The Neighborhood Air Toxics Modeling Project for Houston and Corpus Christi

2008-2010 ANNUAL REPORT OF ACTIVITIES

Prepared for
The Honorable Janis Graham Jack
U.S. District Court, Southern District of Texas
Corpus Christi, Texas

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EXECUTIVE SUMMARY
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On February 1, 2008, the U.S. District Court, Southern District of Texas 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 The University of Texas at Austin (UT) regarding the use of the Settlement Fund. The proposed project, titled as The Neighborhood Air Toxics Modeling Project for Houston and Corpus Christi, was comprised of two stages. In Stage 1, UT will develop, apply, demonstrate and make publicly available, neighborhood-scale air quality modeling tools for toxic air pollutants in the Corpus Christi, Texas and Houston, Texas ship channel regions. In Stage 2, subject to the availability of funds, UT will develop a mobile monitoring station that can be deployed in Corpus Christi and in other regions of Texas and/or extend the operating life of the existing stationary network in the same or modified spatial configuration. On February 21, 2008, the US District Court for the Southern District of Texas issued an order to the Clerk of the Court to distribute funds to UT for the purposes of implementing Stage 1 of the Air Toxics Project. Stage 2 funding has not been awarded by the U.S. District Court.

During the 2008-2009 fiscal year, the first year of the four-year project for Stage I, work was initiated by UT in collaboration with ENVIRON International Corporation in Novato, California and Texas A&M University and focused on the following four tasks for the Corpus Christi area:

(1) Development of a conceptual model and analysis of meteorological conditions and associated temporal trends in air toxics concentrations;
(2) Analysis of existing emissions inventories for major point sources;
(3) Preparation and application of Gaussian dispersion models, which represent the current state of practice for air toxics modeling in the United States; and
(4) Meteorological modeling.

The first three objectives were accomplished by the end of the 2008-2009 fiscal year. Dr. John Nielsen-Gammon's group at Texas A&M University initiated development of the WRF meteorological modeling methodology for the region (the fourth objective) and results from that effort will be included in the 2009-2010 fiscal year report. This Executive Summary highlights the key findings from the first three tasks above. The accompanying reports describe the methodology and results in detail.

1. Conceptual Model Development: Analysis of Meteorological Conditions and Associated Temporal Trends in Air Toxics Concentrations

A conceptual model was developed that describes the seasonality, day-of-week, and diurnal variability of concentrations of total non-methane hydrocarbons (TNMHC) and benzene measured at ground monitoring stations located in the vicinity of the industrialized Corpus Christi Ship Channel. The conceptual model also describes meteorological conditions (e.g., seasonal temperatures, wind speeds, wind directions, frontal passages and other parameters) that are most likely to lead to higher concentrations of air toxics and it identifies geographic areas that potentially contain emissions sources that impact air quality in the region. This type of analysis is typically termed a "conceptual model" because the objective is to develop a conceptual understanding of the types of conditions that are associated with poor air quality.

The conceptual model is primarily based on hourly measurements collected at the seven air quality monitoring stations maintained and operated by UT in support of the Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project (referred to as CCAQP). This initial version of the conceptual model represents the first summary of its type utilizing the extensive data of the CCAQP and provides an important foundation for understanding air toxics concentrations in the region. The results of the conceptual model are important for the selection of historical periods that can be used to develop and test the air quality modeling tools developed for the Corpus Christi area. It is expected that the conceptual model will be subject to continuing updates and enhancements.

Since TNMHC measurements are collected at all seven CCAQP monitoring stations, the spatial and temporal variability of air pollutant concentrations in the Ship Channel area relies heavily on an analysis of hourly TNMHC measurements. Emissions associated with industrial facilities in Corpus Christi comprise a large number of hydrocarbon compounds and the TNMHC measurements provide a surrogate for a broad range of air pollutants. Higher TNMHC concentrations increase the likelihood of high concentrations of air toxic compounds. In addition to the TNMHC measurements, the current conceptual model incorporates an initial analysis for benzene. Benzene was selected because of (1) recognized importance to human health, (2) importance to air quality in Corpus Christi associated with emissions from Ship Channel industrial facilities, and (3) sufficient emissions inventory data to develop and test air quality modeling tools to predict concentrations across the Corpus Christi area. Future updates to the conceptual model will likely address analyses for additional air toxic pollutants.

Figure ES-1 shows the average TNMHC concentrations at each of the seven CCAQP monitoring stations during June 2005 – May 2008. Average TNMHC concentrations during this period vary from 88 ppbC at Solar Estates to 441 ppbC at FHR Easement.

Figure ES-1. Average TNMHC concentrations during June 2005 – May 2008 at the seven CCAQP monitoring stations.

For the purposes of the TNMHC conceptual model development, high TNMHC hours were defined as those hours characterized by a TNMHC concentration of 1000 ppbC or greater. The threshold value of 1000 ppbC was selected because the 1000 ppbC threshold level, which roughly corresponds to the 98th percentile concentration for all hourly CCAQP measurements collected during June 2005 - May 2008, provides a large enough dataset to allow robust statistics for the Corpus Christi area. The 1000 ppbC threshold level is lower than the 2000 ppbC threshold value currently used by the CCAQP Notification Alert Tool, which is a near real-time program that identifies possible pollution events for additional analysis in the Corpus Christi area. It is important to note that the 1000 ppbC threshold used for the purposes of this study is not based on a threshold for human health effects.

The number of hours characterized by TNMHC concentrations of 1000 ppbC or greater during June 2005 - May 2008 ranged from 40 hours at Solar Estates to 2737 hours at FHR Easement. High TNMHC concentrations most often occurred during the nighttime hours, with a maximum frequency of occurrence during 0000 CST - 0700 CST. Day-of-week analyses revealed little differences in weekday/weekend concentrations, with the exception of nighttime hours during winter at some monitoring stations when weekday concentrations were higher. This suggests that higher TNMHC concentrations are strongly associated with sources that have essentially the same emissions on every day of the week, such as industrial sources rather than road traffic.

Across the seven CCAQP stations, TNMHC concentrations of 1000 ppbC or greater occur more often during the fall and winter, and less often during the spring. Most monitoring stations are characterized by strong wind directionality during high TNMHC

events, suggesting the importance of specific emissions sources rather than air stagnation. Emissions sources located to the south and southeast of the FHR Easement and West End Harbor monitoring stations may explain the high frequency of occurrence of concentrations above 1000 ppbC during periods with southerly winds, particularly during summer. High TNMHC events at the Solar Estates, Dona Park and Oak Park monitoring stations most often occur during hours characterized by winds with a northerly component. High TNMHC concentrations at Port Grain and J. I. Hailey occur with roughly equal frequencies during fall, winter, and summer, and are characterized by a wide range of wind directions.

A crucial component of the TNMHC analyses at each of the seven CCAQP monitoring stations was the generation of back-trajectories for high TNMHC hours. The results identify potentially important geographic emissions source regions. For example, Figure ES-2 presents the back-trajectories for hours characterized by TNMHC concentrations of 1000 ppbC or greater at the Oak Park monitoring station. The pattern of back-trajectories indicates that there are potentially important source areas located to the northwest, north, and north-northeast of Oak Park. The reader is referred directly to Figures 3-11 through 3-17 of this report for geographic maps showing the results of the back-trajectory analyses for all seven stations.

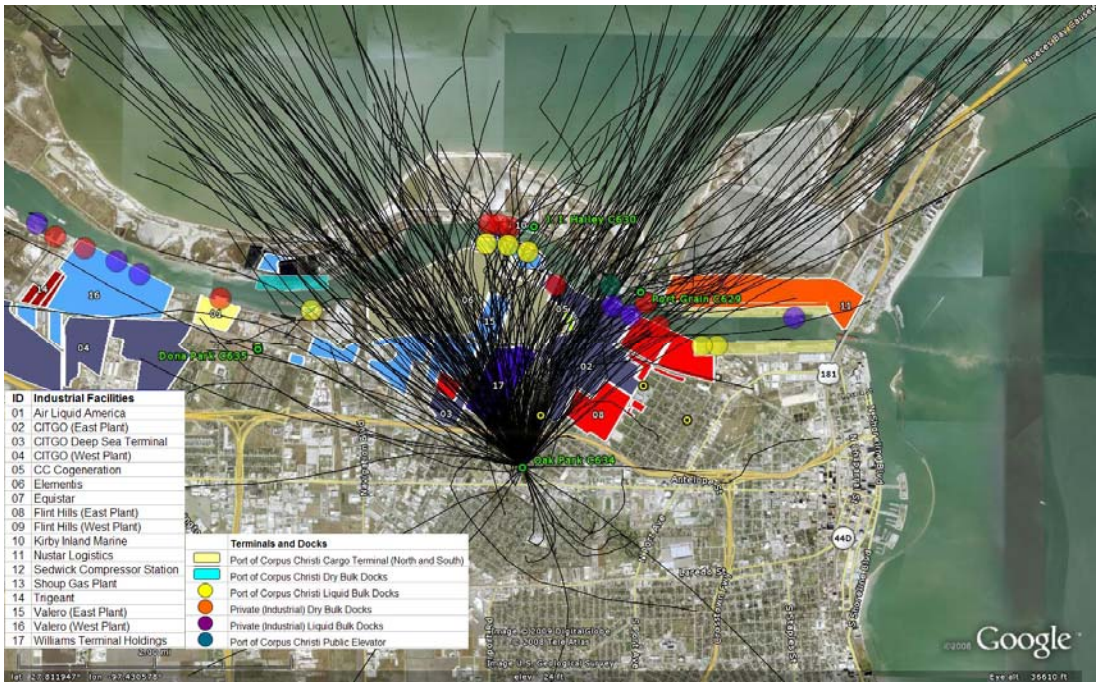


Figure ES-2. Surface back-trajectories as generated by the Corpus Christi Trajectory Analysis Tool for all hours characterized by a TNMHC concentration of 1000 ppb or greater at the Oak Park monitoring station during June 2005 - May 2008.

The synoptic-scale weather patterns on the highest TNMHC days often show a high pressure ridge that extended southward, southwestward, or westward into Texas. Days

characterized by three or more monitoring stations with maximum TNMHC concentrations greater than 1000 ppbC most often occurred during conditions of nearly calm to light northerly surface winds during the early morning hours throughout November - January. At the Port Grain and J. I. Hailey monitoring stations, high TNMHC concentrations often occurred either following the passage of cold fronts during periods of northerly winds, or, more commonly, during periods of southwesterly or southerly winds ahead of approaching or stationary fronts located over northern or central Texas. Onshore southerly flow from the Gulf of Mexico dominated during high TNMHC events at the FHR Easement and West End Harbor monitoring stations.

To investigate the change in seasonal baseline TNMHC concentrations, the hourly maximum concentrations were retrieved for each day during June 2005 – May 2008 at each of the seven CCAQP monitoring stations. The variability of the lowest daily maximum TNMHC concentrations indicates that maximum baseline TNMHC concentrations occurred during fall/winter with minimum values during spring. A 30-day running average of the lowest daily maximum TNMHC concentrations ranged from 50-100 ppbC during spring to 250-300 ppbC during winter.

A similar analysis was conducted to develop a conceptual model for benzene concentrations in the Corpus Christi area. Figure ES-3 shows the average benzene concentrations using all available data collected at the CCAQP and Community Air Toxics Monitoring Network (CATMN) stations during June 2005 – May 2008. The average benzene concentrations ranged from 1.93 ppbC at Solar Estates to 8.92 ppbC at Huisache. The highest concentrations at all monitoring stations occurred during the fall and winter. The maximum by-site seasonal average concentrations ranged from 2.63 ppbC at Solar Estates for winter to 14.11 ppbC at Huisache during fall.

Longer-term trends in annual average concentrations can be assessed using the CATMN data. During 1997 – 2008 annual average concentrations at Huisache indicate a weak trend towards declining benzene concentrations, while the Hillcrest CATMN station shows no clear trend. The Dona Park CATMN station, which measured relatively lower concentrations compared to Huisache and Hillcrest, is characterized by a tendency towards slightly lower concentrations during 2002 - 2008.

Figure ES-3. Average benzene concentrations during June 2005 – May 2008 at (1) CCAQP Oak Park and Solar Estates monitoring stations using hourly measurements, and (2) Corpus Christi CATMN stations using 24-hour sampling measurements.

For the purposes of the benzene conceptual model development, high benzene hours were defined as those hours characterized by a benzene concentration of 30 ppbC or greater at the Solar Estates or Oak Park monitoring stations. The threshold value of 30 ppbC was selected because the 30 ppbC threshold level, which corresponds to the 99th percentile concentration for all hourly CCAQP measurements collected during June 2005 - May 2008, provides a sufficient dataset to allow robust statistics for the Corpus Christi area.

The threshold concentration of 30 ppbC is well below the short-term concentration values determined by TCEQ to impact human health. TCEQ evaluates both measured and predicted (e.g., using dispersion and/or photochemical modeling) concentrations for selected air toxic compounds, including benzene, based on comparison to Effects Screening Levels (ESLs) and Reference Values (ReVs). ReVs are typically used to evaluate measured concentrations for their potential to cause health and welfare effects on sensitive human populations. ESLs are typically used in the air permitting process as comparison levels to help ensure that authorized emissions of air contaminants do not cause or contribute to air pollution. If the predicted (i.e., modeled) maximum air concentrations are below the acute (e.g., short-term or one-hour) and chronic (e.g., long-term or annual) ESLs, adverse impacts on human health and welfare are not expected. TCEQ generally sets the ESL values at 30% of the ReVs. For benzene, the health-based REVs are currently set to 1080 ppbC and 516 ppbC for acute and chronic exposure, respectively. The corresponding acute and chronic ESLs for benzene are 324 ppbC and 8.4 ppbC, respectively. Note that the benzene concentration threshold value of 30 ppbC

used in support of conceptual model development is 9.3% of the acute ESL value of 324 ppbC.

The number of hours characterized by benzene concentrations of 30 ppbC or greater is 25 hours at Solar Estates and 473 hours at Oak Park. The diurnal variability of hourly benzene concentrations reveals that high concentrations are most frequently measured during 0400 CST - 0900 CST, which encompasses the morning rush hour. At both stations, the day-of-week analysis demonstrates a weak pattern of lowest concentrations on Sunday. During winter at Solar Estates when winds are most commonly from the north, the morning is characterized by consistent and substantial differences between the weekday and weekend concentrations. In contrast, the hourly diurnal profiles at Oak Park do not reveal substantial weekday/weekend differences.

The wind direction and back-trajectory analyses identify consistent upwind geographic source regions during high benzene events at Oak Park and Solar Estates. Figures ES-4 and ES-5 present back-trajectories for hours characterized by benzene concentrations of 30 ppbC or greater at the Oak Park and Solar Estates monitoring stations, respectively. Oak Park is dominated by flow from either the north-northwest or (especially) north-northeast. At Solar Estates, winds are generally from the northeast or east. Incorporating these results with wind direction analyses performed using the 24-hour CATMN data suggests potentially important source regions located to the northeast of the Navigation and Huisache stations.

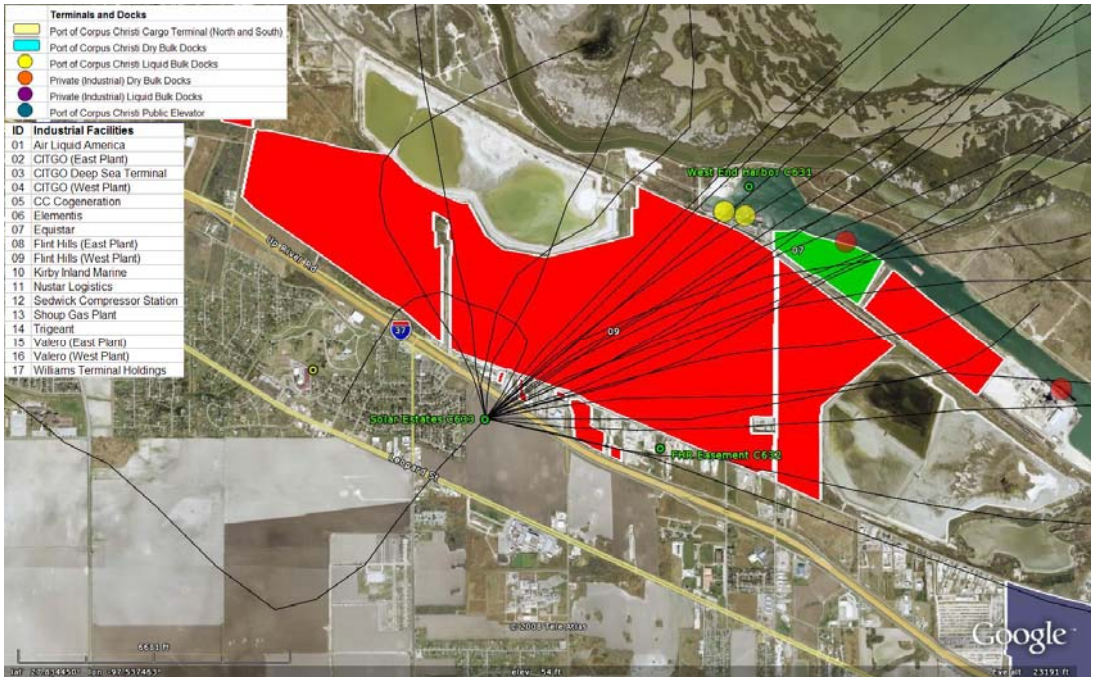


Figure ES-4. Surface back-trajectories as generated by the Corpus Christi Trajectory Analysis Tool for all hours characterized by a benzene concentration of 30 ppb or greater at the Solar Estates monitoring station during June 2005 - May 2008.

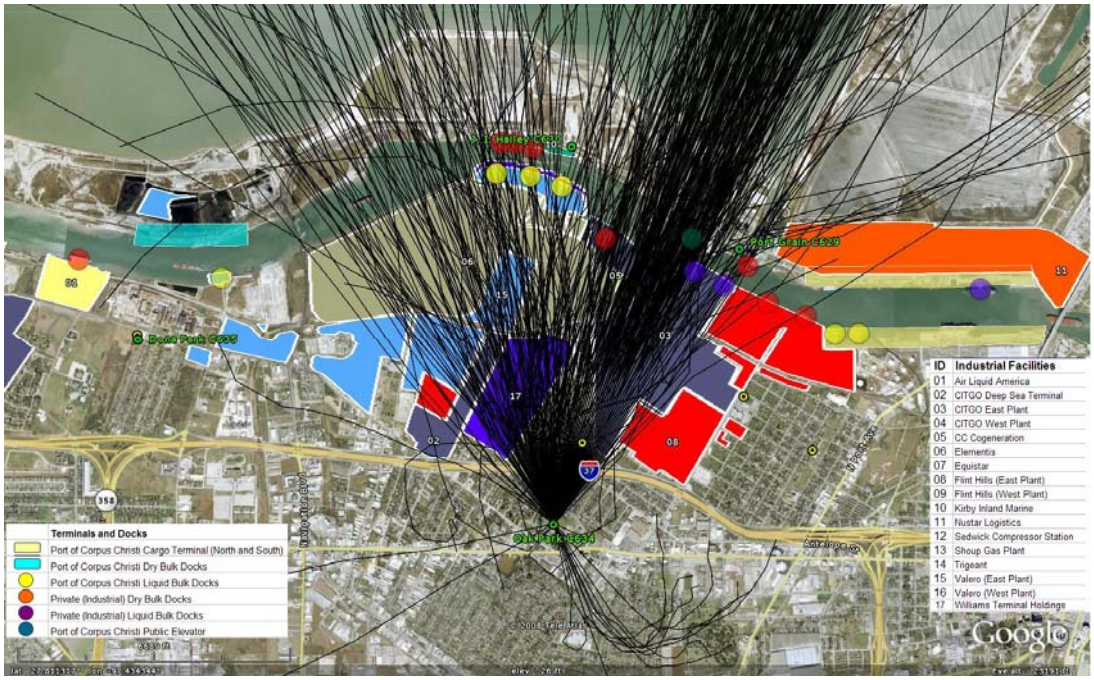


Figure ES-5. Surface back-trajectories as generated by the Corpus Christi Trajectory Analysis Tool for all hours characterized by a benzene concentration of 30 ppb or greater at the Oak Park monitoring station during June 2005 - May 2008.

2. Point Source Emission Inventory Assessment

A key element in performing neighborhood air quality modeling is the development of an inventory of emissions at a high-level of spatial resolution. Multiple emission inventories have been developed by environmental regulatory agencies for the Corpus Christi area, consequently a first step in this project was to assemble and compare the inventories. Eleven point source emission inventories from the Toxics Release Inventory Program (TRI), the National Emissions Inventory (NEI), the State of Texas submittals to the National Emissions Inventory and the Texas Commission on Environmental Quality's photochemical modeling group were used to examine annual trends in point source emissions of toxic air pollutants, to identify differences between reported emissions and emissions used in state or national-level air quality modeling efforts, and to select emissions input data for future Gaussian dispersion modeling and photochemical modeling for the region:

1. 2002 TRI
2. 2003 TRI
3. 2004 TRI
4. 2005 TRI
5. 2006 TRI
6. Submittal by the State of Texas to the U.S. EPA for the 2002 HAP NEI
7. 2002 U.S. EPA HAP NEI
8. Submittal by the State of Texas to the U.S. EPA for the 2005 HAP NEI
9. 2000 TCEQ Photochemical Modeling EI
10. 2005 TCEQ Photochemical Modeling EI
11. ACES 2008 update to the City of Corpus Christi Emission Inventory

These inventories have different origins, objectives and source resolution. The TRI originated under the Emergency Planning and Community Right-to-Know Act enacted in 1986 and expanded reporting requirements under the Pollution Prevention Act of 1990. TRI data for toxic air pollutants have been submitted and compiled annually and are readily accessible to the public through the U.S. EPA. Emissions are summarized only broadly by site in the TRI data, individual stack parameters and locations are not identified. This limited level of spatial resolution is not desirable for neighborhood-scale air quality assessments. Nonetheless, the TRI data provide a very useful continuous annual record of reported emissions for total air emissions as well as for key air toxics such as benzene and related compounds (BTEX: benzene, toluene, ethylbenzene, and xylene) and 1,3-butadiene in Nueces and San Patricio Counties. Examination of the TRI data for 2002 through 2006 indicates that reported air emissions have ranged from 970 tpy to 1345 tpy in Nueces County and have generally decreased over time (ref. Figure ES-6). The largest sources in Nueces County are the Citgo East, Flint Hills West, Ticona Polymers, Valero East, and Valero West Plants. Reported air emissions in San Patricio County have ranged from 35 to 56 tpy with a recent increase in 2006. The variability in annual air emissions can be more than a factor of two for some sites. Investigation of

individual air toxics (ref. Figure ES-7) indicates that reported emissions of many species including BTEX and formaldehyde have decreased by approximately 13-50% in the past two years relative to their 2002 levels in Nueces County. In contrast, emissions of 1,3-butadiene have consistently increased over the past five years.

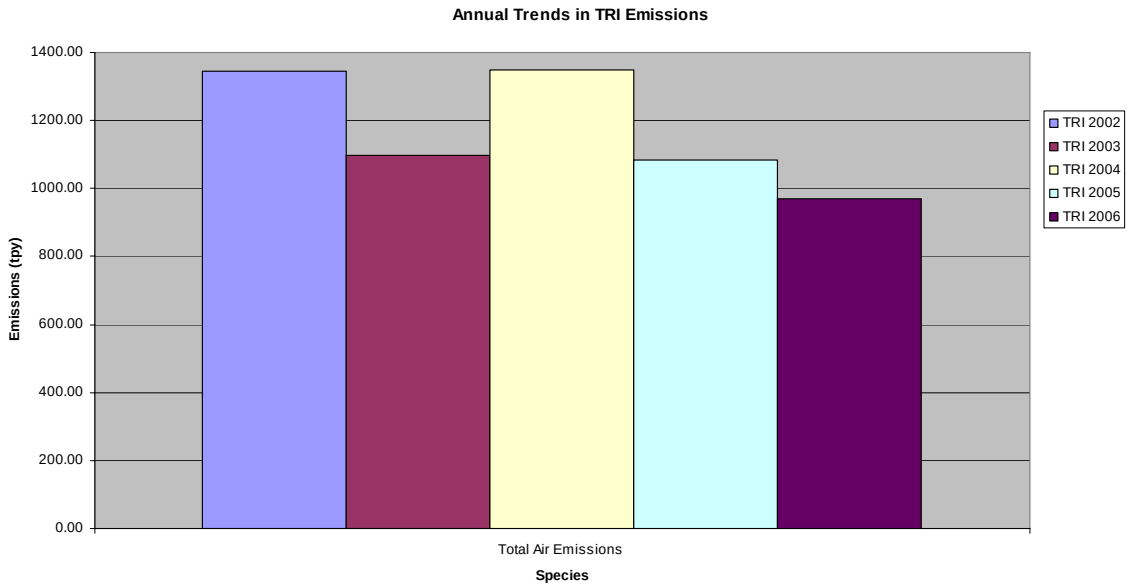


Figure ES-6. Annual trends in total reported air emissions in Nueces County from the 2002 through 2006 TRI databases.

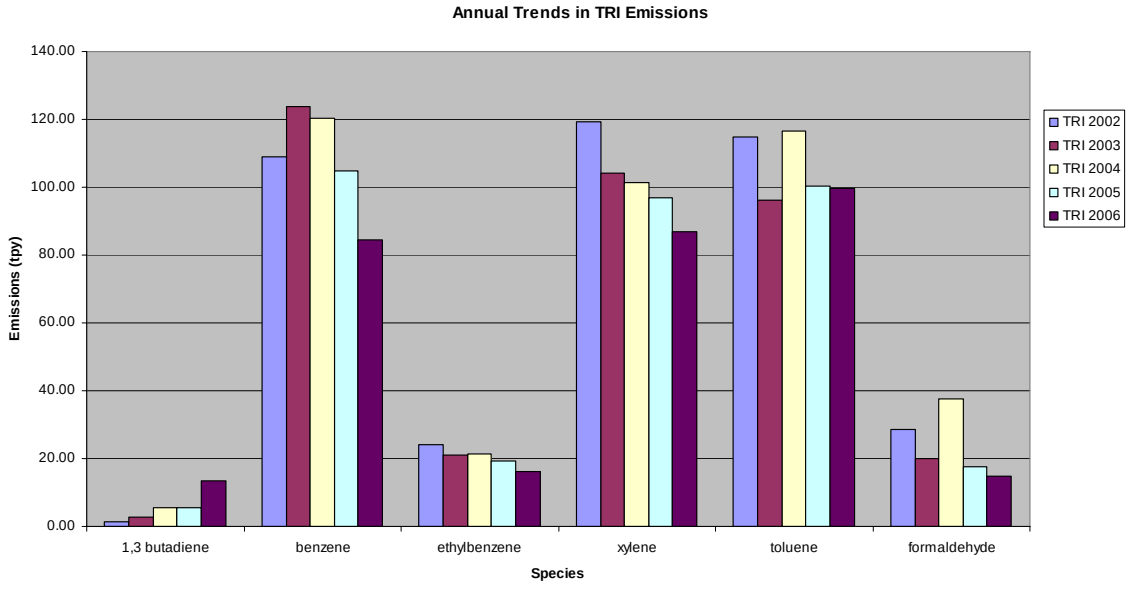


Figure ES-7. Annual trends in the concentrations of selected air toxics in Nueces County from the 2002 through 2006 TRI databases.

The NEI is maintained by the U.S. EPA on a three-year cycle under the Consolidated Emissions Reporting Rule and is widely used on a national level for State Implementation Plan development, compliance demonstrations, air quality modeling studies, and human health risk assessments. Texas submits data for both criteria air pollutant and hazardous air pollutant emissions. According to the U.S. EPA, data from the Texas submittals undergo quality assurance/quality control assessments, but are not otherwise altered before public release of the NEI. The emissions data for the NEI and the TCEQ photochemical modeling activities originate from the same source, the TCEQ STARS database which is a compendium of annual point source emissions as reported by facilities. Both the NEI and the TCEQ photochemical modeling inventories have similar emission point level source resolution and stack parameters. However, the TCEQ applies factors to account for rule effectiveness and to further chemically speciate VOC emissions.

The rule effectiveness factors were found to primarily affect emissions from flares, equipment leak fugitives, external floating roof tanks, internal floating roof tanks, and vertical fixed tanks. Point source emissions of individual air toxics were compared for all eleven inventories under consideration and pronounced differences were found. The most significant differences occurred between the TCEQ Photochemical Modeling Inventories and the other inventories, which was not unexpected given that the Photochemical Modeling Inventories include rule effectiveness and full speciation, whereas the other inventories are based on reported emissions only, and were more striking for certain species. For example, benzene emissions from point sources in Nueces County in the 2002-2006 TRI databases and the 2005 NEI submittal range from approximately 85 to 120 tpy, whereas emissions for the 2002 HAP NEI are 166 tpy, and emissions from the 2000 and 2005 Photochemical Modeling Inventories are 250 to 260 tpy. Differences in point source emissions of formaldehyde are even more substantial with emissions reported to the TRI databases ranging from 15 to 30 tpy versus emissions of 250 to 415 tpy in the TCEQ Photochemical Modeling Inventories. Toluene emissions from point sources in the 2005 TCEQ Photochemical Modeling Inventory (225 tpy) were approximately a factor of two higher than in the other inventories for Nueces County. Point source emissions of xylene and ethylbenzene show relatively better agreement between inventories. Although emissions of 1,3-butadiene show fairly good agreement; emissions increased dramatically in the 2006 TRI relative to the other inventories. Overall, there were substantial differences in the magnitude of emissions between the point source inventories, however, the relative contribution of emissions from specific sites is reasonably consistent for most species.

Maps were developed to compare the location of emission points to site property boundaries focusing on the 2002 HAP NEI, the Texas submittal to the 2005 NEI, and the TCEQ 2005 Photochemical Modeling EI. Emission points in the 2002 HAP NEI were clearly outside of property boundaries for some facilities, and it appeared that the reference datum was shifted towards the south. In addition, individual emission points were not distinguished for some facilities in the 2002 HAP NEI.

These problems with the 2002 NEI coupled with its greater age suggest that the 2005 NEI submittal or 2005 TCEQ Photochemical Modeling EI's provide better representations of sources in the region for air quality modeling assessments. The higher level of chemical speciation in the 2005 Photochemical Modeling EI is desirable for neighborhood-scale modeling and assessment of air toxics in Corpus Christi. In addition, use of this inventory in Corpus Christi provides consistency with modeling activities being undertaken by the TCEQ. However, it is important to recognize that many national-level air quality and human exposure and health risk assessments are expected to eventually be conducted using the 2005 HAP NEI. It is recommended that both 2005 inventories be applied in air quality modeling studies in Corpus Christi initially as the team proceeds, and that both are evaluated against the ambient data from the Corpus Christi network. Future national and state-level emission inventories that include Nueces and San Patricio Counties should continue to be evaluated to track longer trends in reported emissions and to investigate whether trends in reported emissions are consistent with trends in ambient data for the region.

3. Gaussian Dispersion Modeling: A Preliminary Assessment of AERMOD and CALPUFF

Numerous chemical plants, refineries and other industrial facilities near the Corpus Christi ship channel release toxic air pollutants such as benzene into the air. Many of these facilities are located blocks away from residential areas, as can be seen in Figure ES-8. Two air dispersion models, CALPUFF and AERMOD, were used with the 2005 TCEQ Photochemical Modeling Emission Inventory to predict air concentrations of benzene in populated areas and at sensitive receptor locations such as schools and hospitals. There are others sources of air toxic emissions beside industrial facilities, such as mobile sources and small stationary sources, which were not included in this modeling but will be included in the next phase of the study.

Both CALPUFF and AERMOD are publicly available, refined dispersion models required by the U.S. EPA to be used for State Implementation Plan revisions for existing sources and for New Source Review and Prevention of Significant Deterioration programs (http://www.epa.gov/scram001/dispersion_prefrec.htm). AERMOD is a steady-state plume model (http://www.epa.gov/scram001/dispersion_prefrec.htm#aermod). In contrast, CALPUFF (http://www.epa.gov/scram001/dispersion_prefrec.htm#calpuff) is a non-steady state puff dispersion model. Because of the fundamental differences in the nature of the models and their wide use in the United States, predictions of air toxics concentrations in the Corpus Christi area from both models are investigated and compared in this study.

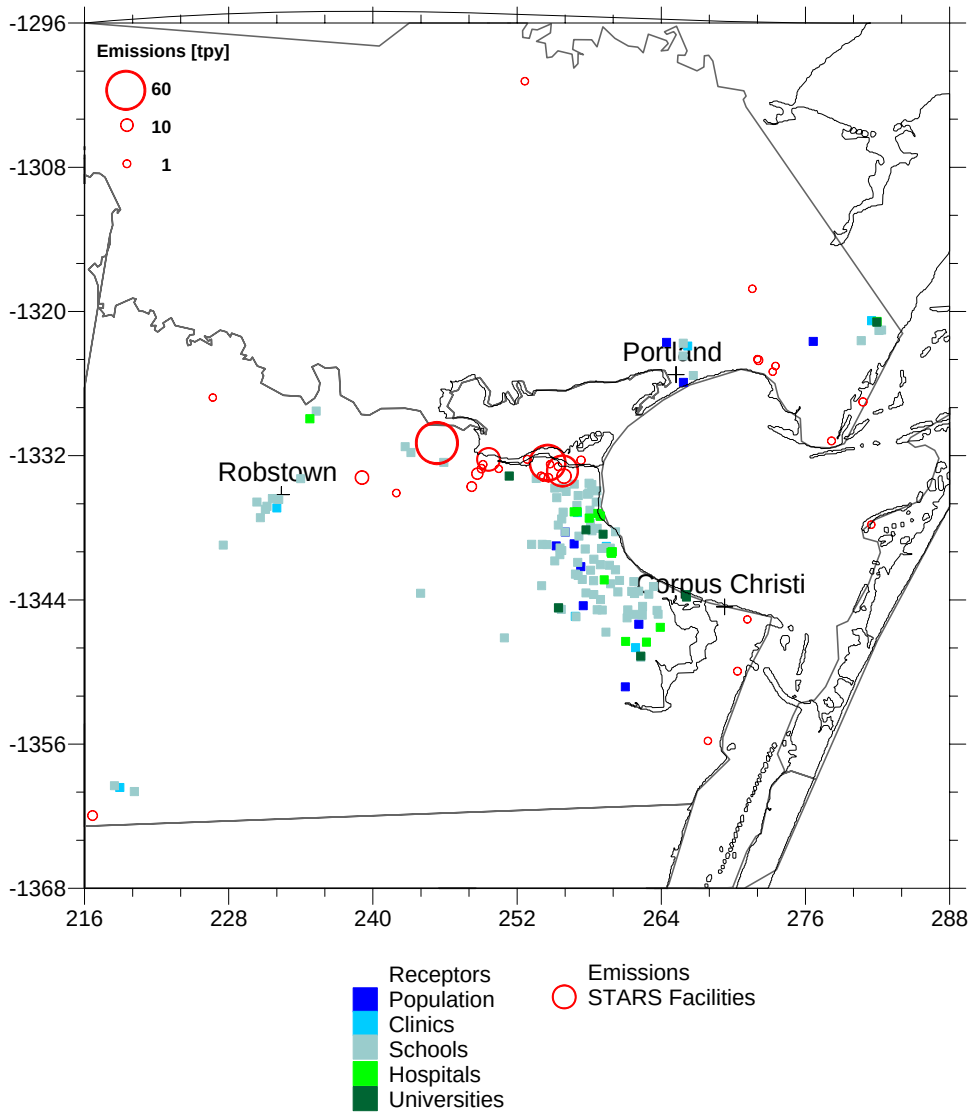


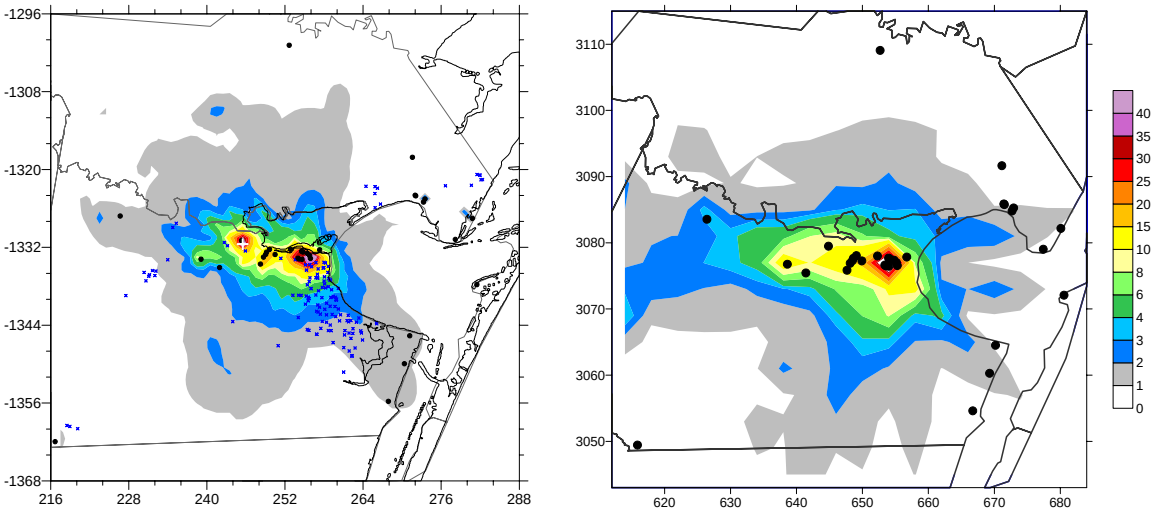
Figure ES-8. Map of the CALPUFF modeling domain with locations of the receptors and emission sources.

CALMET is the meteorological pre-processor for CALPUFF. Several CALMET sensitivity tests were evaluated to select model configurations that produced favorable wind fields in Corpus Christi. The evaluation of CALMET wind field performance was subjective because all available wind observations were employed in creating the wind fields leaving no data for an independent evaluation. Desirable CALMET options were determined to be the use of high-resolution coastline data, terrain kinematics, and additional smoothing aloft to help reduce the magnitude of the vertical velocity. Numerous CALPUFF model options also were tested and favorable CALPUFF options included the use of high-resolution coastline data and using micrometeorological variables to compute dispersion coefficients.

CALPUFF and AERMOD were run from October 1 to November 30, 2006 to evaluate the impacts of benzene from individual and from all chemical plants and refineries near

Corpus Christi. The 2005 TCEQ Photochemical Modeling Inventory was used for the simulations. Figure ES-9 shows spatial plots of the episode maximum concentration to gridded receptors when using CALPUFF on the left and AERMOD with Oak Park meteorology on the right. CALPUFF predicted higher benzene concentrations nearer to the emission sources, with local maxima over the two largest facilities (Flint Hills West and Valero East); AERMOD (with Oak Park meteorology) tended to disperse benzene further downwind than CALPUFF.

Among the discrete receptors, which represent the locations of schools and hospitals, the highest hourly benzene concentration from all sources was comparable, i.e., 34 ppb in CALPUFF and 33 ppb in AERMOD (when using meteorological data from Oak Park), but these occurred at different receptors and on different dates.



CALPUFF. Max = 53.2 ppb, Second peak at 47.4. ppb

AERMOD. Max = 43.5 ppb

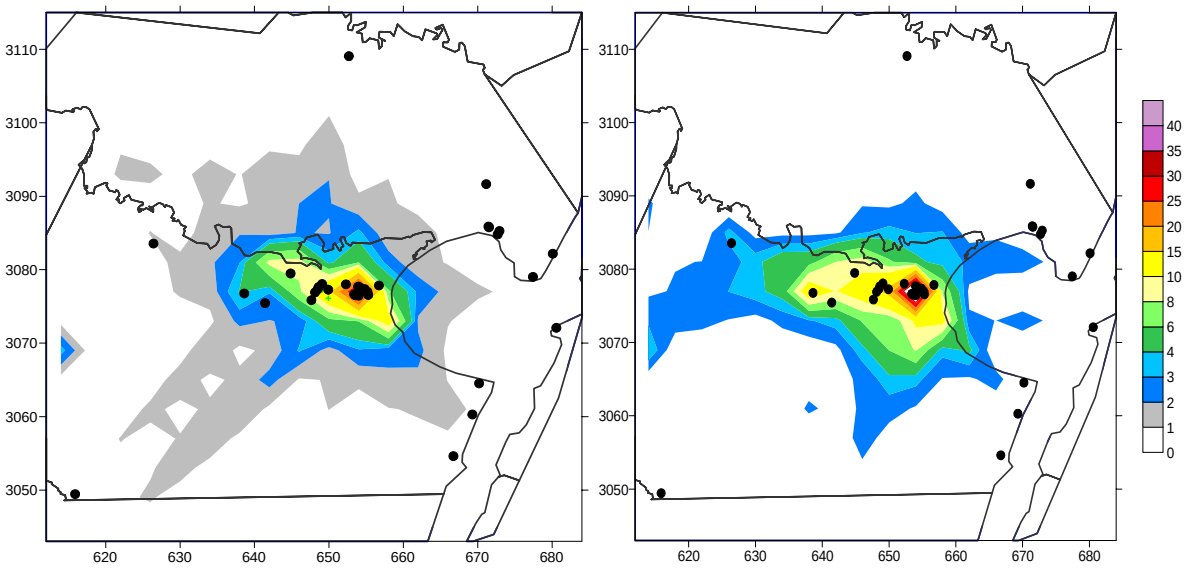
Figure ES-9. Predicted episode maximum hourly benzene concentrations from CALPUFF (left) and AERMOD (right). These represent the highest concentrations predicted by each model at each location during the October 1 – November 30, 2006 modeling period.

The maximum contributions from each of the five largest sources of benzene at any discrete receptor are listed in Table ES-1 from two AERMOD runs, which used meteorology from different surface stations (Solar Estates and Oak Park), and from CALPUFF. Citgo East produced the highest concentration at any discrete receptor in AERMOD for both meteorological datasets, while Valero East produced the highest concentration among individual facilities in CALPUFF.

Table ES-1. Maximum benzene concentrations at discrete receptors from individual facilities using AERMOD and CALPUFF.

Facility	AERMOD (Solar Estates Met)	Date	AERMOD (Oak Park Met)	Date	CALPUFF	Date
All	26.69	Nov 16	32.86	Nov 18	34.20	Oct 22
Flint Hills West	11.55	Nov 16	26.22	Nov 6	19.10	Nov 18
Citgo East	14.37	Nov 16	29.34	Nov 18	18.98	Nov 17
Valero East	11.80	Oct 4	24.92	Nov 6	27.67	Oct 22
Valero West	3.80	Oct 14	6.79	Nov 13	6.01	Oct 6
Koch Petroleum	5.01	Nov 18	12.85	Nov 18	9.50	Nov 6

A significant limitation to AERMOD is its inability to incorporate meteorology from more than one surface site within a single modeling simulation. Figure ES-10 compares the episode maximum benzene concentration from two AERMOD runs using surface meteorology from Oak Park and Solar Estates, which are within 10 km of one another. The use of Oak Park meteorology produced higher benzene concentrations throughout the modeling domain when compared to Solar Estates meteorology, including a domain-wide peak that was 12 ppb larger. Peak contributions from each of the individual facilities to any discrete receptor were twice as large with Oak Park meteorology compared to Solar Estates. These results suggest a high level of uncertainty due to this limitation in AERMOD. CALPUFF uses three-dimensional wind and temperature fields that incorporate meteorological data from multiple sites, which is a major advantage over AERMOD, but requires more computational time. Comparisons between AERMOD and CALPUFF predicted concentrations and observations at the Corpus Christi monitoring stations will be conducted during 2009 through 2010.



AERMOD with Solar Estates Meteorology
Max = 31.8 ppb

AERMOD with Oak Park Meteorology.
Max = 43.5 ppb

Figure ES-10. Predicted episode maximum hourly benzene concentrations from two AERMOD runs using different surface meteorology.