

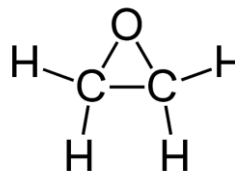
Background on Ethylene Oxide Monitoring Activities

Provided by EPA/OAQPS
To SESARM Fall 2019 Meeting Participants
October 16-17, 2019



Quick EtO Introduction

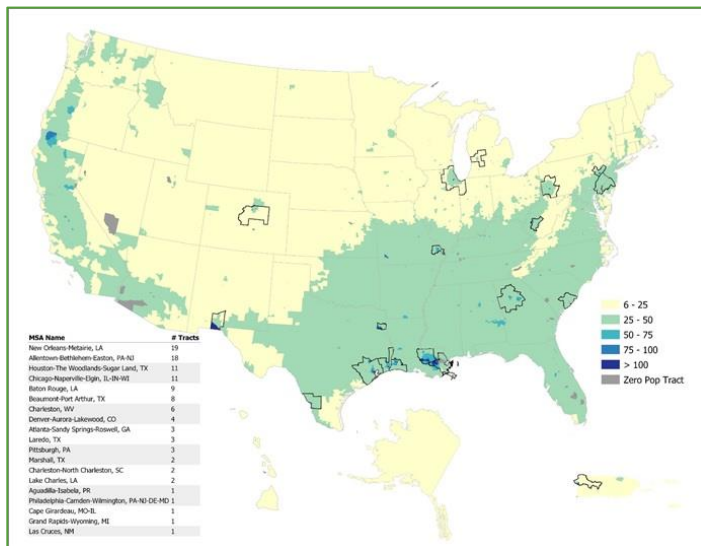
- The National Air Toxics Assessment released in 2018 indicated that ethylene oxide significantly contributes to elevated risks of cancer in some census tracts across the country – i.e., about 20 areas have risks greater than 100-in-a-million (map on next slide).
- In response, EPA has taken a two-pronged approach to address ethylene oxide emissions, including reviewing Clean Air Act regulations for industrial facilities that emit ethylene oxide and getting additional information to determine whether more immediate emission reduction steps are possible in the higher risk areas.
- Ambient air monitoring has been conducted in a few areas with a significant industrial source of ethylene oxide emissions (Willowbrook, IL; Grand Rapids, MI; and Lakewood, CO). In each of these areas, elevated levels of ethylene oxide were recorded at monitoring sites on days when they were downwind of the industrial facility of interest.
 - Lower, yet measurable levels of ethylene oxide were recorded at monitoring sites on days when they were upwind or on days when the industrial facility of interest was not operating.



Ethylene oxide is a flammable, colorless gas used to make a range of 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 equipment. The Clean Air Act lists EtO as a Hazardous Air Pollutant. U.S. EPA recently updated its risk value for ethylene oxide and is working with industry, and state, local and tribal air agencies to address this chemical



NATA Cancer Risk Map - 2018



Primer on EtO Monitoring Challenges

- The only *currently viable* method for analyzing ambient EtO samples is the TO-15, Summa canister method.
 - Measurements are typically averaged over a period of time such as 24 hours.
 - Logistics are cumbersome due to time delay and expense in shipping canisters back and forth to a lab and waiting for the ~2-3 week data validation cycle
 - Method has sensitivity challenges; currently the MDL is in the 0.06 – 0.08 $\mu\text{g}/\text{m}^3$ range. This equates to a long-term cancer risk of 300 to 400 in 10^6 .
- Relatively little current research has been done on issues such as EtO persistence and fate in the atmosphere as well as the role of other sources beyond known NEI emitters (e.g., commercial sterilizers, chemical facilities).
 - We are beginning to engage with EPA/ORD on these issues
- This situation leads to very challenging communication issues when measurable concentrations occur.

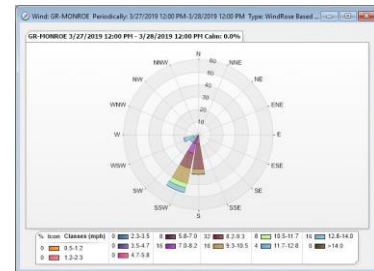
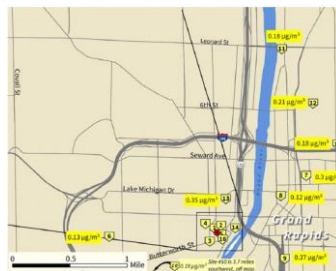


Recent Ambient Monitoring Projects for EtO – Grand Rapids, MI

https://www.michigan.gov/egle/0,9429,7-135-3310_70314_89277---,00.html

Two 1-day duration studies
(Phase I and II)
November 2018 & March 2019

Phase II Results



- The highest concentration of ethylene oxide ($2.08 \mu\text{g}/\text{m}^3$) was measured at a parking lot directly across the street from Viant, Location #2. Given the wind direction, out of the south-southwest/south at speeds of 0-10 mph on the sampling day, the discharge from the air vent at Viant was in direct line with this sample location.
- The Phase II sampling results appear to support a background level of around $0.18 \mu\text{g}/\text{m}^3$ in the Grand Rapids area. This suggested background level can be seen at both Locations #10 and #11.



Recent Ambient Monitoring Projects for EtO – Lakewood, CO

<https://www.colorado.gov/pacific/cdphe/ethylene-oxide>

Two 7-day duration studies
August & October 2018



- For the pre-control monitoring, site #3 on the east side of the Terumo BCT facility had the highest pre-control average concentration over the 7 days of sampling at 3.092 $\mu\text{g}/\text{m}^3$, followed closely by Site #2 on the west side at 2.996 $\mu\text{g}/\text{m}^3$.
- For the post-control monitoring, Site #3 also had the highest post-control average concentration over the 7 days of sampling at 0.993 $\mu\text{g}/\text{m}^3$, followed by Site #2 at 0.774 $\mu\text{g}/\text{m}^3$.
- Mean background levels were approximately 0.253 $\mu\text{g}/\text{m}^3$.

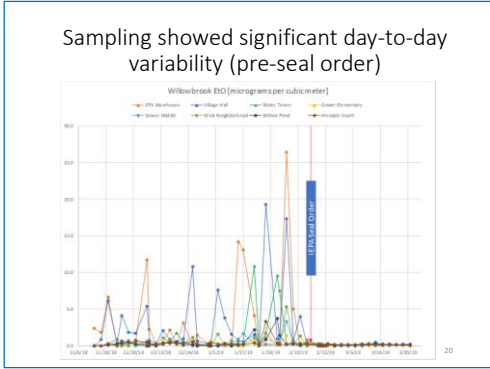


Recent Ambient Monitoring Projects for EtO – Willowbrook, IL

<https://www.epa.gov/il/sterigenics-willowbrook-facility>

4 1/2 Month study -
November 13, 2018 –
March 31, 2019

Average EtO Concentrations ($\mu\text{g}/\text{m}^3$) – November 13 to March 31, 2019

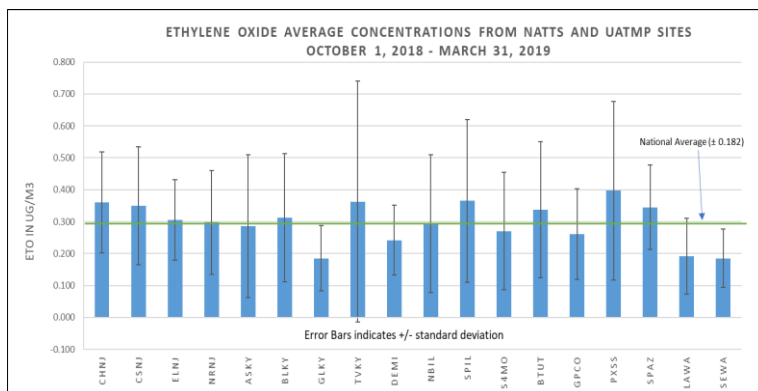


- EPA conducted 24-hour sampling at eight sites near a commercial sterilization facility (Sterigenics). Site averages when the facility was operating (32 sample days) ranged from 0.37 to 3.96 $\mu\text{g}/\text{m}^3$. Highest 24-hour averages exceeded 10 $\mu\text{g}/\text{m}^3$ on several occasions.
- The 6-week average background concentration after the facility was sealed by the IEPA was 0.15 $\mu\text{g}/\text{m}^3$.



Next EPA Steps in Investigating the Distribution of EtO data Across the U.S.

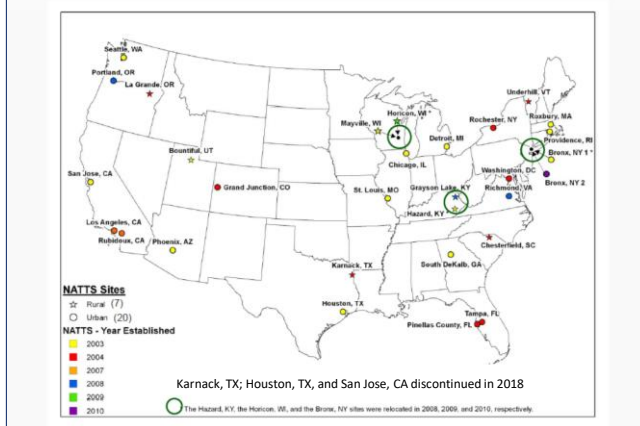
- EPA has worked with the national air toxics contract lab to analyze EtO concentrations at a subset of the NATTS and UATMP sites for the 4thQ 2018 – 1stQ 2019 period
- Outreach calls have been completed with the affected states and the data are in final QA review prior to AQS posting
- The average concentration for this data set is 0.297 $\mu\text{g}/\text{m}^3$
 - Equivalent to a long-term cancer risk of 1500 in 10^6
- There is a statistical difference (lower) between a grouping of [GLKY, LAWA, SEWA] and the other sites



Goals of the NATTS EtO enhancement

- Improve understanding of the national distribution of this compound in areas **away** from major EtO sources in different parts of the country
- Provide national or regional context for the results of case by case modeling results on individual facilities
- Support analysis of community-led ambient monitoring programs
- Increase and improve national air toxics analytical capacity for EtO
 - Analysis currently limited to a few commercial labs and Region 4/Athens
- Training programs with all the NATTS labs began on August 28
 - <https://www3.epa.gov/ttn/amtic/airtox.html>

NATTS Sites & Years Established



Summary – Current Measurement Challenges with EtO

What do we know

- Method for characterizing EtO in the ambient air is adequate although the sensitivity needs to be improved
- Elevated levels of EtO have been measured near known industrial sources
- Ambient data collected from 18 monitoring sites located *away* from known sources has shown lower but measurable levels of EtO

What don't we know

- How do the ambient levels of EtO vary nationally and seasonally across the country
- What are the sources of the EtO being measured away from known sources
- How long does EtO persist in the atmosphere; what is its involvement in atmospheric chemistry and transport
- What are the best methods for measuring EtO in real-time and/or in source streams
- What are the next steps if the presence of EtO is confirmed to be ubiquitous?