Corpus Christi Air Monitoring Project 2003 - 2016
Final Report

Submitted to

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

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United States Environmental Protection Agency, Region 6
Dallas, Texas

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June 12, 2017

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Acknowledgements

This *Corpus Christi Air Monitoring and Surveillance Camera Installation and Operations Project* (Project) was made possible through an order issued on October 1, 2003, by the US District Court for the Southern District of Texas, the Honorable Janis Graham Jack. The order provided $6,700,000 to establish (obtain site access agreements, purchase equipment and shelters, and install the shelters and equipment at the sites) a network of seven air monitoring sites and two surveillance cameras and to operate and maintain the network for 8 of the 11.5 years the network collected data. The US District Court for the Southern District of Texas, the Honorable Janis Graham Jack, also issued an order on February 21, 2008. That order allocated $4,608,453 of the unclaimed settlement funds from the Lease Oil Antitrust Litigation to fund the Neighborhood Air Toxics Modeling project for Corpus Christi and extend the life (air monitoring operations, maintenance and project management) of the network. We are grateful to the Honorable Judge Jack for her vision in issuing the initial court order in 2003, which ultimately was leveraged over the life of the project to more than double the initial funding.

During the 13.5 years the project existed, it received $1,239,379 from the Texas Commission on Environmental Quality's (TCEQ) statewide Supplemental Environmental Project (SEP) program. Additionally, the TCEQ Region 14 office in Corpus Christi, Texas allowed the project team to use their facilities for meetings of the voluntary advisory board and worked with the team to share information and confirm sources of emissions identified by the network. We appreciate their cooperation and support.

Finally, we express our appreciation and gratitude to members of the project's voluntary Advisory Board of community representatives. The Board's dedication and commitment to their responsibilities and contributions of advice and knowledge to the project contributed to the success of the project and increased the relevance of the benefits this project has provided to the Corpus Christi community.

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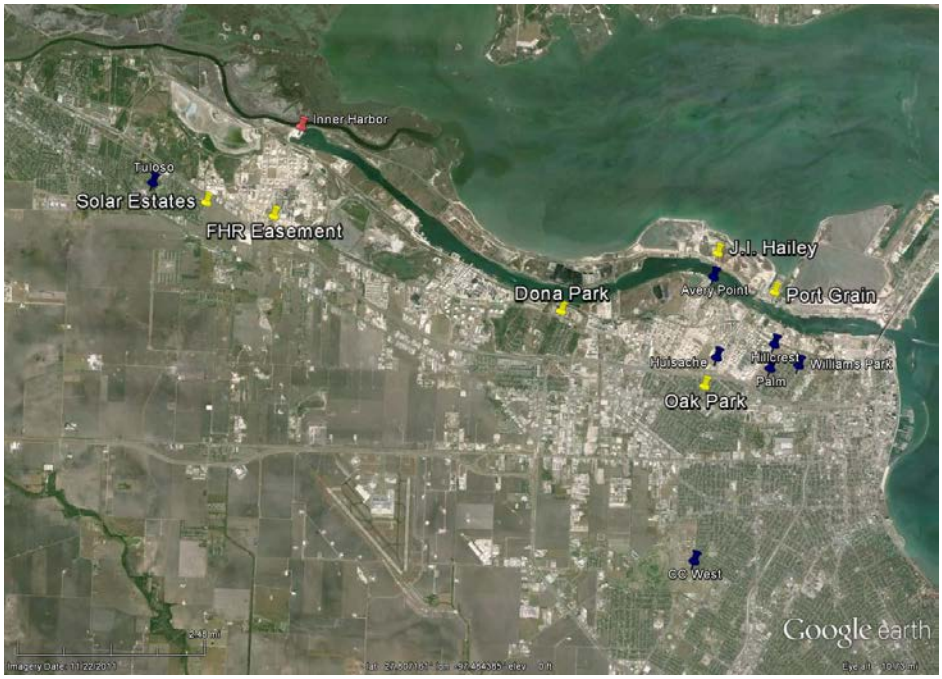
Executive Summary

From late in 2004 through May 21, 2016, The University of Texas at Austin Center for Energy and Environmental Resources operated a network of air quality and meteorological monitoring stations in the Corpus Christi refinery area. The locations of the sites are shown in Figure ES-1.

Figure ES-1. Corpus Christi Monitoring Sites operated by the project shown as yellow and red push-pins. Sites run by the Texas Commission on Environmental Quality are shown as purple push-pins.



The findings resulting from the monitoring were:

- The pollution sources that affect Corpus Christi monitors were often local emission sources, including sources located within a few hundred feet from some sites. Other times the sources were the large industrial sources and ships within Nueces County. Finally there is evidence that emissions sources outside the region, including emissions from the Eagle Ford oil and gas production region, may have added to measured concentrations, particularly after 2012.

- Benzene concentrations at the two project monitoring sites, in residential areas, which made hourly measurements of individual hydrocarbons (Solar Estates and Oak Park), declined after the first three years of the project and had relatively little variation over the subsequent eight years. The highest concentrations were observed at times when the sites were downwind of the refinery area.

- Concentrations of hydrocarbons at the residential monitoring sites that made hourly measurements of hydrocarbons have on rare occasions exceeded odor threshold air monitoring comparison values (AMCV) established by the Texas Commission on Environmental Quality (TCEQ), but have not exceeded any health AMCV. Concentrations of

hydrocarbons have on rare occasions exceeded the TCEQ short-term AMCV, but not since 2007.

- There has been a general downward trend in mean concentrations for most hydrocarbon species at the residential monitoring sites that made hourly measurements of hydrocarbons (Oak Park and Solar Estates); however, the downward trend for several low-molecular weight low-reactivity alkane species was reversed around 2012, followed by a decline in 2015. These changes are hypothesized to be related to changes in natural gas extraction activities, largely in regions north of Corpus Christi.

- At one of the residential monitoring sites that made hourly measurements of hydrocarbons (Solar Estates), concentrations of 1,3-butadiene, significantly above background levels, were observed under southwesterly winds until late 2009. Around late 2009, major process changes were made at an industrial chemical facility three miles southwest of the Solar Estates site, and concentrations of 1,3-butadiene returned to background levels. Because winds from the southwest are infrequent, the exact date of the change is difficult to determine.

- Sulfur dioxide concentrations decreased significantly since the project began. One site, the J. I. Hailey CAMS 630 site located near the port, measured concentrations that did not comply with the U.S. Environmental Protection Agency (EPA) 2010 National Ambient Air Quality Standards (NAAQS) for sulfur dioxide until 2013. Emissions from ships at docks were shown to have been a likely source of the SO_2, affecting the CAMS 630 site and several other monitoring sites. During the project, environmental regulations were implemented that required reduced sulfur content in ship fuel. After the implementation of the regulations, ambient SO_2 concentrations decreased.

- At two of the monitoring sites (Solar Estates and FHR Easement), an unknown SO_2 interferent was detected periodically. The last observed instance of this SO_2 interferent was December 2013. An experiment showed that the interferent affected different SO_2 instruments differently, but the actual interferent chemical was not identified.

- Hydrogen sulfide monitoring showed decreased concentrations over time at some sites but not others. Three project sites and one TCEQ site measured occasional H_2S concentrations exceeding TCEQ 80 ppb rolling 30-minute standard over the course of the project. The last exceedance observed by the network was in 2012.

In addition to monitoring air quality, the project team conducted air quality modeling. Two air-dispersion modeling systems, AERMOD and CALPUFF, were applied to predict benzene and 1,3-butadiene concentrations from emissions sources in the Corpus Christi area. Inventories of benzene and 1,3-butadiene emissions in Nueces and San Patricio Counties, assembled by the Toxics Release Inventory (TRI) program, the TCEQ, and the U.S. Environmental Protection Agency (EPA), were obtained and evaluated. The most detailed of these inventories, an emissions inventory used for photochemical modeling by the TCEQ, was combined with three years of meteorological data (2006-2008) and used to predict benzene and 1,3-butadiene concentrations throughout the Corpus Christi region. Predicted concentrations were compared

with measured concentrations at the residential monitoring sites that made hourly measurements of hydrocarbons (Oak Park and Solar Estates). Key findings from the air dispersion modeling were:

- AERMOD and CALPUFF replicated observed seasonal and locational differences in benzene concentrations, with increases in fall/winter relative to spring/summer at the residential monitoring sites (Solar Estates and Oak Park). Higher observed concentrations during the fall/winter than spring/summer were associated with more frequent northwesterly clockwise through northeasterly winds.

- Observed maximum benzene concentration at Oak Park were under-predicted by both models. This result may be associated with non-routine emissions not necessarily represented in the emission inventory.

- Observed benzene concentrations declined at Oak Park and Solar Estates between 2006 and 2008. These trends are consistent with declines in annual benzene emissions reported in the Toxics Release Inventory (TRI).

- Comparisons of modeled to observed 1,3-butadiene concentrations at Oak Park and Solar Estates during 2006 indicated a strong under-prediction bias by both models. This finding suggested that emissions of 1,3-butadiene could be missing from or under-reported in the emission inventories evaluated in this project. The potential for missing industrial emissions information was particularly pronounced near Solar Estates.

- Spatial maps of predicted mean, percentile, and maximum concentrations of benzene (e.g., Figure ES-2, below) and 1,3-butadiene (e.g., Figure ES-3, below) were developed to allow air toxics concentrations to be estimated in areas without monitoring sites. Maps of predicted benzene concentrations during 2006 were generally similar for both models. The locations of the Oak Park and Solar Estates monitors (shown as green dots in the Figures) were in regions with high-predicted concentrations of benzene and 1,3-butadiene.

Figure ES-2. Predicted annual mean benzene concentrations in the receptor grid (colored area) from AERMOD (left) and CALPUFF (right) for 2006. Property boundaries of the stationary point sources are shown in gray.

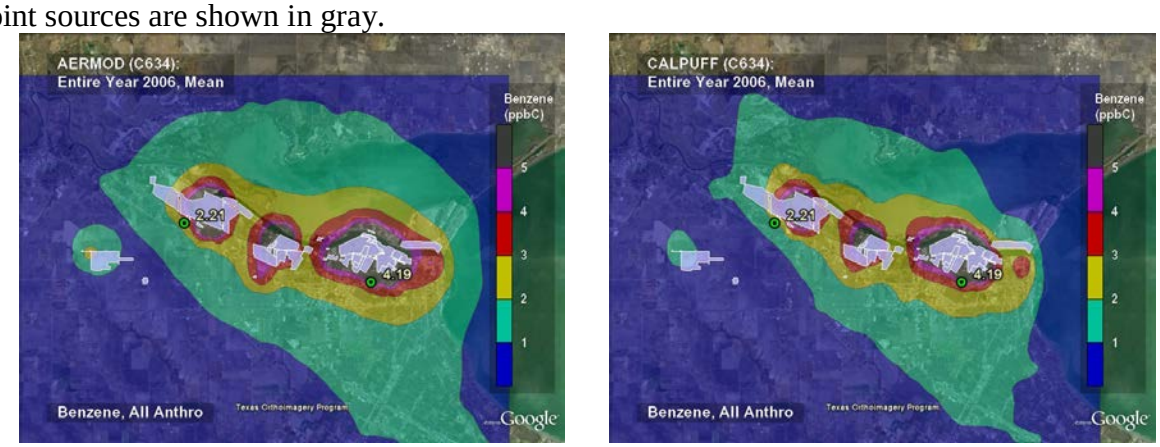
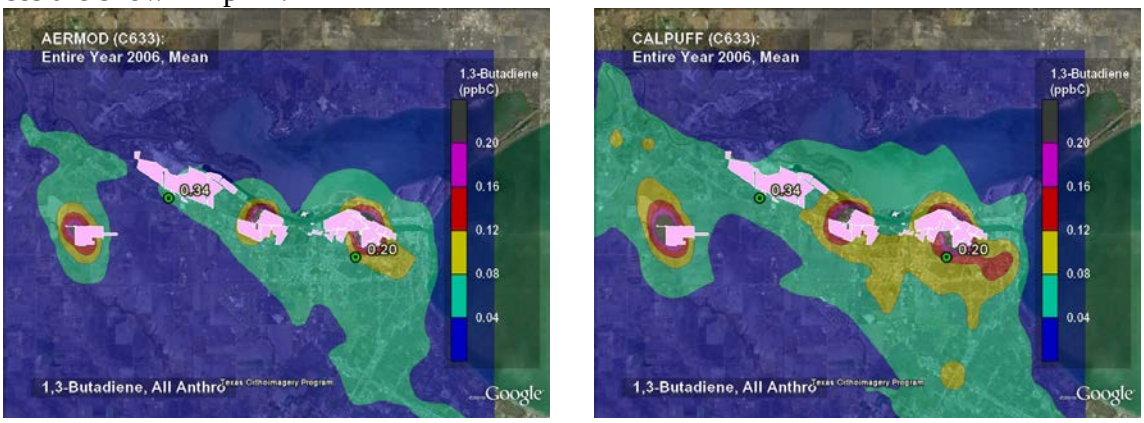


Figure ES-3. Predicted annual mean 1,3-butadiene concentrations in the receptor grid (colored area) from AERMOD (left) and CALPUFF (right) for 2006 using on-site meteorological data from the Solar Estates (C633) monitor for AERMOD. Property boundaries of the stationary point sources are shown in pink.



1.0 Introduction

This document represents the final report of the *Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project*. It provides background on the project, a summary of the work performed, data collected and analyzed, and findings from the project during its 13.5 years of existence, including more than 11.5 years of data collection. The report is organized into five chapters: Chapter 1 provides an overview of the project scope, design, funding, work performed and organization; Chapter 2 provides an explanation of the design and operation of a web-based application, the Corpus Christi Trajectory Analysis Tool, developed by the project and used to assist in the analysis of emissions and their potential source locations; Chapter 3 provides a comprehensive analysis of the air monitoring data obtained during the project and trends identified in the data; Chapter 4 provides a summary of the purpose and objective of the modeling performed, the approach employed and the results obtained; and Chapter 5 provides a summary and conclusions.

This project was initiated with an order issued on October 1, 2003, by the US District Court for the Southern District of Texas to the Clerk of the Court to distribute funds in the amount of $6,700,000, plus interest accrued ($61,718), to The University of Texas at Austin (UT Austin) to implement the court ordered condition of probation (COCP) *Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project* (Project). The Project consisted of establishing an independent network of seven (7) air-monitoring stations, which required obtaining site access agreements; installing all needed pad work, fencing and utilities at the sites; purchasing and installing air monitoring and surveillance camera equipment; operating and maintaining the sites for a minimum of seven (7) years; compiling and analyzing the project's data; providing TCEQ compliant Quality Assurance; constituting, maintaining, and meeting with a volunteer Advisory Board two to three times a year; and providing quarterly and annual reports to the US District Court, the Project's Advisory Board and Corpus Christi, Texas stakeholders as requested.

In addition to the initial funding ($6,761,718) from the US District Court and as a result of the project's existence, the Project received an additional $7,098,247 through other funding opportunities and the interest earned on the funds until they were expended. All of the project funding, sources of funds, and their uses are summarized in Table 1-1, page 1-3. The project was awarded funding for three (3) Supplemental Environmental Projects (SEP) from the Texas Commission on Environmental Quality SEP Program. Prior to the 2005 - 2006 project year (October 1 thru September 30), the first SEP was awarded and used to support the operations and maintenance of the project network for approximately one year and to fund the development of a Trajectory Tool, which assisted Project personnel in understanding the origin of pollutant sources. The second SEP was received prior to the 2005 - 2006 project year and was used to purchase additional canisters to be deployed to the seven monitoring stations. The third SEP enhanced the Trajectory Tool by developing computer tools to assist in estimating a likely path of air contaminants prior to the contaminants reaching any of the seven air-monitoring stations. A second task authorized under the third SEP funded additional canister analysis and the purchase and installation of hardware and software to minimize data loss associated with electrical power losses/interruptions and installation of a wind direction filter at the Flint Hills Site.

Table 1-1. Project Funding Sources and Uses

No.	Source of Funds	Period of Funding	Funding Amount	Interest Earned Prior to or During Period of Funding	Use of Funds
1	Initial Distribution from U.S. District Court	10/2003 - 9/2012	$6,700,000.00		Used for establishing the air monitoring network, purchasing equipment, equipment installation, operations (including Project Management and Quality Assurance), maintenance, data analysis, reporting, constituting, maintaining and meeting with the Project's volunteer Advisory Board.
1.a	Interest Earned While in Court Holding Account - distributed with Court Order			$61,718.00	Same as above, in Item 1
1.b	Interest Earned at UT-Austin	10/2003 - 9/30/12		$815,240.00	Same as above, in Item 1
2	Lease Oil Antitrust Ligation Settlement Fund (Partial)	3/2008 - 12/2011	$1,840,643.24		Stage 1, Phase 1A - Develop, apply, demonstrate and make publicly available, neighborhood-scale air quality modeling tools for the toxic air pollutants in Corpus Christi, TX.
		1/2012 - 12/2016	$2,745,371.68		Stage 1, Phase 1B - Extending the life of the air monitoring network.
2.a	Interest Earned While in Court Holding Account - distributed with Court Order			$16,583.74	Stage 1, Phase 1B
2.b	Interest Earned While in Court Holding Account - distributed with Court Order			$5,854.24	Stage 1, Phase 1B
2.c	Interest Earned at UT-Austin	1/2012 - 8/31/16		$393,273.94	Stage 1, Phase 1B and decommissioning of the air monitoring network.
3	CITGO Refining and Chemicals Company, L.P.	7/2004 - 7/2006	$680,000.00		Task 1 - Extend the operation of the air monitoring network for an additional year.
			$190,000.00		Task 2 - Development of the Automated Trajectory Tool.
3.a.	Interest Earned at UT-Austin			$19,978.03	Same as above, in Item 3
3.b	Interest Earned at UT-Austin			$7,956.39	Same as above, in Item 3
4	Duke Energy Field Services	2/2005 - 8/2005	$5,187.00		Purchase additional canisters for the Network monitoring sites.
4.a	Interest Earned at UT-Austin			$100.15	Same as above, in Item 4
5	El Paso Merchant Energy Petroleum Company	2/2006 - 6/2008	$46,004.00		Task 1 - Enhancement to the Automated Trajectory Tool.
			$90,044.00		Task 2 - Fund additional canister analysis, purchase of power loss hardware and software, and implementation of a wind direction filter.
5.a	Interest Earned at UT-Austin			$1,264.83	Same as above, in Item 5
5.b	Interest Earned at UT-Austin			$5,810.15	Same as above, in Item 5
6	Sherwin Alumina	10/2007-12/2009	$10,244.00		Used for canister analyses.
6.a	Interest Earned at UT-Austin			$557.00	Same as above, in Item 6
7	Texas Molecular Corpus Christi Services, Limited	2/2009 - 9/2011	$67,900.00		Used for the repair and refurbishment of ageing equipment at the active Project sites. Items purchased included 8 computers and 3 multi-gas calibrators.
7.a	Interest Earned at UT-Austin			$6,119.69	Same as above, in Item 7
8	Equistar Chemicals, LP	5/2012 - 5/2013	$150,000.00		Funds were used to extend and enhance the life of the Project Network.
8.a	Interest Earned at UT-Austin			$114.56	Same as above, in Item 8
	COLUMN TOTALS		**$12,525,393.92**	**$1,334,570.72**	
	TOTAL PROJECT FUNDING			**$13,859,964.64**	

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

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

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

In Stage 2, subject to the availability of funds, it was planned that UT Austin would extend the modeling to the Houston, Texas ship channel region, develop a mobile monitoring station that could be deployed in Corpus Christi and in other regions of Texas, and/or further extend the operating life of the existing stationary network in the same or a modified spatial configuration. Based on the decision of the U.S. Court of Appeals for the 5th Circuit on June 27, 2011, UT Austin would not be receiving the Stage 2 funding at any point in the future. Work on the modeling portion of Stage 1 (Phase 1A) was completed June 30, 2011. All subsequent work was on Stage 1 Phase 1B. Field monitoring operations concluded on May 21, 2016, followed by a decommissioning of the six monitoring sites. Additional efforts restored the monitoring sites to their preexisting conditions and to archive and document the activities of this 13.5-year project.

1.1 The Monitoring Network Sites and Equipment

The monitoring network was composed of seven continuous ambient air-monitoring stations (CAMSs) through May 2012 when UT Austin was asked to vacate one of the Port of Corpus Christi sites and was unable to find a comparable available site on which to relocate this site. Through the remainder of the project, the monitoring network consisted of six CAMSs. The sites are shown in the map on page 1-4 in Figure 1-1 with air monitoring instruments and surveillance camera equipment listed in Table 1-2, on page 1-5. Sulfur dioxide (SO_2), hydrogen sulfide (H_2S), hydrocarbon species with one carbon atom to 11 carbon atoms, and meteorological parameters were measured at various CAMSs. Each CAMS is identified with a number as shown in Table 2 and often shown on maps with, for example, "CAMS 633" abbreviated as "C633". Speciated

hydrocarbon chemicals were measured either by an automated chromatogram instrument (auto-GC) or sampled in canisters and quantified later in a laboratory. Methane and the total sum of all other common two carbon atom to 11 carbon atom hydrocarbons (unspeciated) – total non methane hydrocarbon (TNMHC) – were measured at each site.

Figure 1-1. Corpus Christi Monitoring Sites, "X" marks the UT West End Inner Harbor site terminated May2012 and the TCEQ Avery Point site terminated in 2014

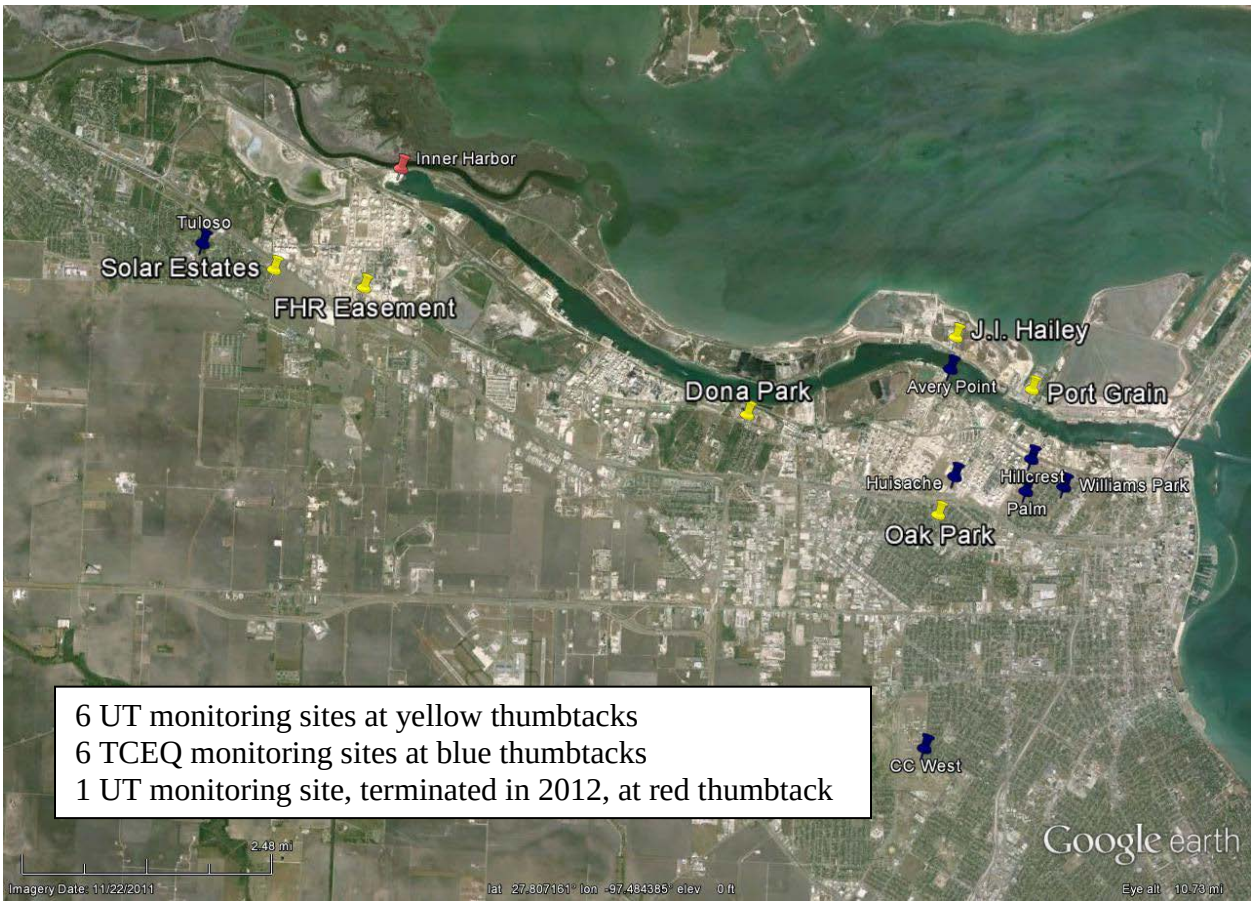


Table 1-2. Schedule of UT Air Monitoring Sites, Locations and Major Instrumentation

TCEQ CAMS#	Description of Site Location	Monitoring Equipment				
		Auto GC	**TNMHC(T) Canister(C)**	**H_2S & SO_2**	**Met Station**	**Camera**
634	Oak Park Recreation Center (**OAK**)	Mar 2005 to May 2016	C: Dec 2004 to Feb 2009 T: Dec 2004 to Apr 2012		Dec 2004 to May 2016	
629	Grain Elevator @ Port of Corpus Christi (**CCG**)		T&C: Dec 2004 to May 2016	Dec 2004 to May 2016	Dec 2004 to May 2016	
630	J. I. Hailey Site @ Port of Corpus Christi (**JIH**)		T&C: Dec 2004 to May 2016	Dec 2004 to May 2016	Dec 2004 to May 2016	
635	TCEQ Monitoring Site C199 @ Dona Park (**DPK**)		T&C: Dec 2004 to May 2016	Dec 2004 to date	Dec 2004 to date	Jan 2005 to May 2016
632	Off Up River Road on Flint Hills Resources Easement (**FHR**)		T&C: Dec 2004 to May 2016	Dec 2004 to May 2016	Dec 2004 to May 2016	
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 May 2016	Dec 2004 to date	Jan 2005 to May 2016
631	*Port of Corpus Christi on West End of CC Inner Harbor (**WEH**) (site terminated)*		T&C: Dec 2004 to May 2012	Dec 2004 to May 2012	Dec 2004 to May 2012	

Table 1-2 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

1.2 Trajectory Analysis Tool

To assist in the near real-time and post-event analysis of air concentrations measured by the Project, UT Austin developed, during the summer of 2006, an interactive web-based application, referred to as the "Corpus Christi Trajectory Analysis Tool" or simply the "Trajectory Tool", using some of the funds from the first SEP. The Trajectory Tool (http://www.utexas.edu/research/ceer/ccaqp/trajectory_tool.htm) is observationally based and can be used to provide an estimate of the paths of air emissions over short (0 - 10 miles)

distances. Results obtained using the Trajectory Tool were integral to the investigation of emissions from local sources, such as Corpus Christi ship channel industrial facilities, that impacted Project pollutant concentrations. A detailed explanation of the design and operation of the Trajectory Tool is provided in Chapter 2, pages 2-1 through 2-19.

1.3 Air Monitoring Data Analysis

As noted in Table 1-2, page 1-5, the monitoring network provided measurements of hydrocarbons, sulfur dioxide, hydrogen sulfide, and meteorology. The Monitoring network began collecting data in December 2004 and operated continuously through May 21, 2016. The air quality measurements have been analyzed and a summary of the findings are presented and explained in detail in Chapter 3, pages 3-1 through 3-136. The summary in Chapter 3 provides explanations of the information obtained from each monitoring site.

1.4 Neighborhood Air Toxics Model for Houston and Corpus Christi

Toxic air pollutants, also known as hazardous air pollutants (HAPs) or air toxics, are pollutants that are classified by the U.S. Environmental Protection Agency (EPA) as known or suspected human carcinogens or as having other adverse environmental or human health impacts, including reproductive, developmental, neurological, and respiratory effects (Rosenbaum et al., 1999). Section 112 of the Clean Air Amendments identifies 189 toxic air pollutants that are subject to regulatory control (https://www.epa.gov/national-air-toxics-assessment). Air toxics can be emitted from numerous anthropogenic sources with different spatial, temporal, chemical and physical release profiles. On a national scale, emissions of air toxics are tracked through the Toxics Release Inventory (TRI) Program, which compiles annual reported emissions from industrial point sources that meet threshold emissions levels, and through the National Emissions Inventory (NEI) for HAPs, which compiles emissions from anthropogenic source sectors, including some not included in the TRI, across the US on a three-year cycle.

In human exposure assessments, atmospheric concentrations of air toxics are frequently determined using both ambient measurements and air quality modeling. Ambient measurement networks for air toxics are not as spatially dense as for criteria pollutants, (e.g., ozone) in most regions of the US (Rosenbaum, 1999; Isakov et al., 2007). Consequently, air quality modeling can be an important supplement for air toxics exposure assessments. Modeling can provide estimates of ambient concentrations in areas where monitors are not located and can indicate potential “hotspots” or areas with elevated concentrations for future investigation. Models can be used with ambient monitoring data to examine air quality trends, to assess the impacts of new or expanding emissions sources, and to evaluate the potential effectiveness of emissions controls.

This overall objective of the modeling work, which was conducted from March 2008 to March 2011, was to apply two air dispersion modeling systems, AERMOD and CALPUFF, to predict benzene and 1,3-butadiene concentrations from emissions sources in the Corpus Christi area. Benzene and 1,3-butadiene are air toxics that are national or regional drivers of carcinogenic risk in the United States, and there are emissions associated with industrial activities that occur in the Corpus Christi region. At the time of this work, Corpus Christi had a population of nearly 400,000 in the encompassing counties of Nueces and San Patricio and was the 6th largest port in the United States with significant petroleum refining and chemical manufacturing industries. Nueces County included a sub-region on the Texas Commission on Environmental Quality’s

(TCEQ's) Air Pollutant Watch List (APWL) for benzene emissions that was de-listed in January 2010.

The motivations for the air dispersion modeling efforts were to compare model predictions with measured concentrations at Oak Park and Solar Estates, to estimate concentrations of these pollutants in areas where ambient monitoring sites were not present, and to provide guidance for potential locations for additional sites should the monitoring network be expanded in the future. The results of this work are presented in Chapter 4, pages 4-1 through 4-49.

1.5 Project Organization and Reporting

The United States District Court that issued the order to implement the project continuously oversaw the project since its inception and received quarterly and annual reports from the project team. The project team consisted of air quality researchers at UT Austin, led by Dr. David Allen, Professor in the McKetta Department of Chemical Engineering and Director, Center for Energy and Environmental Resources. The team included a project manager, data analyst, quality control manager, two contractors hired and managed by UT Austin to operate the sites, and administrative support personnel, who tracked expenditures, helped monitor the budget, assisted in the preparation and dissemination of reports, arranged for and assisted with meetings of the project's advisory board, and maintained the project website.

The project website (http://www.utexas.edu/research/ceer/ccaqp) was used to provide the public access to information about the project, project data, data analysis, copies of quarterly and annual reports, and contact information for project staff. Upon request, project staff would provide presentations to community organizations on the monitoring data and analyses conducted by the project.

1.6 Advisory Board

The project also included a volunteer Advisory Board made up of representatives from the community with interests in air quality in Corpus Christi. The Advisory Board, which was formed three months after the project began, reviewed project plans, consulted on project implementation, received briefings on the data, reviewed quarterly reports, and advised on how data from the project could be of most benefit to the community. The members of the Board when the project ended 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
Ms. Sharon Lewis	City of Corpus Christi
Dr. William Burgin	Local Public Health - Local Air Quality Issues
Ms. Joyce Jarmon	Community Representation
Dr. Glen Kost	Community Representation
Mr. Christopher Schulz	Community Representation

In general, two to three meetings between UT Austin Project staff and the Advisory Board were held each year over the course of the project. Meetings were generally held on the campus of Texas A&M University in Corpus Christi, Texas. In addition to the advisory board meetings UT Austin Project staff occasionally gave presentations to a range of business and citizen groups.

1.7 References

Isakov, V., Irwin, J.; Ching, J. Using CMAQ for Exposure Modeling and Characterizing the Subgrid Variability for Exposure Estimates. Journal of Applied Meteorology and Climatology 2007, 46, 1354-1371.

Rosenbaum, A; Axelrad, D.; Woodruff, T.; Wei, Y.; Ligocki, M.; Cohen, J. National Estimates of Outdoor Air Toxics Concentrations. Journal of the Air & Waste Management Association 1999, 49, 1138-1152.