Refinery Benzene Fenceline Monitoring: Considerations in Addition to Cost
Why Fenceline Monitoring for Benzene?

• In December 2015, the USEPA finalized a rule updating the NESHAPs for Petroleum Refineries, which, in 2018, will require all major source refineries to monitor and report volatile benzene concentrations around the fenceline of their property.
This is the first time a national regulation requires major sources to monitor emissions at key emission sources within their facilities and around their fencelines.

A major source facility is one that emits or has the potential to emit 10 or more tpy of any single air toxic, or 25 tpy or more of any combination of air toxics.
Impact on Refineries

- The EPA estimates the capital cost of this final rule to be approximately $283 million, with an annualized cost of approximately $63 million.
- Final rule will result in a reduction of 5,200 tpy of HAPs and 50,000 tpy of VOCs from the 142 major source refineries.
- EPA estimates on average that it will cost about $2 million per refinery in capital investment and about $450,000/year to comply.
Considerations, Choices

• Site-specific plan for refinery
  – Expertise/resources on staff, or hire consultant?
    • If outsource, which consultant?
  – Determine sampling locations - radial or perimeter
  – Install shelters

• Pilot study

• Sampling
  – Resources on staff or subcontract?

• Pick a lab

• Manage data
Three-Year Pilot Study

• Refinery in Midwest
  – Continued pilot study after completion of 2014 API six-week study
Continuous Fenceline Monitoring

- All refineries must utilize a network of passive diffusive tube samplers at the refinery fenceline
- Monitors must *encircle* the refinery fenceline

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**Area 1 (20° Angles)**
Note: Angles were not placed at 120° and 140°. These angles intersected the inner boundary of a subarea.

**Area 2 (30° Angles)**
Note: Angles were not placed at 240°, 270° and 300°. These angles intersected the inner boundary of a subarea.
Siting Sampling Points

**Perimeter Method:**

- For facilities with a monitoring perimeter length of less than 7,315 meters (24,000 feet), a minimum of twelve sampling locations evenly spaced ± 10 percent of the location interval is required.

- For facilities with a monitoring perimeter length greater than 7,315 meters (24,000 feet), sampling locations are spaced 610 ± 76 meters (2,000 ± 250 feet) apart.
Shelters
Hornets!
Sample Deployment
Fenceline Monitoring – What is it?

- Utilizes *passive sampling*
  - Carbon-based sorbent tubes
  - 14-day sampling duration, for a total of 26 sampling events per year
How Does Passive Sampling Work?

- Sorbent inside the tube is exposed at one end for a known amount of time.
- Concentration is calculated using mass adsorbed on the sorbent and the relative rate of diffusion (uptake rate) of the compound.
Lab Selection: Data Quality

• Is laboratory certified for *air* methods?
• Certified for 325B specifically?
  – Only 5 labs in NELAP database for 325B
Lab Selection: Expertise

- How long performing thermal desorption methods?
  - Sample analysis using a TD/GC/MS system
  - Can lab troubleshoot unexpected results?

- Sample tubes
  - Segregated, dedicated, 2 yrs
Lab Selection: Expertise

- What’s the lab’s capacity?
  - More than one instrument?
  - Contingency plan?

Ex. ALS has 3 instruments
~160 smps/day
~800 smps/week
Lab Selection: Logistics

- Automated shipments
### EPA 325 A/B Chain of Custody Record & Field Test Data Sheet

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**Analysis Requested:**
- Benzene only
- Benzene + Other Target Compounds (List)

**Receipt Temperature:** °C

**Date:**
- Signed by (Signature)
- Date
- Time

**Date:**
- Received by (Signature)
- Date
- Time
Lab Selection: Data Management

• Quick turnaround time of results
  – Standard 5 day TAT

• Compatibility with sampling/back-end software
  – CEDRI-compliant EDD
    (Compliance and Emissions Data Reporting Interface)
Lessons Learned
Benefits to Pilot Study

- Refinery did lots of extra sampling
  - Locations along the property line
  - Adjacent terminal
  - Locations inside but near the fenceline surrounding benzene loading rack, day tanks, sales tanks, vapor destruction unit, nearby tank being cleaned, refinery laboratory and pipeline station
- This additional sampling helped determine that the positive hits in this area were a result of benzene sales and day tank losses
- Also helped rule out the refinery laboratory, pipeline station and vapor destruction unit as contributors
- It was determined that the elevated benzene results in this area were a result of permitted tank losses
Benzene Result vs. Ambient Temperature

![Graph showing the relationship between benzene results and ambient temperature over time.](image-url)

- Benzene Immediate Action Limit
- Average High
- Average Low

Dates: 12/21/2015 to 8/29/2016
Conclusions

- Source identification prior to 2018
- Evaluate perimeter and radial designs if possible
- Meteorology had negligible impact
- Communication = success
- Since the API study, average sample costs have dropped 40-50%.
Thanks!

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