



Air, Climate, and Energy (ACE) Emissions and Ambient Methods for Air Toxics and Contaminants of Emerging Concern

BOSC Subcommittee Meeting, October 12 - 14, 2021
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- Hazardous Air Pollutants (HAPs)
 - Commonly referred to as “air toxics”
 - Subset of 187* air pollutants (Clean Air Act §112) known or suspected to
 - Be acutely toxic
 - Cause chronic human health effects such as cancer, or
 - Have adverse environmental and ecological effects
 - Includes VOCs, SVOCs, acids, metals and other compound classes
 - Sources
 - Anthropogenic (i.e., mobile sources, major stationary sources, area sources),
 - Natural (e.g., wildfires)
 - Can be emitted as well as formed by photochemical reactions (e.g., formaldehyde, acetaldehyde)

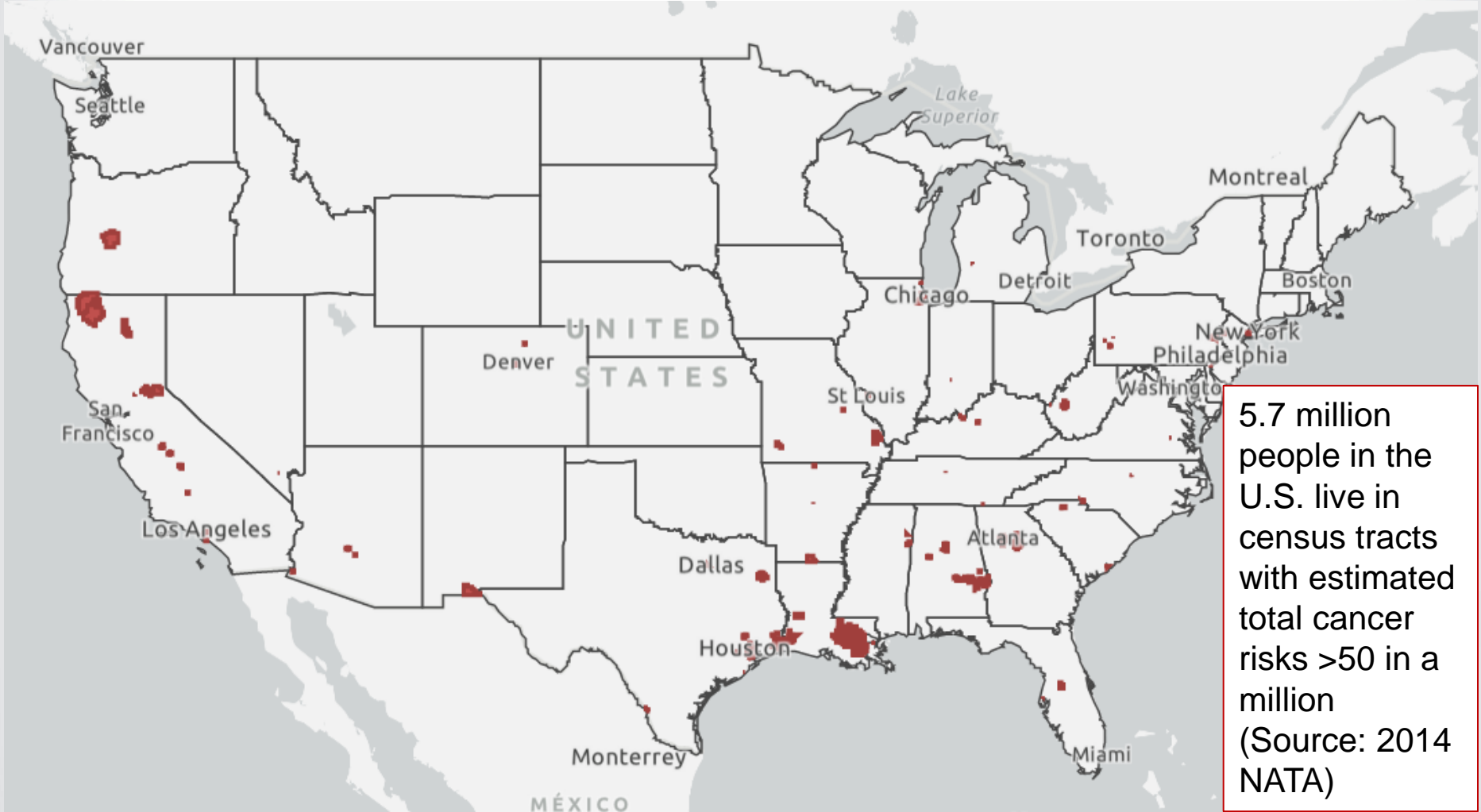
*Will increase to 188 as EPA proposed on June 11, 2021 to add 1-bromopropane.

- Chemicals with relatively recent environmental and health concerns
 - Only recently synthesized in large scale, or
 - New toxicological evaluations indicate higher potential for harm, or
 - Only recently detected using improved measurement methods
- PFAS (Per- and polyfluoroalkyl substances)
 - Persistent chemical with wide use and continuing concerns
 - EPA Council on PFAS (April 2021) and ORD wide research strategy
- EtO (Ethylene oxide)
 - Listed as a HAP
 - More potent carcinogen than previously understood
 - Greater need to understand sources contributing to exposures and risks
 - Importance of EtO in medical equipment sterilization underscored by COVID-19 pandemic
 - Focus on impacted communities and ambient monitoring





Air Toxics Concerns

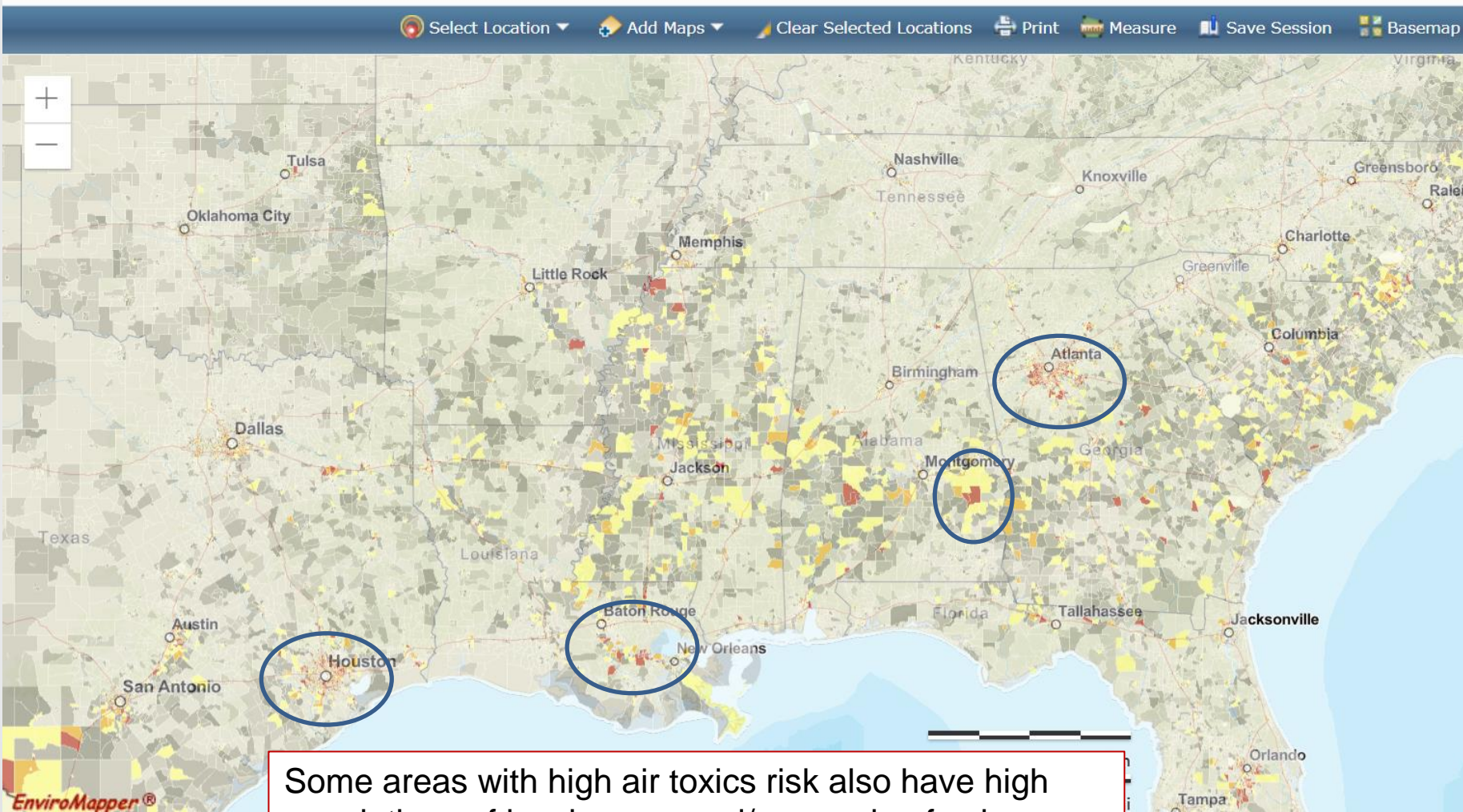


5.7 million people in the U.S. live in census tracts with estimated total cancer risks >50 in a million (Source: 2014 NATA)



Air Toxics and Environmental Justice

EPA EJSCREEN EPA's Environmental Justice Screening and Mapping Tool (Version 2020)

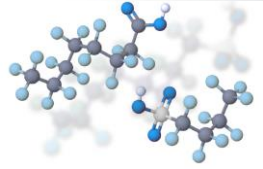


Some areas with high air toxics risk also have high populations of low-income and/or people of color

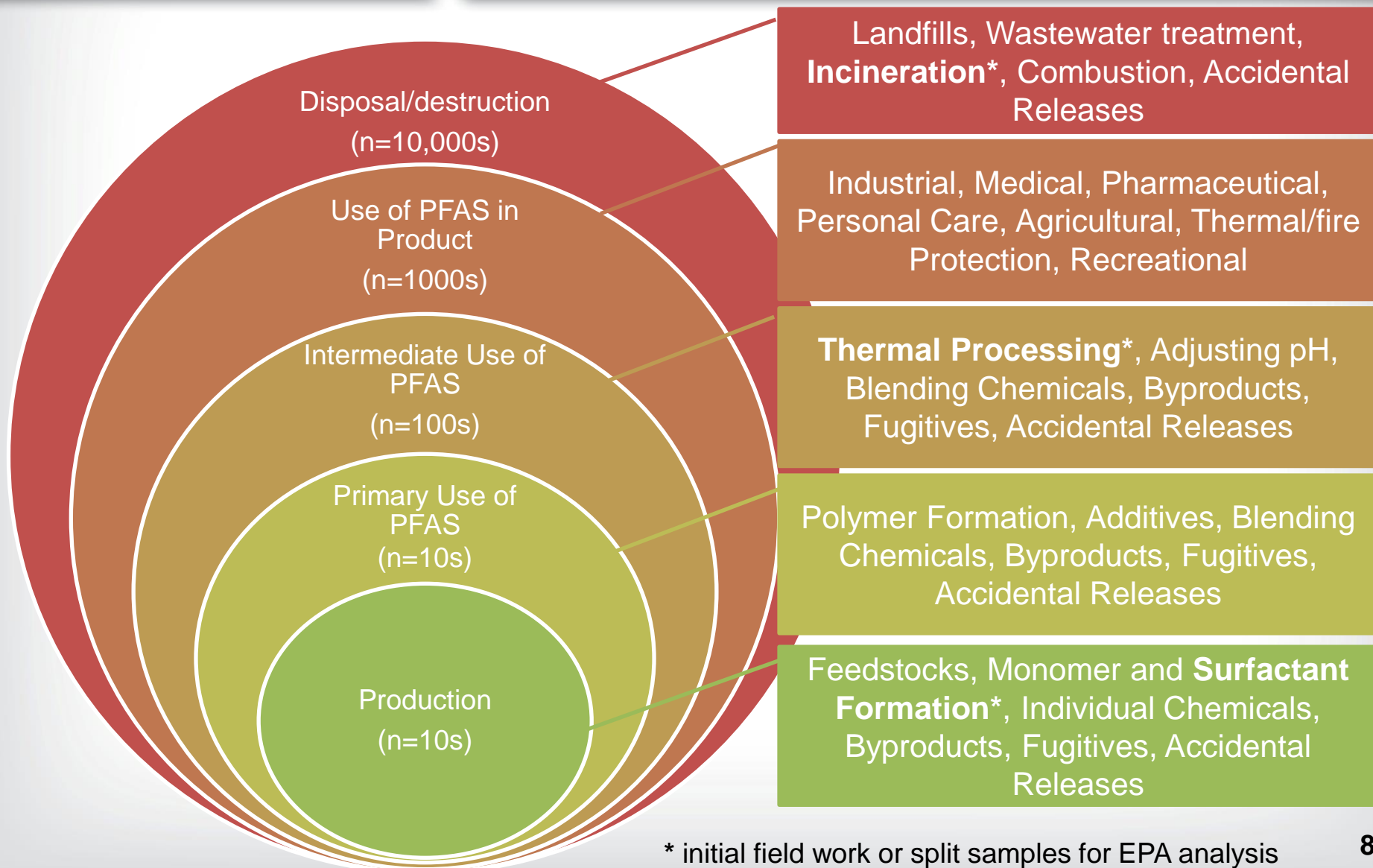
- Concerns:
 - Exposures to air toxics such as benzene and formaldehyde contribute to elevated cancer risk in many communities, including those with environmental justice concerns.
 - Air emissions and deposition are potentially significant routes of exposure.
- Research activities:
 - Growing understanding about exposures to air toxics requires new and expanded methods to measure hazardous air pollutants (HAPs), especially in disproportionately impacted communities.



- Concerns:
 - Strong C-F bonds are highly resistant to breakdown, persist in the environment and bioaccumulate in humans and animals
 - Exposure to certain PFAS chemicals can lead to adverse human health effects
 - Air emissions and deposition are potentially significant routes of exposure
 - Ubiquitous
- Research activities:
 - Validated methods to detect and measure targeted and total PFAS emitted from sources, in ambient air, and deposited onto soils and water bodies
 - Models of fate and transport of PFAS emitted from production and disposal
 - Approaches for measuring emissions impacts of PFAS thermal destruction methods, including products of incomplete combustion




Many Sources of PFAS



* initial field work or split samples for EPA analysis

- Concerns:

- Use in medical/dental sterilization; fumigation (spices, cosmetics, library/museum materials); chemical synthesis (e.g., ethylene glycol) 
- “carcinogenic to humans” (via inhalation route) and updated unit risk estimate (URE) (~60x higher than 1985 assessment) – EPA’s Integrated Risk Information System (IRIS) assessment, Dec 2016
- >30 EtO-emitting facilities nationwide could exceed 100-in-a-million risk level – EPA’s 2014 National Air Toxics Assessment (NATA), Aug 2018

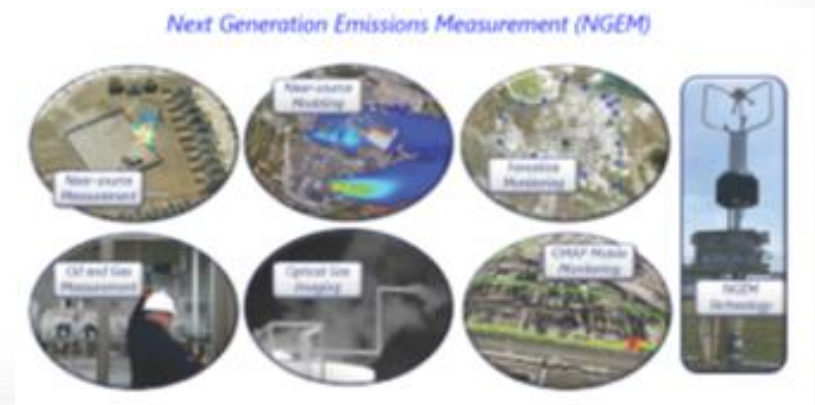
- Research activities:

- Ambient air measurement methods for source and near-source environments, including real-time instrumentation capable of detecting EtO at low concentrations (ppt)
- Better understanding of emissions from all sources (point, area, mobile), including from motor vehicles (on-road and non-road) under varying technology, fuel, and operating conditions
- Improved CMAQ modeling of EtO chemistry, fate, and transport (currently modeled but emissions are highly uncertain)

- Developing methods for measuring PFAS air emissions, ambient PFAS concentrations, and deposition
 - source emissions, including after controls installed
 - thermal destruction, and measurement of products of incomplete combustion
- Modeling PFAS fate and transport using the CMAQ model
- Measuring emissions of EtO
 - Mobile sources
 - Fugitive sources
 - Background and near-source emissions
- Developing real time ambient EtO measurement methods
- Improving CMAQ modeling of EtO fate and transport



- Analyzing spatial patterns of VOC HAP concentrations in frontline communities
- Developing methods to measure fugitive air toxics emissions from oil and gas operations
- Conducting field evaluations of methods for near source VOC HAP monitoring
- Developing a citizen science approach to use odors to identify potential air toxics emission sources





Charge Question 1

The ACE research program is implementing research to develop new methods to quantify source and near-source emissions, as well as ambient levels of toxic air pollutants and contaminants of emerging concern. These methods are needed to identify pollutant sources and levels of exposure for communities and individuals.

- **What suggestion(s)/recommendation(s) does the Subcommittee have on ORD's implementation of its air toxics and contaminants of emerging concern measurements methods research, and how this research will improve our understanding of these pollution sources and exposures, particularly for disproportionately impacted communities? [RA1, RA2, RA4]**

- ORD scientists from the Center for Environmental Measurement (CEMM) are addressing these scientific challenges.
- Next, Alice Gilliland will provide an overview of the Centers' scientific approaches to deliver outputs and products related to air toxics and emerging air contaminants of concern.

