Ethylene Oxide (EtO) Sampling in North Charleston

Presentation Overview

- Background and Objectives
- Sampling and Data
- What We Learned
- Questions Raised
- Next Steps
- Conclusions

Background

- In 2019, DHEC performed limited ethylene oxide (EtO) sampling in ambient air to help inform the Department of ambient air concentrations.
- During the initial sampling, EPA began offering grants to help states perform air sampling projects. This was to help both EPA and states learn more about EtO collection, sampling methods, and the ambient air concentrations.

Project Background

- DHEC and the North Charleston community have a history of working collaboratively on air sampling projects.
- In 2021, DHEC applied for and received one of EPA's community-scale grants to sample and measure ambient concentrations of ethylene oxide (EtO) in the North Charleston area.

Project Objectives

- Measure EtO concentrations in the ambient air in the North Charleston area which has contributions from stationary and mobile sources;
- Measure ambient concentrations at a location with a high traffic pattern and no known EtO stationary sources.

What is Ethylene Oxide (EtO)

- It is a Hazardous Air Pollutant (HAP) and is regulated.
- Ethylene oxide is a flammable, colorless gas used to make a range of consumer products, including antifreeze, textiles, plastics, detergents, and adhesives.
- EtO also is used to sterilize equipment and plastic devices that cannot be sterilized by steam, such as medical and dental equipment.

More information on EtO

- It is naturally occurring in trees and other vegetation.
- The Centers for Disease Control and Prevention (CDC) states that environmental exposures to EtO may also include vehicle exhaust from gasoline and tobacco smoke.
- The Food and Drug Administration (FDA) states that EtO is currently used to treat approximately 50% of sterile medical devices, about 20 billion medical devices annually.
- Some spices and dehydrated vegetables also are sterilized with EtO.

Health risks associated with EtO

- Studies show breathing air containing elevated levels of EtO over many years can increase the risk of cancers of the white blood cells, including non-Hodgkin lymphoma, myeloma, and lymphocytic leukemia. Studies also show that long-term exposure to EtO increases the risk of breast cancer in women.
- A review of the SC Cancer Registry data for cancers in the area monitored did not find any cancer clusters.

Charleston Sampling locations

- Four locations were included in the project:
  - FAA site (Hwy 78 exit off I-26)
  - Gethsemani Community Center
  - Rosemont Community
  - Irving Avenue (Collocated*)

*Collocated samples are two side-by-side canisters setup and collected at the same time.

Sampling Locations

FAA is more than 10 miles away from the Rosemont site.

Background EtO sampling

Chesterfield Site

- National Air Toxics Trends Station (NATTS)
- Rural area with no known point sources of EtO
- Near a wildlife refuge and state forest

Chesterfield Background Site

The Chesterfield site is over 100 miles north of the project area.

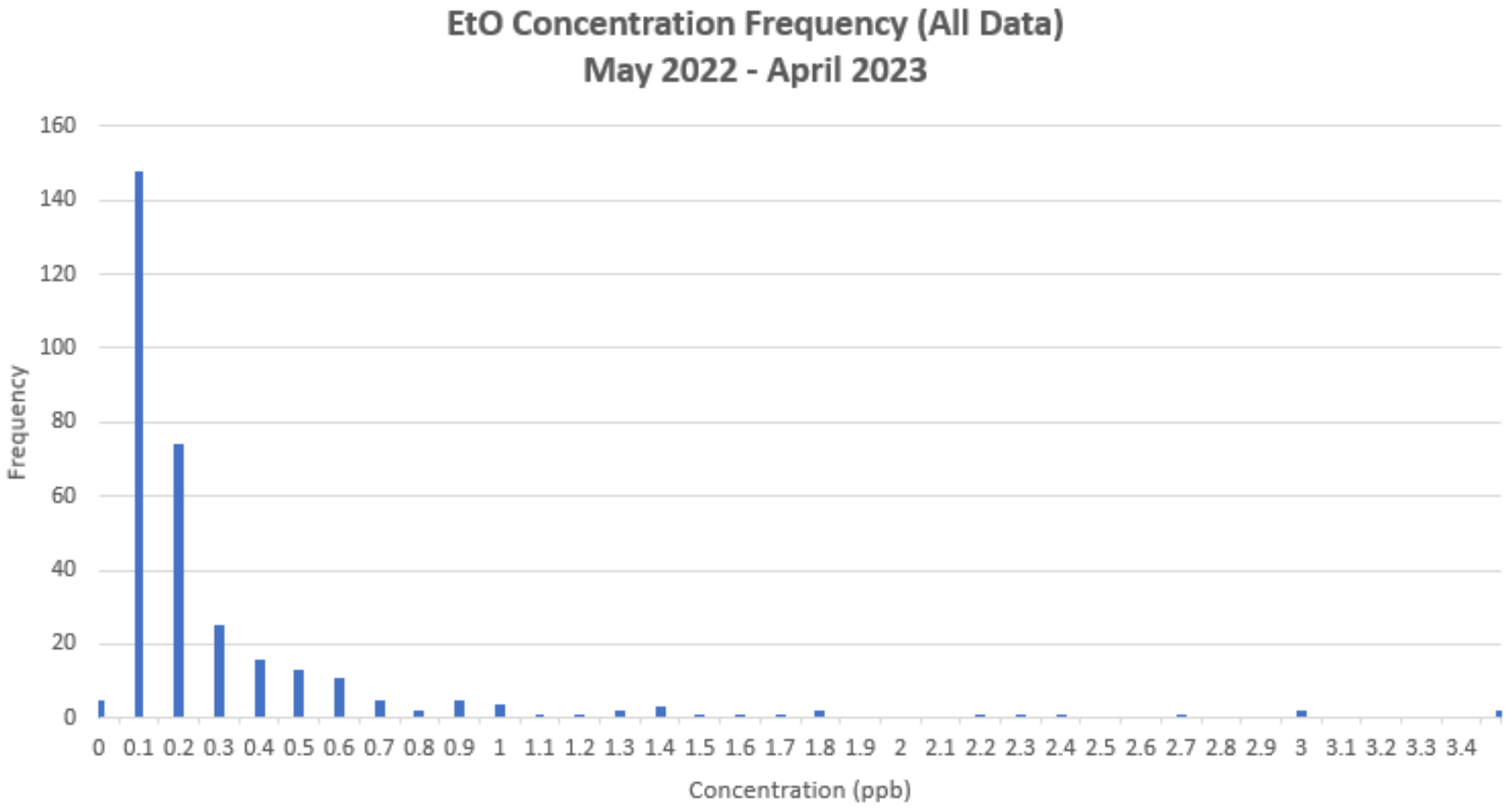
Sample Collection

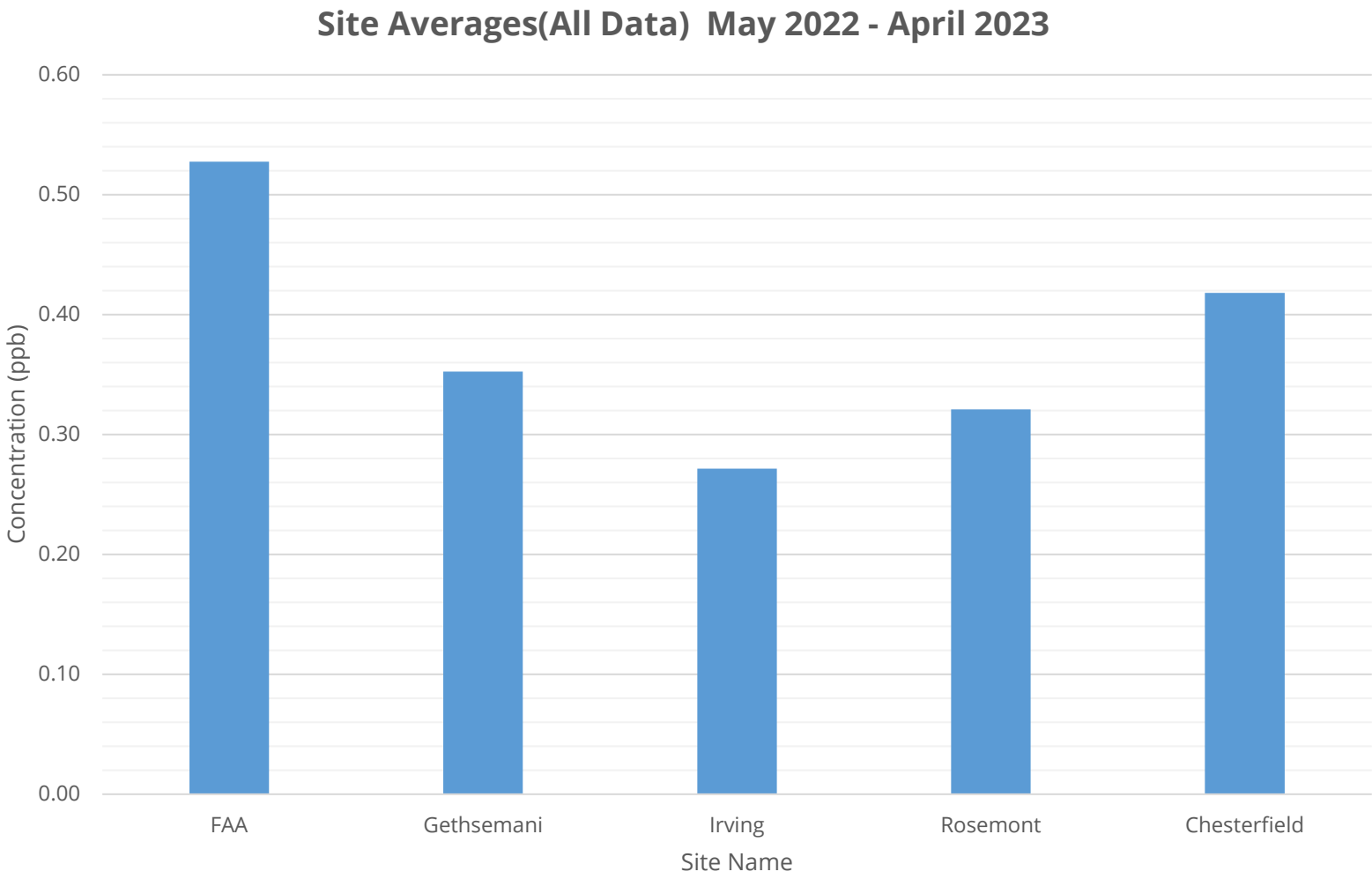
- Samples were collected every 6th day according to the EPA's air sampling schedule.
- Samples were collected in all weather conditions.

Sampling Technique

Sampling and Analysis

- Canisters seen in the previous slide are used to collect a sample over a 24-hour period.
- Collection occurred from midnight one day to midnight the next day.
- Collected samples were sent to EPA's contract laboratory for analysis.


EtO Concentration Frequency (All Data)
May 2022 - April 2023
Frequency
160
140
120
100
80
60
40
20
0
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1 1.1 1.2 1.3 1.4 1.5 1.6 1.7 1.8 1.9 2 2.1 2.2 2.3 2.4 2.5 2.6 2.7 2.8 2.9 3 3.1 3.2 3.3 3.4
Concentration (ppb)


Site Averages(All Data) May 2022 - April 2023
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Concentration (ppb)
FAA
Gethsemani
Irving
Rosemont
Chesterfield
Site Name

What did we learn?

- Collection and analysis of the very low concentrations of EtO in ambient air is difficult, and EPA and DHEC are working to improve the accuracy of the measurement.
- This is not unusual for new measurements at extremely low concentrations.

What did we learn?

- There is evidence that concentrations determined using the current recommended method can sometimes be biased high, indicating a concentration in the lab results from the sample was higher than the actual concentration in the ambient air.
- The reported average concentrations can be considered a conservative estimate and actual average concentrations are likely to be lower than what is reported.

What did we learn?

- EtO was found in places we did not expect to see it.
- Emissions of EtO have been reduced by more than 80% in the North Charleston area since 2019.

Questions raised by this project

Are there better methods or method improvements for measuring EtO?

- EtO measurements across the country show that sample collection and method improvements are needed.
- There are several sample collection and analysis methods being evaluated by EPA.
- The work done in this project will help EPA as they continue to make improvements.

Next Steps

- EPA and OSHA are reviewing their regulations for opportunities to further reduce EtO emissions and exposures.
- EPA has proposed three (3) regulations and finalized one (1) to reduce the amount of EtO emitted to the environment.
- According to EPA, releases of EtO to the air have decreased by approximately 48% nationwide.

Conclusions

- Many states have sampled EtO in ambient air and found similar results.
- Data from rural areas is similar to data from urban areas.
- More research is needed to improve the method to measure very low ambient concentrations, define background, and understand the data.
- In the North Charleston area, EtO emissions have decreased by over 80% since 2019.

DHEC is committed to staying engaged nationally as the EPA works to establish standards for reducing hazardous air pollutant emissions like EtO. DHEC will also continue to work with South Carolina facilities and communities to reduce the potential health risks associated with air toxic emissions as more information about EtO becomes known.

For more information on EtO:

https://scdhec.gov/EtO

https://www.epa.gov/hazardous-air-pollutants-ethylene-oxide

Questions?

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