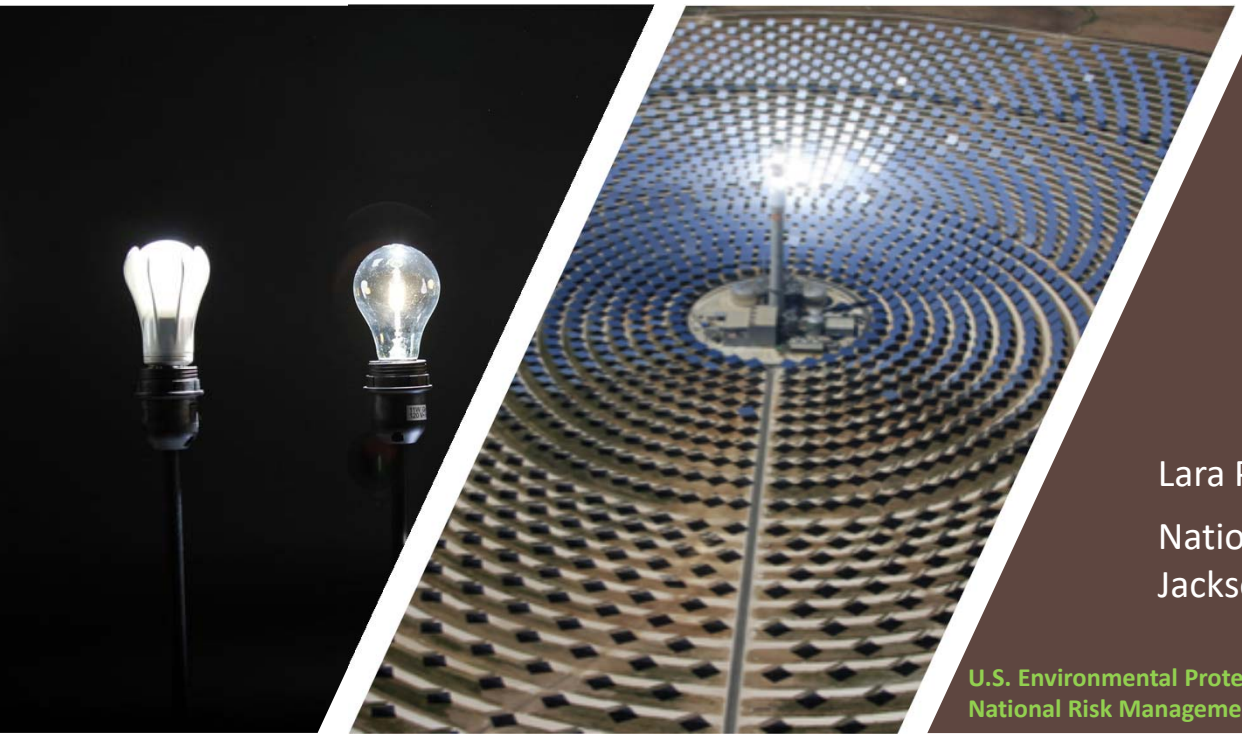


Ensuring the Best from Our Work Despite Challenges

Lara P. Phelps

National Environmental Monitoring Conference
Jacksonville, FL – August 6, 2019

U.S. Environmental Protection Agency, Office of Research & Development
National Risk Management Research Laboratory, Air and Energy Management Division

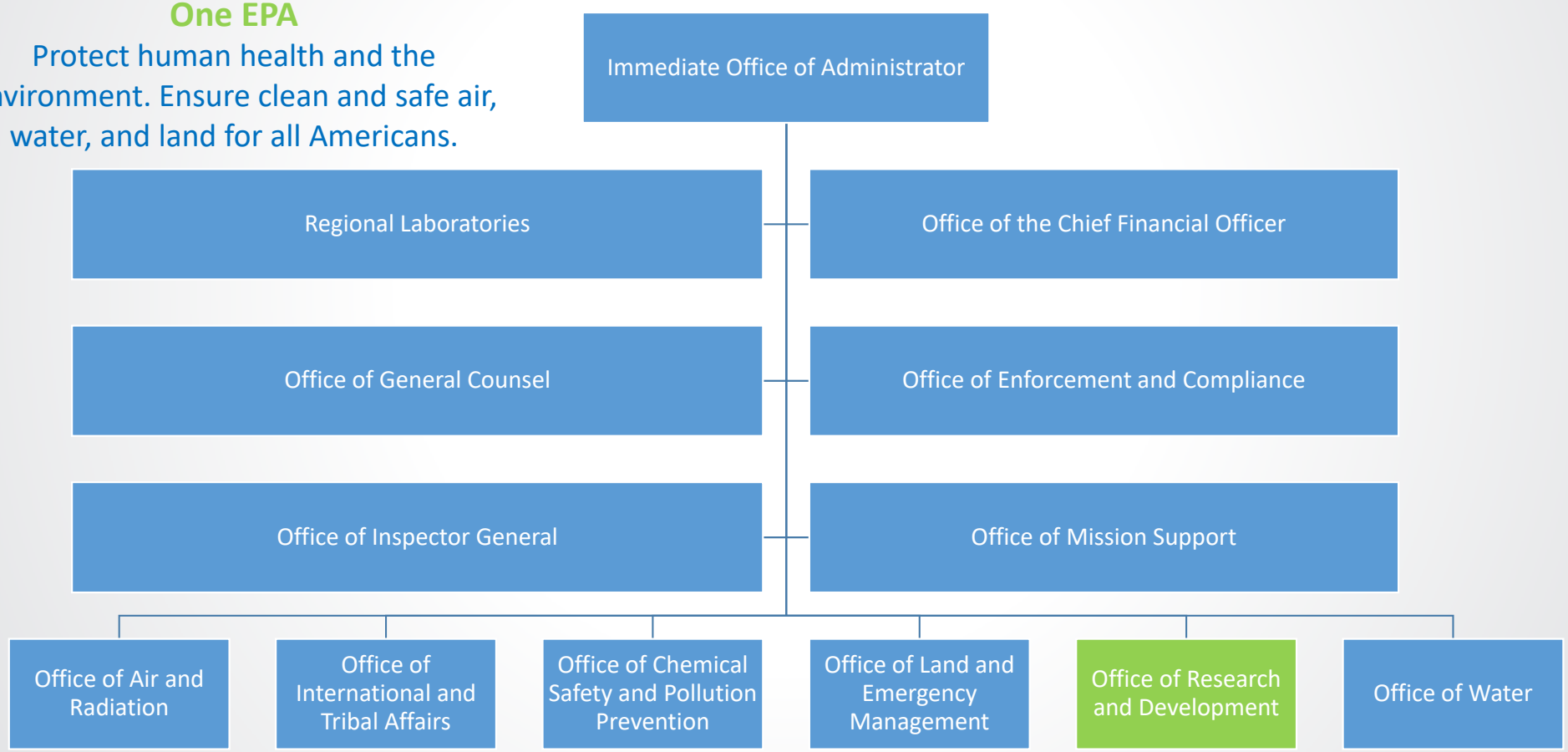
GENERAL OVERVIEW

- Structure, Mission, and Vision
  - U.S. Environmental Protection Agency
  - Office of Research and Development
  - National Research Programs
  - National Risk Management Research Laboratory
- Leveraging Resources and Advancing Research
  - Examples of Collaborative Projects
  - Next Generation Emissions Measurements (NGEM)
  - Measurement and Characterization Tools
  - Research Underway and Emerging
- Summary
- Questions

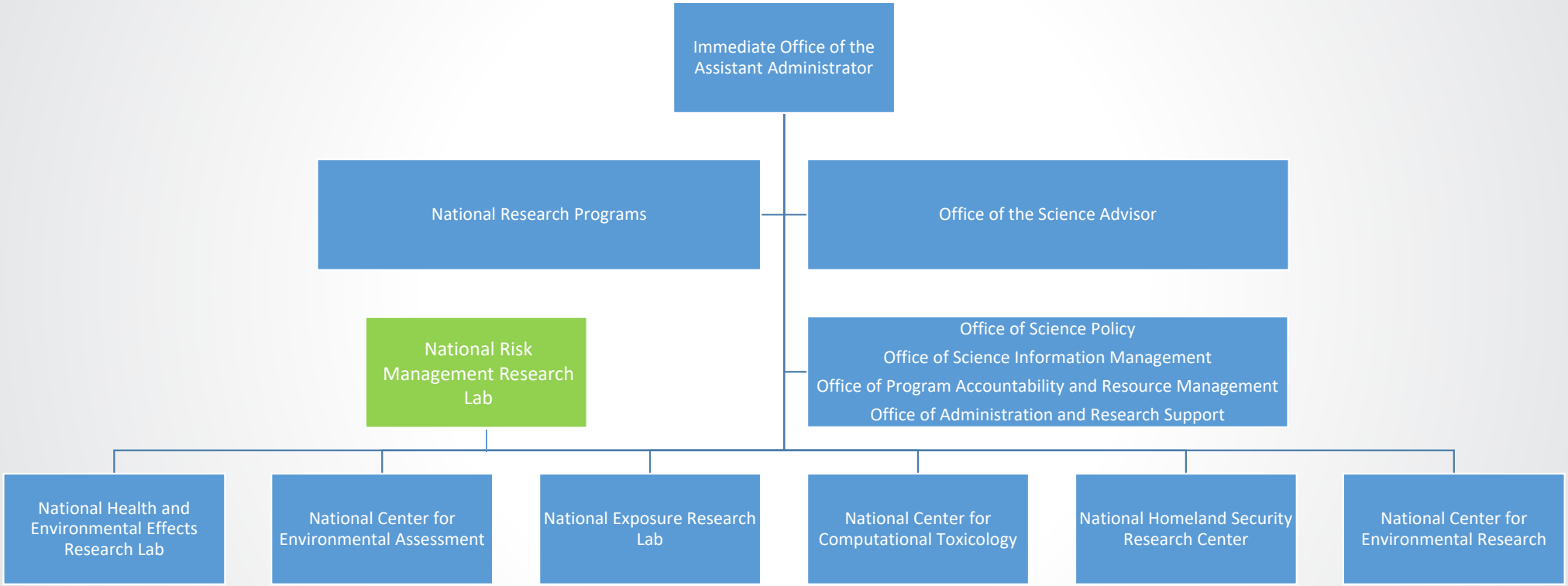
EPA ORGANIZATIONAL CHART

One EPA

Protect human health and the environment. Ensure clean and safe air, water, and land for all Americans.



ORD ORGANIZATIONAL CHART



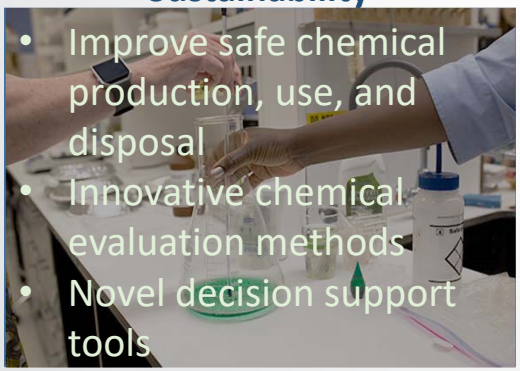
NATIONAL RESEARCH PROGRAMS

Air & Energy

Sustainable & Healthy Communities

Homeland Security

Chemical Safety for Sustainability



Human Health Risk Assessment

Safe & Sustainable Water Resources

NATIONAL RISK MANAGEMENT RESEARCH LABORATORY (NRMRL)

- NRMRL
  - Air and Energy Management (RTP, NC)
  - Land and Materials Management (Cincinnati, OH)
  - Water Systems (Cincinnati, OH)
  - Groundwater, Watershed, and Ecosystem Restoration (Ada, OK)

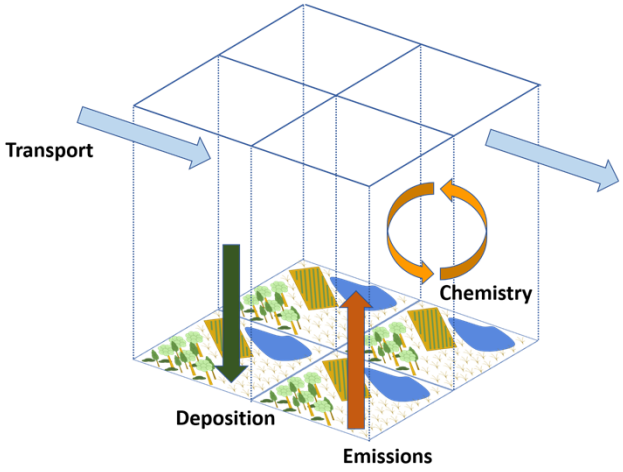
Air and Energy Management Division

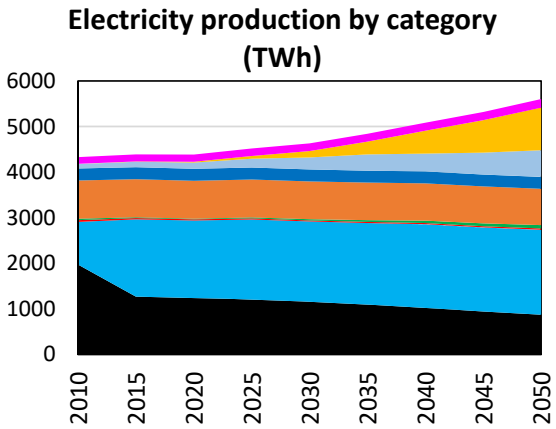
- Perform advanced method development for air pollutant sampling, characterization, and analysis;
- Provide solution-oriented mitigation of air pollutant sources;
- Develop robust decision-making tools to minimize environmental impact of industrial sources; and
- Assess environmental implications of energy system choices.

- Accomplish our mission through diverse stakeholder partnerships from industry collaborators to government Agency's to everyday citizens.

LEVERAGING & ADVANCING RESEARCH

- Atmosphere-biosphere Exchange – Nitrogen and Ammonia (John Walker)
- Global Change Assessment Model (GCAM) with GLIMPSE Interface (Dan Loughlin)
- Green Infrastructure Impact on Air Pollution and Health (Richard Baldauf)
- Leaching Environmental Assessment Framework (LEAF) (Susan Thorneloe)
- MARKEL/TIMES Model for NYC (Ozge Kaplan)
- VOC Emission Tracker (VET) Detecting Fugitive Air Toxic Emissions (Sue Kimbrough)
- Household Energy Research (Jim Jetter)
- And so much more……





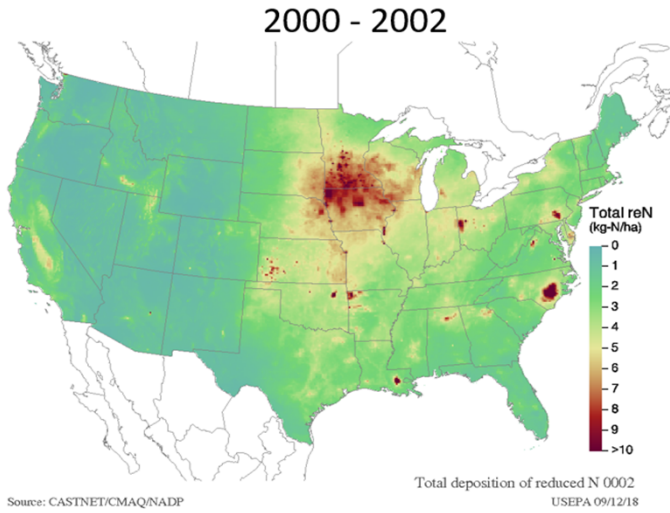
ATMOSPHERE-BIOSPHERE EXCHANGE

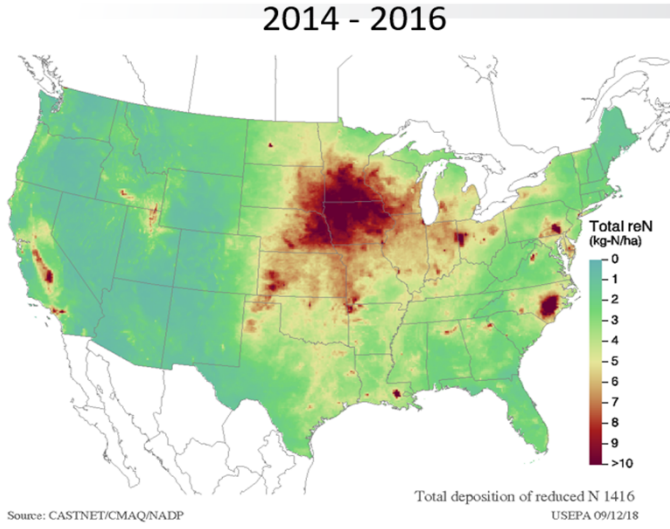
- Collaboration has recently focused on reactive nitrogen – “Air Pollution and its Impacts to Ecosystems and Wellbeing”.
  - Internal research laboratories
  - Interagency Agreement with U.S. Forest Service

- Process-level flux measurements, field scale modeling, improvement of monitoring methods.

- Supports the review of the secondary National Ambient Air Quality Standards (NAAQS) for nitrogen dioxide, sulfur dioxide, particulate matter, and critical loads for nitrogen and acidity.

Atmospheric deposition of NH_3 and NH_4^+





NEXT GENERATION EMISSIONS MEASUREMENTS (NGEM)

Personal Sensors

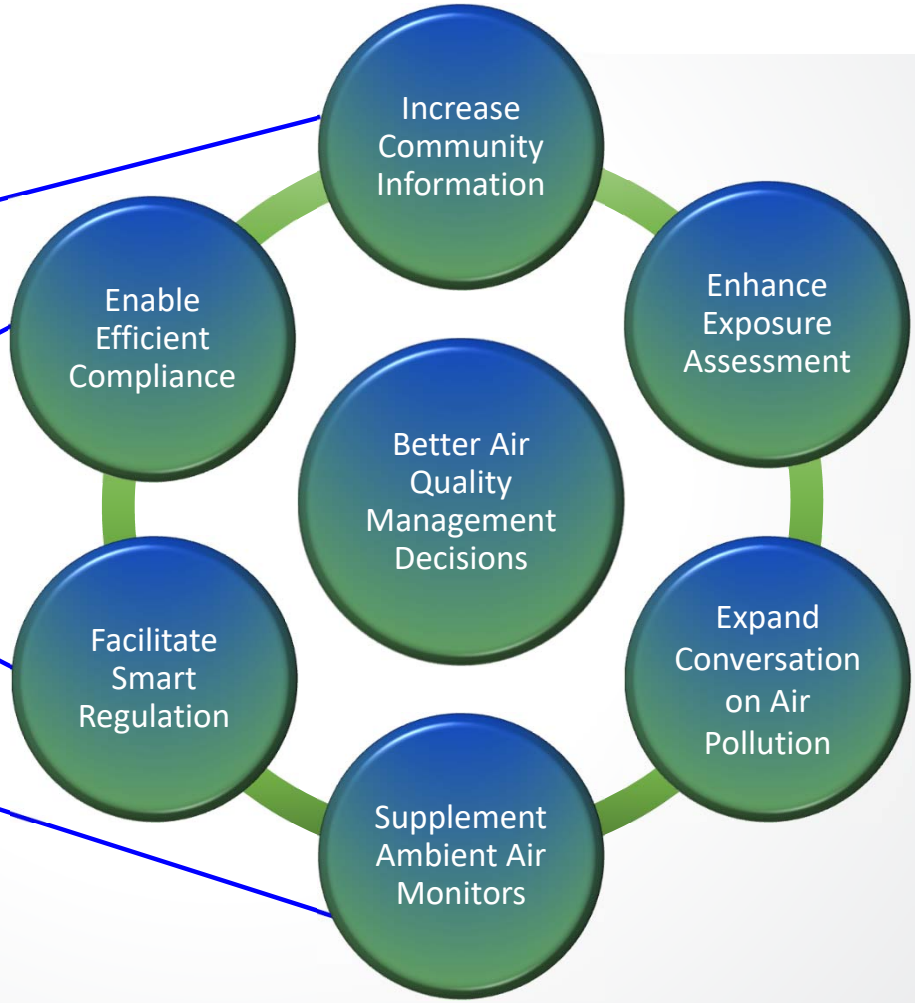
Ambient and Indoor Sensors

Sensors for Industry / Energy / Near Source Impacts

(Eben Thoma, Rachelle Duvall)

NGEM

- Reduce emissions
- Improve work practices
- Reconcile inventories
- Improve transparency
- Enable new management strategies

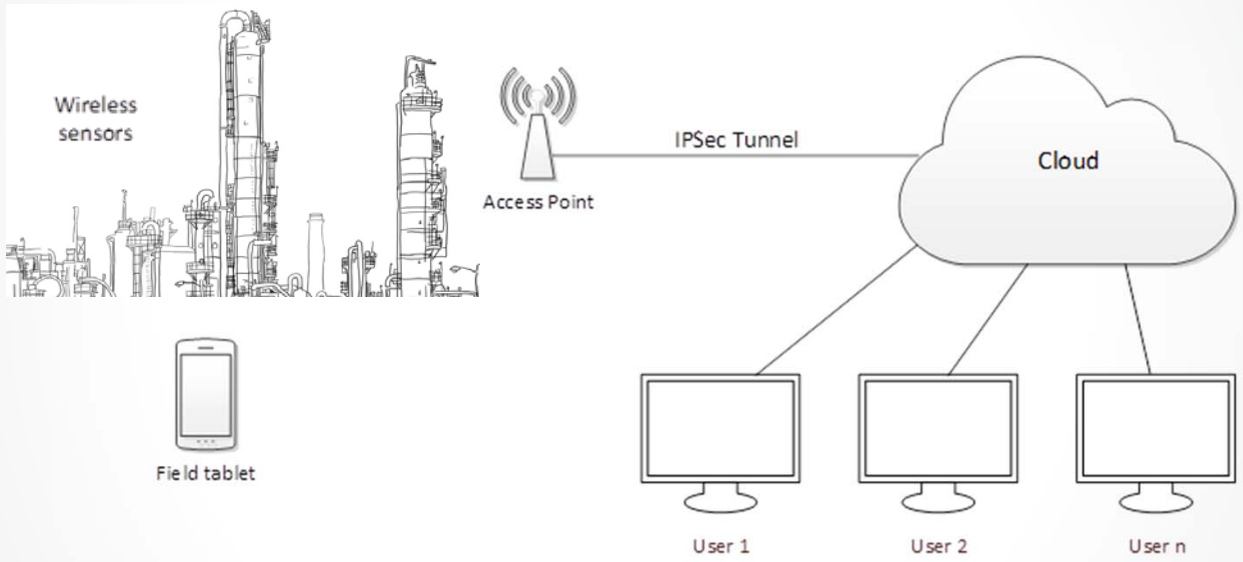


FHR-MOLEX-EPA LDAR INNOVATION CRADA

(Eben Thoma)

- Flint Hills Resources (FHR), Molex LLC, and EPA ORD initiated a cooperative research and development agreement (CRADA) in June 2017.
- Objective – Develop and validate innovative leak detection and repair (LDAR) approaches that can help find leaks soon after they occur.
- Currently – Industry uses manual Method 21 to inspect each component for leaks.
  - Inefficient: Most components aren't leaking.
  - Expensive: Safety exposure, high human capital churn.
  - Non-efficacious: Doesn't catch everything, long time between checks.
  - Error-prone: Record keeping for millions of inspection events.
- Vision – Work together to use emerging sensor technologies to do a better job of protecting the environment and save companies money.

THE SENSOR BASED SYSTEM APPROACH



The new approach is a multilayered system that includes sensors, software, data, and procedures.

WHAT WE KNOW SO FAR ABOUT LDAS

- A 24x7 LDAS network is a great partner with “on demand” Optical Gas Imagining (OGI).
- Sensors can detect leaks that are well below what OGI can routinely see, but are not as sensitive as Method 21 (as one would expect).
- It’s all about required sensor node density…..Is it cost effective?
- Small leaks as low as 1.5 g/hr can be detected in relatively open settings from significant distances.
- What happens in a complex process unit where wind flow is obstructed and more interferences exist? Can realistic node densities still be achieved?
- Initial results indicate that the key to high detection performance is in NGEM data analytics that can perform collaborative detection schemes.

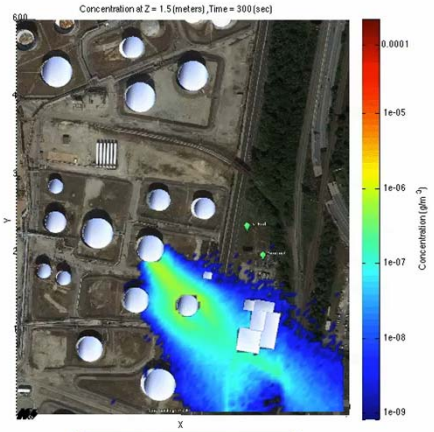
NGEM – PRESENT AND FUTURE

- New approaches for difficult sources
- Sensors in facilities and in communities
- Crowdsourcing odor and other observations
- Hybrid measurement/model systems
- Predictive and transparent informetric

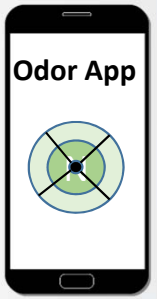
Metrology

Facility Sensors

Personal and Community Sensors



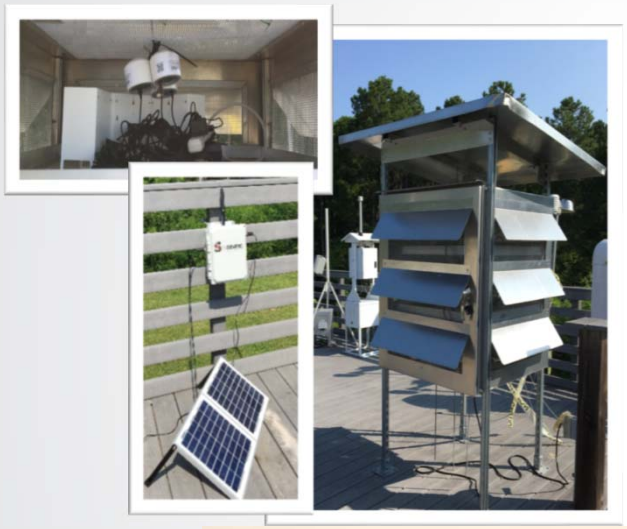
Informetrics



Metadata

Geospatial

ORD EMISSION MEASUREMENT TOOLS



Low-cost PM Sensors

Method Modifications

USGS UAS with ORD "Kolibri" Sensor/Sampler

ORD EMISSION CHARACTERIZATION TOOLS

- 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

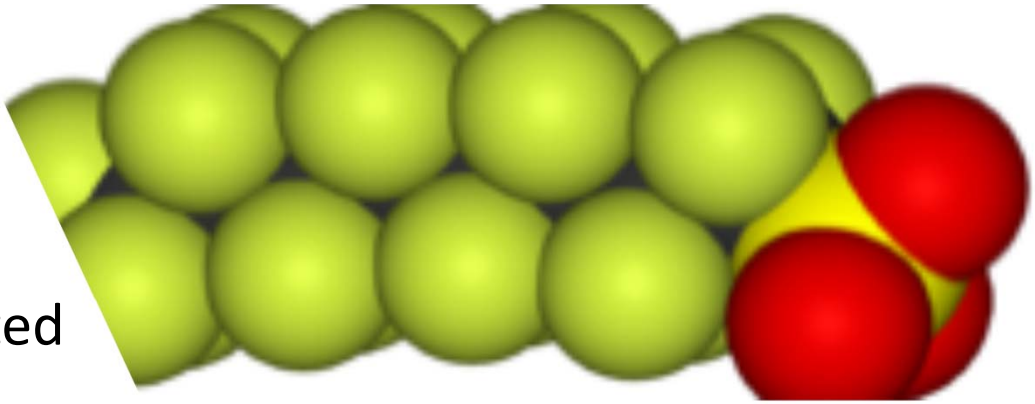
AEMD's Stationary Diesel Facility (200kW genset)

NHSRC's Laboratory EtO sterilizer

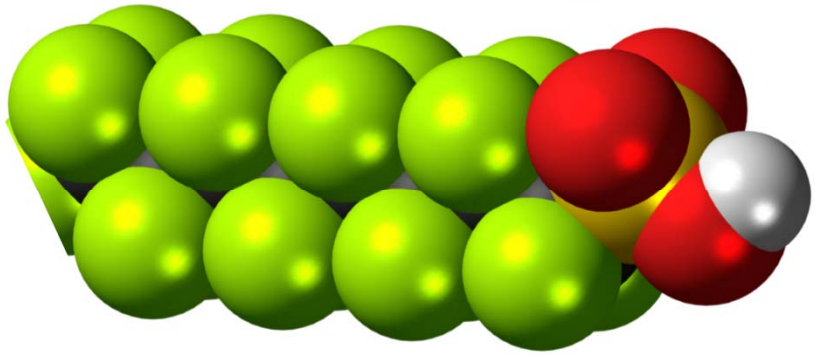
AEMD's Multi-Pollutant Control Research Facility (MPCRF)

EMERGING AREAS

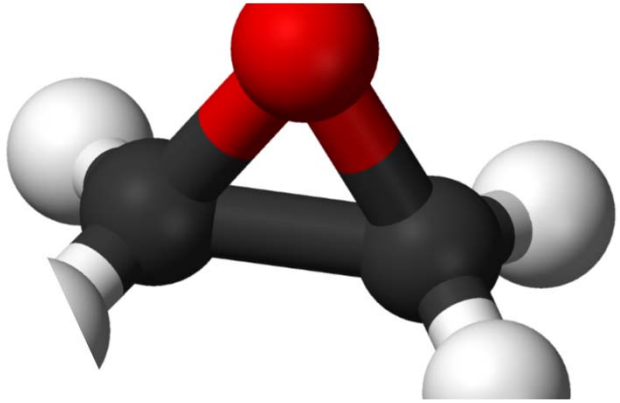
Per-fluorinated



Poly-fluorinated



Ethylene Oxide



SUMMARY

- With the ability to measure our environment at previously unseen levels of detection, the landscape of science is constantly evolving.
- Emerging environmental issues and contaminants of concern are being investigated to answer the immediate questions of uncertainty with regards to public health and exposure.
- Novel, innovative technology is being unveiled at a rapid pace and evaluated for relevance in measurement and monitoring priority areas.
- The development or application of an innovative approach; improvement in problem solving capacity; and formation of successful alliances with stakeholders are strategic means for advancing our knowledge to the rapidly changing surroundings.

QUESTIONS

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