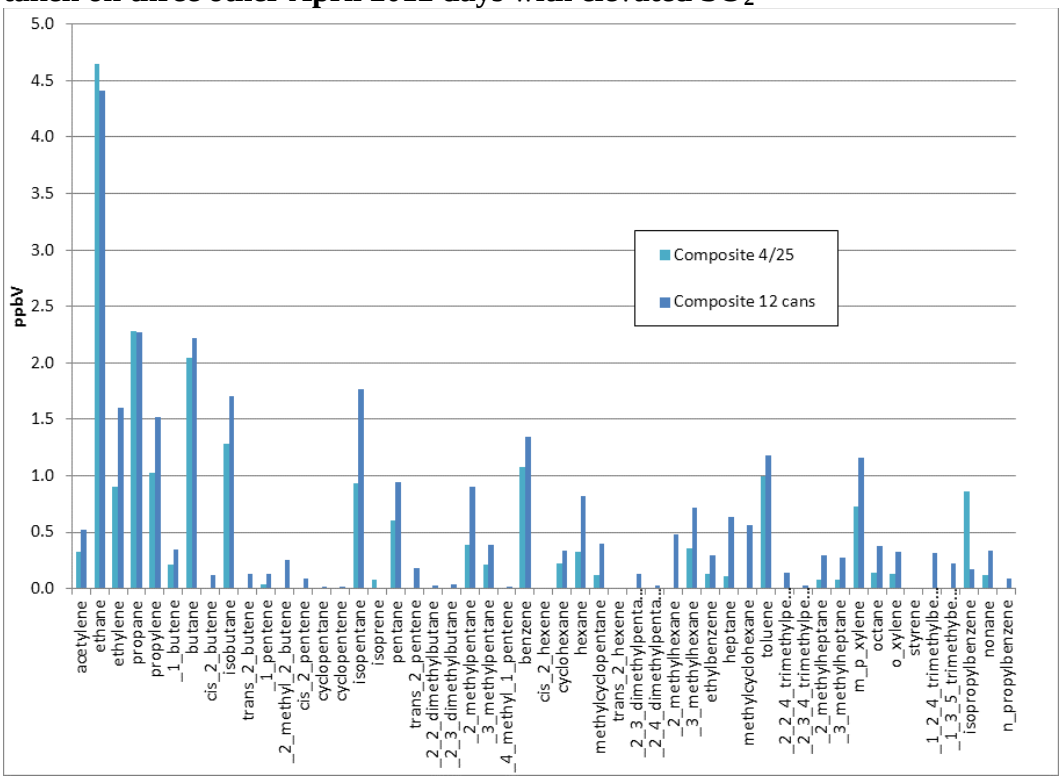


Figure 5. Average concentrations from canisters at JIH C630 for four samples taken coincident with low concentrations of SO_2 and TNMHC, April 25, 2012 and 12 samples taken on three other April 2012 days with elevated SO_2



2. Summary of Total Nonmethane Hydrocarbon Monitoring at Seven Sites

In this section, trends in total nonmethane hydrocarbon (TNMHC) concentrations at five UT CAMS sites – CCG C629, JIH C630, WEH C631, FHR C632, and DPK C635 – are discussed. The data from each site, over each calendar quarter July 2005 through September 2012, are compared to assess seasonality and trends. As has been shown in past reports, each site measures its highest concentrations when the wind blows from the industrial source areas, including areas where natural gas extraction is occurring. Sites can measure elevated concentrations throughout the year, owing to exposure to industrial sources and natural gas extraction, as well as urban area emissions. Several meteorological factors affect the concentrations. In winter months, winds tend to be slower and the air does not mix as much as in the summer, giving air pollutants more opportunities to accumulate. So all else being equal, one can expect higher concentrations for many pollutants in colder weather months. Wind direction also plays an important role.

Because of concern about the frequency of elevated concentrations, the frequency of such events scale has been graphed in Figures 6 through 10, on pages 19 through 21. The frequency is determined by counting the number of observations at or above 2000 ppbC (5 minute average) and then dividing by the large number of valid five-minute observations per quarter (approximately 25,000). Each site's data are graphed on different scales in the following figures. The FHR C632 site frequency values are graphed over the widest range, as that site had been affected by a particular source that has ceased operation, thus leading to a rapid decline in concentrations in late 2007. Two other sites also show a significant decline since 2005: Port Grain C629 and J. I. Hailey C630. West End Harbor C631 dropped after the first year but shows no trend since. The Dona Park C635 site has shown dramatic changes from year to year, and realized an increase in frequency in 2011. This is hypothesized to be related to natural gas extraction on the north side of Nueces Bay, but may also be related to nearby industrial activity and land use changes just to the north of the site.

Figure 6. Frequency of >2000 ppbC TNMHC at Port Grain C629, 3Q CY05–3Q CY12

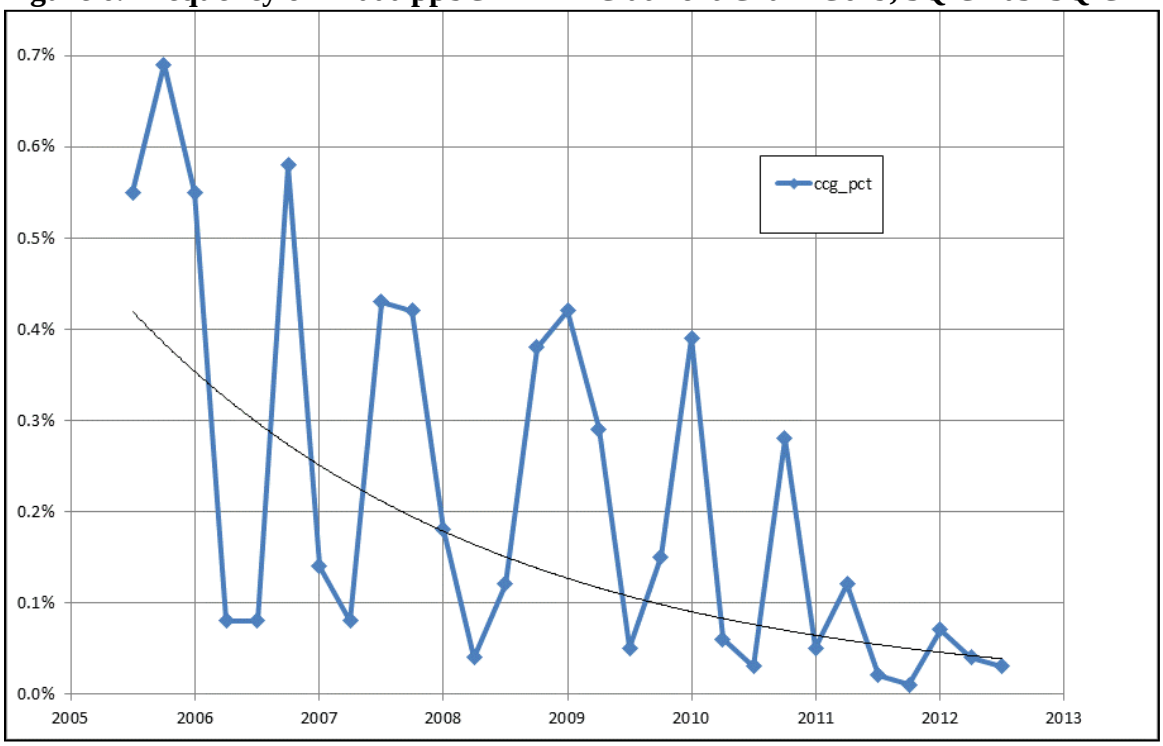


Figure 7. Frequency of >2000 ppbC) TNMHC at J.I. Hailey C630, 3Q CY05 – 3Q CY12

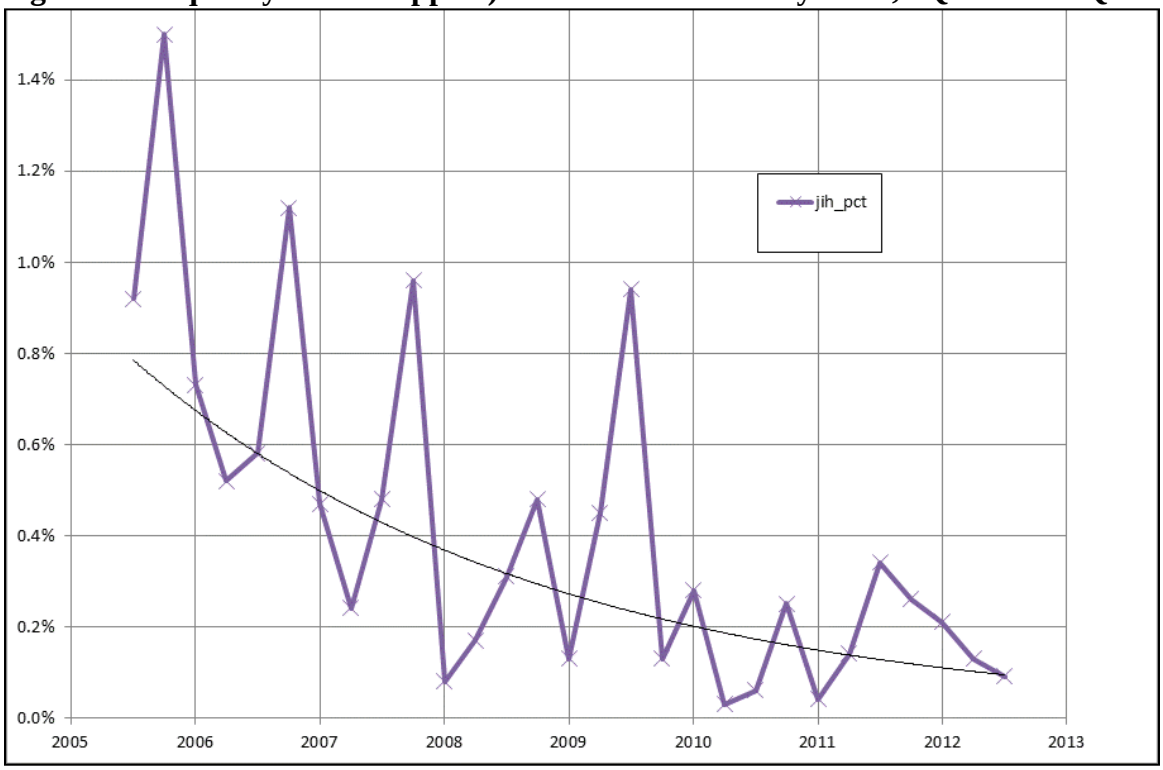


Figure 8. Frequency of >2000 ppbC TNMHC at West End Harbor C631, 3Q CY05 – 3Q CY12

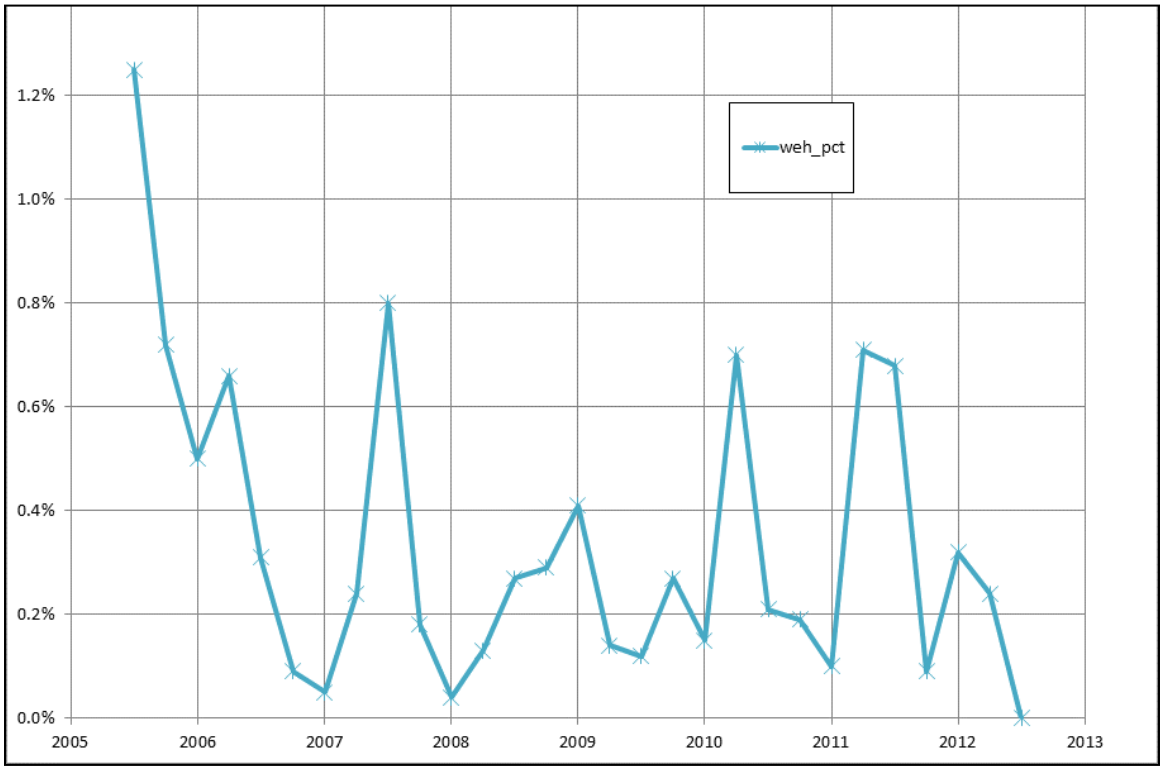


Figure 9. Frequency of >2000 ppbC TNMHC at Flint Hills Resources C632, 3Q CY05 – 3Q CY12

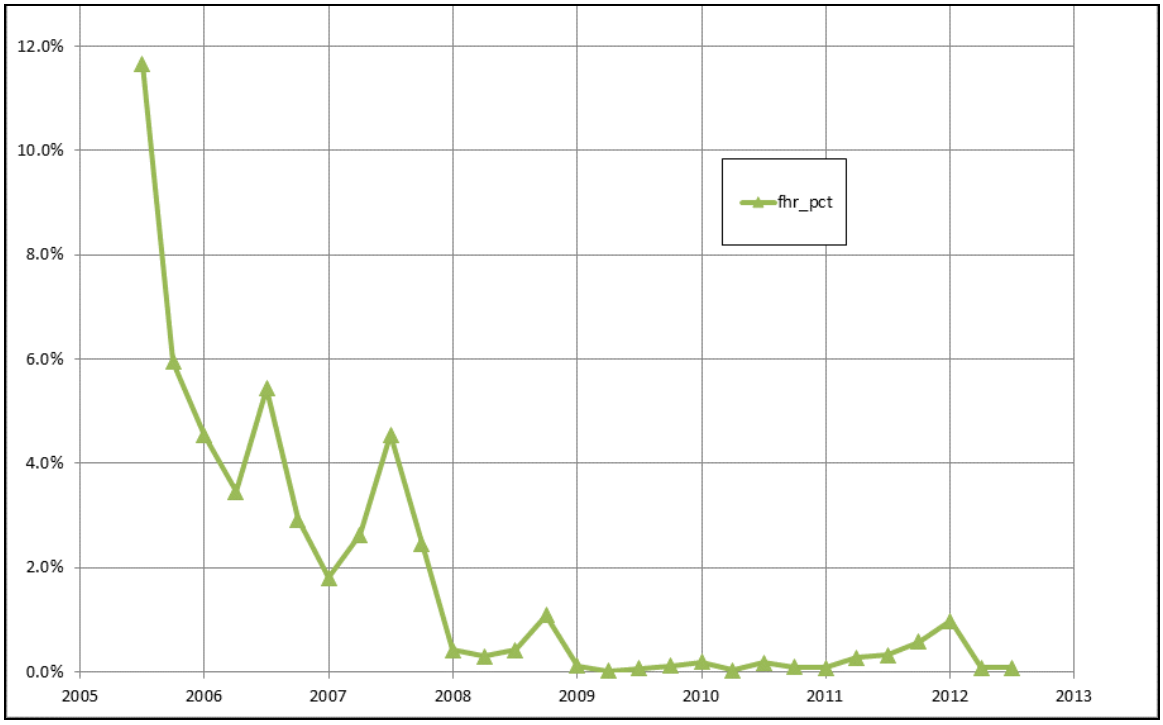
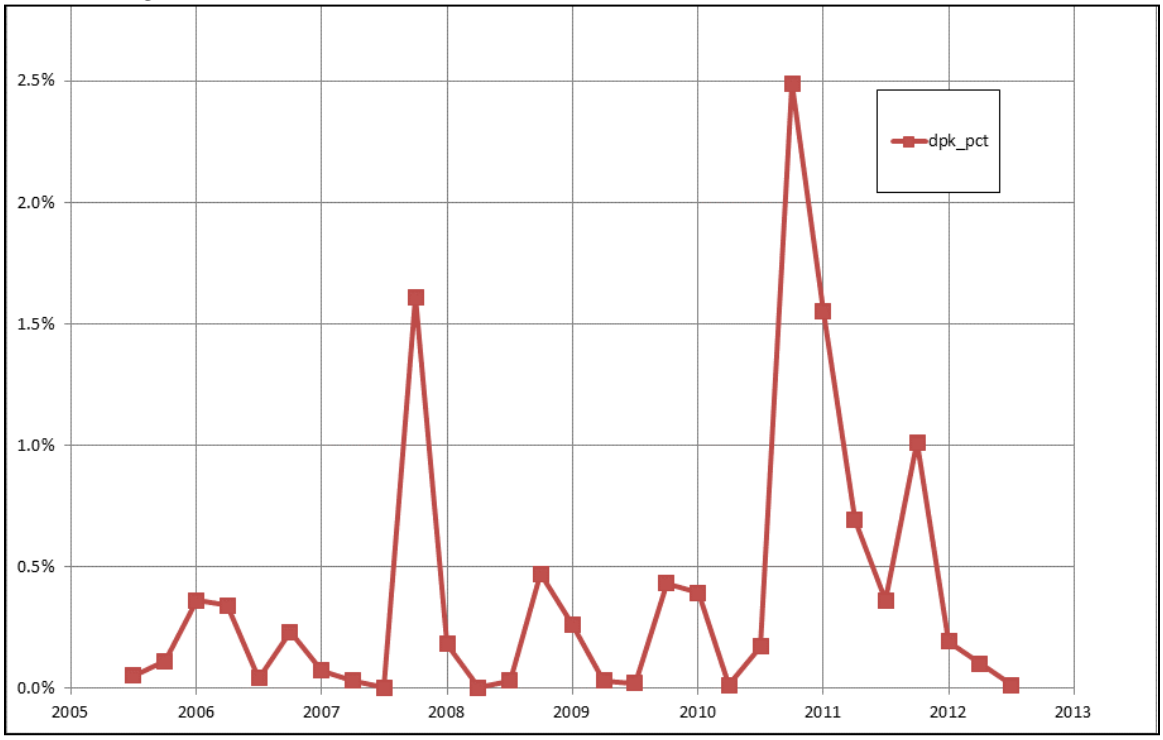


Figure 10. Frequency of elevated (>2000 ppbC) TNMHC at Dona Park CAMS 635, 3Q CY05 – 3Q CY12



3. Auto-GC Data Summaries in Residential Areas

In this section the results of semi-continuous sampling for hydrocarbons at the project auto-GC sites – Solar Estates C633, Oak Park C634 – are presented. These sites are located in residential areas. Solar Estates and Oak Park are generally downwind of industrial emissions under northerly winds. TCEQ began operating a new auto-GC at their Palm C83 site located between the TCEQ's Hillcrest and Williams Park CAMS sites in the Hillcrest neighborhood in 2010. In examining aggregated data one observes similar patterns of hydrocarbons at all three sites. The TCEQ Palm C83 site's concentration statistics are similar to those at Oak Park and Solar Estates.

Table 4, on page 23, summarizes data for Solar Estates and Oak Park from FY 2012. Table 4 shows the average concentrations along with the maximum one-hour and 24-hour average concentrations for 27 hydrocarbon species of interest. All concentration values in the table are in ppbV units. No concentrations or averages of concentrations were greater than TCEQ's air monitoring comparison values (AMCV) during FY 2012.

The rows for ***benzene*** are bold-faced in Table 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.

Figure 11, on page 24, shows the mean concentration for the 27 species of interest from FY 2012 at Oak Park and Solar Estates. The mean concentrations are similar between the two sites. Mean concentrations by fiscal year are shown for Oak Park in Figure 12, on page 25, and Figure 13, on page 26, shows the same graphical synopsis for Solar Estates. Note that in these two figures, the data for the first year, FY 2005, was incomplete with only seven months of data, as monitoring began in March of CY 2005. As is clear in these two graphs, species mean concentrations more or less fall into three categories. The lower molecular-weight and less chemically-reactive alkane species (ethane, propane, butane, iso-butane, pentane, and iso-pentane) have mean concentrations greater than 1.0 ppbV. The second category would be the lower molecular-weight and more reactive alkenes (ethylene and propylene) and some six and seven carbon species (hexane, benzene, cyclohexane, and xylene-isomers), which have mean concentrations between 0.2 and 1.0 ppbV. The third category based on mean concentration is all the other species averaging less than 0.2 ppbV. In comparing graphs we can make the following conclusions:

1. Ethane means are about the same at both sites. For other alkane species, concentrations at Oak Park are generally higher.
2. Mean concentrations have declined overall since FY 2005.
3. Mean concentrations have no apparent trend over the past three or four years.

Table 4. Auto-GC statistics for FY 2012

	Oak Park FY12			Solar Estates FY12		
Species	**1-Hour**	**24-Hour**	**Mean**	**1-Hour**	**24-Hour**	**Mean**
Ethane	276.764	50.564	6.956	143.246	28.505	7.349
Ethylene	42.087	4.996	0.522	25.682	2.864	0.302
Propane	339.126	43.659	4.661	100.374	19.158	4.613
Propylene	33.144	2.264	0.315	14.034	1.605	0.171
Isobutane	51.866	12.991	1.530	46.045	6.026	1.415
n-Butane	85.459	18.794	2.402	79.586	12.341	2.060
t-2-Butene	6.192	0.588	0.172	2.059	0.190	0.018
1-Butene	5.100	0.384	0.044	3.096	0.232	0.022
c-2-Butene	4.479	0.369	0.069	1.820	0.165	0.012
Isopentane	71.649	10.620	1.496	42.578	4.293	0.995
n-Pentane	72.057	7.991	0.952	16.284	2.622	0.678
1,3-Butadiene	0.887	0.143	0.031	6.911	0.470	0.023
t-2-Pentene	3.086	0.347	0.053	1.750	0.154	0.010
1-Pentene	1.535	0.178	0.029	8.456	0.401	0.009
c-2-Pentene	1.596	0.178	0.026	0.917	0.079	0.004
n-Hexane	30.435	3.832	0.445	7.010	1.040	0.270
Benzene	**21.471**	**2.557**	**0.377**	**3.692**	**0.673**	**0.148**
Cyclohexane	8.313	1.139	0.167	5.590	0.787	0.144
Toluene	11.616	2.399	0.400	5.014	0.891	0.197
Ethyl Benzene	1.126	0.173	0.040	3.440	0.195	0.022
p-Xylene + m-Xylene	4.027	0.664	0.130	15.965	0.930	0.123
o-Xylene	1.151	0.190	0.040	5.807	0.318	0.024
Isopropyl Benzene &Cumene	16.669	4.458	0.049	1.755	0.120	0.007
1,3,5-TMB*	1.204	0.188	0.015	1.025	0.190	0.011
1,2,4-TMB*	2.093	0.224	0.050	0.952	0.159	0.021
n-Decane	3.747	0.310	0.032	2.432	0.239	0.026
1,2,3-TMB*	0.617	0.112	0.011	0.415	0.058	0.008

* TMB= trimethylbenzene

Although the Long Term Health Work Group only asks for reports on the 27 species in Table 4, above, the auto-GC measure 46 species. No measured species had a value above its AMCV in FY 2012.

Figure 11. Average concentrations of 27 hydrocarbon species at auto-GCs at Oak Park and Solar Estates for FY 2012

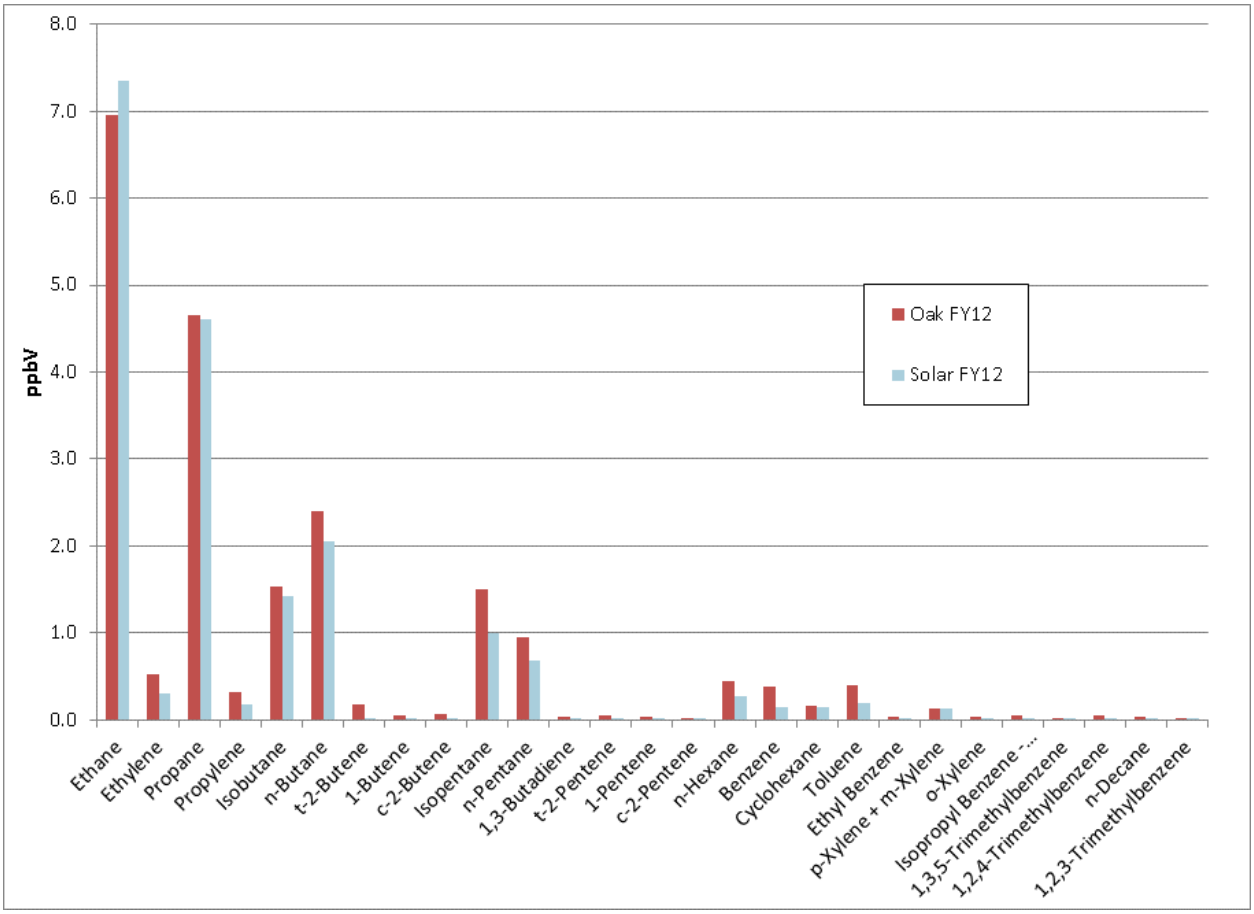


Figure 12. Mean concentrations for 27 hydrocarbon species at Oak Park auto-GC, by FY 2005 - 2012

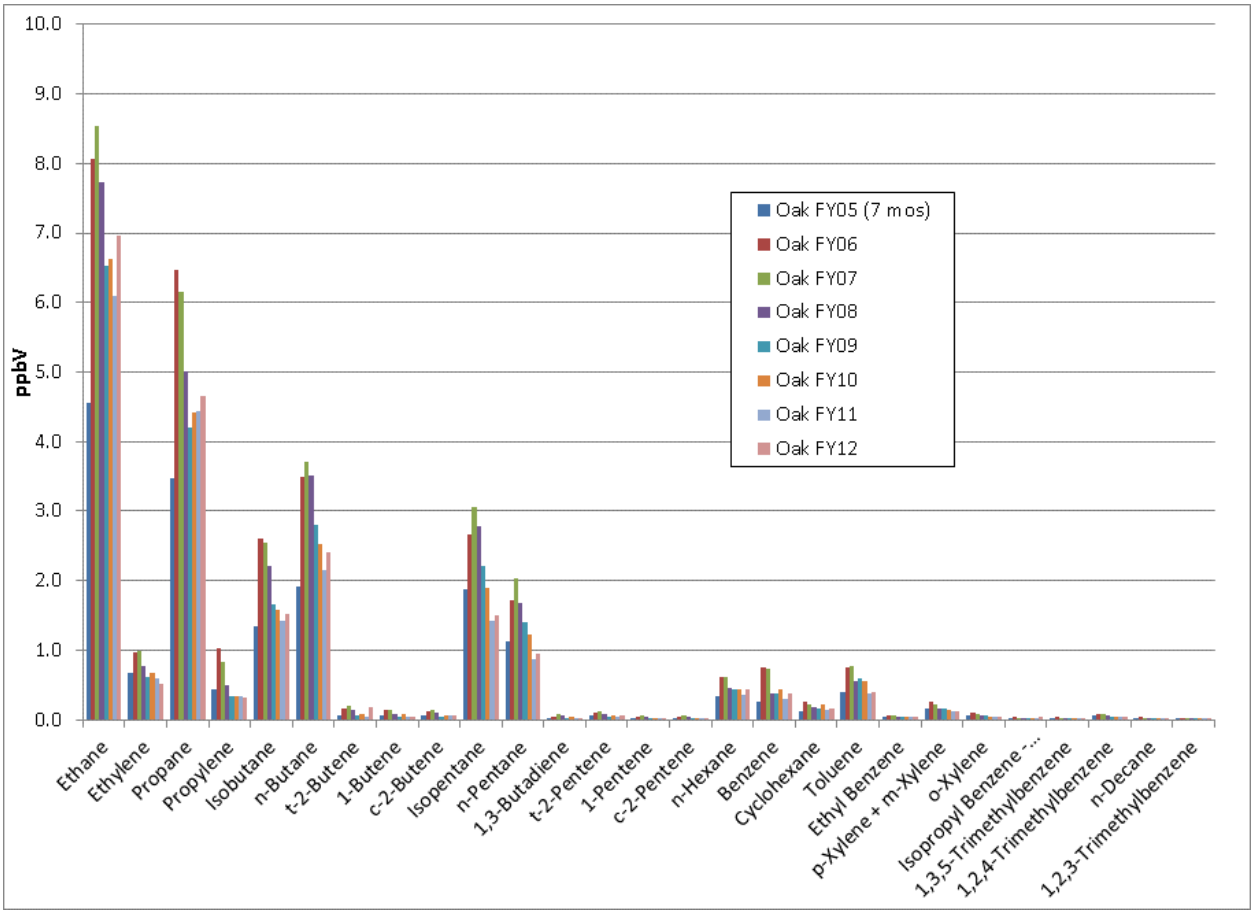
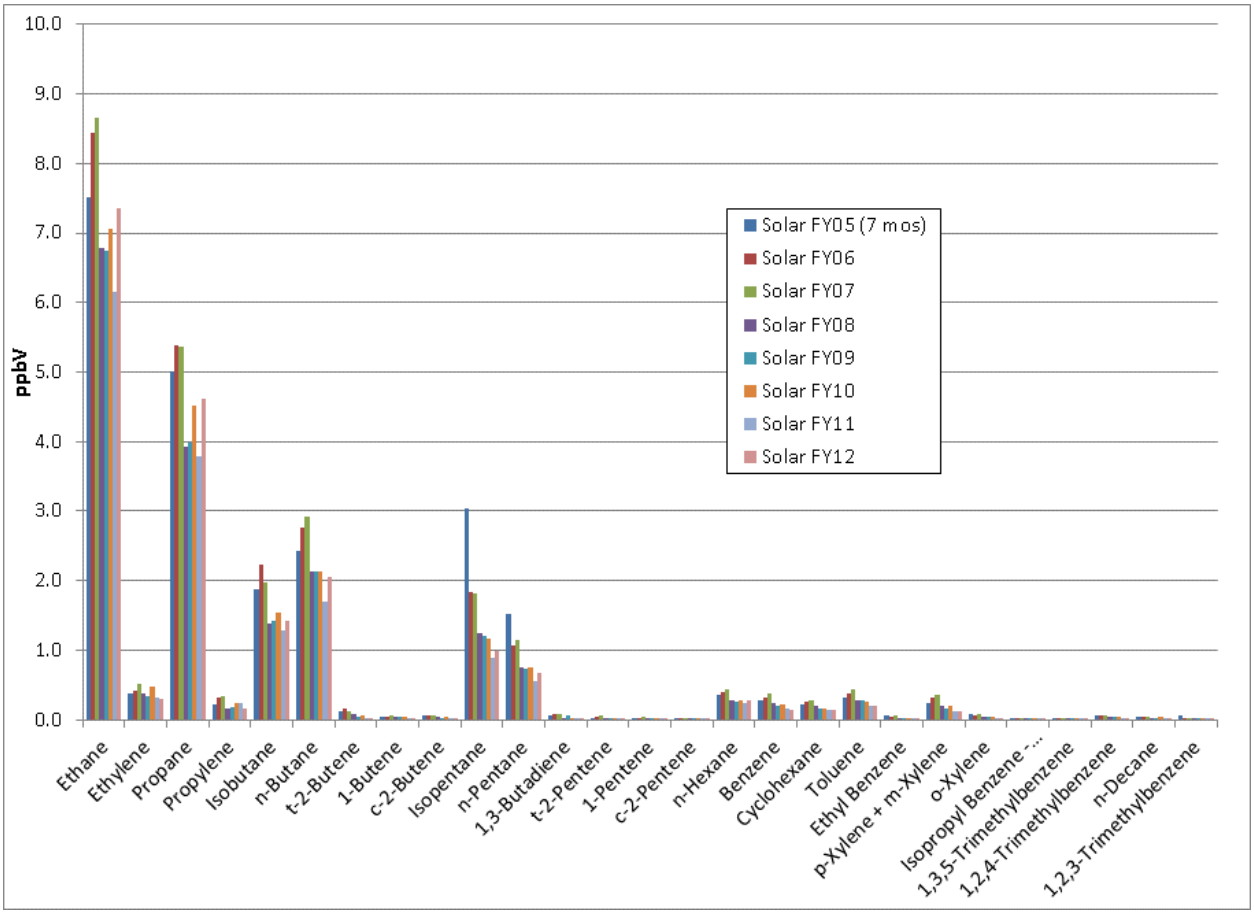


Figure 13. Mean concentrations for 27 hydrocarbon species at Solar Estates auto-GC, by FY 2005 - 2012



As was noted above, benzene tends to be a species of concern because measurements and averages can be a sizable fraction of the AMCV. In recent years, benzene concentrations have declined in Corpus Christi at both UT and at TCEQ canister sampling sites. In January 2010, the TCEQ removed Nueces County from its Air Pollution Watch List for benzene based on the improvements in air quality.

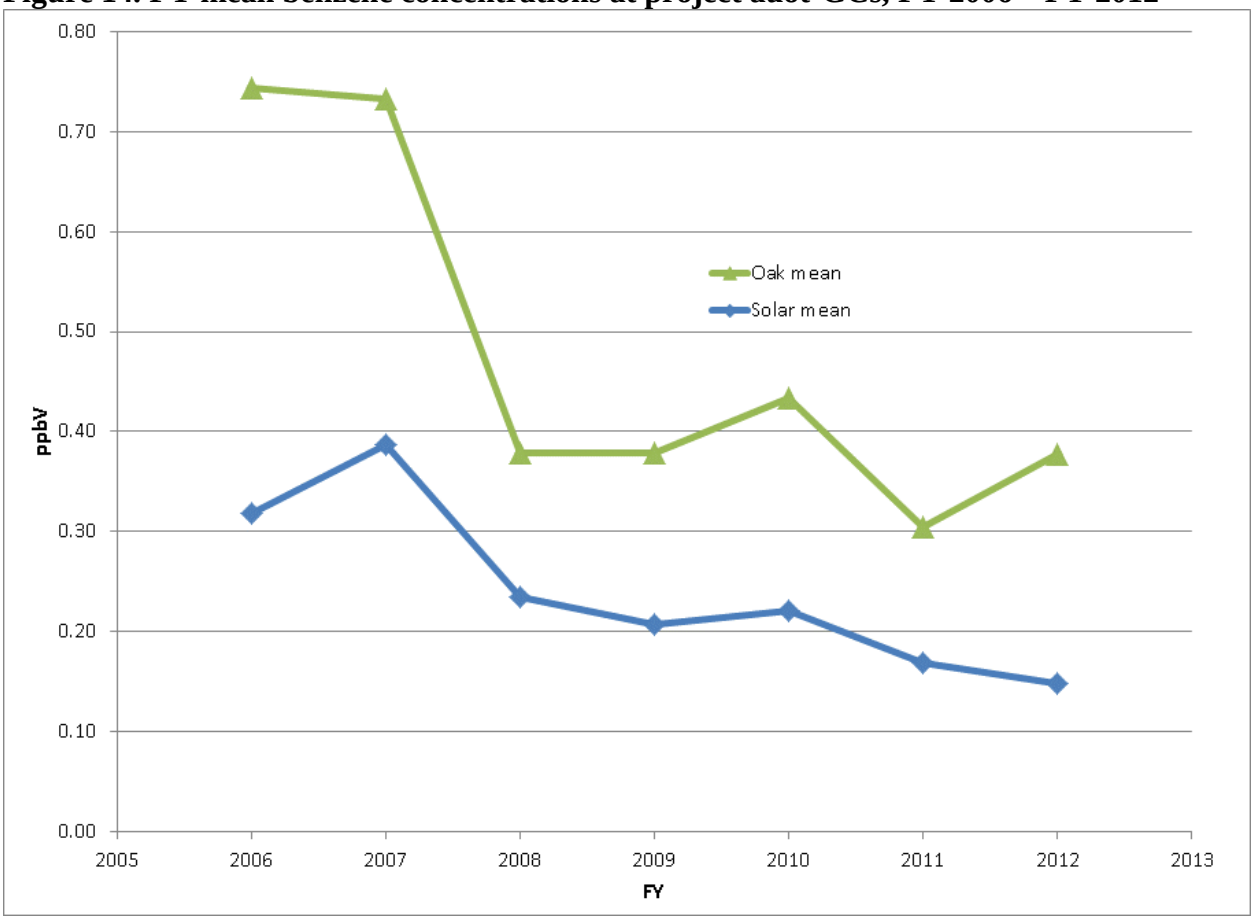
Table 5, on page 27, shows the concentrations at all the auto-GCs operating in Texas in FY 2012 in rank order for mean concentration. The mean concentration at Oak Park is 3rd highest among 26 sites, after having been 8th highest among 24 sites last year. Although the concentrations for FY 12 are higher at Oak Park from the previous year, the change is not statistically significant in the context of the variation over the past four years of annual means. Solar Estates ranks in the lower half of all sites. The AMCV for benzene for long-term (e.g., annual) data comparisons is 1.4 ppbV. Figure 14, on page 28, shows the FY average benzene concentrations at the Oak Park and Solar Estates auto-GC sites since monitoring began.

Table 5. Statistics on benzene ppbV at 24 auto-GCs operating in Texas in FY 2012

Site	Num Samples	Peak 1-Hr ppbV	Peak 24-hr ppbV	Mean
Hous. Lynchburg Ferry	5,847	57.191	6.466	0.953
Hous. Channelview	7,556	84.127	5.236	0.527
CC Oak Park	7,205	21.471	2.557	0.377
Hous. HRM-3 Haden Rd	7,303	15.735	1.554	0.331
Houston Clinton	6,957	11.933	1.226	0.322
Hous. Deer Park	6,871	22.852	2.083	0.313
Hous. Cesar Chavez	7,260	5.240	1.461	0.308
BPA Beaumont-Downtown	7,590	23.883	1.513	0.284
Odessa Hays	7,512	6.776	0.951	0.276
CC Palm	7,370	87.410	7.186	0.275
BPA Nederland High School	7,610	11.578	1.369	0.271
Houston Milby Park	7,690	5.845	1.130	0.263
El Paso Chamizal	7,646	7.106	1.533	0.255
Hous. Wallisville Rd	7,542	19.577	4.931	0.222
El Paso Delta	7,726	3.443	0.850	0.190
Fort Worth Northwest	7,341	2.067	0.574	0.172
Texas City 34th St	7,379	11.987	0.898	0.166
DFW Decatur Thompson	7,741	5.369	0.433	0.159
Dallas Hinton	7,712	16.536	0.900	0.149
CC Solar Estates	7,555	3.692	0.673	0.148
DFW DISH Airfield	7,772	1.391	0.475	0.141
DFW Everman Johnson	7,493	1.303	0.429	0.132
DFW Eagle Mountain Lake	7,652	0.818	0.407	0.131
Hous. Danciger	7,284	11.894	1.828	0.129
DFW Flower Mound Shiloh	7267	0.906	0.442	0.125
Hous. Lake Jackson	7238	0.972	0.322	0.081

* Hous. = Houston area
DFW = Dallas / Fort Worth area
BPA = Beaumont / Port Arthur area
CC = Corpus Christi area

Figure 14. FY mean benzene concentrations at project auot-GCs, FY 2006 – FY 2012



4. Sulfur Dioxide Concentrations around Corpus Christi

J. I. Hailey CAMS 630

One hour SO_2 concentrations above 75 ppb are considered to be individual exceedances of the level 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 three-year 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. The resulting statistic is called the *design value* for a monitoring site. Table 6, below, contains the design values for Corpus Christi monitors (TCEQ and UT) for recent three-year periods. The JIH C630 site shows noncompliance in each three-year period to date. A row has been entered in Table 6 for the 2010 – 2012 period, although not all 2012 data have been validated. The fourth highest daily maximum at JIH for 2012 through three validated quarters was 61.4 ppb on January 6, 2012, which would be the 99th percentile value in a full year, and was already high enough to create a rolling three year average over 75 ppb.

Concentrations appear to have declined over the course of 2012 at JIH C630. If the lower concentrations continue through 2013, then the JIH site would come into compliance with the current SO_2 NAAQS at the end of 2013.

Table 6. SO_2 NAAQS design values for Corpus Christi area sites, ppb units, values greater than 75 ppb represent noncompliance

Years	C21	C4	C629	C630	C631	C632	C633	C635	C98
2005-2007	8	24	34	**119**	38	21	51	34	36
2006-2008	8	21	31	**131**	33	19	31	31	32
2007-2009	9	18	30	**89**	32	17	21	23	28
2008-2010	9	17	26	**103**	21	13	11	22	33
2009-2011	9	12	19	**80**	15	13	30	20	27
2010-2012*	8	10	15	**76***	8	12	40	12	23

* Only partial year for 2012

Research to date has concluded that emissions from ships operating in the Corpus Christi ship channel and docked along the shores are major contributors to elevated SO_2 concentrations at JIH and to some extent at other sites. The main source of SO_2 is believed to be the result of emissions from diesel engines used in dockside ships' auxiliary engines running on high-sulfur diesel fuel. However, over the course of 2012, SO_2 concentrations at JIH have been steadily declining. This is reflected in Figures 15, 16, and 17, on pages 30 and 31. Figure 15 shows the time series of 5-minute SO_2 measurements at JIH over the period from June 1, 2011 to January 23, 2012. Episodes of elevated SO_2 were frequent over this period. Figure 16 shows the time series of 5-minute SO_2 measurements at JIH over the period a year later, from June 1, 2012 to January 23, 2013. The y-axis is the same in both figures, but the range of SO_2 concentrations is much smaller over the more recent period. The two periods plus the intervening period are shown in Figure 17, using only measurements with coincident wind direction from the southerly directions associated with the highest 1 percent of concentrations. In Figure 17 there is a note to

indicate the date June 1, 2012. The significance of this date comes from Title 40 of the Code of Federal Regulations (40CFR). This is the codification of federal law related to protection of the natural environment, and Part 80 of 40CFR deals with the regulation of fuels and fuel additives. Part 80, Subpart I is titled Motor Vehicle Diesel Fuel; Nonroad, Locomotive, and Marine Diesel Fuel; and ECA Marine Fuel, and specifies a schedule for reducing sulfur content in diesel fuel used by smaller boats and ships and for reducing sulfur content in fuel used by larger "Emission Control Area" ships, those large vessels operating within 200 nautical miles (230 miles) of the coast. The requirements in 40CFR Part 80.510 specify that by June 1, 2012, sulfur content in marine diesel fuel must drop from the 500 ppm limit set in 2007 to a new 15 ppm limit. A provision in an international treaty to which the U.S. is party will require additional reduction in sulfur content in the larger ocean going vessel (OGV) fuel in 2015. However, the OGVs generally operate smaller diesel motors while at dock, and it is very likely that the fuel employed for these smaller motors now has lower sulfur content. Thus, both small ships motoring in the ship channel and large ships docked in the ship channel may now be producing lower emissions of SO_2.

Figure 15. Five-minute SO2 at JIH, June 1, 2011 – January 23, 2012

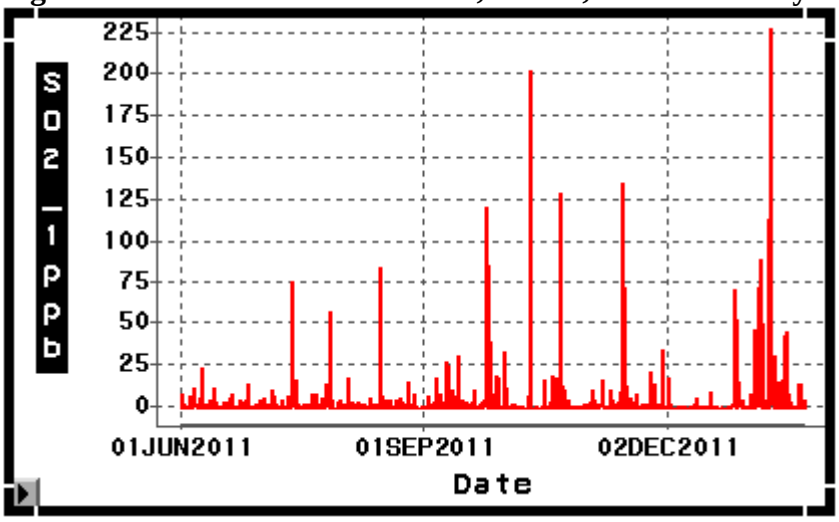


Figure 16. Five-minute SO_2 at JIH, June 1, 2012 – January 23, 2013

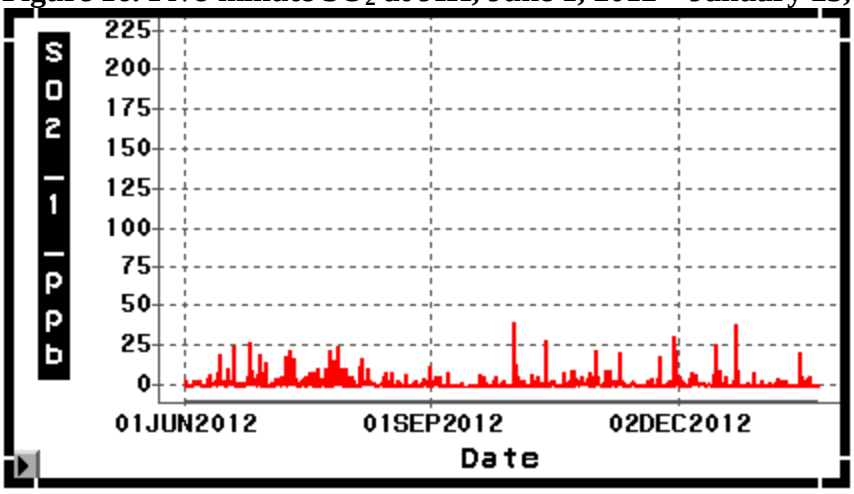
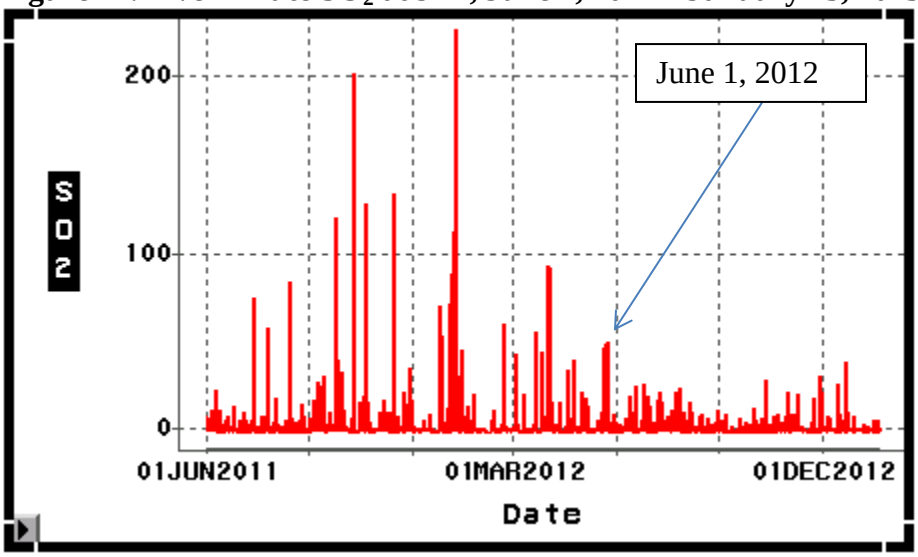


Figure 17. Five-minute SO_2 at JIH, June 1, 2011 – January 23, 2013, 120 < WDR < 270 deg.



Solar Estates CAMS 633 and FHR CAMS 632, and TCEQ's Tuloso CAMS 21

In Table 6, on page 29, the site with the second highest design value for SO_2 in 2005 – 2007, 2009 – 2011, and 2010 – 2012 is the Solar Estates C633 site. In FY 2012, a significant effort went into trying to determine why this site occasionally measured SO_2 concentrations above the level of the NAAQS. Of concern to UT and the TCEQ was the fact that small, if any, SO_2 emissions were expected to be associated with the particular wind direction from which the elevated concentrations were measured. UT studied the behavior of the SO_2 data from Solar Estates and observed the following patterns. Elevated SO_2 was primarily associated with:

- A narrow range of wind directions, from the southeast between 135 and 180 degrees, with the highest average concentration at 156 degrees;
- Mondays through Fridays, and an occasional Saturday, particularly on weekends near major holidays;
- After 5 a.m. local time to around 6 p.m. local time (with adjustment made at changes between daylight savings and standard time).

Because of the concern about elevated SO_2 measurements at Solar Estates, data from the two nearest neighboring sites, the UT FHR C632 site and the TCEQ's Tuloso C21 site, were also studied. FHR C632 also measures elevated SO_2 when the wind blows from a direction – southwest – consistent with the suspected upwind source of measured SO_2 at Solar Estates, under the same temporal patterns as Solar Estate. However, because southwest winds are the lowest frequency of occurrence winds, relatively few elevated measurements were made at FHR. The brand of SO_2 instrument used at the UT CAMS site is the Thermo-43C.

TCEQ's Tuloso C21 site measures SO_2 with a different instrument – the API-100A – and is located on the other side of a residential neighborhood from Solar Estates. Tuloso C21 has never measured elevated SO_2 from the southeast as would be expected based on the directionality observed at Solar Estates and FHR. Figure 18, on page 34, shows an aerial map of three of the CAMS sites along with locations of SO_2 point sources reported in the 2008 TCEQ emissions

inventory. Figure 18 also shows the location of the suspect source for the elevated SO_2 measurements at Solar Estates and FHR: the Sam Kane Beef Processors plant on Leopard St.

The Mon. – Fri., 5 a.m. – 6 p.m. temporal pattern described above suggests Solar Estates and FHR have been affected by emissions from some activity associated with a business or businesses not related to the refining industry, which tends to operate 24-hours per day and 7 days per week. Furthermore, the elevated concentrations have been measured only within specific time periods:

- Period 1: Beginning before mid-Dec. 2004 (start of monitoring program) // Ending May 11, 2005, 2 pm CST
- Period 2: Beginning between Oct. 5, 2006, 9 pm CST and Oct. 6, 2006, 6:45 pm CST // Ending between Jan. 12, 2007, 4 pm CST and Jan. 13, 2007, 2 am CST
- Period 3: Beginning May 25, 2011, 11:50 am CST and continuing into 2013

In order to look for the source of the SO_2 emissions affecting the Solar Estates and FHR monitors, UT sent its mobile monitoring truck with a different brand of SO_2 monitor (ML-9850) to Corpus Christi; however, while the Solar Estates site measured elevated SO_2, the monitor in the vehicle parked outside did not. This led to the decision to install spare monitors in the Solar Estates CAMS shelter to test the original site instrument. The spare instruments were also installed for a period in the nearest TCEQ CAMS 21 site at Tuloso Midway Middle School, a short distance away. The project began on April 18, 2012, and data have been examined through September 30, 2012. There were five phases to the experiment, shown in Table 7, on page 33. As was mentioned above, the normal SO_2 instrument operating at Solar Estates is a Thermo-43C and the normal instrument operating at the TCEQ Tuloso C21 is an API-100A. Three additional SO_2 instruments – one provided by TCEQ and two by UT – were operated two-at-a-time for a period at Solar Estates and then moved to Tuloso, then moved back to Solar Estates. TCEQ created a portable CAMS 210, not tied to a specific geographic location, for collecting and tracking the data from the spare collocation monitors. When two or more instruments run at one CAMS, they are differentiated by "parameter occurrence code" (POC) numbers. For C210, POC 1 corresponds to the spare TCEQ instrument, and POC 2 corresponds to the spare UT instrument. Initially, both spare instruments were ML-9850 analyzers. On May 8, the spare UT ML-9850 at Solar Estates was replaced with a Thermo-43C analyzer. On June 13, the spare TCEQ ML-9850 and UT Thermo-43C were moved to the Tuloso C21 site. After June 29, 2012, the spare instruments were moved back to Solar Estates. On September 6, the spare UT Thermo-43C was outfitted with an SO_2 scrubber designed to remove SO_2 from the air stream entering the instrument. The role of the SO_2 scrubber was to test for the presence of SO_2 as opposed to some other chemical that could trigger a reaction by the SO_2 instruments. The hypothesis was that if SO_2 were in the air, a normal SO_2 instrument would measure the concentration but that an SO_2 instrument with an SO_2 scrubber would not. The type of gas scrubber employed is a component containing a material with crystalline structure with openings that act as a sieve on the molecular size-scale, and which also can filter on the polarity of molecules. The nature of the molecular sieve used as an SO_2 scrubber is that it is configured size specific and polarity specific for the removal of SO_2 molecules, and installed at the intake to the SO_2 analyzer.

Table 7. Monitoring configurations at CAMS 633 and 21, April 18 – June 29, 2012 and August 15 – September 30, 2012

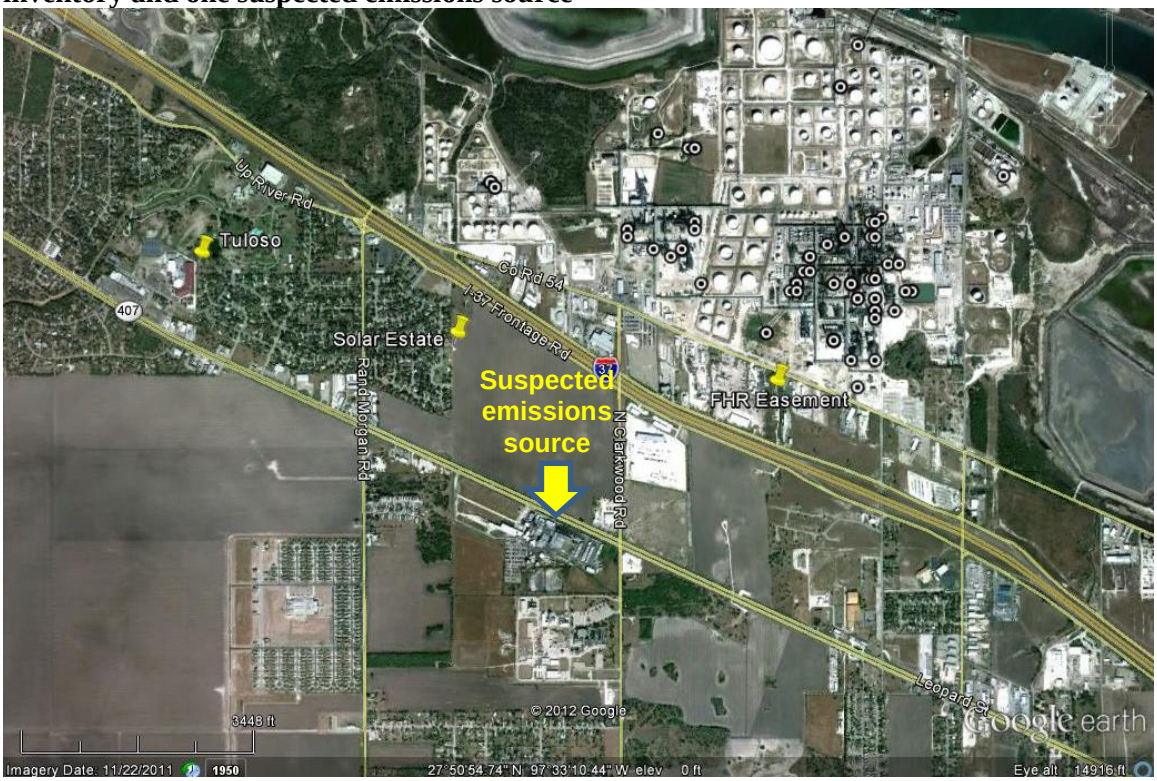
Configuration nickname	Site	Normal station monitor	TCEQ CAMS 210 (POC 1)	UT CAMS 210 (POC 2)	Start	End
C633 ml9850	Solar 633	Thermo-43C	ML-9850	ML-9850	4/18/12	5/8/12
C633 teco43	Solar 633	Thermo-43C	ML-9850	Thermo-43C	5/9/12	6/13/12
C21 collocate	Tuloso 21	API-100A	ML-9850	Thermo-43C	6/13/12	6/29/12
C633 teco43-2	Solar 633	Thermo-43C	ML-9850	Thermo-43C	8/15/12	9/6/12
C633 scrub	Solar 633	Thermo-43C	ML-9850	Thermo-43C w scrubber	9/7/12	9/30/12

The basic conclusions from the experiment are as follows:

- Qualitatively, the two collocated ML-9850 analyzers running from April 18 to May 8 at Solar Estates had good agreement with each other.
- Qualitatively, the two collocated Thermo-43C analyzers running from May 9 to June 13 at Solar Estates had good agreement with each other.
- **At Solar Estates, the ML-9850s reported statistically and significantly lower concentrations than the Thermo-43Cs when the wind blew from the southeast during the hours that the suspect source of SO_2 was operating, but generally agreed with the Thermo-43Cs under other wind directions or during non-operating periods for the suspected emissions source.**
- Qualitatively, the three instruments running at Tuloso C21 from June 13 to June 29 had good agreement with each other under all wind directions.
- None of the three instruments running at Tuloso measured unusually elevated concentrations when the wind blew from the southeast, with the exception of one five-minute value measured on May 21, a date before the spare instruments were located at C21.
- The TCEQ ML 9850 had quality problems that affected its utility for intercomparisons during the second period (C633 Thermo 43C) of the study.
- The FHR CAMS 632 site measured elevated SO_2 concentrations on three days over the study period when wind blew from the southwest. This is consistent with past measurements and the site, and the wind directions associated with elevated concentrations are consistent assuming an emission source on Leopard St. that would also affect Solar Estates C633 under southeast winds.
- When an SO_2 scrubber was added to the spare Thermo 43C at Solar Estates, the following results were observed:
    - When wind blew from the north through east, both the spare ML-9850 and the normal station Thermno-43C occasionally measured elevated SO_2 associated with refinery emissions. The scrubbed Thermo 43C did not measure SO_2 under these conditions.
    - When wind blew from the southeast and the normal station Thermo-43C measured elevated SO_2, so did the scrubbed Thermo-43C, although the concentrations were about 35 percent lower with the scrubbed instrument than with the normal station instrument.

All of these data results point to a tentative conclusion that the SO_2 measured under southeast winds is likely not actually SO_2 but some other unknown chemical, or a combination of some amount of SO_2 and another unknown chemical. In February 2013 the experiments ended and the spare SO2 instruments were taken out of service. The question of how to interpret SO_2 measurements taken at Solar Estates under southeast winds or FHR under southwest winds is still undecided. Further research into this issue is conditional on the allocation of additional funding from a source other than this project.

Figure 18. Aerial map of three CAMS sites and SO_2 point sources in the 2008 TCEQ emissions inventory and one suspected emissions source



Conclusions from the FY 2012 Data

In this year's report, several findings have been presented:

- Periodic air pollution events continue to be measured on a routine basis, but values of hydrocarbons above the TCEQ's air monitoring comparison values (AMCVs) were not observed.
- Hydrocarbons measured by the two project auto-GC have been lower in the past four years than in the first three years of the project.
- Total nonmethane hydrocarbons measured at most sites appear to be continuing a long term decline in mean concentration and in the frequency of elevated concentration measurements. The Dona Park site appears to have had significant fluctuations in concentrations and no clear trend.
- Under EPA's NAAQS for SO_2, the JIH C630 site appears to be noncompliant. However, since June 1, 2012, concentrations have been significantly lower.

Further analyses will be provided upon request.

APPENDIX B

Web Site Statistics

Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project
Web Site Statistics

	Calendar Year 2005			Calendar Year 2006			Calendar Year 2007			Calendar Year 2008			Calendar Year 2009			Calendar Year 2010			Calendar Year 2011			Calendar Year 2012		
	Hits	**Views**	**Visits**	**Hits**	**Views**	**Visits**	**Hits**	**Views**	**Visits**	**Hits**	**Views**	**Visits**	**Hits**	**Views**	**Visits**	**Hits**	**Views**	**Visits**	**Hits**	**Views**	**Visits**	**Hits**	**Views**	**Visits**
The University of Texas at Austin Corpus Christi Web Sites:																								
Main Web Site (All Pages)	44,572	16,122		50,623	25,903		45,492	25,223		61,930	37,496		64,482	***		45,469	***		115,823	***		189,526	***	
Trajectory Tool Web Site ("ceer_trajectory" directory)	288		21	367		230	39,425		4,385	56,513		9,495	48,078		9,939	39,388		9,292	29,154		9,285	26,083		9,179
SubTotal - UT Web Sites	**44,860**	**16,122**	**21**	**50,990**	**25,903**	**230**	**84,917**	**25,223**	**4,385**	**118,443**	**37,496**	**9,495**	**112,560**	**0**	**9,939**	**84,857**	**0**	**9,292**	**144,977**	**0**	**9,285**	**215,609**	**0**	**9,179**
TCEQ Web Sites:																								
Monitoring Operations Corpus Christi AutoGC Page								342			1,176			1,338			1,324			2,015			1,077	
SubTotal - TCEQ Web Sites	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**342**	**0**	**0**	**1,176**	**0**	**0**	**1,338**	**0**	**0**	**1,324**	**0**	**0**	**2,015**	**0**	**0**	**1,077**	**0**
Total - Both Institutions	**44,860**	**16,122**	**21**	**50,990**	**25,903**	**230**	**84,917**	**25,565**	**4,385**	**118,443**	**38,672**	**9,495**	**112,560**	**1,338**	**9,939**	**84,857**	**1,324**	**9,292**	**144,977**	**2,015**	**9,285**	**215,609**	**1,077**	**9,179**

Denotes this count not collected

*** Views are no longer available on UT's Urchin Weblog system

TCEQ opened all 21 AGC site's to the public on 1-1-10, since there are 2 Corpus Christi AGC sites, we use this formula ((Total Daily Views / 21) * 2) to estimate the Views for this report

Definition of Terms:

Hit - A request for a file from the web server. Available only in log analysis. The number of hits received by a website is frequently cited to assert its popularity, but this number is extremely misleading and dramatically over-estimates popularity. A single web-page typically consists of multiple (often dozens) of discrete files, each of which is counted as a hit as the page is downloaded, so the number of hits is really an arbitrary number more reflective of the complexity of individual pages on the website than the website's actual popularity. The total number of visitors or page views provides a more realistic and accurate assessment of popularity.

Page View - A request for a file whose type is defined as a page in log analysis. An occurrence of the script being run in page tagging. In log analysis, a single page view may generate multiple hits as all the resources required to view the page (images, .js and .css files) are also requested from the web server.

Visit / Session - A series of requests from the same uniquely identified client with a set timeout. A visit is expected to contain multiple hits (in log analysis) and page views.

APPENDIX C

Financial Reports

ANNUAL PROGRESS REPORT
TO THE U.S. DISTRICT COURT
FOR THE
CORPUS CHRISTI AIR MONITORING AND SURVEILLANCE CAMERA PROJECT

Financial Summary

A. PROJECT EXPENDITURES

First Year Paid Expenditures	(10/2/03 - 9/30/04)	$ 663,448.81
Second Year Paid Expenditures	(10/1/04 - 9/30/05)	$1,291,272.21
Third Year Paid Expenditures	(10/1/05 - 9/30/06)	$ 461,868.36
Fourth Year Paid Expenditures	(10/1/06 – 9/30/07)	$ 688,645.02
Fifth Year Paid Expenditures	(10/1/07 – 9/30/08)	$ 997,731.32
Sixth Year Paid Expenditures	(10/1/08 - 9/30/09)	$ 896,094.86
Seventh Year Expenditures	(10/1/09 - 9/30/10)	$ 969,694.76
Eighth Year Expenditures	(10/1/10 - 9/30/11)	$ 701,436.96
Current Year Expenditures	(10/1/11 - 9/30/12)	$ 867,677.81
Total Project Expenditures	(10/2/03 - 9/30/12)	$7,537,870.11

Note: Summary of Expenditures found in *Exhibit A*, page 39.

B COCP FUNDS REMAINING

Initial deposit on 10/2/03	$6,761,718.02
Less expenditures through 9/30/12	($7,537,870.11)
Plus interest earned as of 9/30/12	$ 815,240.00
Total	$ 39,087.91
COCP FUNDS REMAINING* AS OF 9/30/12	**$ 39,087.91**

*A charge of $3,084.60 posted in early October 2012. The remaining funds are indirect cost for the project and were fully expended with the final indirect cost reconciliation of the account which occurred in early January 2013.

EXHIBIT A

Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project

Expenditure Summary for the Project Period 10/2/03 through 9/30/12

DESCRIPTION	**Budget Allocation through Year 7**	**Prior Year paid Expenditures**	**Current Year paid Expenditures**	***TOTAL EXPENDITURES**	***BALANCE AVAILABLE**
SALARIES & WAGES	1,205,080.88	(1,183,826.02)	(21,254.86)	(1,205,080.88)	*0.00*
CEER ADMIN SALARIES	162,071.38	(161,965.38)	(106.00)	(162,071.38)	*0.00*
FRINGE BENEFITS	300,505.18	(276,150.36)	(24,354.82)	(300,505.18)	*0.00*
Canister and Other Analysis	114,455.00	(114,455.00)	(0.00)	(114,455.00)	*0.00*
Supplies and Utilities	527,142.23	(522,443.14)	(4,684.09)	(527,127.23)	*15.00*
Cell Phone Allowance	1,815.00	(1,485.00)	(345.00)	(1,830.00)	*(15.00)*
SUBCONTRACT	3,538,580.92	(3,430,742.12)	(107,838.80)	(3,538,580.92)	*0.00*
Interest Program Expenditures	0.00	(126,995.29)	(685,160.11)	(812,155.40)	*(814,105.40)*
TRAVEL	30,103.73	(29,976.25)	(127.48)	(30,103.73)	*0.00*
EQUIPMENT	0.00	0.00	0.00	0.00	*0.00*
TOTAL DIRECT COSTS	5,879,754.32	(5,848,038.56)	(843,871.16)	(6,691,909.72)	*(814,105.40)*
INDIRECT COSTS **/15% TDC**	881,963.70	(822,153.74)	(23,806.65)	(845,960.39)	*36,003.31*
TOTAL EXPENDITURES	$6,761,718.02	($6,670,192.30)	(867,677.81)	(7,537,870.11)	(778,102.09)

CORPUS CHRISTI AIR MONITORING AND SURVEILLANCE CAMERA PROJECT

University of Texas at Austin
Annual Audit Report Results

The University's Annual Reports and Audit Statements are made available for public review at the following website:

http://www.sao.state.tx.us/reports/main/12-328.pdf

Attached is a copy of The University of Texas at Austin's Certification Statement for the Office of Management and Budget (OMB) Circular A-133 Audit conducted during the 2010/2011 fiscal year. The OMB Circular A-133 Audit for the 2010/2011 fiscal year is currently being conducted. The results of the 2009/2010 Audit will be made available at the above website. It is anticipated the audit results will be posted in late Spring 2013.

SUBRECIPIENT AUDIT FORM

(including financial reports and internal controls)

FOR FISCAL YEAR ENDING AUGUST 31, 2011

SUBRECIPIENT'S LEGAL ENTITY NAME AND ADDRESS

The University of Texas at Austin
Office of Sponsor Projects, Suite 4.300
101 E. 27th Street, Stop A9000
Austin, TX 78712-1539

☒ Our audit report for the subject fiscal year has been completed.

The A-133 Audit for The University of Texas at Austin is issued as part of the statewide audit conducted by the State Auditor's Office. A complete copy of the audit report is available at:

http://www.sao.state.tx.us/reports/main/12-018.pdf Federal Portion

Or at http://www.sao.state.tx.us/reports/; select the Statewide Reports link.

The report contains the finding, corrective action plan and anticipated implementation dates. Findings for The University of Texas at Austin begin on page 369. Prior year findings are addressed beginning on page 629.

Authorizing Signature: _____ **Date:** 2/29/12

Jason Richter
Associate Director, Office of Sponsored Projects

APPENDIX D

Supplemental Environmental Projects

SEP Project List

APPENDIX D

Supplemental Environmental Projects (SEP) awarded to The University of Texas at Austin

No.	SEP (Name)	Docket No.	Period of Performance	Award Amount	Interest Earned as of 9/30/12	UT Account Number	Project Description - Notes
1	CITGO Regfining and Chemicals Company, L.P.	2001-1469-AIR-E	7/2004-7/2006	$680,000.00	$19,978.03	26-7690-94	Task 1 - Extend the operation of the air monitoring network in Corpus Christi for an additional year.
				$190,000.00	$7,956.39	26-7690-95	Task 2 - Development of the Trajectory Tool
2	Duke Energy Field Services	2003-1122-AIR-E	2/2005-8/2005	$5,187.00	$100.15	26-4254-75	Purchase additional canisters for the Corpus Christi monitoring sites.
3	El Paso Merchant Energy Petroleum Company	2001-1023-AIR-E	2/2006-6/2008	$46,004.00	$1,264.83	26-7693-36	Task 1 - Enchancement to the Automated Trajectory Tool.
				$90,044.00	$5,810.15	26-7692-88	Task 2 - Additional Canister Analysis, Power Loss Hardware and Software and Wind Direction Filter.
4	Sherwin Aluminia	2004-1982-IR-E	10/2007-12/2009	$10,244.00	$557.00	26-7695-56	Used for canister analyses.
5	Texas Molecular Corpus Christi Services, Limited	D1-GV-07-001054	2/2009-9/2011	$67,900.00	$6,119.41	26-7697-82	Used for the repair and refurbishment of ageing equipment at the active Project sites. Items purchased include 8 computers and 3 multi-gas calibrators. Also, the Auto GC systems at Oak Park and Solar Estates were refurbished. * See note below.
6	Equistar Chemicals, LP	D1-GV-06-002509	5/2012-5/2013 **See note below	$150,000.00	$53.10	26-7701-70	Funds will be used to extend and enhance the life of the Project Network. ** See note below
	TOTAL			**$1,239,379.00**	**$41,839.06**		

* Originally the Texas Molecular and Equistar funds were to be used to purchase a FLIR ThermaCAM GasFindIR-HS (IR camera) and accessories, to train subcontractor personnel in use of camera,and to conduct video taping recording in the Corpus Christi refinery row area. When the Equistar funds were reduced (see note below) it was determined that the funding necessary for the camera was not available, and there were other ways the funds could be put to use to benefit the extension of the life of the network.

APPENDIX D

Supplemental Environmental Projects (SEP) awarded to The University of Texas at Austin

** A check in the amount of $400,000 was received by UT Austin 12/08/08 and was deposited in a holding account pending approval by the TCEQ of a UT Austin SEP Proposal. Subsequent to the March 31, 2009 Quarterly Report to the Court, the TCEQ notified UT Austin that Equistar Chemicals (a subsidiary of LyondellBasell Industries and US affiliate Loyondell Chemical Co.), filed for Chapter 11 bankruptcy on January 6, 2009 and that the $400,000 ordered to be paid by Equistar for this project might be subject to a collection effort in that proceeding on behalf of the creditors. As a consequence, the funding for the Equistar SEP award was placed on indefinite hold. Subsequently the Bankruptcy Trustee filed a lawsuit against UT to recover the $400,000 as a "preferential transfer" which can void transfers that take place within certain time limits of filing for bankruptcy.	
The Texas Attorney General represented UT in that lawsuit. On February 7, 2011, UT was notified that the Assistant Attorney General handling the case, with the agreement of the TCEQ, succeeded in getting an agreed settlement under the terms of which UT paid $250,000 to the Bankruptcy Trustee and UT retained the remaining balance free and clear. On February 14, 2011, a payment in the amount of $250,000 was mailed to the Bankruptcy Trustee.	
Due to the reduction of the award amount and that a notice to proceed was never issued for the Equistar funds, UT contacted the TCEQ to determine the procedures UT should follow to move forward in utilizing the funds. On March 18, 2011, UT was asked to submit a new Third-Party Application to the SEP Program by June 1, 2011. This would allow UT to transition the Equistar funds to a new SEP Agreement, as the term of the older agreement has ended. UT submitted a new Third-Party Application to receive SEP funding on June 1, 2011. As of the writing of this report, that Application is still under review.	