



# Understanding Emissions Inventories and Measurement Systems

Benicia CAP  
December 5, 2020



# Understanding Emissions Inventories

## The limits of estimating and measurement systems



How long is this knife?

### Estimates are:

- Approximate
- Require making assumptions
- May vary depending on the estimator
- Accuracy varies depending on the method used
- Often used when direct measurement isn't possible



### Measurements are:

- More accurate than estimates
- Precision varies with the measurement system used
- Inherently limited by technology
- Minimum Detection Limit: how low can you reliably measure? Can the presence of a substance always be confirmed?

# Emissions Inventory methodology Is Source-specific

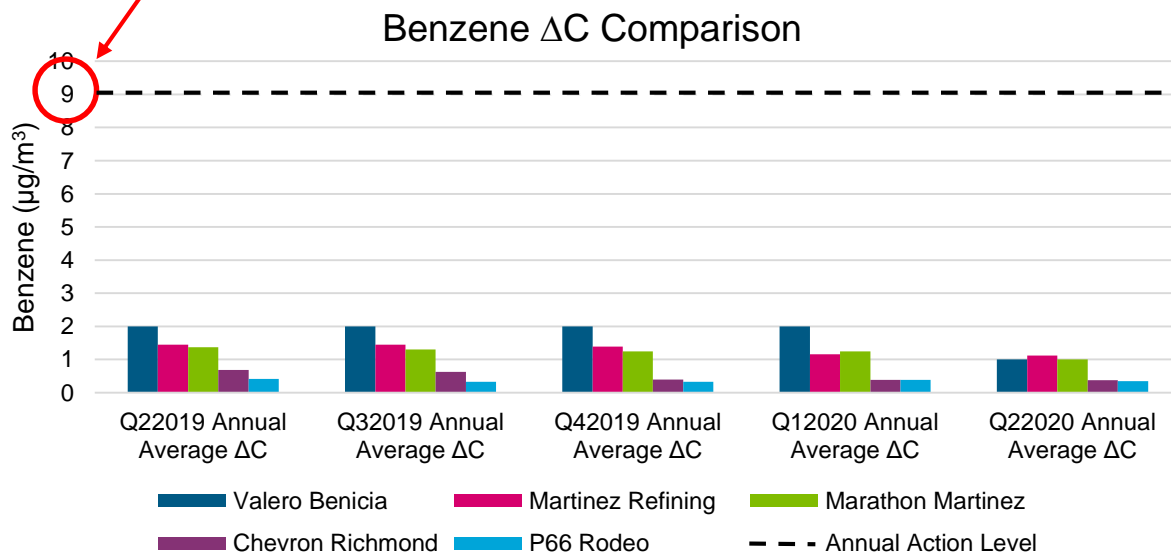
Sources w/Estimated Emissions	Sources Directly Measured
Storage tanks (EPA model used)	Most Combustion sources (Boilers and Furnaces have Continuous Emissions Monitors, or CEMs)
Fugitive Emissions (speciation – representative composition used)	Fugitive Emissions (leak rate in ppm, Method 21 requires trained user)
Wastewater emissions to Air (EPA model used)	Wastewater emissions to water (3 <sup>rd</sup> party laboratory data is very precise)
Cooling Towers	Flue Gas Scrubber (CEMs for CO, CO <sub>2</sub> , NO <sub>x</sub> , SO <sub>2</sub> , source test for PM)
Maintenance activities such as painting, vessel depressurization, vehicles	Painting formulation (solvent) Vessel depressurization VOC measured

Passive RSR monitors encircling the Refinery are reliable measurement systems. Open-path monitors measure ambient air quality **from all sources**. Minimum Detection Limit can confound data usefulness and interpretation.

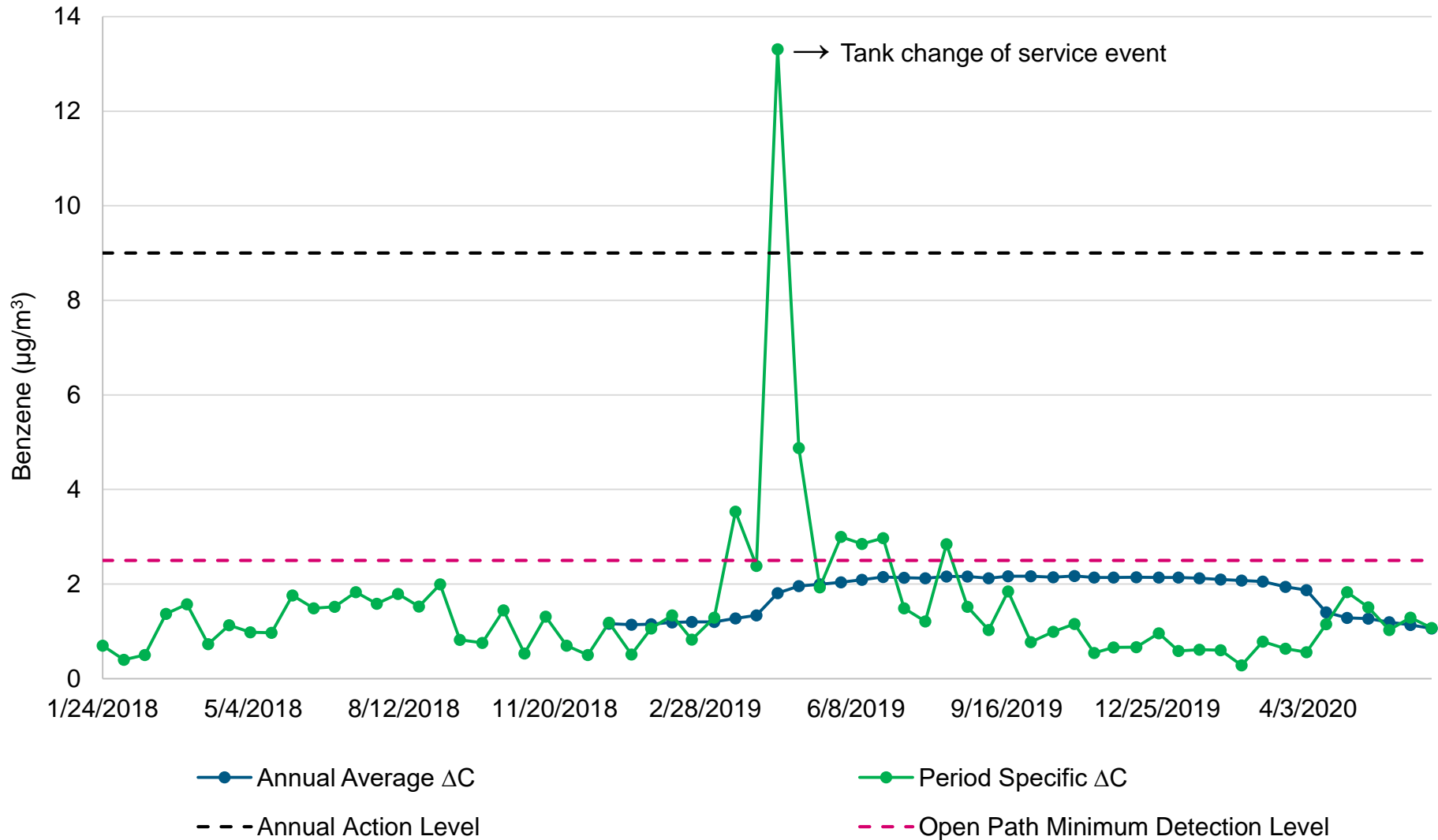
# Benzene Emissions in Detail

- OSHA defines the benzene permissible exposure limits as (a) a Time-weighted average of 1 ppm (part per **million**) over 8 hours, and (b) a short-term exposure limit of 5 ppm in any 15-minute period. (Note: 1 ppm = 1000 ppb)
- The Passive sampling action level is 2.8 ppb (parts per **billion**) or 1/357<sup>th</sup> of the OSHA permissible exposure limit.
- Note: 0.0028 ppm = 2.8 ppb = to **9 $\mu\text{g}/\text{m}^3$**  (just a different scale we'll see on subsequent charts)
- Therefore, the Passive sampling action level is **Health Protective**

*Passive sampling results are averaged over 12 months and compared to the action level. Updated each quarter, all 5 Bay Area refineries are well below the annual action level of 9 $\mu\text{g}/\text{m}^3$ .*



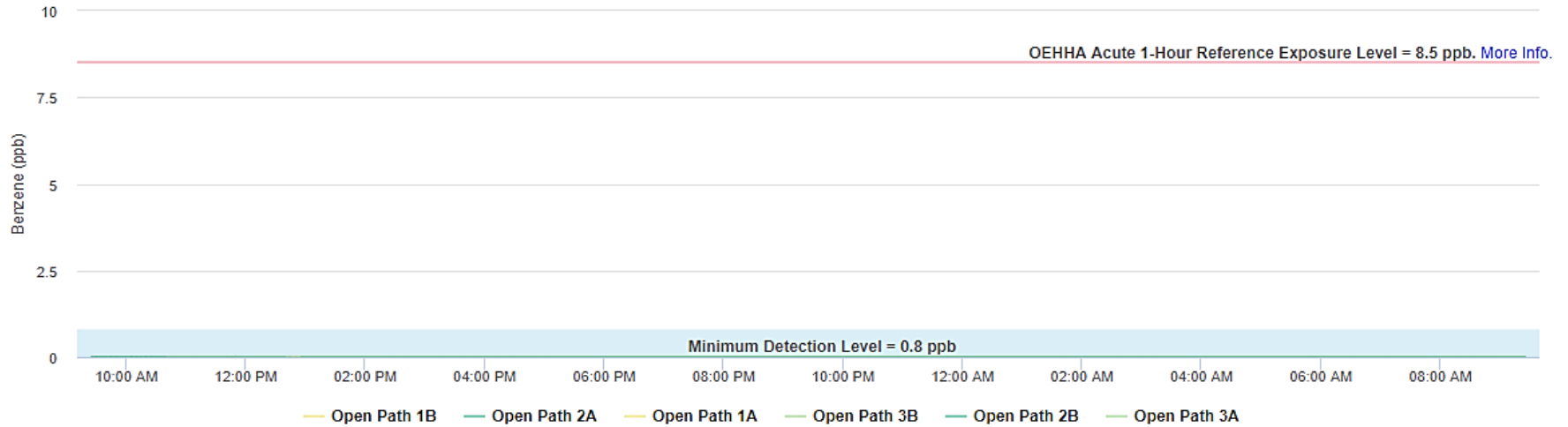
# Fenceline Monitoring Passive Sampling - In compliance since rule implementation in January 2018



# Fenceline Open Path Monitoring – Ambient levels usually below minimum detection level

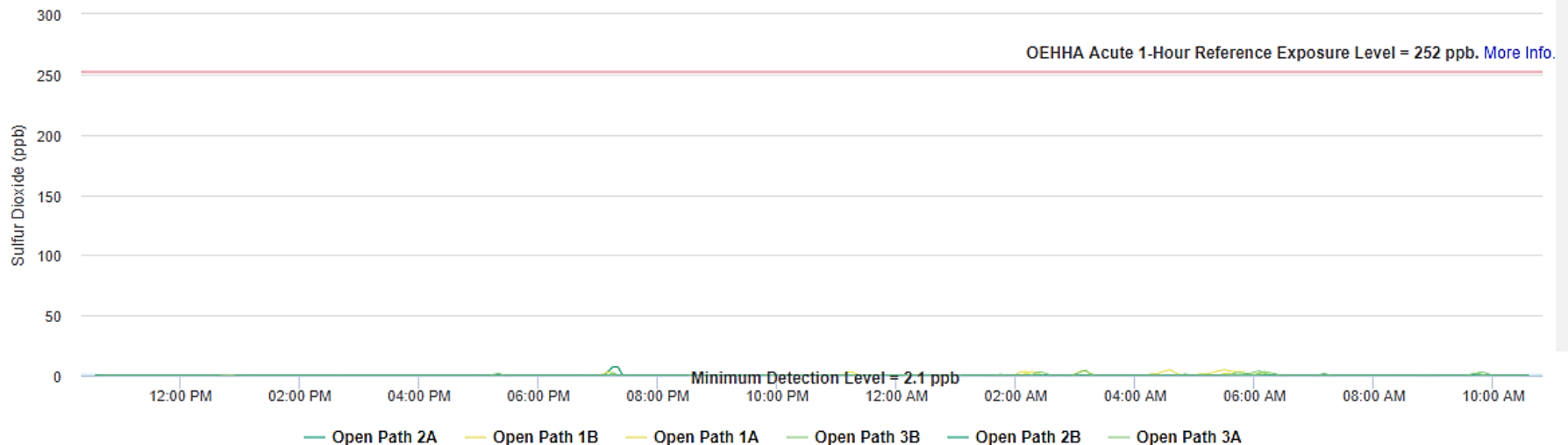
## Benzene (ppb)

5-Minute Averages



## Sulfur Dioxide (ppb)

5-Minute Averages



# Fenceline Open Path Monitoring – Event measurements can be above minimum detection level

December 5, 2020 refinery upset measured by Open-path monitors

