Fenceline Monitoring Applications, and Measurement Technology

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Fenceline Monitoring Requirement for Petroleum Refineries

- Fenceline Monitoring Work Practice in the Refinery NESHAP.
  - Established requirement to monitor benzene along the perimeter of US refineries.
  - Required a specific method for sampling and analysis of benzene (Methods 325A/B).
  - Reporting requirements for the monitored data.
  - Set an "action-level" at the fenceline and required analysis and corrective action when this "action-level" was exceeded.

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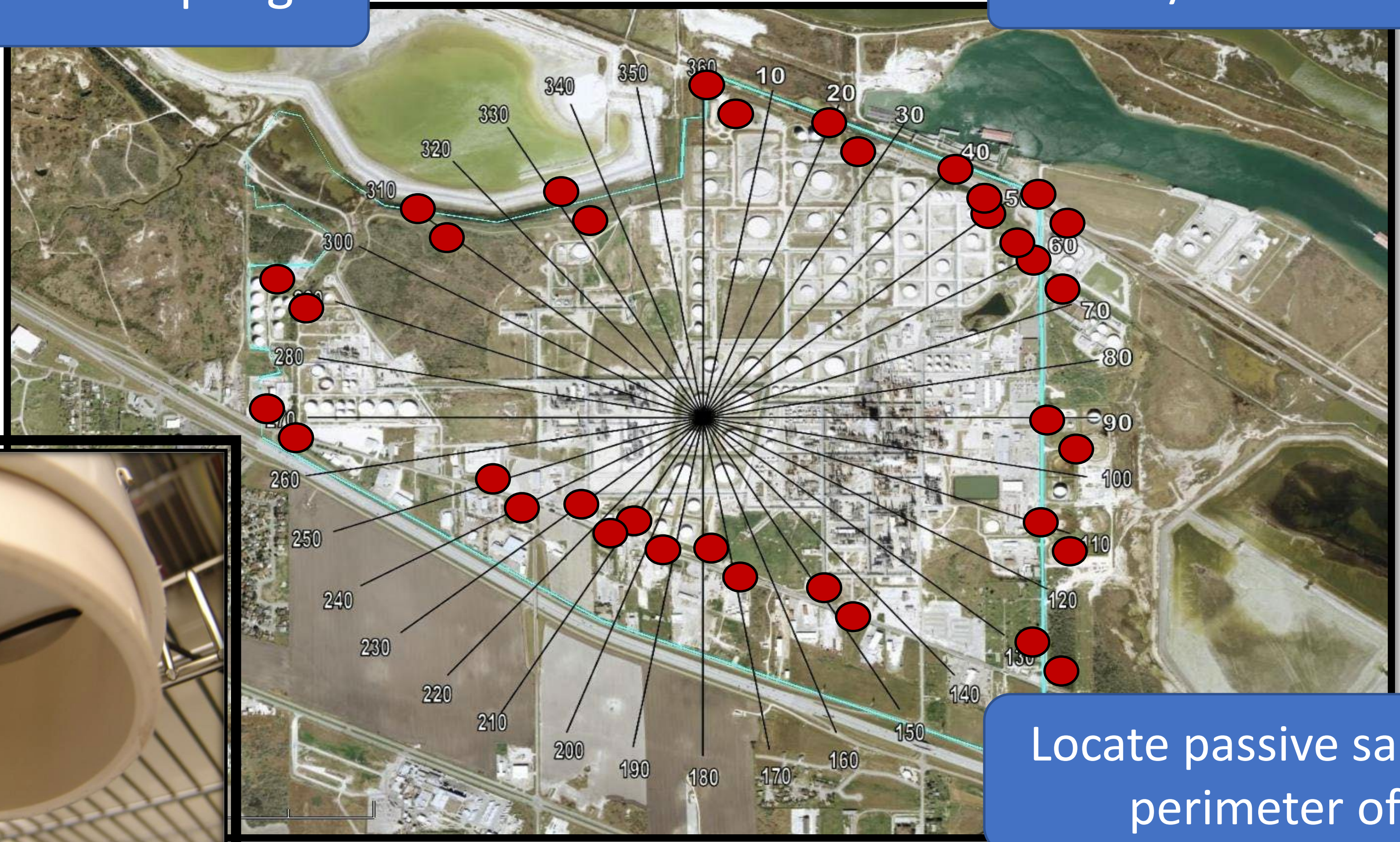
Passive Fenceline Monitoring – EPA Method 325A/325B

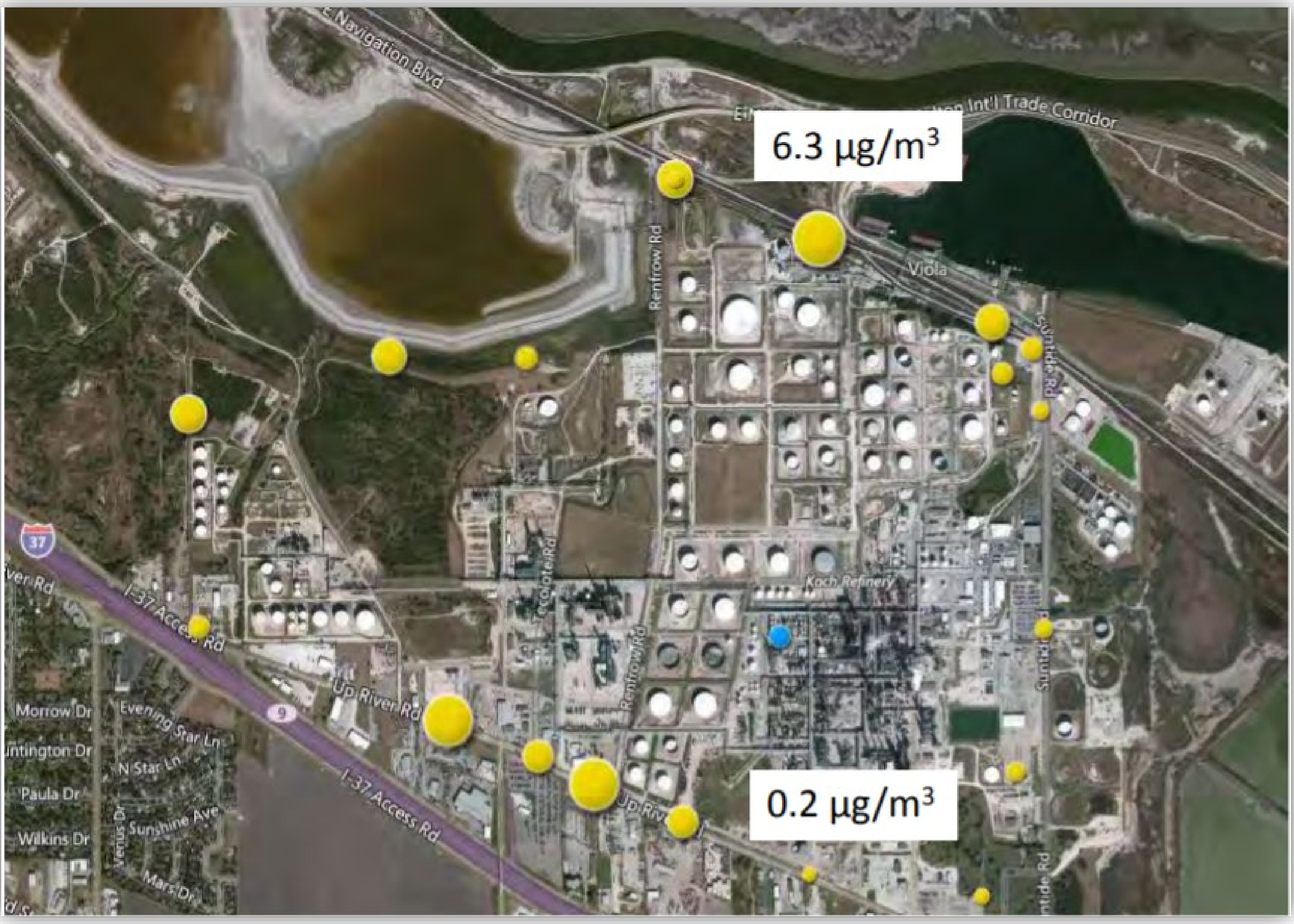
Passive Sampling

Facility fenceline monitoring



Locate passive samplers around the perimeter of each refinery

What is an action level for Fenceline Monitoring?



2-Week average readings

ΔC = High Value – Low Value
High Value – 6.3 ug/m^3
Low Value – 0.2 ug/m^3
ΔC = 6.1 ug/m^3

Annual average ΔC -
The average of the most recent 26 ΔC values.

Action level in the refinery rules is an annual average ΔC concentration of >9 ug/m^3.

Work Practice Associated with Fenceline Monitoring

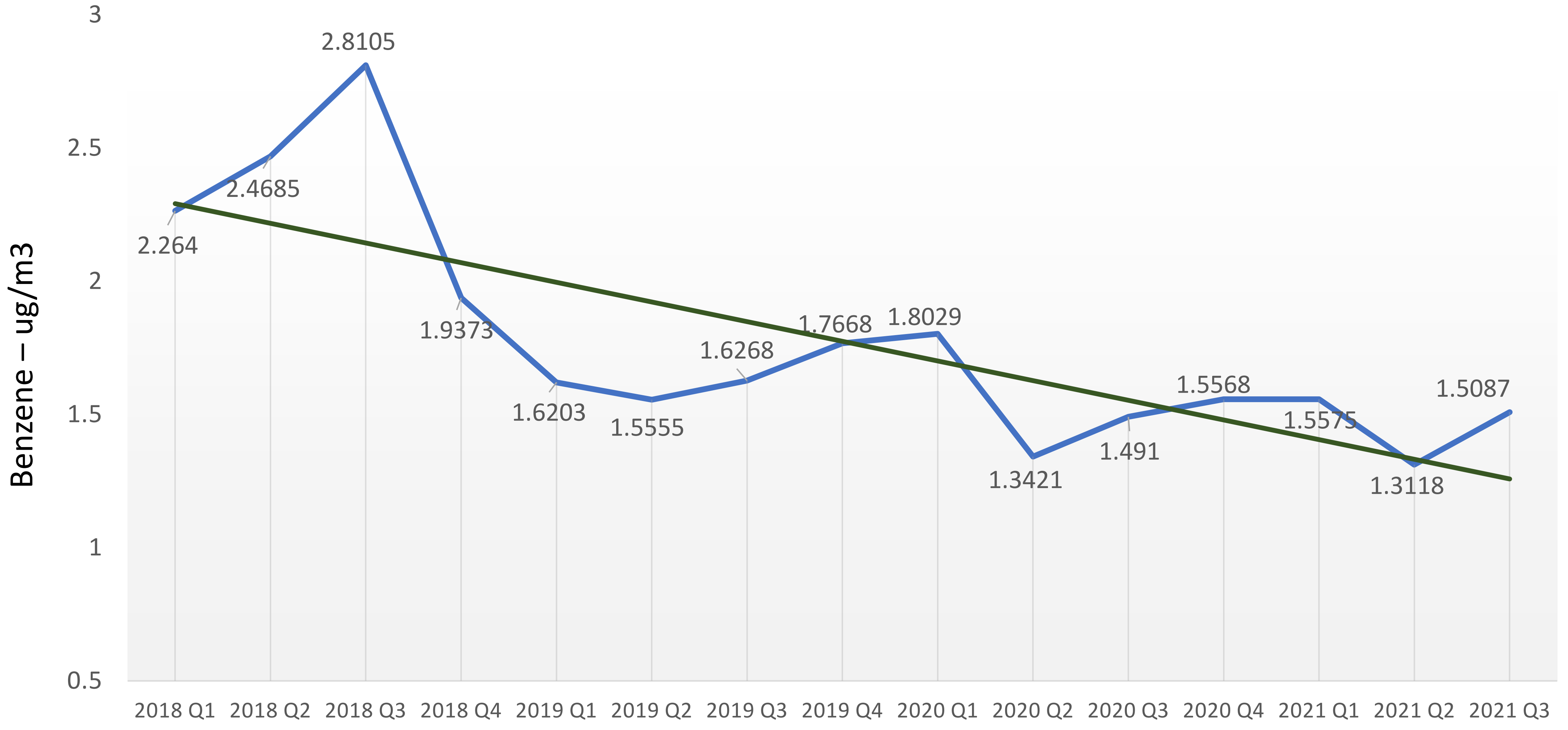
Root Cause Analysis and Corrective Action upon exceeding an established benzene action-level along the perimeter of these facilities.

- Time thresholds for investigation and corrective actions.
- Submission of corrective action plan to EPA if exceedance persists or repair completion is delayed.

Benefits from this approach

- Fenceline monitors are at ground level and capture VOC/HAP emissions emitted from fugitive sources (e.g., storage tanks, wastewater collection systems, equipment leaks, etc.).
- These are typically the sources that are most difficult to quantify using standard methods and make up most emissions of VOC and HAP at chemical plants and refineries.
- Emission reductions sooner and outside of prescriptive fugitive program.

Industry Wide Average Fenceline Concentration, since Q1 2018



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Fenceline Monitoring in other Sectors

- What fugitive emission source(s) is of concern;
- What pollutant(s) to measure related to fugitive emissions;
- What measurement technology is feasible; and
- What type of action level to “trigger” further action is most appropriate?

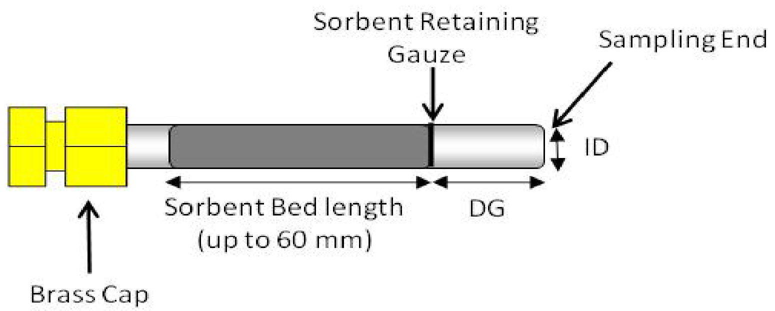
Measurement Considerations

- Sensitivity requirements could be dependent on ambient background, modeled concentrations at the boundary line, inhalations unit risk estimate, or other factors.
- The more reactive and volatile a compound, such as formaldehyde or ethylene oxide (EtO), the more difficult it is measure at very low concentrations (*e.g.*, "risk level" concentrations).
- Cost of deployment and ease of use.
- Recent development of next generation emissions monitoring tools with potential application to fenceline monitoring.

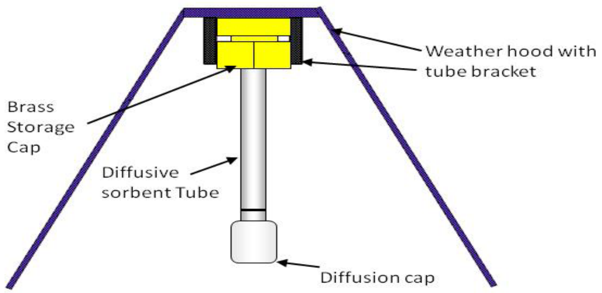
Measurement Technology

Fenceline Measurement Tools – Integrated Approaches

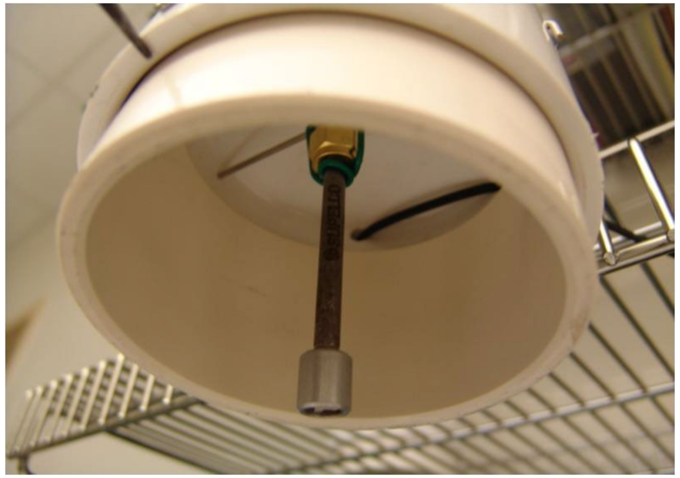
- Passive Sorbent Tube (EPA Method 325A/B)
  - Promulgated method
  - Provides a single measurement for the sampling period (1 to 14 days)
  - Low cost
  - Thermal desorption and cryogenic concentration and measurement by GC/MS
  - Efforts underway to expand the analyte list for this method



Cross Section View of Passive Sorbent Tube



PS Tube Sampler



PS Sampler Example
PVC Pipe version with weatherproof hood

Fenceline Measurement Tools – Integrated Options

- TO-15/TO-15A
  - Time-integrated ambient measurement method that includes a target list for 97 VOCs.
  - Utilizes specially lined canisters for sampling.
  - Time integration sampling is typically 1 day and usually requires off-site laboratory analysis.
  - Guidance methods vs. compliance method

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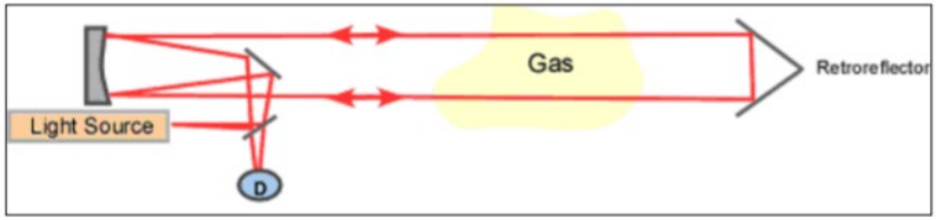
Fenceline Measurement Tools – Integrated Options

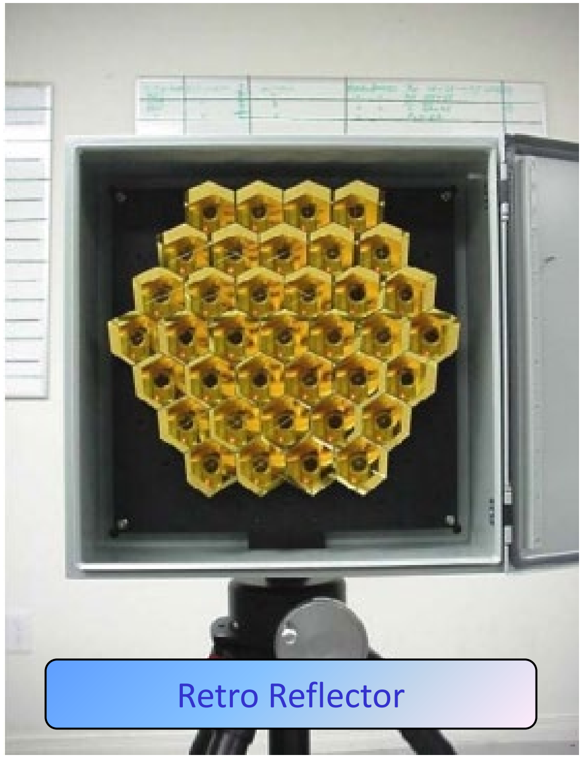
- Reactive/Coated Sorbents
  - Based on sorbents that react and "lock" compounds that are reactive and/or volatile (*e.g.*, formaldehyde, EtO, vinyl chloride).
  - Existing approaches for ambient measurements of formaldehyde (*i.e.*, EPA Method TO-11), and we are undertaking work for EtO applications.
  - Wet chemistry and solid extractive concentration, which can cause sensitivity issues and increase cost.
  - Guidance methods vs. compliance method

Real-Time Monitoring Options – Open Path

- Open Path FTIR and UV-DOAS
  - Realtime measurement of a large set of air toxics (both inorganic and organic).
  - Costly to implement and generally lacks the sensitivity to measure for long term chronic risks.
  - Measurement can be confounded by complex air sheds.
  - Is being applied to fenceline measurements in California.
  - Toxic Organic method for open-path FTIR (EPA Method TO-16)
  - Guidance methods vs. compliance method




(FTIR) Transmitting and Detecting Unit


Retro Reflector

Real-Time Monitoring Options – Point Monitors

- Speciated air toxics approach: Realtime optical instrumentation (*e.g.*, CRDS, QCL, FTIR). wide range of capability and applications.
  - Newest set of technologies being applied to air toxics work.
  - Higher cost but application provides real-time data.
  - Mature technology that has been applied to point-source measurement for a while.
  - Fixed monitor or multi-point extractive system.
  - Need promulgated methodology

Real-Time Monitoring Options – General Point Monitors

- Surrogate measurement for HAP
- Lower cost "VOC" continuous monitors capable of low concentrations, integrated with real-time meteorological (met) data,
- Desired sensitivity for many of the problematic compounds such as EtO?

Thank You and Questions?

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Approximate Risk Levels

Compound	Chronic URE (inhalation) per ug/m³	Risk Level (1 in 10,000)	
		ug/m³	ppbv
Ethylene Oxide	3.0×10^{-3}	0.02	0.011
Chloroprene	3.0×10^{-4}	0.2	0.054
1,3 Butadiene	3.0×10^{-5}	3	1.33
Ethylene Dichloride	2.6×10^{-5}	4	0.98
Formaldehyde	1.3×10^{-5}	8	6.40
Benzene	7.8×10^{-6}	45	13.8
Vinyl Chloride	4.4×10^{-6}	23	8.8