Fenceline Ambient Monitoring

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- 15 Years Experience
- Certified Consulting Meteorologist
- Ambient Air Quality Monitoring Systems
- Meteorological Monitoring Systems
- Air Toxics
- Quality Assurance
- Independent Performance and System Audits
- Network Design, Integration, and Installation
- Data Management and Interpretation

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1. Current Regulatory Drivers
2. Monitoring Method and Implementation
3. Reporting Requirements
4. Looking Forward

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Regulatory Drivers

- Federal
- State
- Local

Federal Fenceline Monitoring Requirements

- Refinery Sector Rule
  - 40 CFR Part 63 Subpart CC §63.658
  - Passive monitoring for benzene
  - Sampling in accordance with Methods 325A and 325B
- *Prevention of Significant Deterioration (PSD)*
  - *40 CFR Part 52.21(m)*
  - *Preapplication (preconstruction) analysis*
  - *Post-construction monitoring*
    - *Monitoring for any criteria or non-criteria pollutant at EPA Administrator's discretion*
- *Clean Air Act - Section 114 Information Collection Requests (ICRs)*
  - *Chemical Manufacturers ICR*
    - *Compounds of Interest: Ethylene Oxide, Benzene, 1,3-butadiene*

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State & Local Fenceline Monitoring

- California
  - Assembly Bill 1647
    - Refineries required to develop fenceline monitoring programs
    - BAAQMD Reg. 15, Rule 12, SCAQMD Rule 1180, Valley Air District Rule 4460
  - Oil & Gas Rule –
    - upwind/downwind methane monitoring
- Colorado
  - Regulation 7
    - Methane monitoring before, during, and after pre-production operations.
- City of Chicago
  - Bulk Material Storage Rules –
    - PM_{10} fenceline monitoring
    - HAPs monitoring at the fenceline
  - Rules for Large Recycling Facilities –
    - PM_{10} fenceline monitoring near sensitive receptors
    - HAPs monitoring at the fenceline

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Monitoring Methods

- Passive Sampling

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Diffusive Passive Sampling

- Method 325A and companion Method 325B describe the methodology and placement of samplers for collecting VOC concentrations
- Stainless Steel Sorbent Tube Packed with absorbent selected on pollutant of interest
  - Carbograph 1 TDTM, Carbopack BTM, or Carbopack X®, or equivalent
- Placed along fenceline in protected hood to minimize effects of precipitation and solar heating
- Sample frequency is 14-days and can be reduced after 2 years of consecutive samples below 0.9 µg/m^3

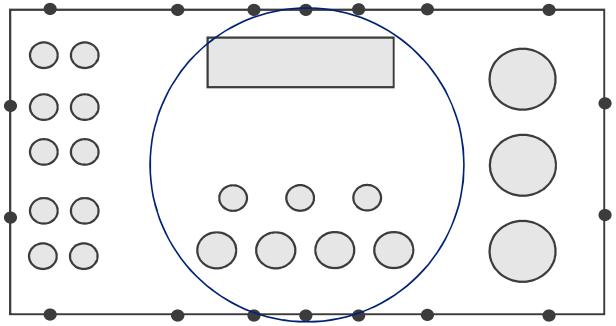
Weather hood

Stainless Steel Sorbent Tube

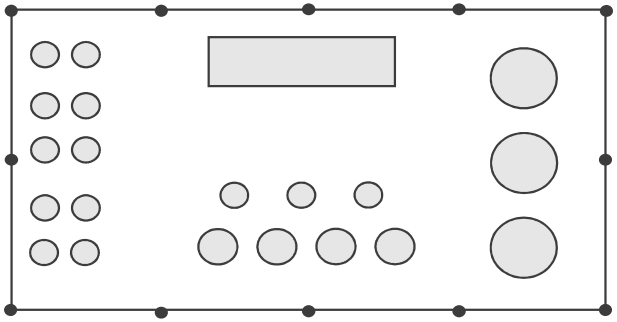
Picture source: SKC

Diffusive Passive Sampling

- Siting Considerations
  - Two options to determine quantity of passive samplers
    - First option allows placement of monitors along the fenceline at equiangular spacing circling the geometric center(s)
    - Second option suggests placement of monitors at equidistant spacing around the perimeter of the facility.
    - The choice of placement is driven by facility size and shape



Option 1 – Equiangular



Option 2 – Equidistant

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Diffusive Passive Sampling

Example Equidistant sampler placement

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Diffusive Passive Sampling

- Advantages
  - Simple device (no power or equipment required)
  - Low technical skill requirement (sample handling and shipping)
  - Certified laboratory data
  - Ease of deployment
  - Low start-up cost
- Disadvantages
  - Long lead time (sample collection, shipping, & lab analysis)
  - Moderate to high per-sample cost for analysis
  - Short-term episode detection impossible
  - Measurement interference possible due to meteorological and other environmental conditions

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Monitoring Methods

- Time Integrated Sampling

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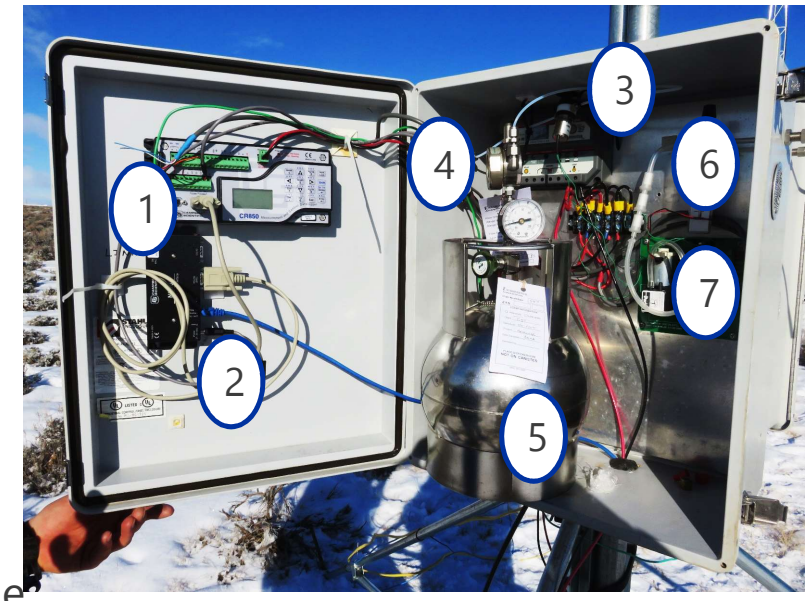
Time-Integrated Samples

- Particulate Samples
  - Filter-based Federal Reference Method (FRM)
  - PM_{10}, $PM_{2.5}$, Metals
- Summa canisters TO-14a, TO-15, TO-15A
  - Short-term samples using flow controllers and automated timers
  - 97 VOC compounds
- Carbonyls TO-11A
  - Short-term samples using pumps to draw sample air through cartridge
  - Cartridges packed with DNPH absorbing solution



1. Datalogger - controls valve on/off position
2. Telemetry - for remote communication
3. Solenoid valve - flow open/close
4. Flow Controller - regulates sample flow
5. Summa Canister
6. DNPH Cartridge
7. Sample Pump

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Time-Integrated Samples

- Advantages
  - Simple setup (low-power system)
  - Moderate technical skill requirement (sample handling and shipping)
  - Certified laboratory data
  - Sample speciation to detect several compounds
  - Can obtain short-term samples or triggered sample events
  - VERY low minimum detection limits
  - Moderate start-up cost
- Disadvantages
  - Long lead time (sample collection, shipping, & lab analysis)
  - Moderate to high per-sample cost for analysis
  - Can be labor intensive based on sample schedule

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Monitoring Methods

- Continuous Point/Area Monitors
- State & Local Air Monitoring Systems (SLAMS)
- Typical EPA NAAQS Monitoring

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Continuous Point/Area Monitors

- Continuous analyzers provide air quality measurements in near-real time
- Analyzers and Sensors available for a variety of parameters
- Variety of different measurement methods
  - Federal Methods (FRM/FEM)
    - Typical of EPA reporting and NAAQS compliance monitoring
  - Near-reference monitors
  - Low-cost sensors

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Continuous Point/Area Monitoring

Example Area/Point Fenceline Monitoring Network

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Continuous Point/Area Monitors

Reference Monitors FRM/FEM

- Advantages
  - Near-real time concentrations
  - Frequent measurements with 1-minute to hourly data resolution
  - Meet strict performance criteria set by EPA and accepted for compliance measurement
  - Verifiable – can easily be calibrated in the field to reference standards
- Disadvantages
  - Requires climate-controlled shelter
  - Requires line-power
  - Considerable start-up costs
  - High-level technical support required
  - On-going maintenance

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Continuous Point/Area Monitors

Near-Reference Monitors

- Advantages
  - Near-real time concentrations
  - Frequent measurements with 1-minute to hourly data resolution
  - Verifiable – can easily be calibrated in the field to reference standards
  - Low-power systems available
- Disadvantages
  - Does not meet EPA designation
  - Moderate start-up costs
  - High-level technical support required
  - On-going maintenance

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Continuous Point/Area Monitors

Low-Cost Sensors

- Advantages
  - Near-real time concentrations
  - Frequent measurements with 1-minute to hourly data resolution
  - Low-power
  - Low start-up cost
  - Ease of deployment
  - Used for spatial saturation
- Disadvantages
  - Does not meet EPA designation
  - Quantifying error difficult
  - Factory calibration required (not in field)
  - High-level data analysis required

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Monitoring Methods

- Open Path Monitoring

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Open Path Fenceline Monitoring

- A basic system includes an analyzer, an emitter/receiver set, and an optical fiber cable
  - Fourier Transform Infrared (FTIR)
  - Ultraviolet Differential Optical Absorption Spectroscopy (UV-DOAS) – more sensitive for BTEX
- Configurations can measure path of 1 meter to 1.5 kilometers
  - Gases such as NO, NO_2, SO_2, O_3, BTX, NH_3, CO, CO_2, HF, H_2O, CH_4, Hg, HCl, among others

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Open Path Fenceline Monitoring

Example Open Path Fenceline Monitoring Network

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Open Path Fenceline Monitoring

- Advantages
  - Continuous measurements across fenceline
  - Real-time and high frequency (5-minute) data for rapid analysis
  - Annual calibration
- Disadvantages
  - Considerable start-up costs
  - High-level data management and interpretation
  - Interference from water vapor and other compounds can cause false positive/negative detections

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Monitoring Methods

- Community-Based Monitoring

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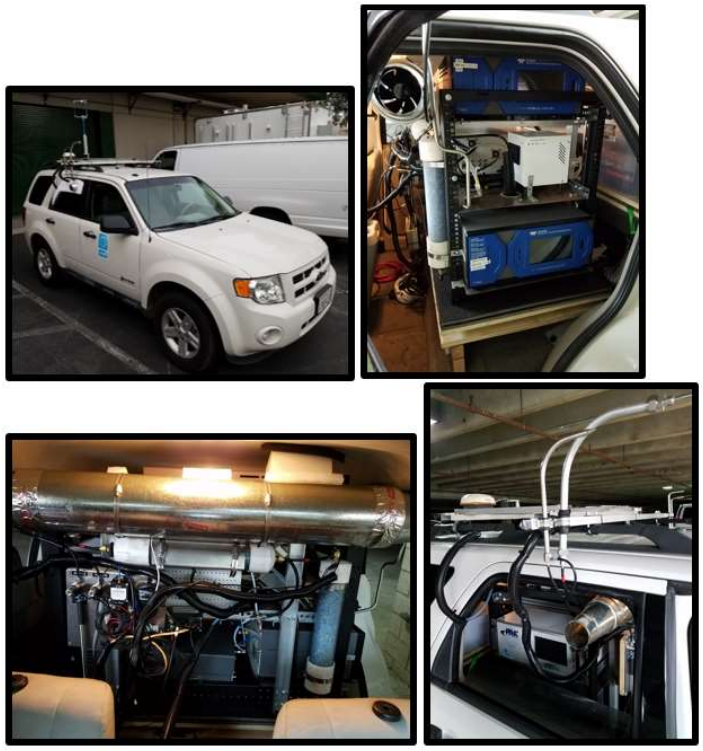

Community-Based Monitoring

- Mobile monitoring stations
  - Typically have FRM/FEM and other high-quality monitoring equipment
  - Placed along fenceline of industrial sources for verification
- Stationary point/area monitors
  - Placed in strategic areas of community
- Stationary low-cost sensor networks
  - Placed throughout community for network saturation

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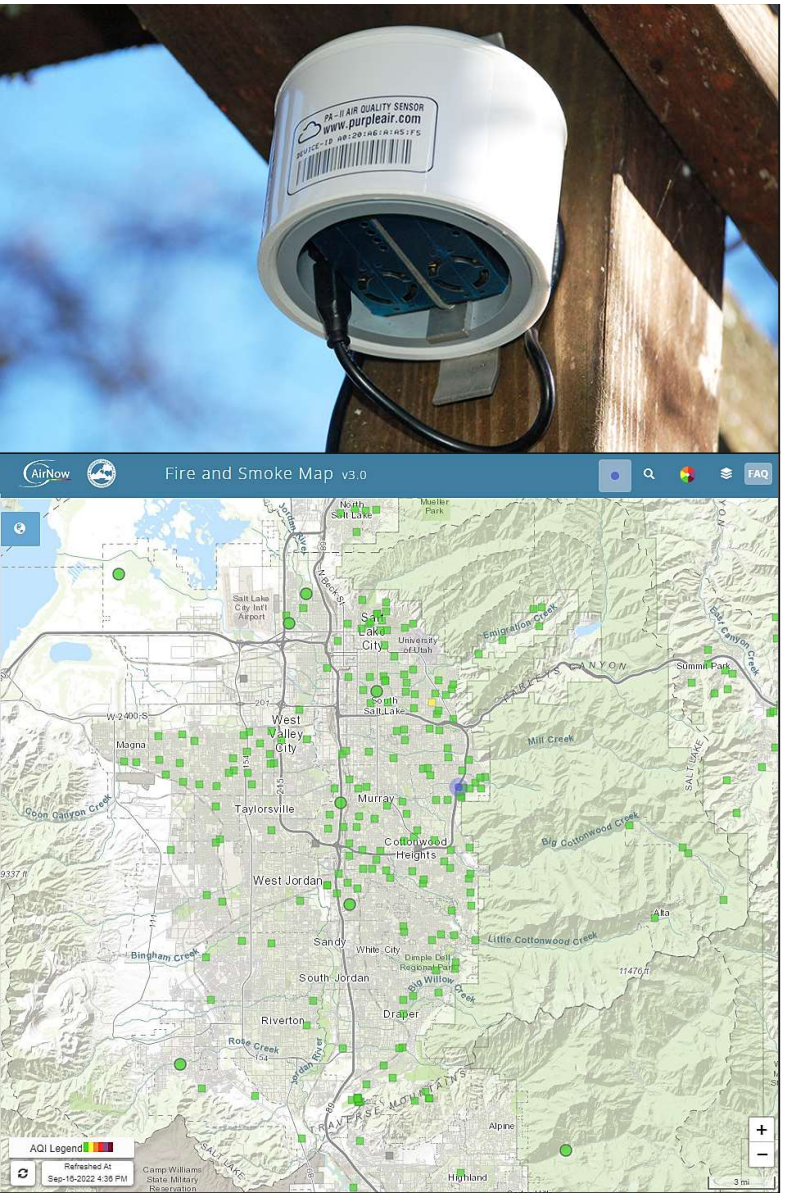
Picture source: SCAQMD AB617 Community Air Monitoring Page



Community Monitoring

Low-Cost Sensors

- EPA encouraging Citizen Scientists to become active in local air quality
- EPA has developed the Air Sensor Toolbox to aid in public understanding of measurement quality control
  - https://www.epa.gov/air-sensor-toolbox
- Data are being used for hot-spot identification in near-real time

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Reporting

- Data Quality
- Alarm Notifications

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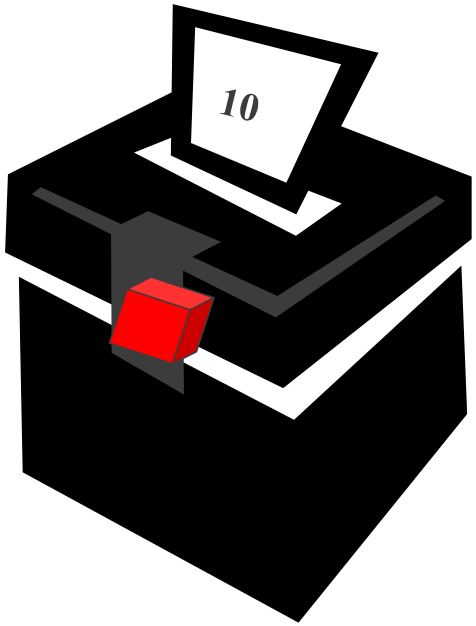
Numbers vs. Data



- Ambient data can be good or bad. The adequacy of the *Quality Assurance* and *Quality Control* (QA/QC) allows you to tell the difference.
- Avoid having a black box or number generator
  - Push a button, get a number

When does a number become data?

- Number + Context + QA/QC = Data
- Data user should be able to determine if data can be corrected, qualified, or rejected. Otherwise, the monitor is a Black Box.

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Alarming Requirements

Integrated alarm system that is audible and visible continuously in the control room at the facility

Confirm alarm trigger for any reading that is above applicable threshold

Notify Agency of any alarm condition within specified timeframe

(typically 24 hours)

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Reporting and Recordkeeping Requirements

Store at least **24 months** of continuous instrument data.

Be able to generate **hourly, daily, weekly, monthly, and annual** reports upon request.

Official dataset and/or data summary report within specified timeframe (monthly, quarterly, annually)

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Looking Forward

- New Regulation
- Emerging Guidance/Initiatives
- Environmental Justice

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Looking Forward

- Continued focus by EPA on monitoring fugitive emissions
  - Hazardous Organic NESHAP (HON) – December 2022?
  - Coke Oven Risk and Technology Review (RTR) – Yet to be proposed
- NAAQS update for $PM_{2.5}$ – Due summer of 2022. Now fall?
- Environmental Justice
  - Agencies continue push to understand impacts on sensitive and disadvantaged communities
  - States are leading the way on including EJ analysis in permitting
  - Achieving community understanding and involvement through real time measurements and analysis
    - Low-cost sensor and Citizen scientist encouragement by agencies
    - Real-time modeling to identify air pollution origin

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Looking Forward – How to be involved

- Understand upcoming RTR and NESHAP
- Be involved with community to understand local concerns
- Understand and comment on proposed regulation
  - Federal and local agencies
- Evaluate your risks
  - Emissions inventories
  - Conduct EJ evaluation
  - Create a public involvement/engagement plan
  - Conduct internal monitoring

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