



Refinery Benzene Fenceline Monitoring: Considerations in Addition to Cost



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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

- 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

- 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

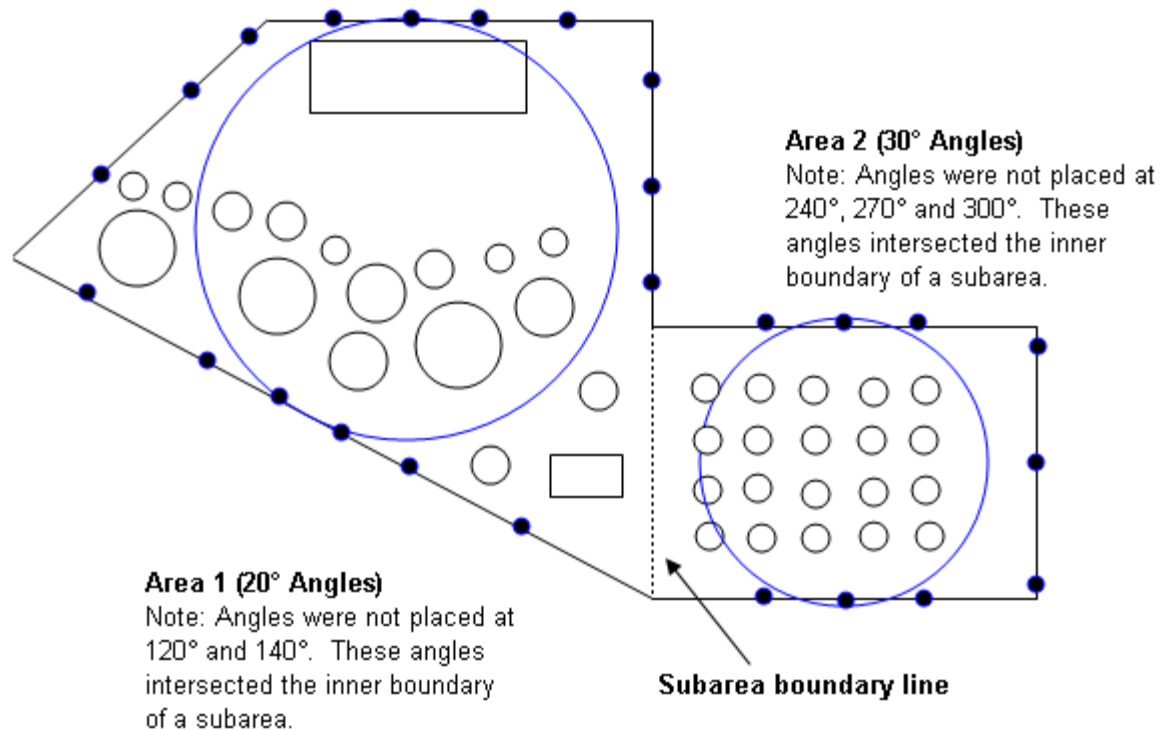


FIGURE 3.7.3 - Facility divided into three sub-areas:

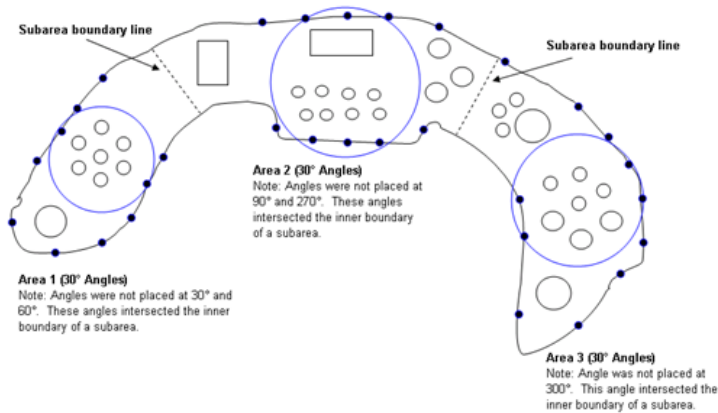


FIGURE 3.7.2 - Facility divided into two sub-areas:

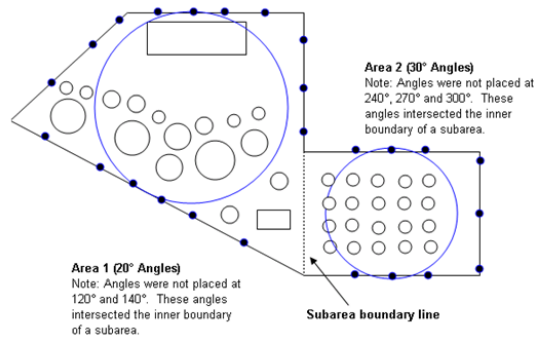
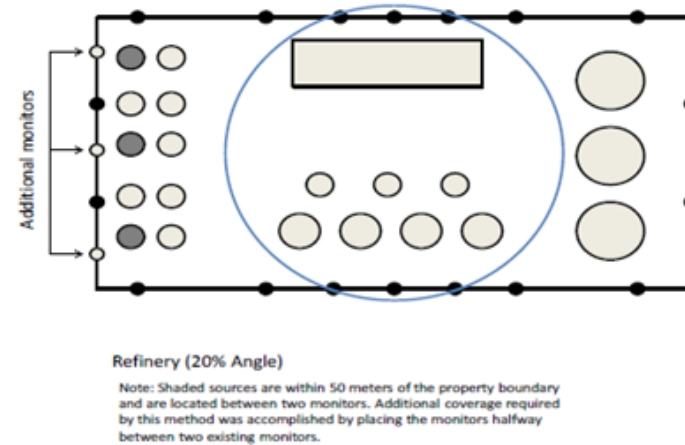


FIGURE 3.7.1 – Rectangular Facility with acreage between 750 and 1500 Acres:



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 ($2,000 \pm 250$ feet) apart.

Siting Sampling Points

Shelters





Hornets!

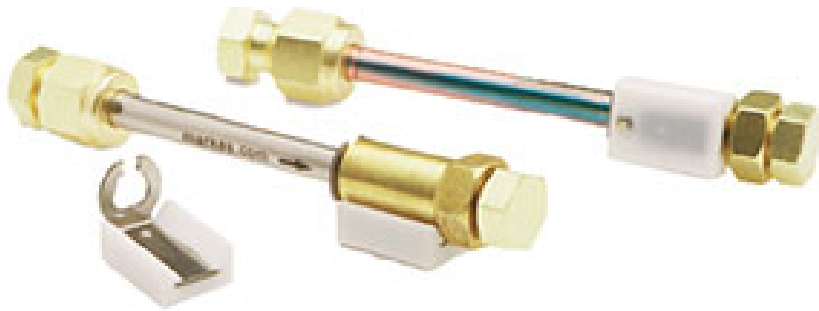
Sample Deployment



Fenceline Monitoring – What is it?



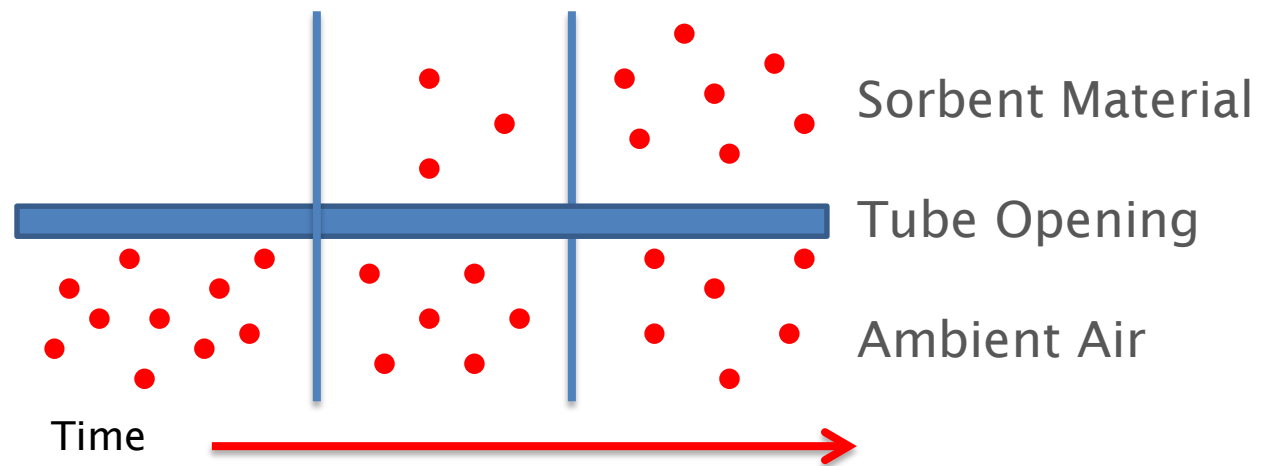
- Utilizes *passive sampling*
 - Carbon-based sorbent tubes
 - 14-day sampling duration, for a total of 26 sampling events per year



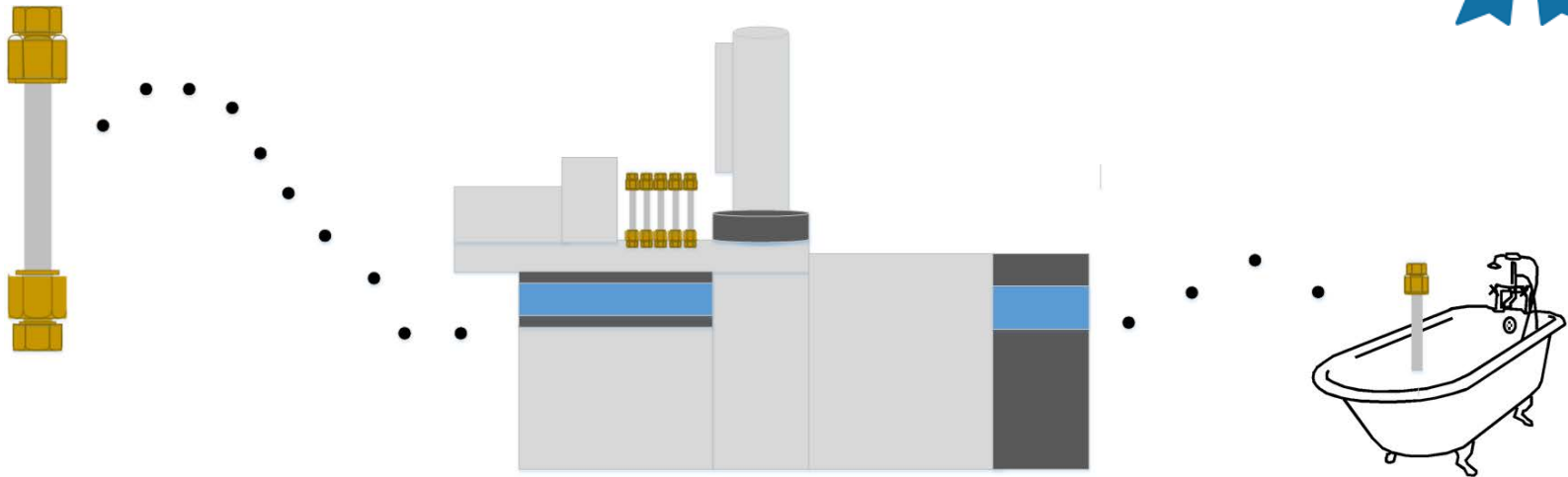
How Does Passive Sampling Work?



- 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



- Is laboratory certified for *air* methods?
- Certified for 325B specifically?
 - Only 5 labs in NELAP database for 325B



- 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



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

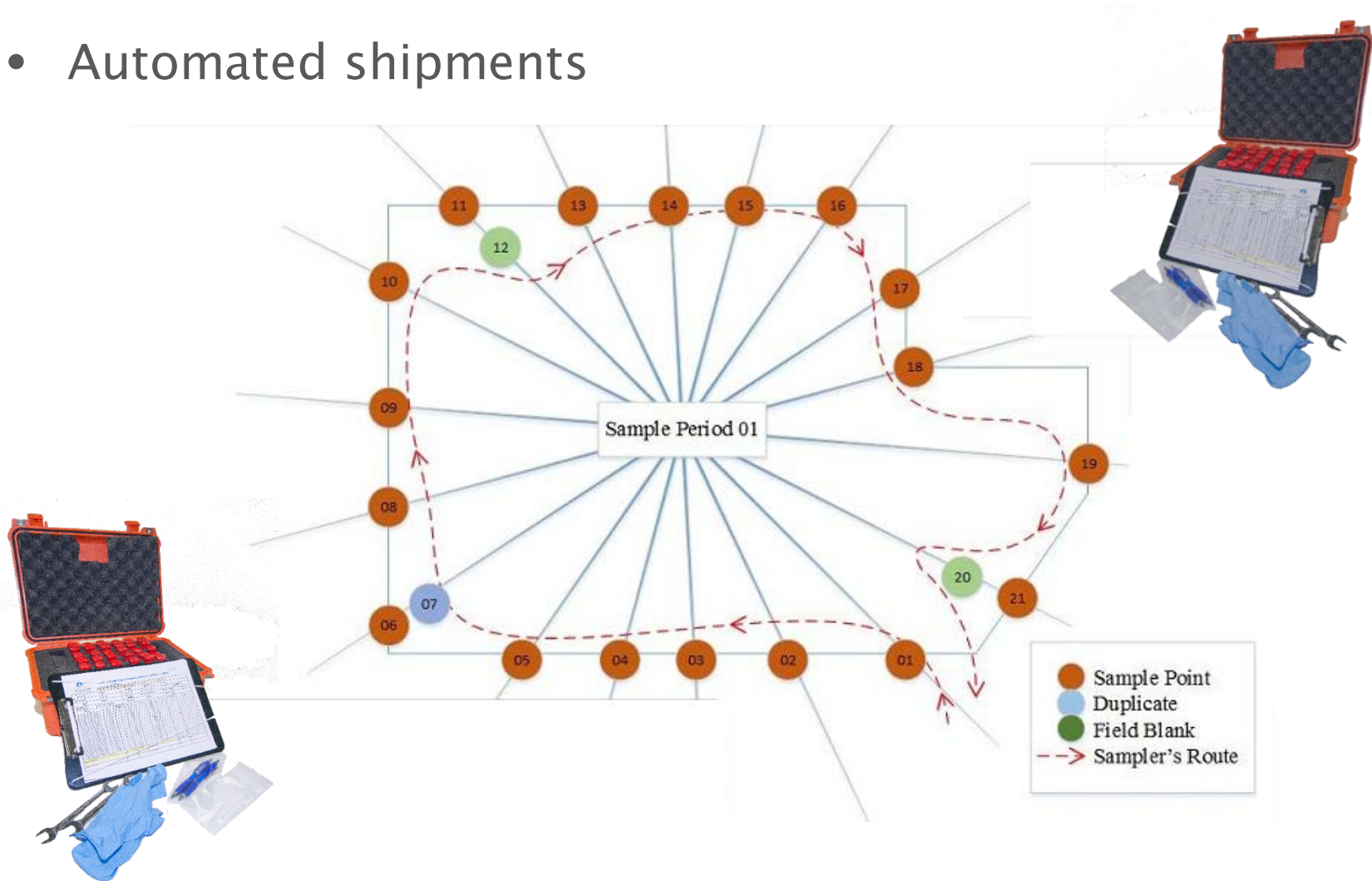
Ex. ALS has 3 instruments

~160 smps/day

~800 smps/week



- Automated shipments



EPA 325 A/B Chain of Custody Record & Field Test Data Sheet

Requested Turnaround Time in Business Days (Surcharges) Please Circle:								ALS Project No.	
1 Day (100%) 2 Day (75%) 3 Day (50%) 4 Day (35%) 5 Day (25%) 10 Day (Standard)									
Client Name	Refinery X			Site Name	site 01			ALS Contact:	
Project Manager	John Smith			Location Address	123 Refinery Drive			SAMPLING CONDITIONS	
Phone	867-5309			City, State, Zipcode	Refineryville, RI, 00001			Ambient Temperature (°F):	
Email Address for Result Reporting	John.Smith@RefineryX.com			PO Number	PO0001			Barometric Pressure (inHg):	
Sample ID	Tube ID	Sample, Blank, or Duplicate	Start Date	Start Time	End Date	End Time	Location (GPS)	Comments	
01-Location 1-14-SA-BNZ-105210	105210	SA	1/4/16		1/18/16				
02-Location 2-14-SA-BNZ-105211	105211	SA	1/4/16		1/18/16				
03-Location 3-14-SA-BNZ-105212	105212	SA	1/4/16		1/18/16				
04-Location 4-14-SA-BNZ-105213	105213	SA	1/4/16		1/18/16				
05-Location 5-14-SA-BNZ-105214	105214	SA	1/4/16		1/18/16				
06-Location 5-14-DU-BNZ-105215	105215	DU	1/4/16		1/18/16				
07-Field Blank-14-FB-BNZ-105216	105216	FB	1/4/16		1/18/16				
08-Location 6-14-SA-BNZ-105217	105217	SA	1/4/16		1/18/16				
09-Location 7-14-SA-BNZ-105218	105218	SA	1/4/16		1/18/16				
10-Location 8-14-SA-BNZ-105219	105219	SA	1/4/16		1/18/16				
11-Location 9-14-SA-BNZ-105220	105220	SA	1/4/16		1/18/16				
12-Location 10-14-SA-BNZ-105221	105221	SA	1/4/16		1/18/16				
13-Location 11-14-SA-BNZ-105222	105222	SA	1/4/16		1/18/16				
14-Location 12-14-SA-BNZ-105223	105223	SA	1/4/16		1/18/16				
15-Location 13-14-SA-BNZ-105224	105224	SA	1/4/16		1/18/16				
16-Location 14-14-SA-BNZ-105225	105225	SA	1/4/16		1/18/16				
17-Location 15-14-SA-BNZ-105226	105226	SA	1/4/16		1/18/16				
18-Location 16-14-SA-BNZ-105227	105227	SA	1/4/16		1/18/16				
19-Location 17-14-SA-BNZ-105228	105228	SA	1/4/16		1/18/16				
Analysis Requested: <input type="checkbox"/> Benzene only <input type="checkbox"/> Benzene + Other Target Compounds (List)								Receipt Temperature °C	
Relinquished by: (Signature)		Date:	Time:	Received by: (Signature)		Date:	Time:		
Relinquished by: (Signature)		Date:	Time:	Received by: (Signature)		Date:	Time:		

01-LOCATION 1-14-SA-BNZ

- Quick turnaround time of results
 - Standard 5 day TAT

- Compatibility with sampling/back-end software
 - CEDRI-compliant EDD
(Compliance and Emissions Data Reporting Interface)



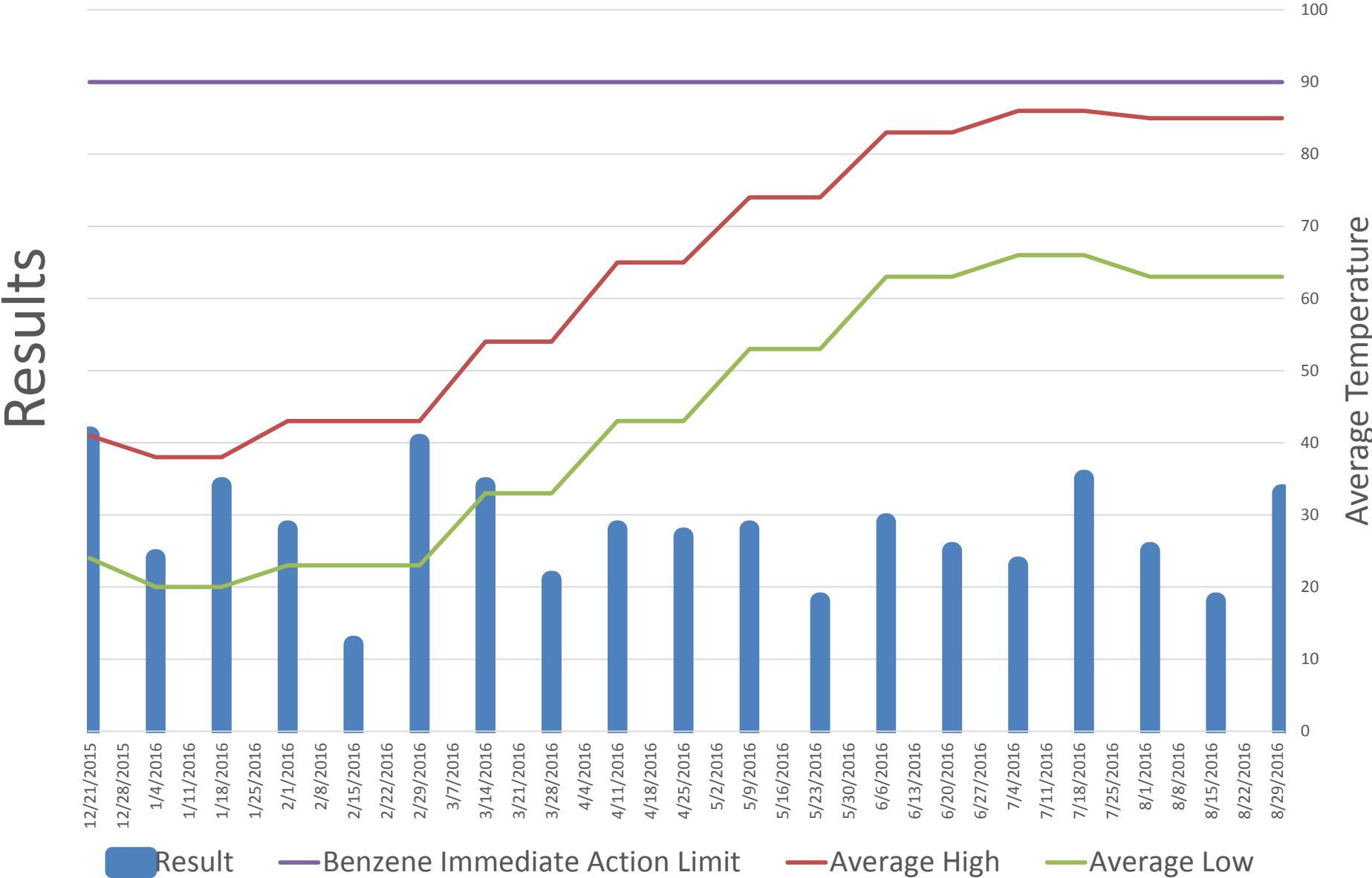
Lessons Learned

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



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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