Leak Detection and Recent Emissions Research Activities from US EPA's Air, Climate, and Energy Program

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US EPA/Office of Research and Development/Air, Climate, and Energy National Research Program

US Department of Transportation
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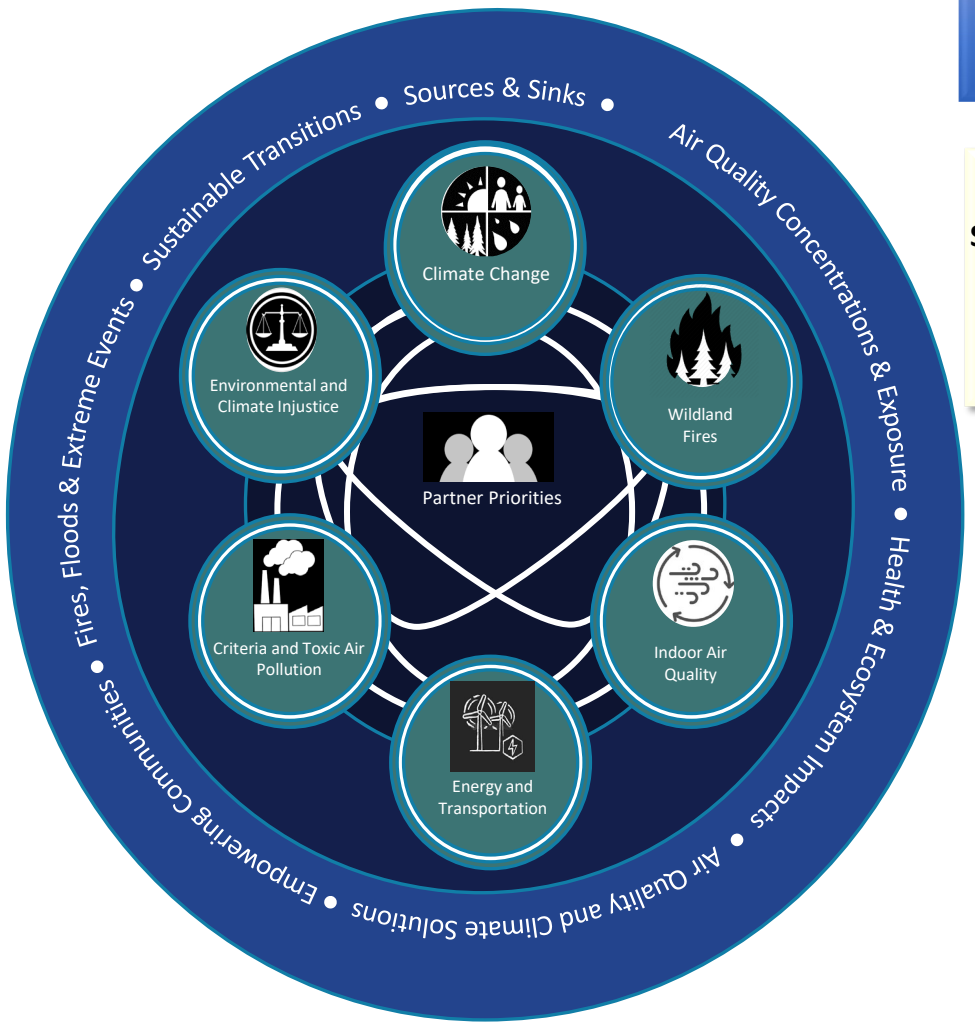
Air, Climate, and Energy Research Program

A holistic vision to reduce environmental and health inequities AND respond to the impacts of climate change.



Topic 1: <u>UNDERSTANDING</u> Air Pollution and Climate Change and Their Impacts on Human Health and Ecosystems

Research Area 1: **Sources and Sinks** of Air Pollution and Climate Forcers

Research Area 2: **Air Quality Concentrations and Exposure** Characterization: Measurements

Research Area 3: **Air Quality Concentrations and Exposure** Characterization: Modeling

Research Area 4: Health **Impacts** of Air Pollution and Climate Change

Research Area 5: Ecosystem **Impacts** of Air Pollution and Climate Change

Topic 2: <u>RESPONDING</u> to Risks and Impacts and Preparing for the Future

Research Area 6: Scientific Support for Climate Change and Air Quality Policy Solutions

Research Area 7: Empowering communities and individuals to improve public health

Research Area 8: Responding to Risks of Fires, Floods, and Other Extreme Events

Research Area 9: Transitions to a Sustainable Future

Air, Climate, and Energy Strategic Research Action Plan (Fiscal Years 2023-2026)

EPA-ORD Interest in Emissions and Leaks

Provide high quality scientific and technical information and data for:

- National emissions inventories
- International reporting (e.g. GHG reporting)
- Regulatory and voluntary emissions reductions programs

Research to improve measurement of emissions from multiple sectors and sources

Fugitive emissions (leaks), malfunctions, and area sources:

- Unexpected or unknown until discovered
- Difficult to measure and control
- Difficult to represent in inventories
- Difficult to model (impacts are uncertain)
- Potentially located near populations

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Next Generation Emission Measurements (NGEM)

ORD collaborates with industry, state and local regulators, communities and technology companies to develop and use new measurement and information technologies to better protect the environment, create more efficient emission management strategies, and improve community wellbeing.

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1. Quick Response (QR) code links to EPA's NGEM website Individually numbered QR codes will be used throughout with a full list of QR code addresses found at the end of the presentation

Problem: malfunction on an oil and gas site

- VOC and methane emission
- Made visible by NGEM
- Unmanned site operation
- When did it start?
- How long did it last?

This source is easily detectable by several forms of NGEM

Need to find it and fix it fast

NGEM combines multiple types of data collection

Fenceline Sensors

In-plant Sensors

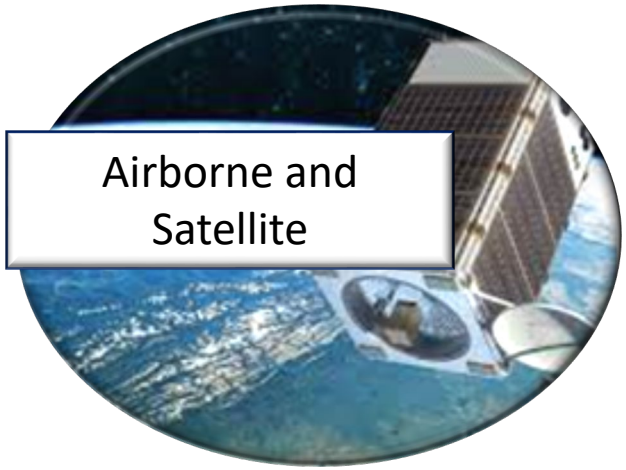
Near-source Sampling

Mobile Measurements

Open-path Fenceline

Optical Gas Imaging

Field Instruments



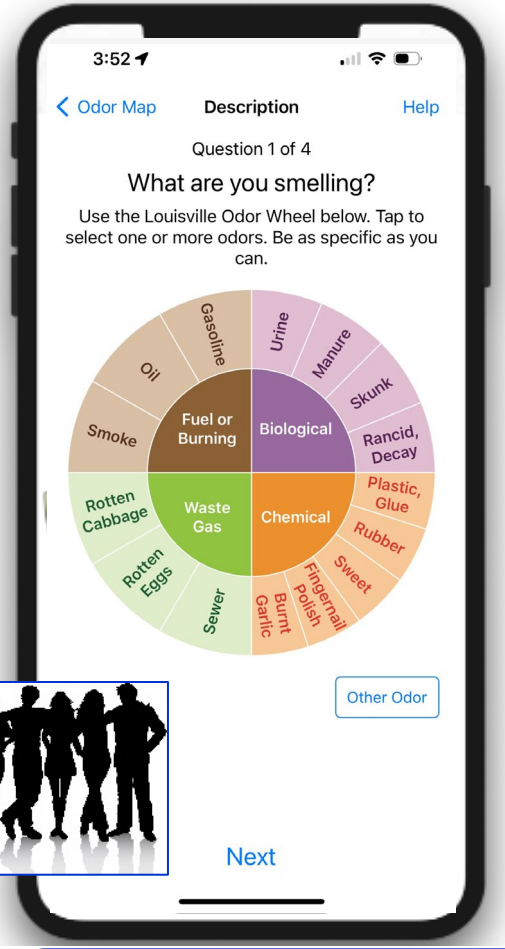
Airborne and Satellite

Participatory Science (EPA Odor Explore App)

NGEM combines multiple types of information

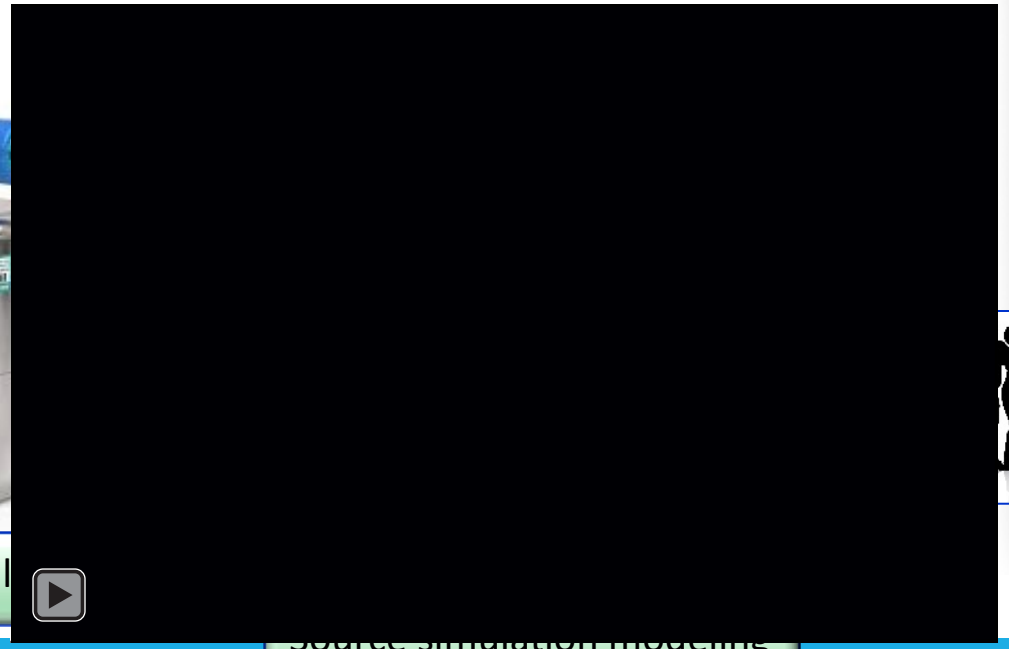
- Air pollutant and wind data
- Emission source modeling
- Optimally acquired laboratory samples
- Odor information near sources

EPA Beta Odor Explore App



Measurements

Lab anal



Source simulation modeling

Community supplied data

EPA ORD has helped advance NGEM technologies

- Example: **SPod VOC fenceline sensor**
- EPA's prototype sensor pod (SPod) combines non-speciated VOC and wind information to help detect, locate, and quantify nearby emission sources
- SPods can automatically trigger a canister grab sample while in an emission plume for laboratory analysis to determine what is in the air
- Commercial variations of the SPod are now being used by industry, regulators, and community groups

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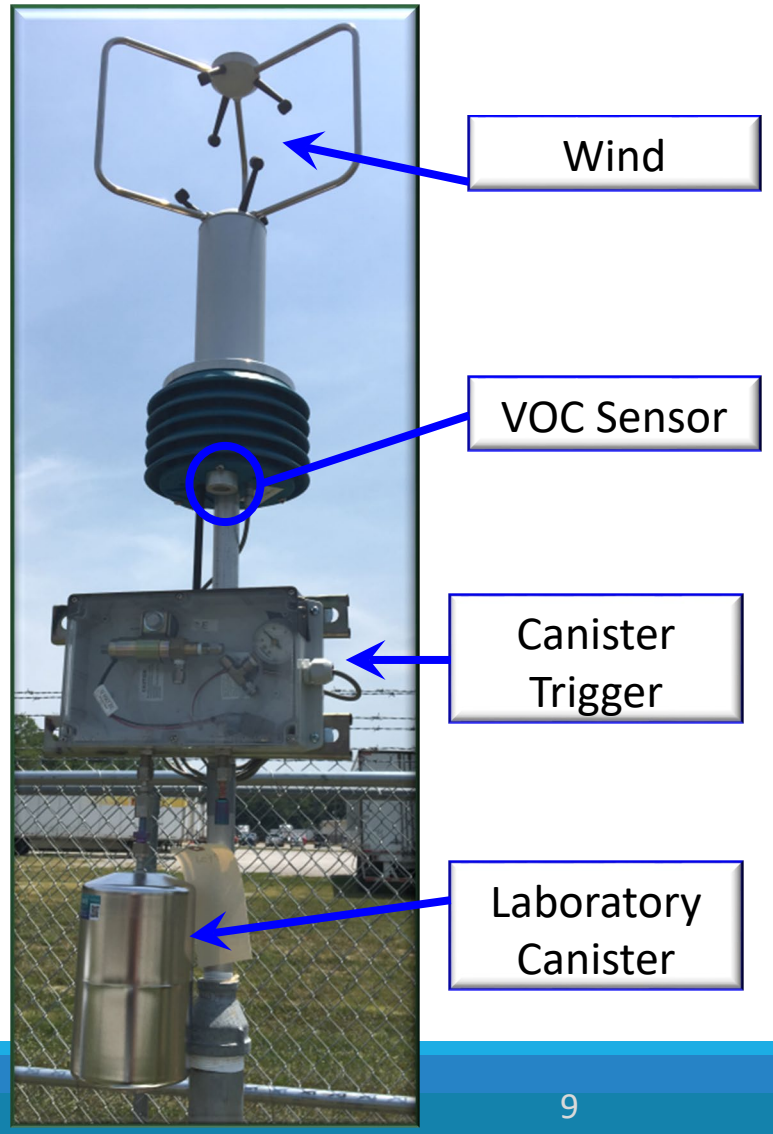


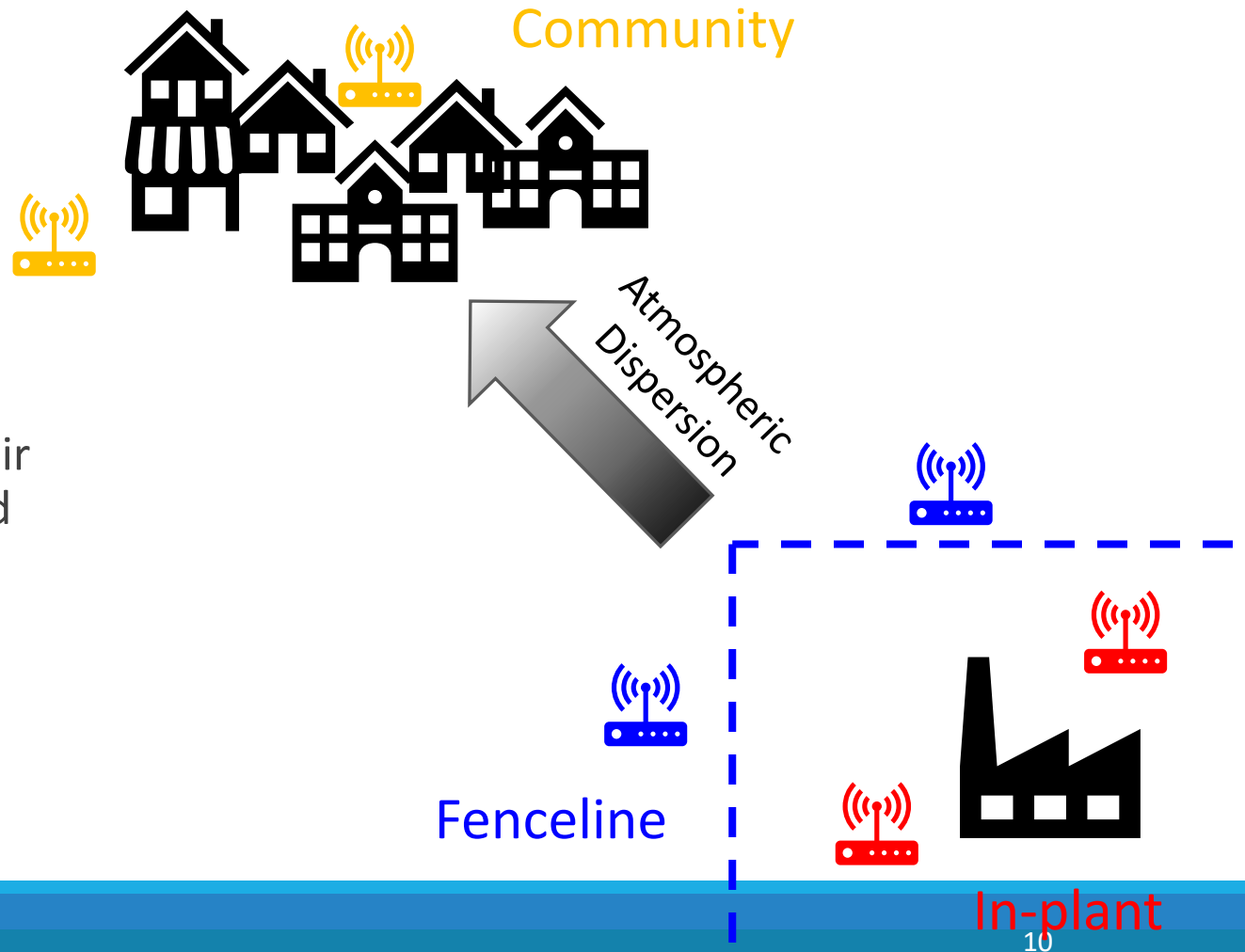
Requirements vary by application and distance

Near emission sources:

- Lower sensitivity technologies
- Detect a group of compounds (e.g., VOC sensors)

Farther from emission sources:,

- Higher sensitivity technologies
- Compound-specific instruments for certain air toxics like ethylene oxide, 1,3-butadiene, and benzene



NGEM approaches vary by distance to the emission source

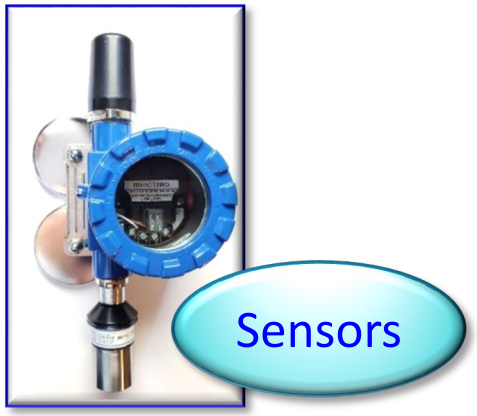
Community Measurements

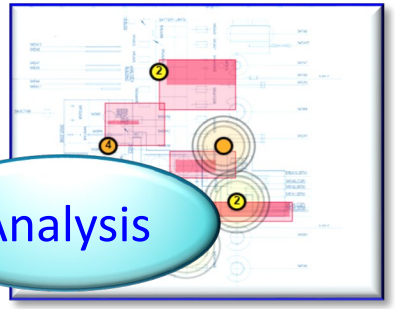
Fenceline Monitoring

Emission

In-plant Leak Detection

In-plant leak detection sensor network





- Developed with industry
- VOC sensors placed in many locations inside the facility “stand watch” for leaks
- Automated analysis sends alerts
- Repair crews find the issue and fix it faster

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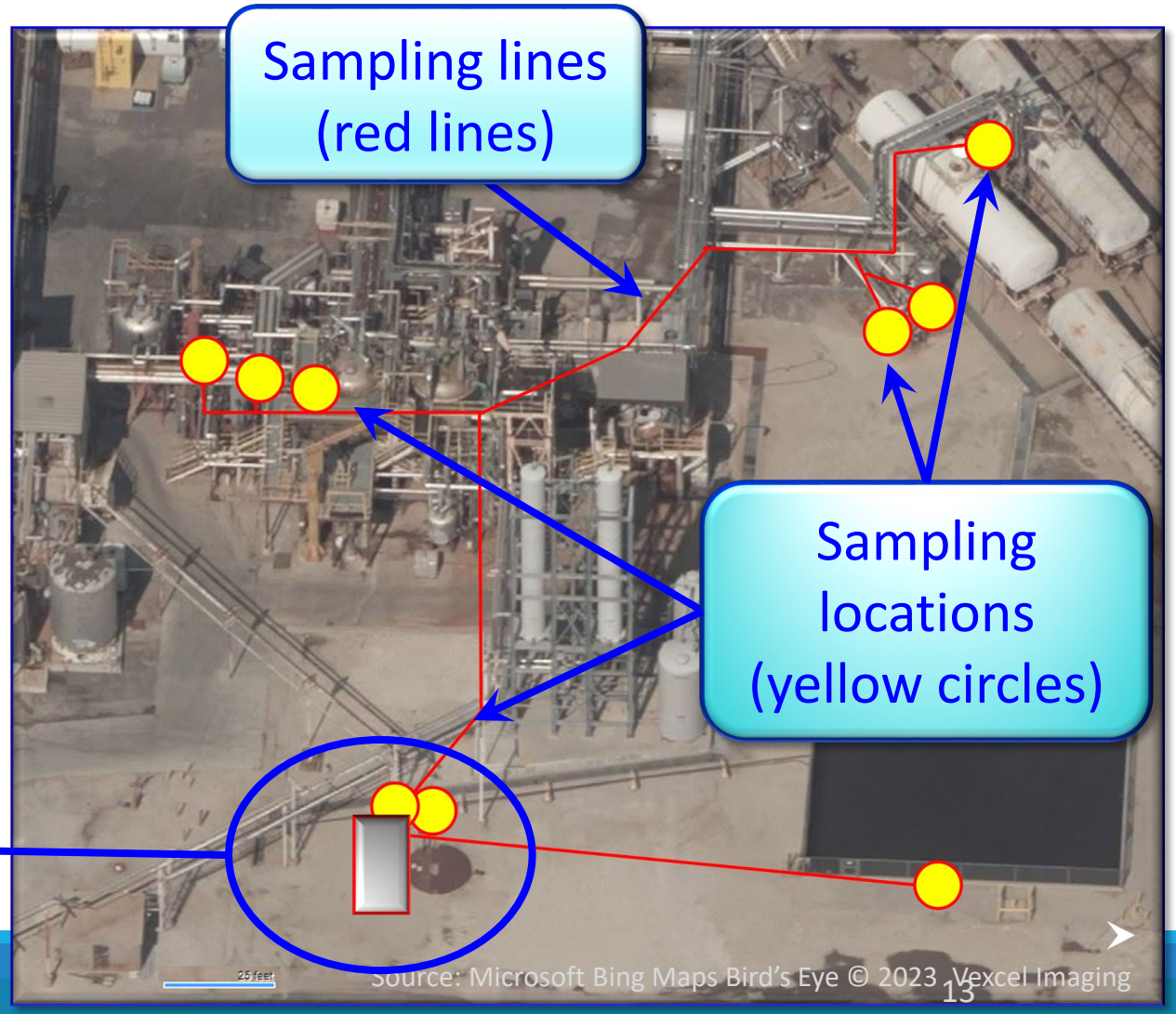
In-plant leak detection for toxic air pollutants

- Developed with industry
- For some air pollutants, we need to measure the specific compound
- We need higher performance and more expensive NGEM instruments
- In these cases, the air sample is brought to the NGEM instrument by long sampling lines



EPA's Odor Explore App and ROCS

- EPA's Odor Explore App adds new dimensions to odor reporting (in pilot testing)
- Reporting an odor is easy and intuitive
- Trigger canister samples during odor events using new remotely operated canister samplers (ROCS)
- Combine odor data with other NGEM measures to support solution development
- **Study** in Rubbertown (industrial area of Louisville, Kentucky)

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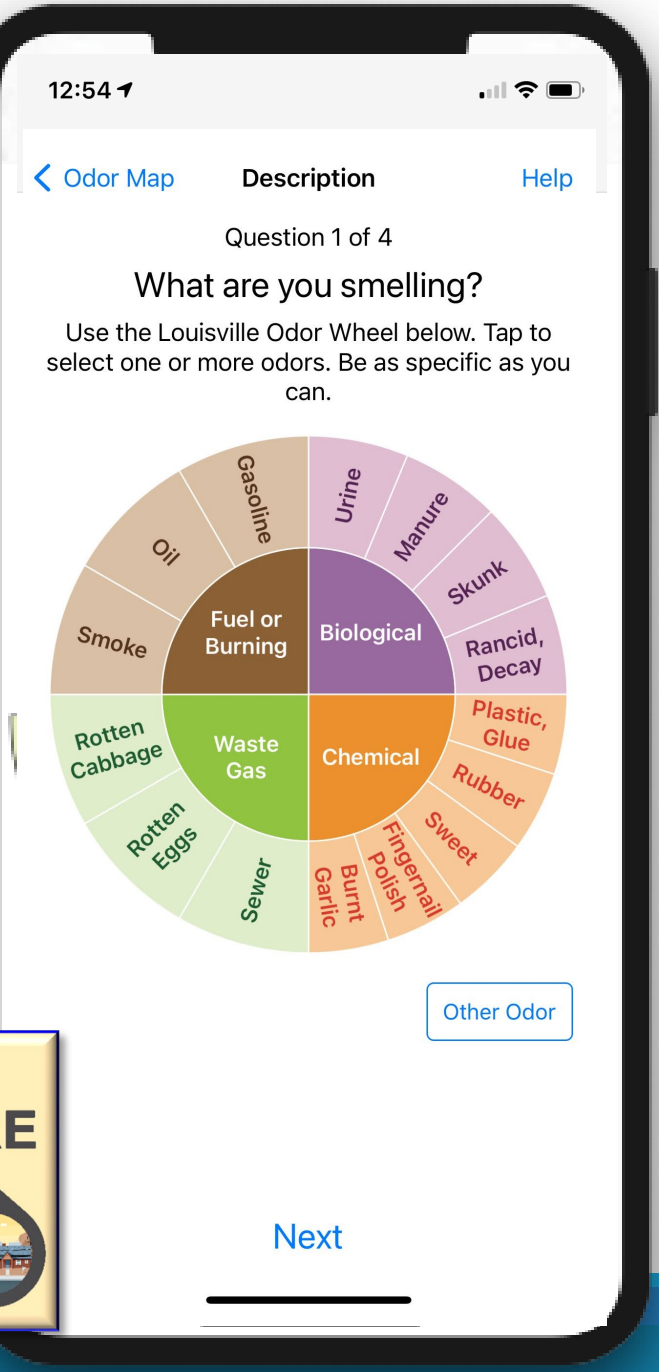

Examples of NGEM usage

- Industry is beginning to use NGEM in oil and gas production, petrochemical facilities, and landfills to reduce emissions
- Regulators are beginning to use NGEM to inform compliance with existing regulations, write new measurement-based rules, and use newly available data to improve source emissions inventories

EPA Refinery Fenceline Monitoring	Canada Petrochemical Fenceline Monitoring	South Coast AQMD Fenceline Air Monitoring Rule 1180	Bay Area AQMD Refining Emissions Tracking	California Air Pollution Assembly Bill	Colorado Act Concerning Emission of Air Toxics
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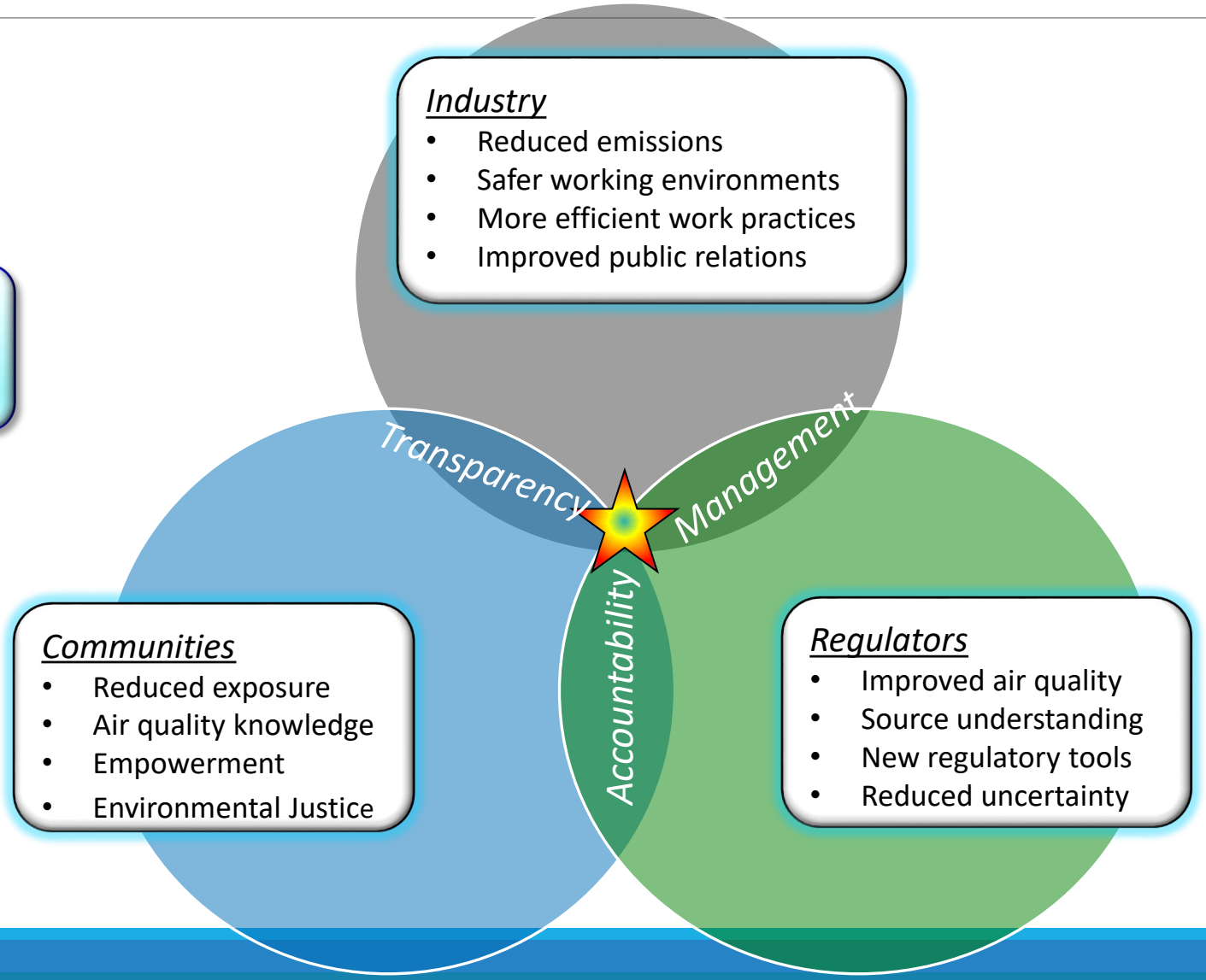
AQMD = Air Quality Monitoring District

NGEM benefits industry, regulators, and communities

Thanks!



Experts

Wyatt Champion (champion.wyatt@epa.gov):	Fenceline communities, NGEM modeling, tank emissions
Rachelle Duvall (duvall.rachelle@epa.gov):	EPA Odor Explore App and participatory science
Ingrid George (george.ingrid@epa.gov):	VOC analysis, ROCS, field air toxics NGEM
Ali Gitipour (gitipour.ali@epa.gov):	Air toxics instrumentation and near-source NGEM
Megan MacDonald (macdonald.megan@epa.gov):	NGEM data management, analytics, and SENTINEL App
Eben Thoma (thoma.eben@epa.gov):	Industrial use of NGEM and general questions

Webinars

NGEM Emission Measurements: Helping to Improve Air Quality and Source Understanding
ACE Research Webinar October 17, 2023
Presenters: Eben Thoma & Rachelle Duvall

Sensor Pods for Volatile Organic Compound Fenceline Monitoring and Data Analysis
Webinar, December 1, 2022
Presenters: Eben Thoma & Megan MacDonald

QA code web addresses cited in this presentation

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