

Neighborhood Air Toxics Modeling For Corpus Christi and Houston

The University of Texas at Austin
Center for Energy and Environmental Resources

in collaboration with
ENVIRON International Corporation
and
Texas A&M University

Background

- On February 1, 2008, the US District Court of the Southern District of Texas Corpus Christi, 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 UT Austin for use of the Settlement Fund.
- The **Neighborhood Air Toxics Modeling Project for Houston and Corpus Christi** was proposed as a two stage project.
 - **Stage 1:** 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.
 - **Stage 2:** Enhance the current measurement network to investigate the spatial distributions of air pollutant concentrations in order to evaluate and improve the performance of the neighborhood-scale models developed in Stage 1 and to inform the public. This could include the addition of a mobile monitoring station that can be deployed in Corpus Christi and other regions of Texas and/or extension/modification of the existing ground monitoring network.

Status

- Stage I has been funded as a 4-year effort and major tasks have been identified.
- Stage II is pending.
- UT Austin and our collaborators at ENVIRON and TAMU have developed project plans for Year 1 and work is on-going.

Major Project Tasks: Stage I

1. Develop a conceptual model of meteorological conditions and emission characteristics likely to lead to high concentrations of air toxics in the Corpus Christi area.
2. Develop emission inventory and land use/land cover input data for neighborhood-scale modeling in Corpus Christi.
3. Apply dispersion models to estimate neighborhood-scale concentrations of air toxics in Corpus Christi.
4. Develop improved meteorological models of air pollutant dispersion in the Corpus Christi area.
5. Develop combined gridded and plume models to estimate neighborhood-scale concentrations of air toxics in Corpus Christi.
6. Apply the combined dispersion and gridded modeling tools to estimate concentrations of air toxics in Corpus Christi.
7. Apply the model framework developed in Corpus Christi to the Houston Ship Channel region in east Harris County, Texas.

Year 1: Project Technical Approach

- **Conceptual Model Development**

(UT with peer review from TAMU and ENVIRON)

- Obtain and process the data collected on air toxics concentrations and meteorology by the *Corpus Christi Air Monitoring and Surveillance Camera Installation and Operation Project*.
- Analyze the TNMHC hourly observations to describe the temporal (seasonality, time-of-day, and day-of-week) variability and spatial scale of air toxic pollutant events.
- Investigate the relationship between high pollutant concentrations and winds as measured at each monitoring station.
- Obtain additional VOC monitoring data (i.e., auto-GC observations from the Solar Estates and Oak Park monitoring stations and pollutant event canister samples from the seven Corpus Christi Air Quality Project monitoring stations) for supporting analyses.

Objectives:

To describe the frequency of occurrence, spatial scale and duration of air toxic pollutant events in the Corpus Christi area using integrated analyses of the ambient monitoring data, emissions, and meteorological patterns.

To select historical episodes for dispersion and photochemical modeling.

Year 1: Project Technical Approach

- **Meteorological Modeling**

(TAMU with assistance from UT and ENVIRON)

- Select appropriate meteorological model (WRF).
- Select appropriate historical episodes based on the conceptual model and availability of observational meteorological datasets.
- Select a complex land surface model based on integration with the met model and availability of high-resolution LULC observational datasets.
- Conduct a series of sensitivity tests to evaluate model behavior at incrementally finer horizontal and vertical resolutions.
- Conduct sensitivity tests to assess model behavior using various mixing schemes under daytime, nighttime, and morning transition conditions.
- Develop an interface between the meteorological and photochemical models.

Objective:

To develop an optimized meteorological model that will be used to drive the air quality modeling of selected air toxics at a neighborhood-scale in Corpus Christi.

Year 1: Project Technical Approach

- **Point Source Emission Inventory Development**

(UT and ENVIRON)

- Obtain and analyze point source emissions data (annual, ozone season and event data as available) for Corpus Christi
 - TCEQ STARS Database
 - Toxic Release Inventory (TRI)
 - EPA National Emissions Inventory (NEI)
 - Upset reports for periods of interest identified through conceptual model
- Process and merge data for dispersion and photochemical modeling

Objective:

To develop an inventory and understanding of point sources of air toxics in the Corpus Christi area for dispersion and photochemical modeling.

Year 1: Project Technical Approach

- **Dispersion Modeling**

(UT and ENVIRON)

- Evaluate existing Gaussian plume models and their application in related studies of air toxics modeling in U.S. cities (AERMOD and CALPUFF).
- Select historical episodes for dispersion modeling in Corpus Christi based on the conceptual model and observational datasets
- Select historical episodes for the Houston area based on observational data from TexAQS II
- Process observational data for both areas and conduct meteorological modeling (AERMET and CALMET)
- Evaluate potential use of WRF meteorological fields with dispersion models
- Prepare point source emission files
- Estimate plume concentrations from individual sources in Corpus Christi and combine to estimate total air toxics concentrations in Corpus Christi from point sources
- Inter-compare dispersion model predictions in the Corpus Christi area

Objective:

Apply and evaluate common dispersion models, which represent the current best practice for neighborhood-scale air quality modeling, to estimate concentrations of air toxics in Corpus Christi and the Houston Ship Channel.