Fenceline Air Quality Monitoring—Advanced Topics for Particulate and Gaseous Contaminants

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Environmental Resources Management

The business of sustainability

ERM

Presenters

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- 40+ years air monitoring experience
- Technical Director of North American air monitoring service line
- Past chair AWMA Air Monitoring Technical Committee
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- 5 years air monitoring experience
- Senior Consultant/Project Manager
- Data telemetry/processing expert

Today's Lineup

- Fenceline air monitoring review
- Common FLM challenges
- Data telemetry/processing solutions
- Hardware solutions
- What does the future hold?

Fenceline Air Quality Monitoring Review

Introductory Topics

(Scott Adamson, Trinity Consultants; September 20, 2022 CIBO)

- Drivers
- Monitoring Methods and Implementation
- Reporting

Fenceline Air Quality Monitoring Review

Drivers

- Federal air regulation
  - New Source Performance Standard--NSPS
  - National Emission Standard for Hazardous Air Pollutants—NESHAP
- State and municipal regulation
  - California oil & gas rule
  - City of Chicago bulk material storage ordinance
- Enforcement action resolution—Consent Agreement/Order
- “Social License to Operate”—SLO

House bill would beef up air monitoring at industrial sites

The legislation is part of a series of bills to bolster EPA's ability to keep tabs on chemicals and other air pollutants linked to cancer, asthma and other ills.

BY:
SEAN REILLY
| 12/06/2022 06:27 AM EST

Rep. Josh Harder (D-Calif.).Justin Sullivan/Getty Images

E&E DAILY | A new House bill would expand EPA efforts to track and publicize hazardous air pollutant releases from a select group of "high-priority" chemical plants and other industrial sources.

Under H.R. 9386, sponsored by Rep. Josh Harder (D-Calif.), the EPA administrator would deploy fenceline monitoring at 100 plants — selected by the agency — that emit cancer-causing ethylene oxide or other air toxics linked to "local health threats." Within six years, EPA officials would be required to publicly report the monitoring data, along with any steps the agency has taken as a result.

Fenceline Air Quality Monitoring Review

Methods and Implementation Design

- Considerable variation, depending upon monitoring objectives
- Common feature: monitoring sites located on, or just inside fenceline (e.g., ***not*** ambient air)

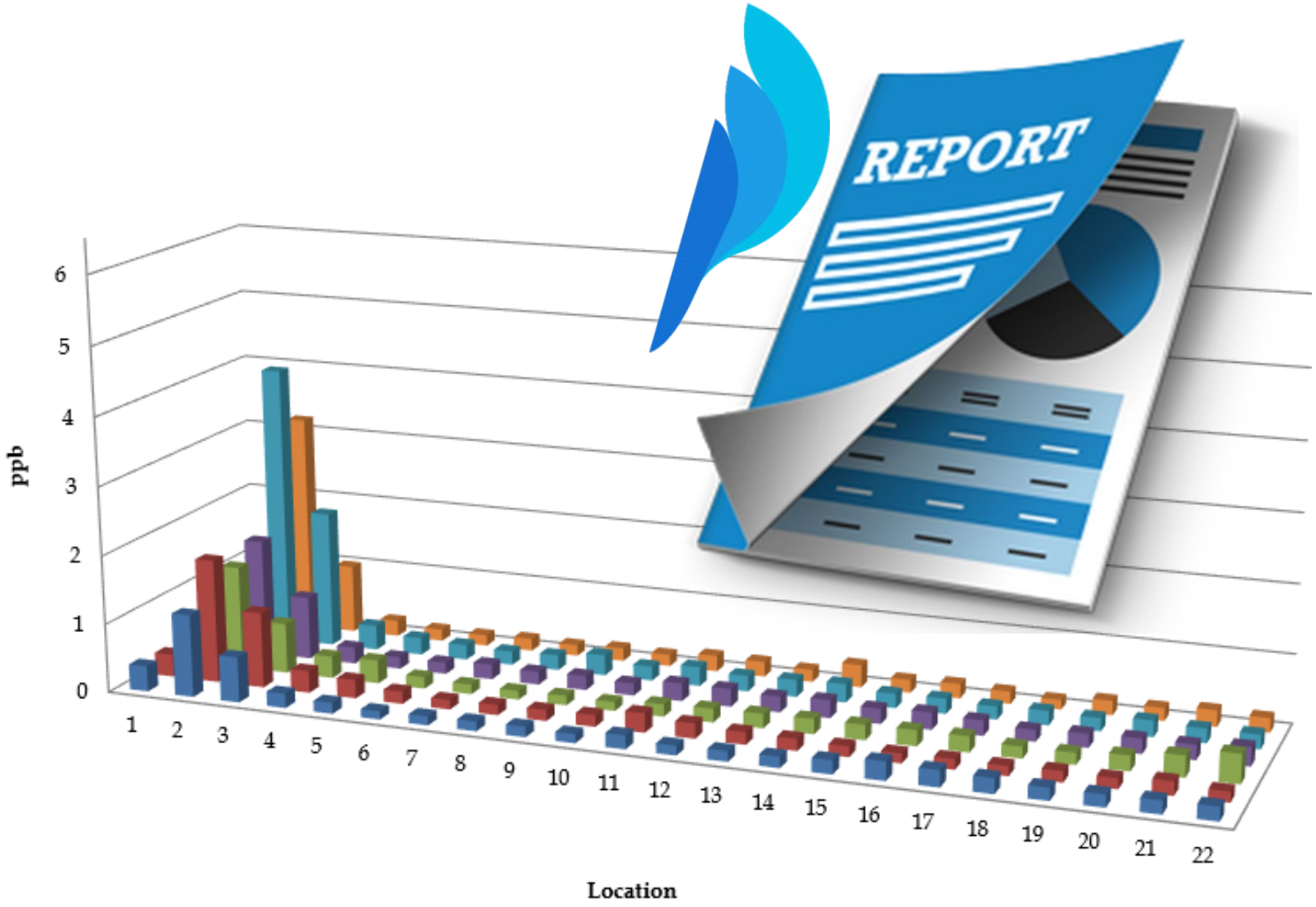
Key design factors

- Number of sites
- Monitored parameters
- Measurement frequency
- Passive or active sampling; continuous monitoring

Fenceline Air Quality Monitoring Review

Reporting

- Hard copy
- Static web site
- Dynamic web site



Common Fenceline Monitoring Challenges

1. High regional ("background") contaminant concentration
2. Confounding impacts from neighboring facility emissions
3. Insufficient temporal resolution to correlate "hits" with a particular wind direction/emission source bearing

4. High laboratory costs
5. High capital cost
6. Complex wind fields from aerodynamic effects
7. Chemical speciation or particle size selection requirements

Potential Solutions to Fenceline Monitoring Challenges

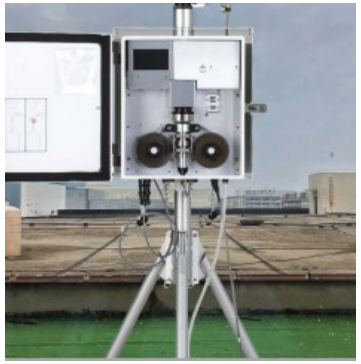
- High “backgrounds” and impacts from neighboring sources can be addressed by strategically-sited “upwind” monitoring sites
  - Continuous measurements can be adjusted in real-time to “net-out” background level
- Cost may be controlled and temporal resolution improved by use of air sensor technology
- Accurate wind field data can be collected by incorporating multiple monitoring locations, if required
- Chemical speciation can be provided by proper measurement technique

Monitoring Instrument Options:

- **Passive** (diffusion) samplers and whole air **integrated** sampling (evacuated canister, absorption/adsorption tube) continue to have a place in fenceline monitoring
- **Continuous** "reference" and "near-reference" instruments offer numerous advantages.

Continuous

Particulate Matter



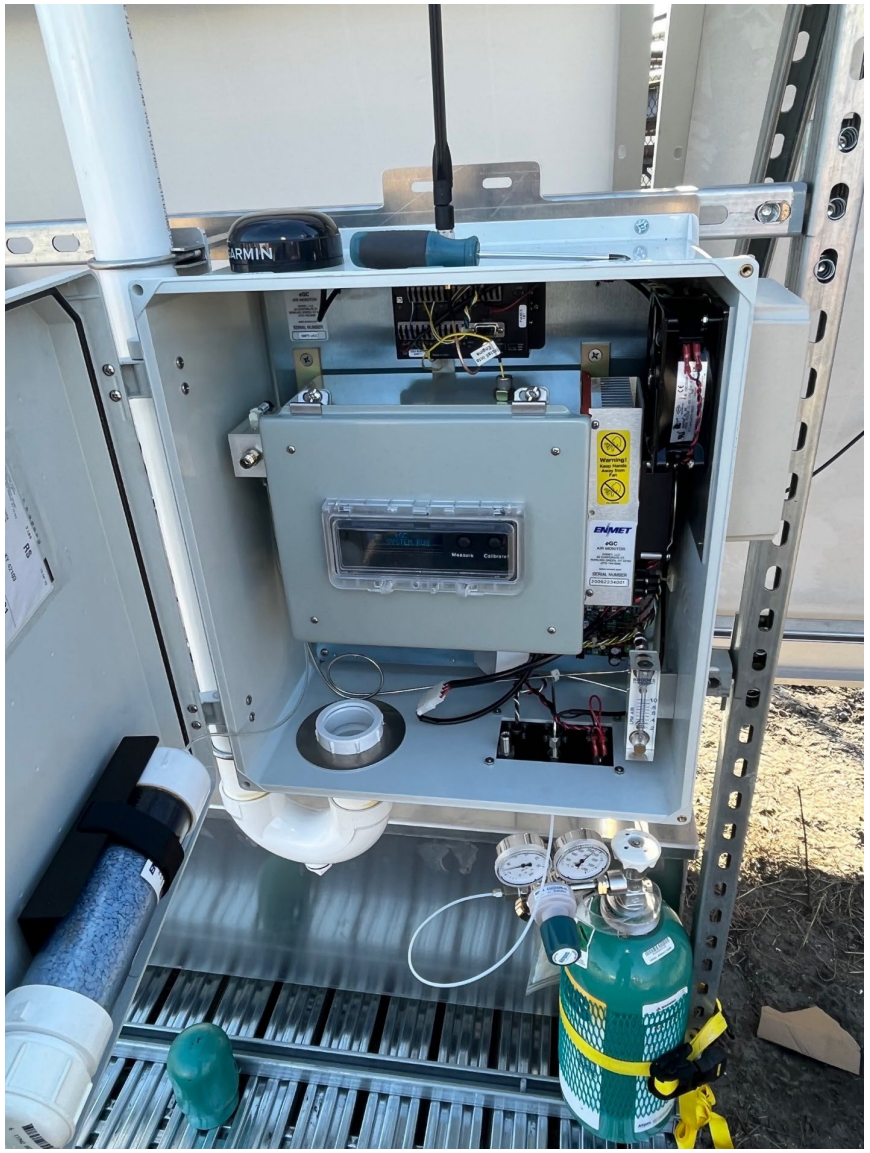
Beta attenuation and light-scattering monitors

Gaseous Contaminants

High Temporal Resolution, Speciated Measurements

Measurement depends on the fenceline monitoring objectives

- Passive or integrated samples, followed by lab analysis, can yield speciation—but not the continuous, high resolution data needed for advanced data processing approaches
  - **Speciation, but poor temporal resolution**
- A continuous analyzer is available for most constituents of interest
  - **Speciation, and good temporal resolution**
  - Cost may be managed by only instrumenting “hot spots” and/or by use of a portable instrument



Petroleum Refinery Case Study

- Refinery fenceline monitoring yielded benzene exceedances in a high density industrial area
- The measurements were 14-day averages from passive diffusion tubes
- Solution was to develop a site-specific monitor plan, relying on semi-continuous GC measurements.
- **The instrument selected featured:**
  - Benzene-specific output
  - Low GC power demand permitted solar-powered installation
  - Robust design avoids need for climate-controlled shelter
  - Can measure a range of speciated compounds—providing a measurement approximately once every 10 minutes.

Construction Fenceline Case Study

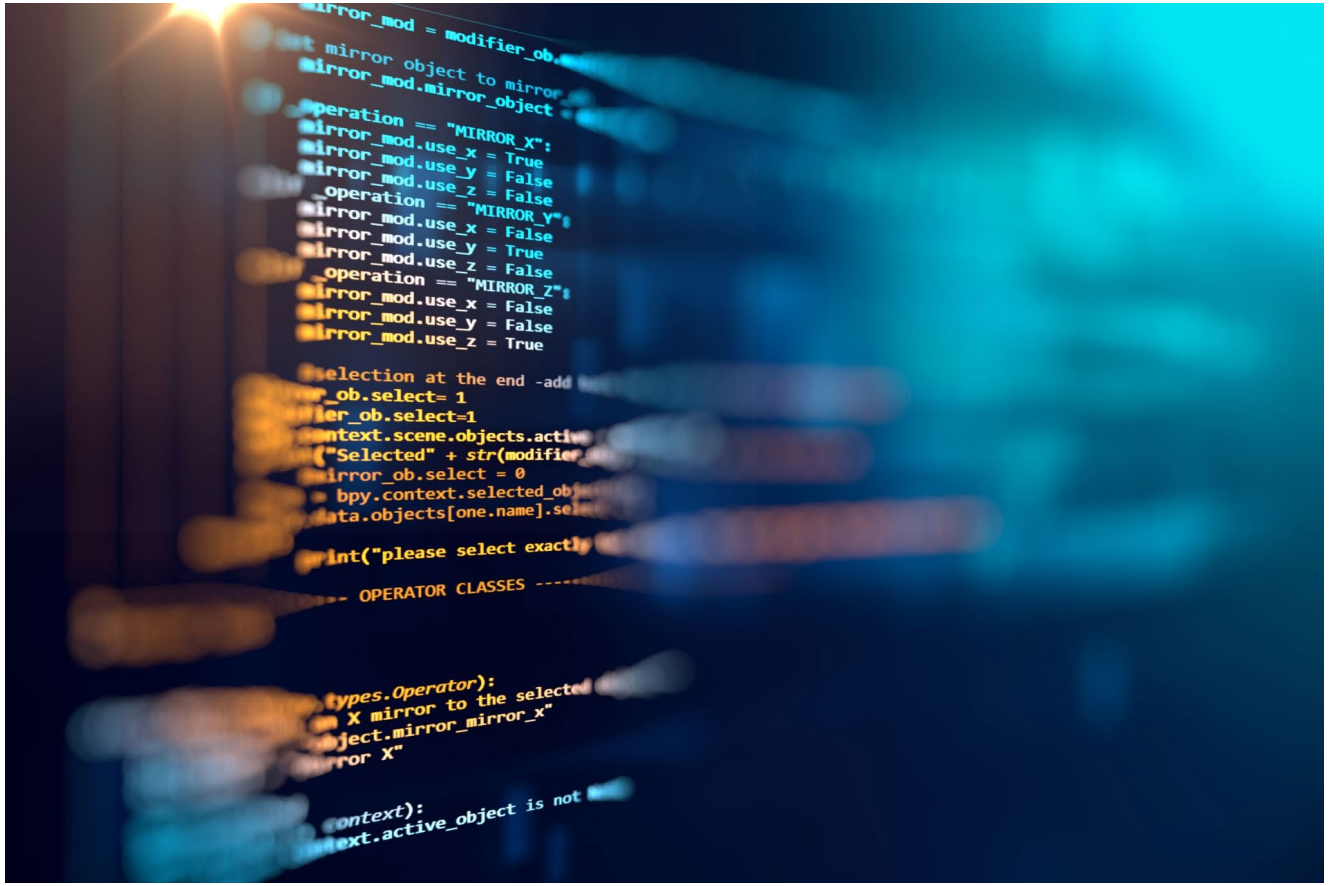
Innovative Data Processing Solution:

Perimeter air quality and meteorological monitoring program served by a real-time natural language processing script can provide numerous advantages

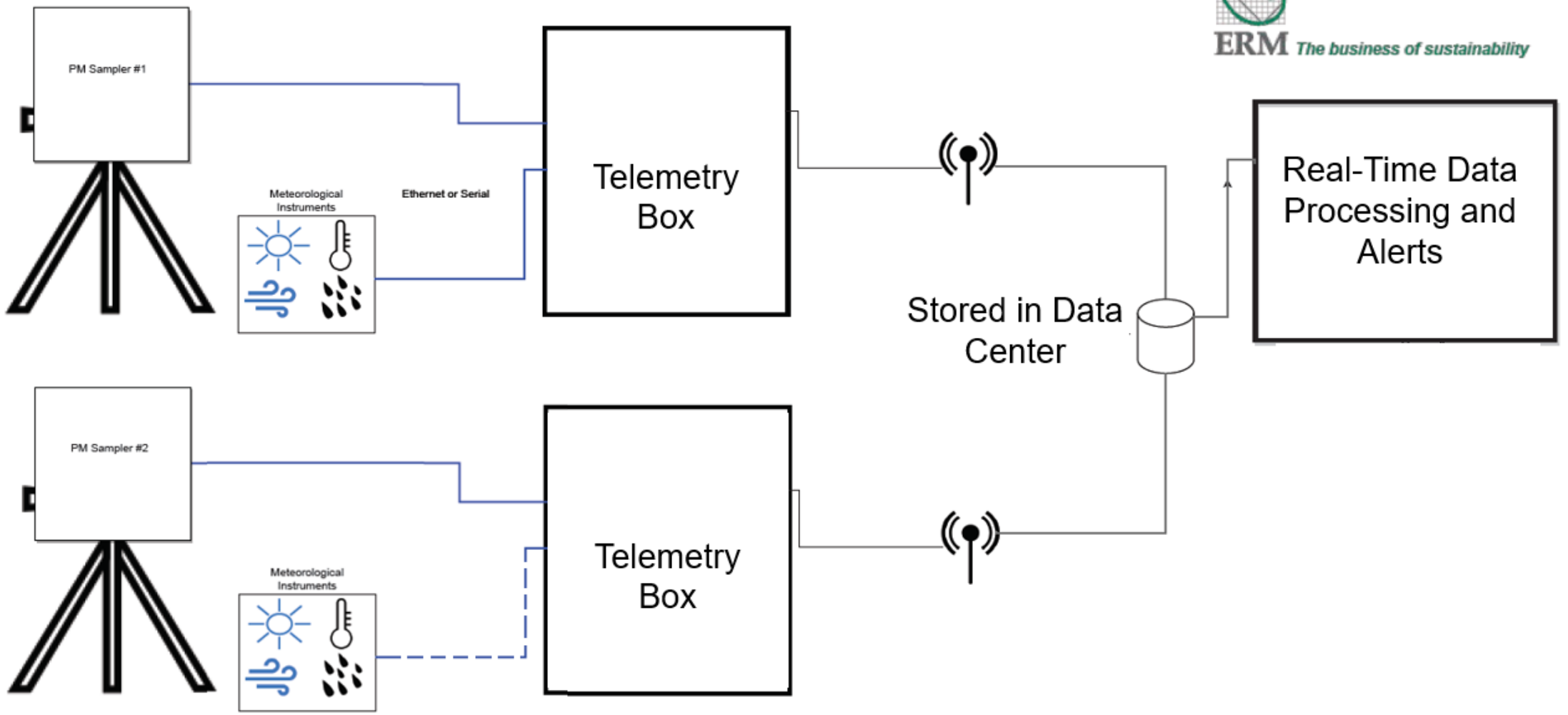
- **Advantages:**
  - Real-time net-out of background, other source impacts from “downwind” monitoring values
  - Real-time alerts above determined threshold
- **Considerations:**
  - Requires high temporal resolution monitoring data
  - Additional telemetry costs

Real-Time Analysis Specifications

- Reads in instrument PM data and Met data
- Checks for diagnostic alarms
- Computes averages
- Identifies upwind sampler and subtracts background concentration
- Compares to appropriate threshold value
- Sends emails and/or text alerts to stakeholder and onsite staff

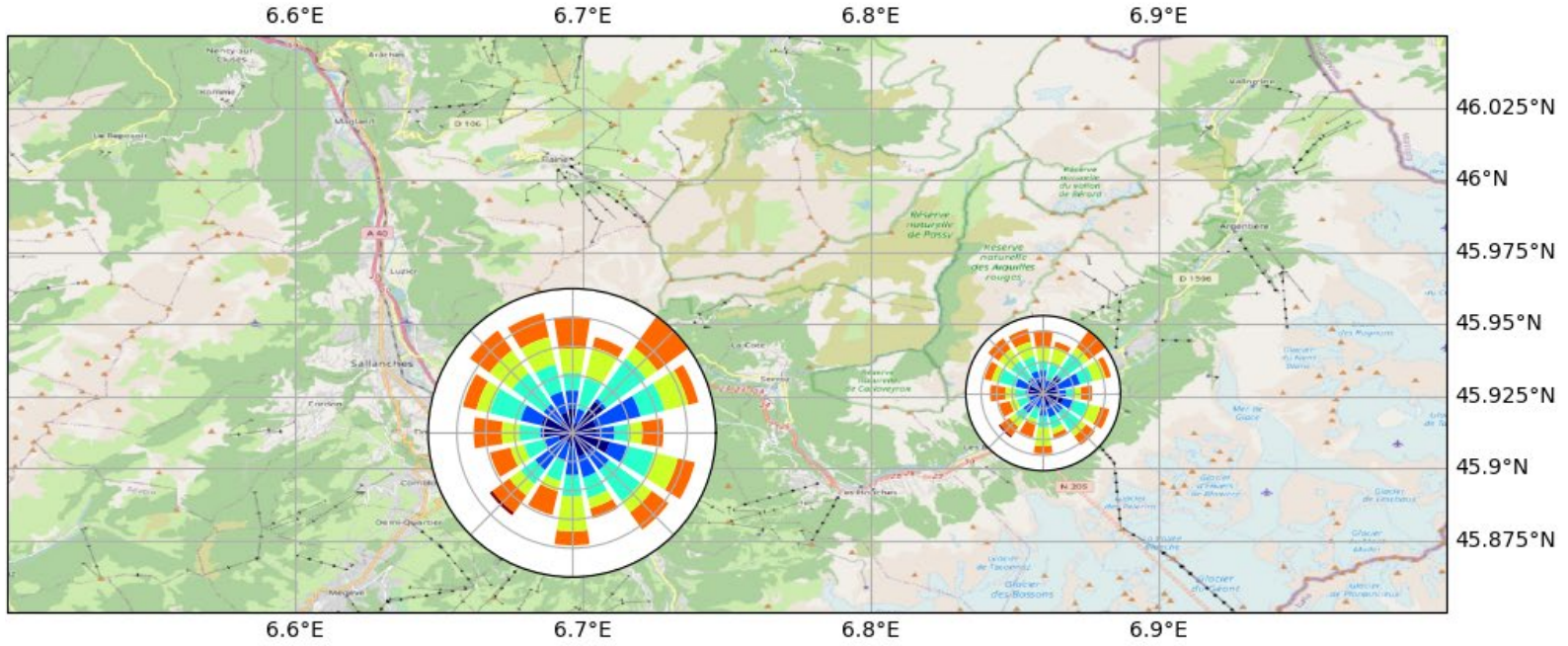


Standard Monitor Network/Data Flow Configuration

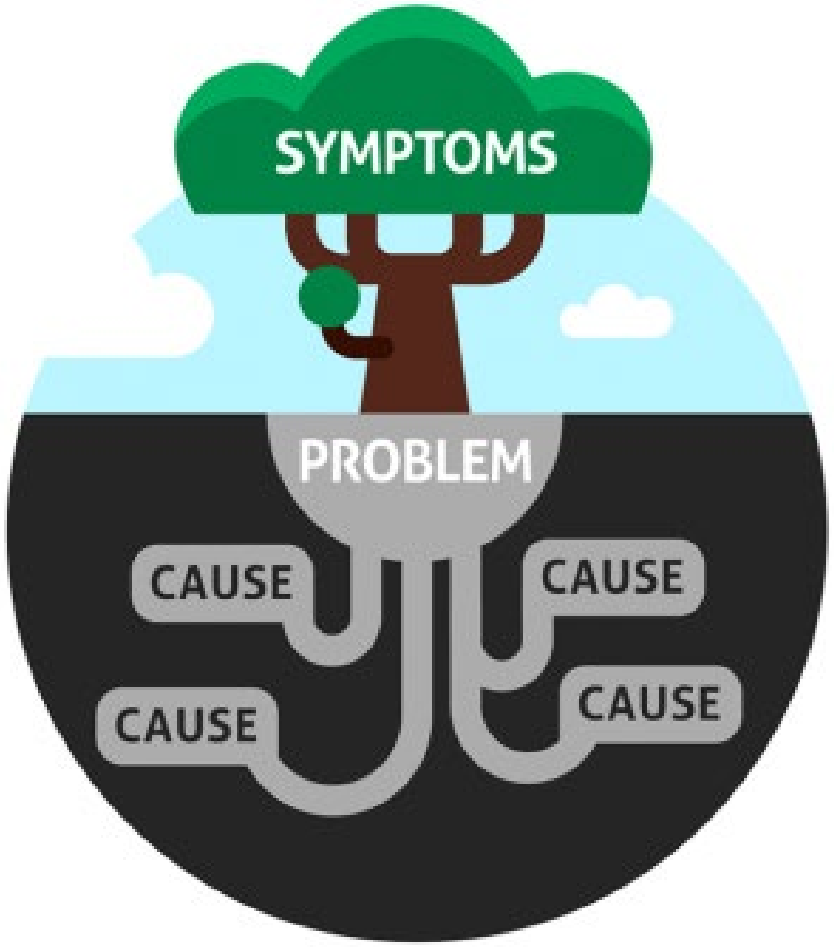


Visualizing Data

- Dashboard
  - Remotely see all data in real-time
- Root Cause Analysis
  - Filter Data above threshold value
  - Plot wind rose at each monitoring location
    - This will show the most frequent wind direction for these event



Petroleum Refinery Case Study

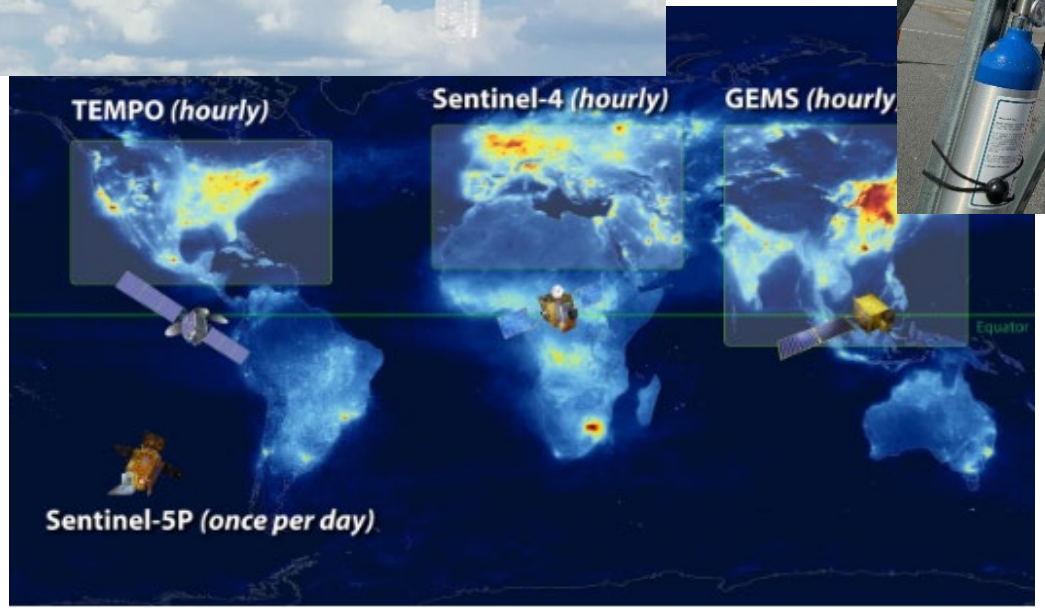


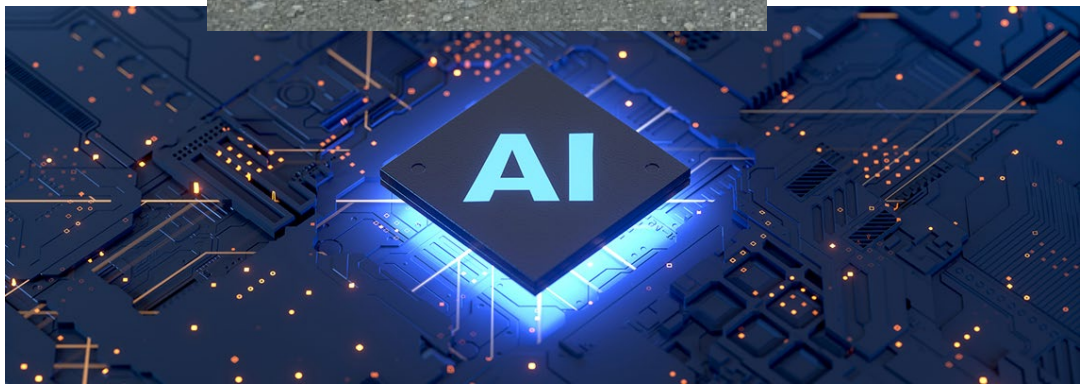
The site specific monitoring plan will yield high resolution speciated VOC concentration data.

These data can be correlated with on-site wind data to readily determine whether an exceedance was due to the refinery, or the adjacent facility.

If wind data points to the refinery as the culpable emission source, the VOC speciation results can provide valuable insights into which specific refinery emission source is the root cause.

A Look to the Future





Questions?

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How About Now?