

METEOROLOGICAL EFFECT & HEALTH HAZARD ANALYSIS OF VOC POLLUTION



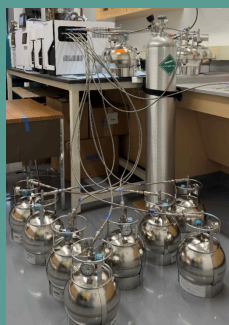
The case of the Industrialized Region of Southeast Texas

WHY NOW?

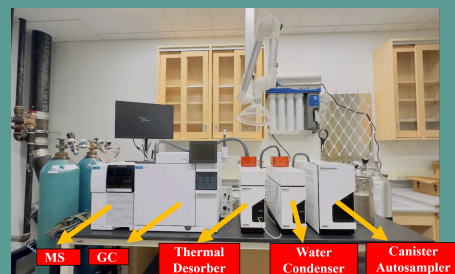
Toxic “volatile organic compounds” (VOC) can be emitted by oil refineries, petrochemical industries, transportation, petroleum shipping channel and other man-made industrial sources. The factors affecting VOC concentrations in the air should be addressed to develop an effective mitigation plan. Systematically evaluating the long-term health consequences of toxic VOC exposure can yield a comprehensive picture of the inherent risks, consequently reinforcing the critical need for decisive action in controlling and reducing VOC pollution.

WHAT WE DID

The SETx-UIFL research team analyzed sixty-five toxic VOCs (classified by the EPA) using the EPA TO-15 method with GC-MS. The research team collected and analyzed 889 outdoor samples and 240 paired indoor and outdoor samples from three sampling sites selected based on potential VOC sources and proximity to nearby neighborhoods. The research team assessed temporal patterns of VOC concentrations across sites, their correlation with meteorological factors, and associated health impacts. The research team also evaluated the top-ranked aggressive VOCs based on emission inventories in the Southeast Texas region and chemical toxicity levels. The researchers also conducted a comparative study of indoor and outdoor pollution alongside an analysis of outdoor pollution patterns across different time scales.



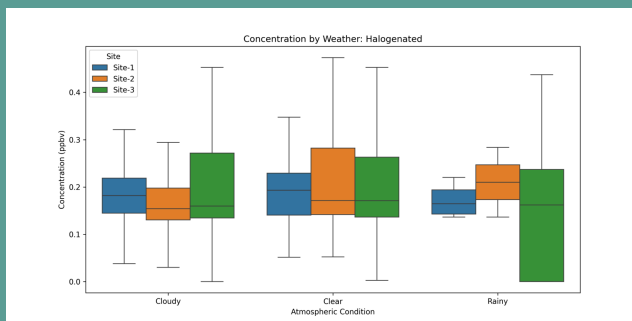
Laboratory setup for canister analyses



Instruments used for the analysis of the pollutants in the air

FINDINGS

- Different groups (aromatic, halogenated, chlorinated and straight chain) concentration varies in different season for the 3 sites. For example, naphthalene, chloromethyl benzene and 1,3 – butadiene are the 3 topmost hazardous compounds from samples collected from all 3 sites. They are the riskiest in terms of respiratory hazard. Further analysis is needed to draw more conclusions.
- Concentration variation is significantly influenced by meteorological factors such as wind speed, wind direction, temperature, and humidity. Further analysis is needed to draw more conclusions.
- Risk of human health hazard in terms of cumulative hazard, carcinogenic hazard and target organ-specific hazard varies with season in different sites as the contribution by the VOC group changes accordingly. The research team analyzed the risk factors of all 65 chemical compounds based on more than 1000 canister samples collected in one year. A higher overall risk is found in winter and fall in site 1. The result demonstrates the impact of one important meteorological factor, namely wind direction to risk. With this information, it may be important to establish neighborhood-specific air quality alerts depending on wind direction, season, among other factors. Further analysis is needed to draw more conclusions.



Aggregated concentrations of Halogenated pollutants under different weather conditions

MORE ABOUT SETX-UIFL

The Southeast Texas Urban Integrated Field Lab (SETx-UIFL) is one of four projects funded in 2022 by the U.S. Department of Energy to study how climate, environment, and urban changes affect cities. A team of over 80 researchers from UT, Lamar University, Texas A&M, Prairie View A&M, Oak Ridge National Lab, and Los Alamos National Lab has collected data and conducted modeling across hazards including flooding, hurricanes, heat stress, and air quality. Our Why: Southeast Texas faces numerous hazards, yet smaller communities like this one have often felt forgotten compared to larger cities. The SETx-UIFL was designed to explore the complex dynamics of disaster vulnerability for this economically and culturally vibrant region. We believe Southeast Texas is a bellwether for the entire Gulf Coast, and an exemplar for strategies that protect people and places. We hope this effort supports your path toward lasting resilience.



SIDNEY LIN

Lamar University
sidney.lin@lamar.edu

