Ethylene Oxide (EtO) Emissions:
ORD Efforts

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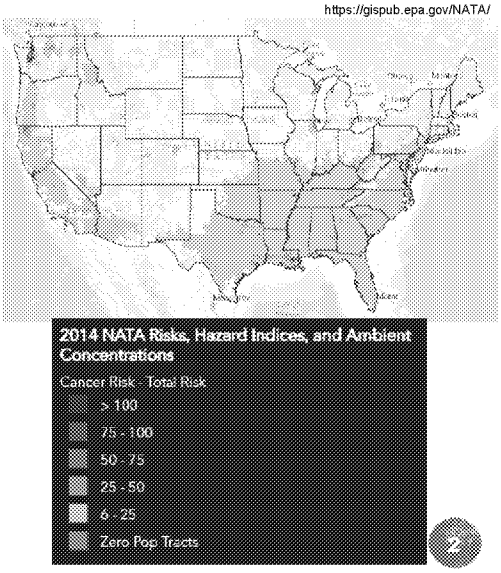
EPA

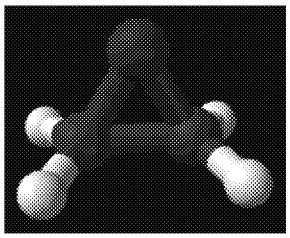
EtO emissions – suddenly a hot topic?

- Background:
  - December 2016, Integrated Risk Information System (IRIS) assessment released for EtO
    - Conclusion - EtO is carcinogenic to humans, issuing an Unit Risk Estimate (URE) ~60 times more potent than previously thought
    - IRIS/NATA/URE cancer risk > 100-in-a-million is **20 ng/m³ (~10ppt)**
    - National Air Toxics Assessment (NATA) identified roughly 30 EtO-emitting facilities nationwide with cancer risk greater than 100-in-a-million
      - *(released to public in September 2018)*
  - EPA Compendium Method TO-15 (modified) detection limit is **0.082µg/m³ (~50ppt)**
- No method to date is sensitive enough to measure at these low levels

https://gispub.epa.gov/NATA/



How we get it and what it's used for?



C_2H_4O
EtO is a colorless, flammable gas with an odor that is faint but sweet

- Formation:
  - Occurs from oxidizing ethylene in the presence of a silver catalyst
- Uses (including but not limited to):
  - Production of solvents, antifreeze (ethylene glycol), textiles, detergents, adhesives, polyurethane foam, and pharmaceuticals
  - Low-temperature sterilization processing for food, medical equipment/supplies, and other sensitive materials
- Emissions:
  - Uncontrolled emissions from point and area sources?
  - Fugitive emissions from industrial facilities?
  - Half-life of ~200 days, unlikely formed in the atmosphere

How did NRMRL get involved?

- Region 5 approached OAQPS
  - EtO sterilizer at Sterigenics in Willowbrook, IL
  - Issue surfaced right before shutdown!
- OAQPS approached ORD/NRMRL researchers for help:
  - Develop more sensitive measurement technologies and methods
  - Emission characterizations for EtO
- Region 5 and OAQPS funding to develop instrumentation
  - FY19 RARE grant with R5/R6 ($150K over next two years)
  - OAQPS added "seed money" to get started ($200K to date)
  - Instrumentation, methods to measure at the new health risk level – 10ppt
- OAQPS funding instrument development Method 301 validation studies ($100K)
- Working now to gain a better understanding of EtO emissions, measurement, and monitoring capability/possibilities

EPA

More background on Willowbrook, IL…

- Sterigenics:
  - EtO sterilizer facility in Willowbrook, IL (Chicago-area)
  - Complying with current regs – test emissions once every 5 years using Method 18
    - Voluntarily collecting TO-15 samples for analysis (but shared emissions data with EPA for comparison)
    - Company attributed elevated emissions of EtO on diesel delivery trucks, which is not supported by emissions data
- So, "Where's the EtO coming from?"
  - Fugitive, stack, and/or background emissions

"The Sterigenics clampdown: As U.S. EPA fiddles, Illinois EPA acts"
–Chicago Tribune, Feb. 18, 2019

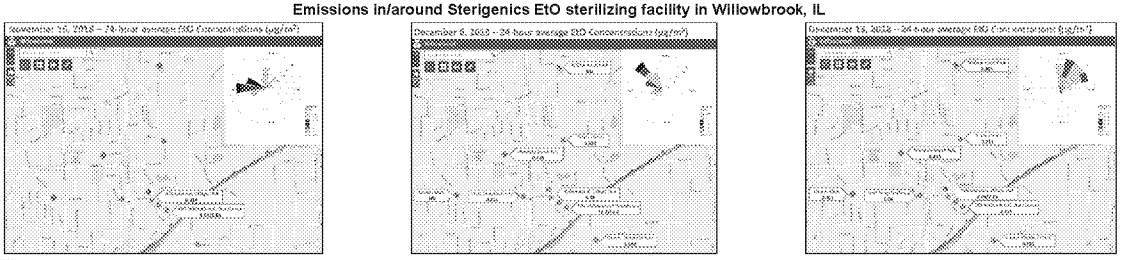
"Hundreds demand answers from EPA officials, closing of Sterigenics in Willowbrook"
–The Daily Herald, Nov. 2018

"Lipinski to Participate in Ethylene Oxide and Sterigenics Community Forum on November 29 in Willowbrook"
–Congressman Lipinski Press Release, Nov. 2018

Emissions: fugitive, stack, and background

- Illinois EPA issues "Seal Order" for Willowbrook Sterigenics facility
  - February 15, 2019
- Numbers to remember:
  - TO-15 (modified) detection limit is **0.082µg/m³ (~50ppt)**
  - IRIS/NATA/URE cancer risk > 100-in-a-million is **20 ng/m³ (~10ppt)**

Emissions in/around Sterigenics EtO sterilizing facility in Willowbrook, IL



Sampling, data reduction, and data analysis provided by OAQPS and Region 5 (available on EPA website)

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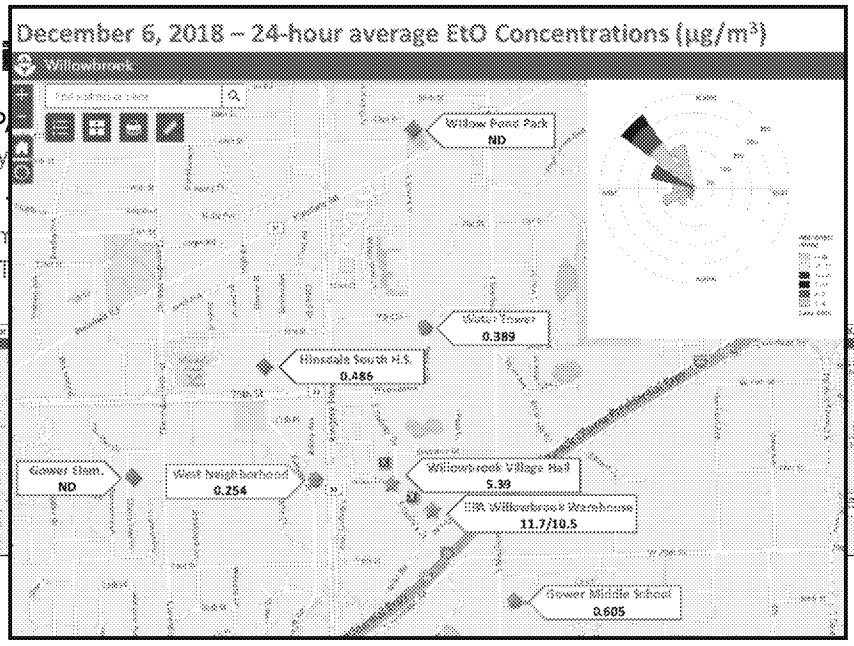
- Illinois EP
  - February
- Numbers
  - TO-15 (m
  - IRIS/NAT

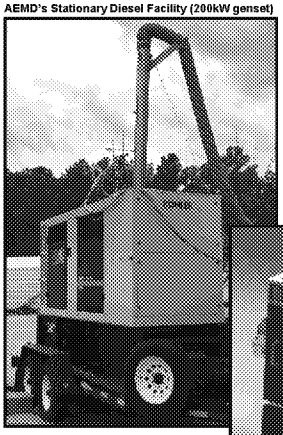


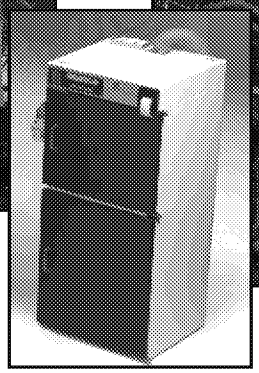
ORD Instrumentation and Methods Development

- EPA Compendium Method TO-15
  - Contract lab analyzing ambient samples for OAQPS
  - ORD considering application to source sampling
- New low-level measurements for near-source, background emissions (RARE project)
  - Online, real-time and semi-continuous sampling
  - Testing existing measurement technologies
- Develop source (stack) measurement instrumentation, techniques, and methods
  - Complicated issues – measurement environment
  - Ancillary factors like high quality reference gas needs, sampling losses
  - Considering multiple technologies and approaches
  - Validation studies necessary to identify instruments and methods

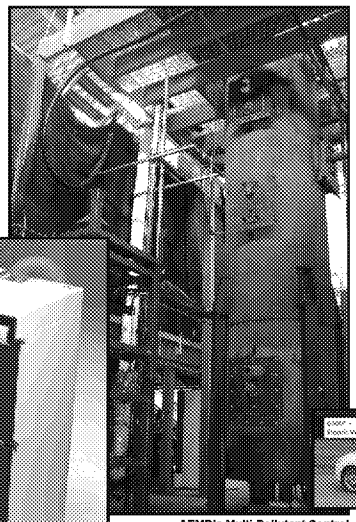
ORD Emissions Characterization Tools

AEMD's Stationary Diesel Facility (200kW genset)

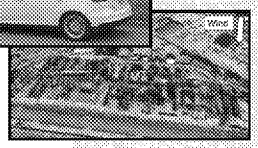




NHSRC's Laboratory EtO sterilizer



AEMD's Multi-Pollutant Control Research Facility (MPCRF)



- Laboratory and pilot-scale **source** emissions characterization
  - Stationary diesel genset
  - Multi-Pollutant Control Research Facility (MPCRF)
  - EtO sterilizer
- Field studies
  - Rural and urban settings
  - Near-source
  - Fugitive emissions
- Geospatial measurement of air pollution (GMAP) for source and community impact assessment

Where are we now?

Deliberative Process / Ex. 5

Where are we going from here?

Deliberative Process / Ex. 5

¿¿Questions??

For further information or more in-depth discussion, please contact us:

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