

Satisfying the Corrective Action Requirements of the Refinery Sector Rule

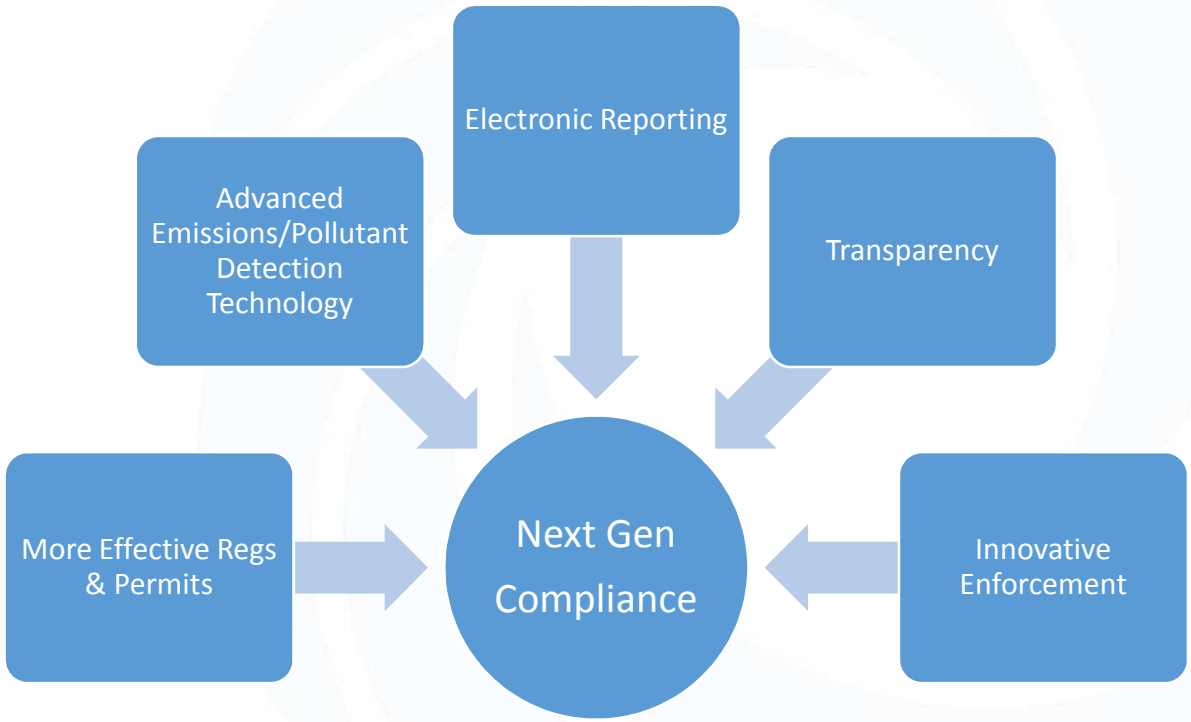
International Petroleum Environmental Conference
Air Emission II Session

November 11 , 2016

Presentation Objectives

1. Review EPA's Next Gen Compliance Strategy
2. Introduce Refinery Sector Rule in context of EPA's Next Gen Compliance Strategy
3. Highlight corrective action requirements of RSR
4. Explore corrective action and root cause analysis using a benzene fenceline monitoring case study

Five Elements Define EPA's Next Generation Compliance Strategy



Explained in Next Generation Compliance Strategy: 2014-2017 dated October 2014.

Refinery Emissions Have Been Regulated for Decades By Two Standards

1. New Source Performance Standards (NSPS)
   - 1974: Fuel Gas Combustion Devices, Fluid Cat Cracking Units, Sulfur Plants
   - 2008: Added Delayed Cokers, Flares, Process Heaters
2. Maximum Achievable Control Technology (MACT) Standards
   - 1995 (MACT 1): Non-combustion or Evaporative Sources (equipment leaks, tanks wastewater, miscellaneous process vents, heat exchange systems, cooling towers)
   - 2002 (MACT 2): Combustion Sources (Cat Cracking Units, Catalytic Reformer Units, Sulfur Recover Units)

NSPS and MACT Require Periodic Reviews

- NSPS
  - CAA Section 111 (b) requires EPA to set and periodically review emission standard for new sources of criteria air pollutants, volatile organic compounds, and other pollutants

- MACT
  - CAA Section 112 (d) requires EPA to set emission standards for HAP emitted by major stationary sources based on performance of maximum achievable control technology
  - Two reviews are required:
    - Residual Risk Assessment – Are further reductions warranted?
    - Technology – Are better controls now available?

As a result of these reviews, EPA promulgated the Refinery Sector Rule (RSR) on 12/30/2015 with an effective date of 2/1/16.

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)

RSR Reflects Next Gen Compliance Strategy

Next Gen Strategy Element	RSR Component
More Effective Regulations & Permits	Self-reinforcing drivers of root cause analysis and corrective action
Advanced Emissions/Pollutant Technology	Fenceline monitoring for benzene
Electronic Reporting	Fenceline data reported electronically
Increased Transparency	Electronically reported fenceline data are available for public review on EPA websites
Innovative Enforcement	To be determined

RSR Uses “Corrective Action” More Than 150 Times

Distinction between “Correction” and “Corrective Action”

Correction

Fix the problem

Corrective Action

Determine the cause of the problem

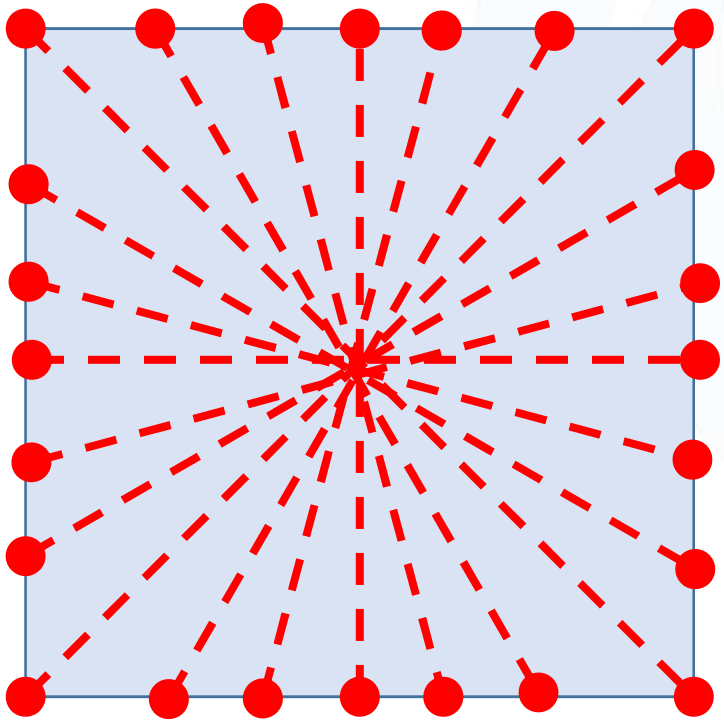
Prevent problem recurrence by addressing cause

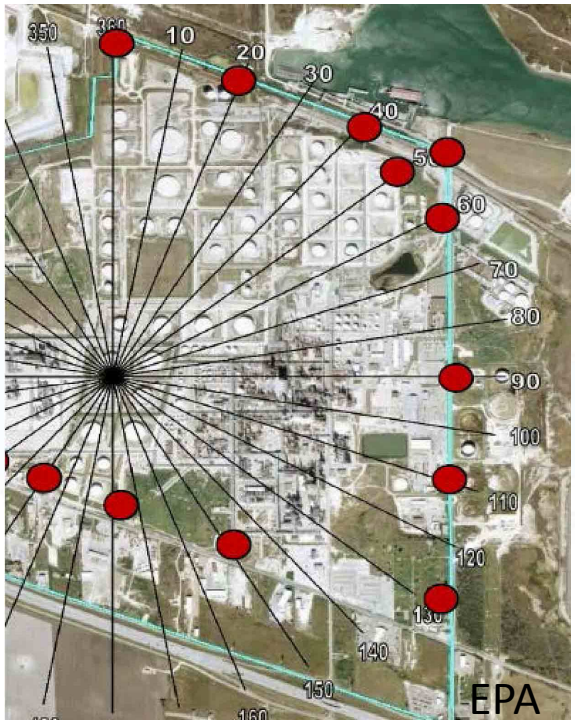
Fenceline Monitoring Program Requirements (1/2)

- 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.

Monitor Placement Varies with Facility Size (1a/2)

Facility Size, Acres	Angle, Degrees	Number of Monitors
Less than or equal to 750	30	12
Greater than 750 but less than 1500	20	18
Greater than 1500 acres	15	24





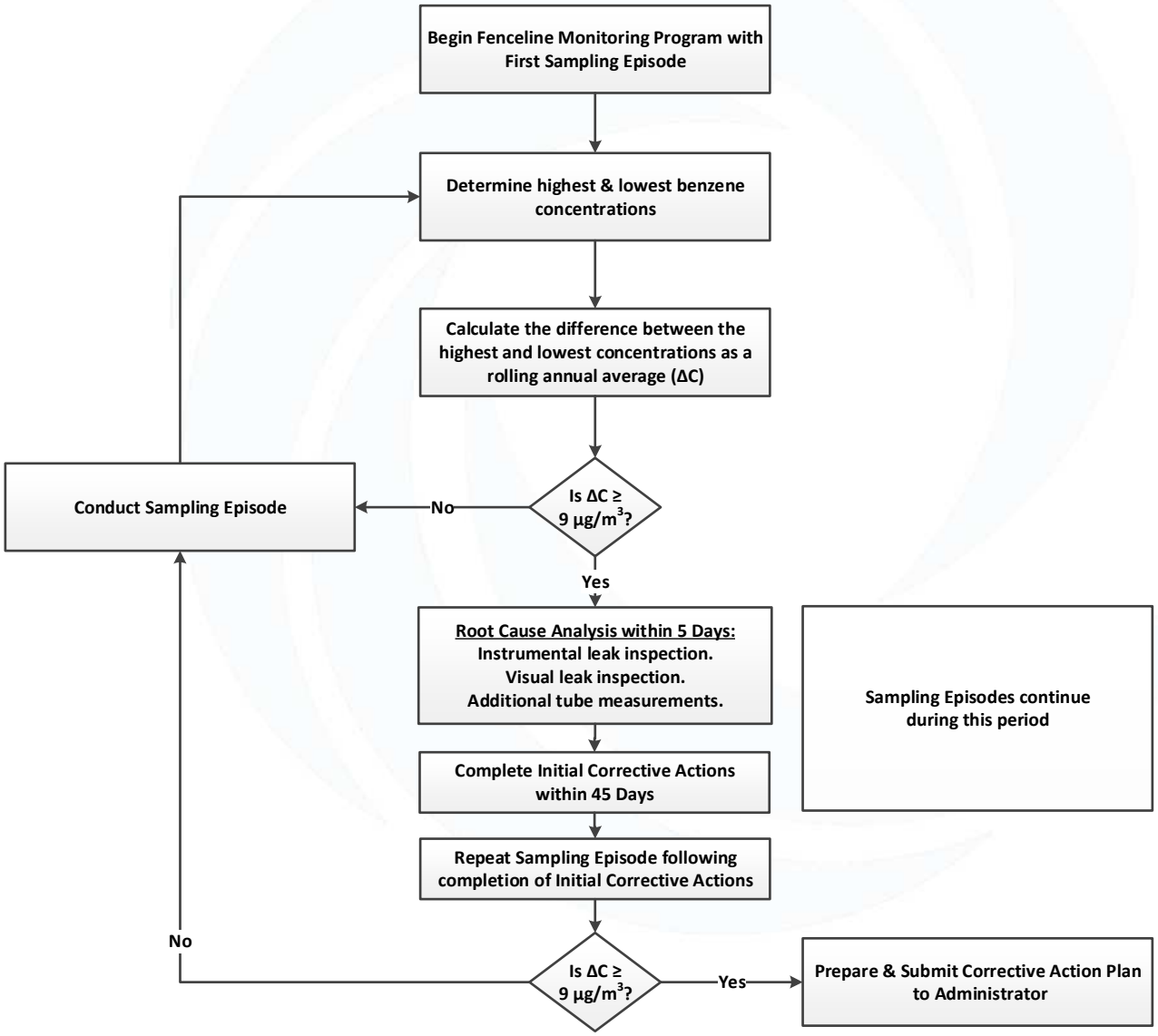
24 samplers placed along fenceline

Note that extra samplers are required near known sources of VOC emissions

Fenceline Monitoring Program Requirements (2/2)

- 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.
- Corrective action is required if difference in concentrations exceeds 9 $\mu g/m^3$ as a rolling annual average.
- Report data quarterly using EPA's Compliance and Emissions Data Reporting Interface (CEDRI).

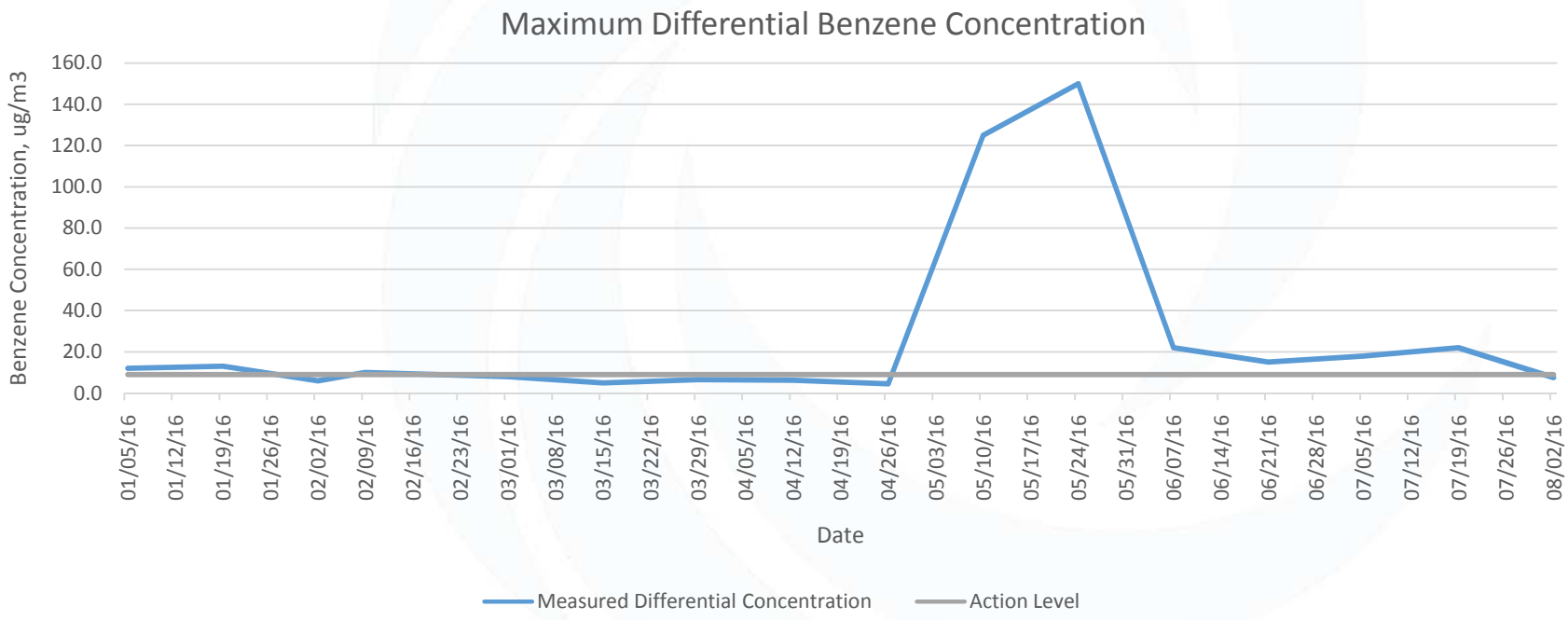
Evaluate Data within 30 Days of Sample Collection



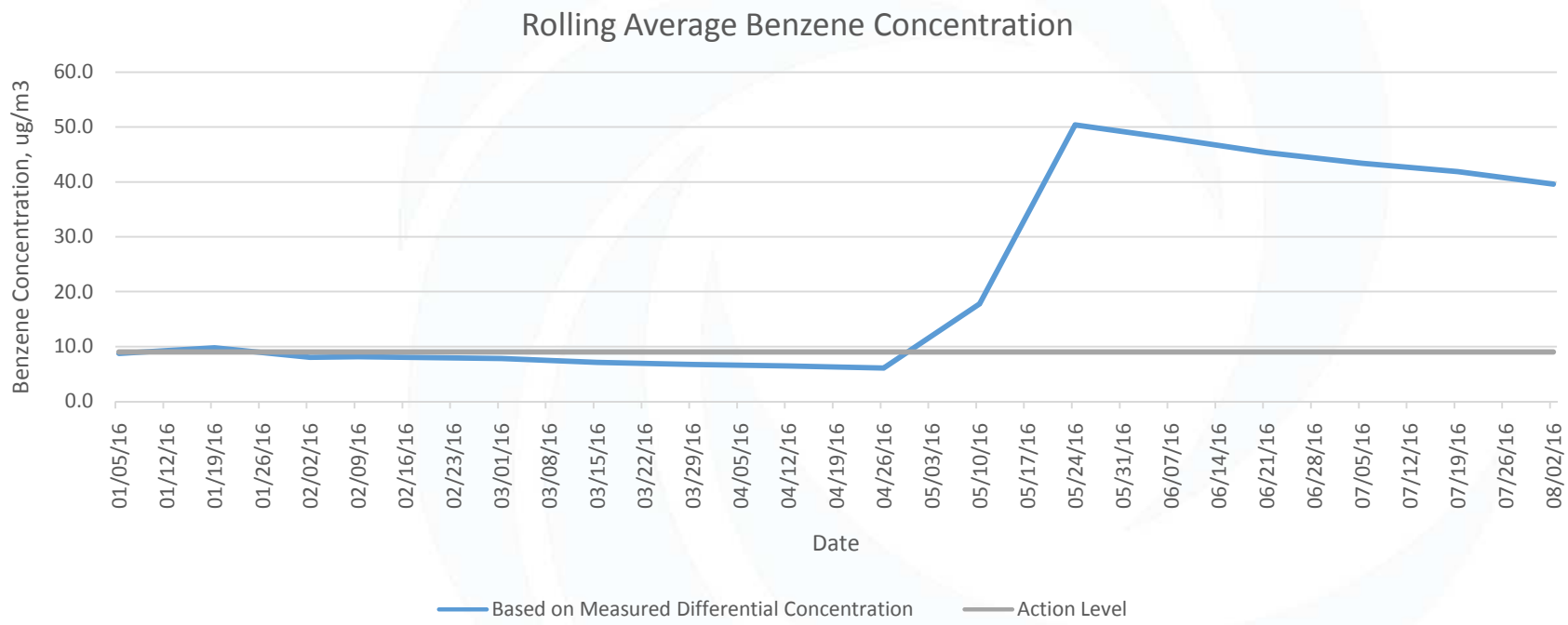
Fenceline Monitoring Case Study

- Small refining operation within a distribution terminal
- 12 fenceline monitoring locations with onsite met station
- Background monitoring yielded data below action level for 4 months
- Then it spiked, persisting above action level for several sampling episodes

Case Study Fenceline Monitoring Data, Maximum Differential Benzene Concentration



Case Study Fenceline Monitoring Data, Rolling Average Benzene Concentration



Root Cause Analysis (RCA) Approach[1]

	RCA Step	Case Study
1	Define the Problem	Benzene action level exceed by 10-fold at 2 measurement locations for multiple sampling episodes
2	Understand the Process	Sampling and analytical operations Refinery operations
3	Identify Possible Causes	Sampling/analytical errors Changes in facility operations
4	Collect Data	Compile sampling/analytical data Review facility operations
5	Analyze Data	Sampling/analytical data fine, but may have option of reporting differently if tank is non-refinery Elevated benzene data traced to tank cleaning operations

[1]*Root Cause Analysis: The Core of Problem Solving and Corrective Action*, D. Okes, 2009

Case Study Root Cause Analysis Results

- Elevated benzene concentrations resulted from tank cleaning operations that occurred between upwind and downwind monitoring stations.
- But was this the root cause?

No, the root cause was failure to consider the potential consequences of atypical or irregular refinery or terminal events

Case Study Corrective Action

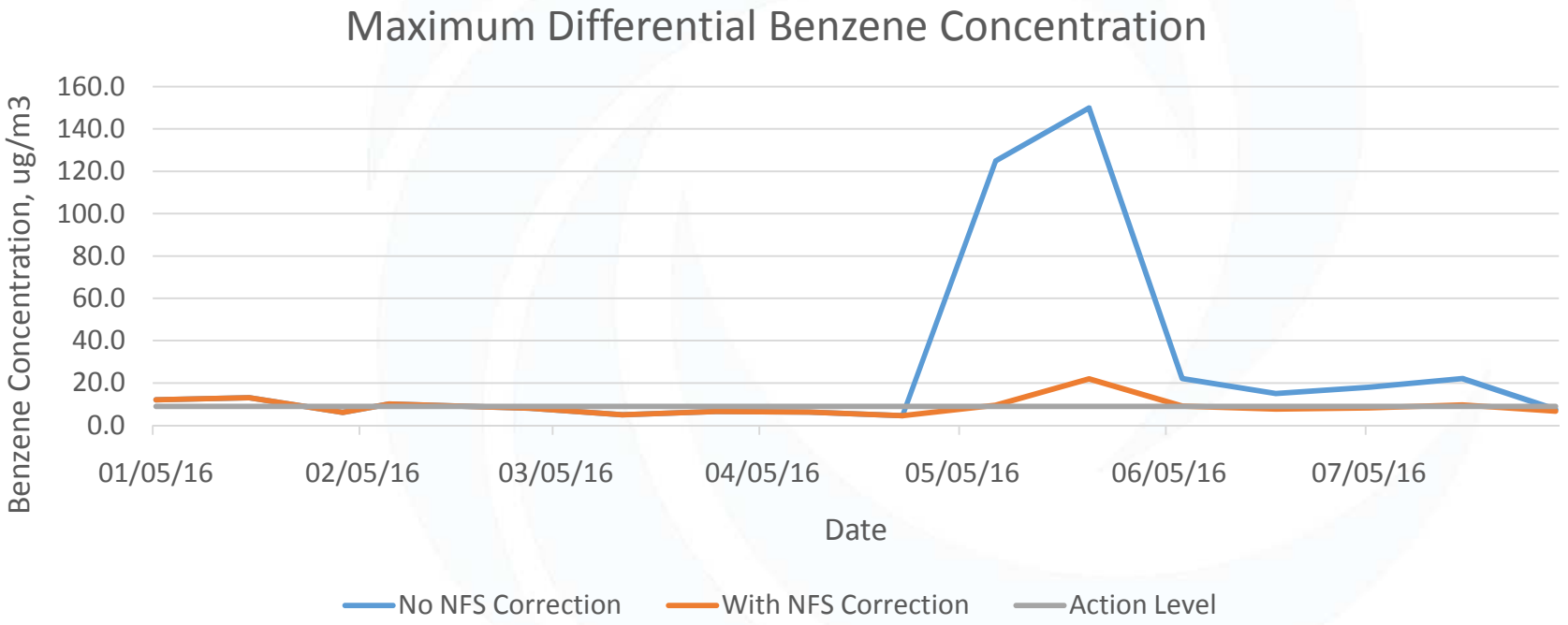
- Assess the potential impact of planned atypical or irregular operations on fenceline benzene concentrations before they occur

- Explore data management options that may allow management of interfering near field sources (NFS)

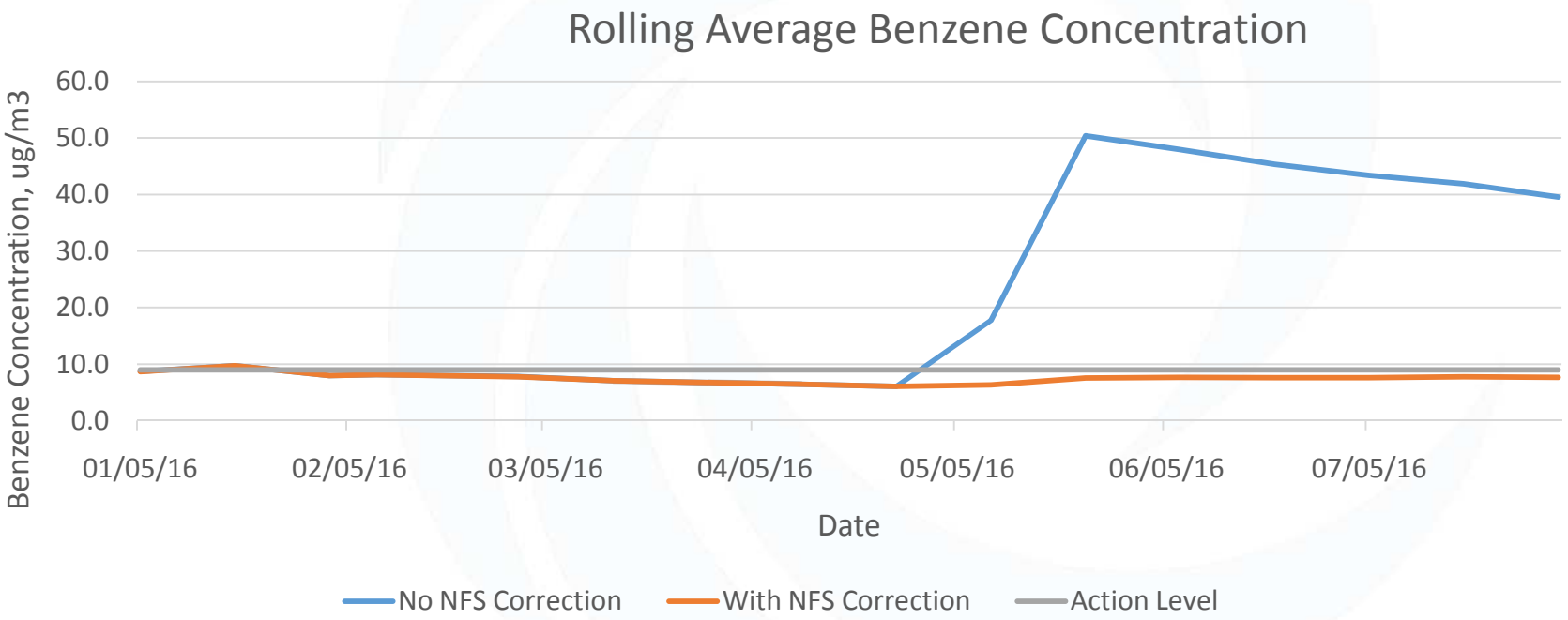
Seven Steps to Effective Correction Action

1. Clear description of the problem as determined by root cause analysis.
2. Summary of planned action to correct the problem.
3. Identification of the individuals responsible for implementing the planned corrective action.
4. Description of the operational changes, resources, and training requirements to achieve or perform the corrective action.
5. Schedule for completing the corrective action.
6. Plans for monitoring the effectiveness of the corrective action.
7. Documentation of corrective action completion.

Adjustment of Measurement Data for Interfering NFS Changes the Picture…..



And the Rolling Average



Fenceline Monitoring Program Design Considerations

- Collect 6 – 12 month's worth of data in advance of the compliance date to identify problems.
- 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.

Thank you

Questions?

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RSR Promulgation Process Relatively Quick

Date	Action
5/15/2014	Proposed RSR signed in compliance with a court order
6/30/2014	Proposed RSR in FR on (FR 79, 336879)
4/17/2015	Scheduled date for RSR promulgation
6/16/2015, 9/30/2015	Promulgation extension dates
9/29/2015	RSR signed on 9/29/15
12/1/2015	RSR published in FR (FR 80, 75177)
2/1/2016	RSR effective date
1/30/2018	Refineries must start fenceline monitoring

Concentrations Calculated Based on Uptake Rate and Sampling Interval

$$C_m = [m \div (U \times t)] \times 10^6$$

Where:

C_m = measured concentration in µg/m^3
m = desorbed mass in µg
U = diffusion sampler uptake rate in ml/min
t = sampling time in minutes

C_m is then corrected to normal temperature and pressure

Fenceline Monitoring Program Requirements

Key EPA Documents Govern Sampling Program

EPA-454/R-99-005, Meteorological Guidance for Regulatory Modeling Applications, February 2000

EPA-454/B-08-002, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements, March 2008

EPA-454/B-13-003, Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II: Ambient Air Quality Monitoring Program, May 2013

Rule Allows for Interfering Near-field Source Correction

- Essentially subtract the contribution from the interfering source:

  $\mathbf{\Delta C_i = MFC_i - NFS_i - UB}$

  where:

  $\mathbf{\Delta C_i}$ = Differential Concentration for location *i*

  $\mathbf{MFC_i}$ = Measured Fenceline Concentration for location *i*

  $\mathbf{NFS_i}$ = 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)