Assessment of Benzene Fenceline Monitoring Data for Corrective Action Planning and Near-field Source Correction
Presentation Objectives

1. Review regulatory framework for benzene fenceline monitoring.
2. Provide a broad overview of fenceline monitoring requirements.
3. Examine some of the details and challenges associated with implementing a fenceline monitoring program.
4. Outline considerations for fenceline monitoring program design and implementation
Refinery Sector Rule (RSR) Establishes Three Key Requirements

1. Emission control requirements for:
   - Storage Tanks
   - Flares
   - Delayed Coking Units
2. Elimination of exemptions to emission limits during startup, shutdown, and malfunctions
3. Fenceline monitoring for benzene
   - Method 325 A: VOC from Fugitive & Ambient Sources (Sampler Placement)
   - Method 325 B: VOC from Fugitive & Ambient Sources (Analysis)
Fenceline Monitoring Program Requirements (1/3)

- Deploy a network of diffusive samplers around the perimeter of the site in accordance with EPA Method 325A.

- Two deployment options:
  1. Placed at different angles circling the geometric center of the facility along the fenceline. Size of property determines the angles.
  2. Placed along the fenceline every 2000 meters.
     - Monitor placed 1.5-3.0 m above the ground.

- Diffusive samplers analyzed by EPA Method 325B using GC/MS.
## Monitor Placement Varies with Facility Size (1a/3)

<table>
<thead>
<tr>
<th>Facility Size, Acres</th>
<th>Angle, Degrees</th>
<th>Number of Monitors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than or equal to 750</td>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>Greater than 750 but less than 1500</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Greater than 1500 acres</td>
<td>15</td>
<td>24</td>
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</tbody>
</table>

24 samplers placed along fenceline

Note that extra samplers are required near known sources of VOC emissions
Sampling episode is defined as 14 days unless there is a reason to sample for a shorter period.

Tubes placed in shelters and time and date are noted.

Tubes are recovered, thermally desorbed to measure mass of collected benzene using GC/MS.

The difference between the highest and lowest measured benzene concentrations is determined.

Annual rolling average of the difference is calculated.

Background and interfering near-field source adjustments are allowed if described in a sampling plan that is submitted to agency for review and approval.
Root Cause Analysis (RCA) & Corrective Action (CA) is required if difference in concentrations exceeds 9 µg/m³ as a rolling annual average.

- RCA
  - Method 21, optical gas imaging, visual inspections, additional 325A sampling

Submit a formal Corrective Action Plan (CAP) to EPA if corrective action is ineffective or will take more than 60 days.

- Attempted corrective actions, additional measures, schedules

Report data quarterly using EPA’s Compliance and Emissions Data Reporting Interface (CEDRI).
Root Cause Analysis/Corrective Action Action Timeline

- **Action Level Exceeded**
  - **Evaluate Data within 45 Days**
  - **Perform Root Cause Analysis (RCA) within 5 Days**
  - **Complete Corrective Action (CA) within 45 Days**

**Sampling Period End Date**

**Submit Corrective Action Plan (CAP) to Agency within 60 days of triggering event if:**

- Corrective Action Is Ineffective
- Corrective Action Takes Longer than 45 Days to Complete
Real World RCA and CAP Timeline

Benzene Fenceline Data

- No Regulatory Action Required
- RCA & CA Required
- CA Declared Complete
- CAP Required

**Date**
- 01/05/16
- 02/05/16
- 03/05/16
- 04/05/16
- 05/05/16
- 06/05/16
- 07/05/16
- 08/05/16
- 09/05/16

**Benzene, µg/m³**
- 0.0
- 20.0
- 40.0
- 60.0
- 80.0
- 100.0
- 120.0
- 140.0

**Legend**
- Period Difference
- Rolling Average
- Action Level

**Notes**
- RCA = Root Cause Analysis
- CA = Corrective Action
- CAP = Corrective Action Plan
Maximum Differential Concentrations

Maximum Differential Benzene Concentration

Benzene Concentration, ug/m³

Date

01/05/16 01/12/16 01/19/16 01/26/16 02/02/16 02/09/16 02/16/16 02/23/16 03/01/16 03/08/16 03/15/16 03/22/16 03/29/16 04/05/16 04/12/16 04/19/16 04/26/16 05/03/16 05/10/16 05/17/16 05/24/16 05/31/16 06/07/16 06/14/16 06/21/16 06/28/16 07/05/16 07/12/16 07/19/16 07/26/16 08/02/16

Benzene Concentration, ug/m³

0 20 40 60 80 100 120 140 160

Measured Differential Concentration

Action Level
Have Long-term Effect on the Calculated Rolling Average
What Caused the Spike?

- Compliant tank cleaning operations.
  - Possibly an “interfering near-field source”
Rule Allows for Interfering Near-field Source Correction

- Essentially subtract the contribution from the interfering source:

\[ \Delta C_i = MFC_i - NFS_i - UB \]

where:

- \( \Delta C_i \) = Differential Concentration for location \( i \)
- \( MFC_i \) = Measured Fenceline Concentration for location \( i \)
- \( NFS_i \) = Near-Field Interfering Source Concentration for location \( i \)
- \( UB \) = Uniform Background Concentration
NFS Correction Requires Site-Specific Monitoring Plan

- Site-Specific Monitoring Plan must:
  - Outline the justification for interfering NFS
  - Document criteria for UB sampling location(s) selection
  - Document criteria for interfering NFS sampling location(s) selection
  - Describe the fenceline measurement location(s) affected by the NFS(s)
  - Describe the calculation procedures

- When NFS correction are used, an on-site meteorological monitoring station is required to measure:
  - Temperature and barometric pressure (hourly)
  - Wind speed and direction (hourly)
  - Sigma theta (daily)
Adjustment of Measurement Data for Interfering NFS Changes the Picture.....

Maximum Differential Benzene Concentration

Benzene Concentration, ug/m³

Date

01/05/16 01/12/16 01/19/16 01/26/16 02/02/16 02/09/16 02/16/16 02/23/16 03/01/16 03/08/16 03/15/16 03/22/16 03/29/16 04/05/16 04/12/16 04/19/16 04/26/16 05/03/16 05/10/16 05/17/16 05/24/16 06/07/16 06/14/16 06/21/16 06/28/16 07/05/16 07/12/16 07/19/16 07/26/16 08/02/16

- Black: No NFS Correction
- Blue: With NFS Correction
- Red: Action Level
Rolling Average Benzene Concentration

- No NFS Correction
- With NFS Correction
- Action Level
Fenceline Monitoring Program Design & Implementation Considerations

- Evaluate the data as it is generated.
- Under the RSR triggers for RCA, CA, and CAP.
- Test root cause analysis and corrective action plan approaches.
- If interfering NFS are identified, develop a site-specific monitoring plan.
- Site-specific monitoring plans require time to develop and time for approval.
Questions?

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