Benicia Refinery
Benicia, California

Community Ambient Air Monitoring

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- Center for Toxicology and Environmental Health, LLC (CTEH)
  - Provided expert ambient air sampling and analysis during March event and refinery startup
  - Daily reports provided to City, BAAQMD, EPA and Solano County
  - Converting data into information is the key to understanding air quality

- Sampling occurred around the clock throughout the community: up-, down- and cross-wind of refinery

- Substances sampled included:
  - Benzene
  - Carbon Monoxide
  - NO2 (NOx)
  - PM2.5 (particulate matter equal to or less than 2.5 microns in size)
  - SO2 (sulfur dioxide)
  - Toluene
  - VOCs (volatile organic compounds)
  - Xylene

- Notation: the '<' (less than) character is used to indicate that readings were below the limit of detection

Community Ambient Air Monitoring

PM2.5 Results (March 21)

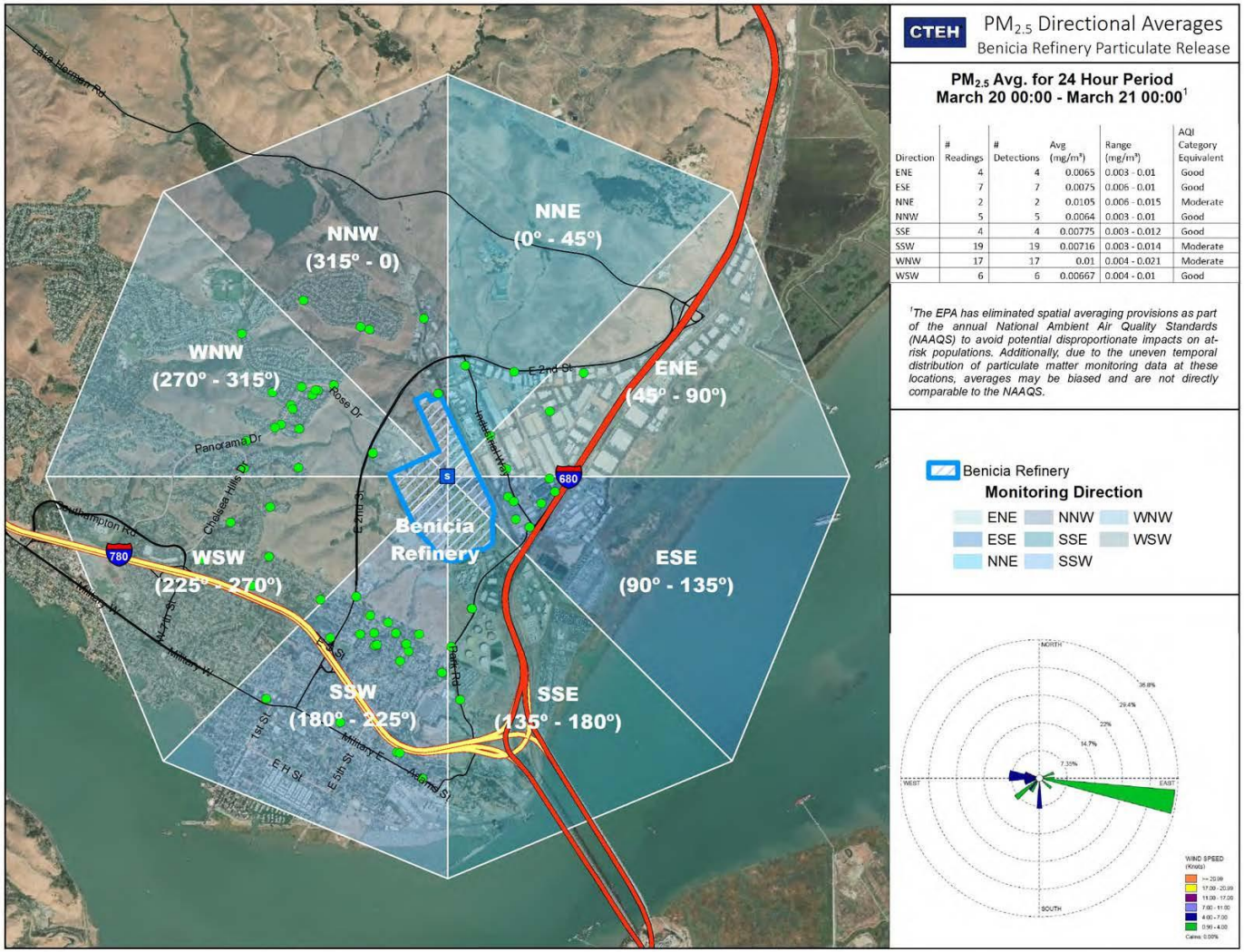
Table 1: Community Hand-Held Real-Time Air Monitoring Results

Analyte	Instrument	# Readings	# Detections	Range
Carbon Monoxide	MultiRAE	63	0	< 1 ppm
NO_2	MultiRAE	64	0	< 0.1 ppm
PM_{10}	AM510/AM520/DustTrak	61	61	0.002 - 0.02 mg/m3
$PM_{2.5}$	AM510/AM520/DustTrak	65	65	0.003 - 0.014 mg/m3

[1]Maximum detections preceded by the "<" symbol are considered non-detections below the limit of detection (LoD) value to the right.

Additionally, at the request of public health officials, particulate matter (PM2.5 and PM10) data have been grouped by downwind direction and averaged over a 24-hour period for comparison to AQI category equivalents. Wind-rose maps are provided for the corresponding time periods (**Appendix B**). It is notable that the USEPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS. Comparisons to AQI category equivalents are provided for illustration purposes only.

PM2.5 Results (March 21)



Air Monitoring Challenges

- Associating emission with the sources can be challenging
  - To which source do we attribute the emissions?
  - PM sources include: I-680/I-780 traffic, locomotives, ships, refinery, bbqs, restaurants with vented grills, tree pollen, road dust, lawnmowers, etc.
  - Fingerprinting of emissions may be possible if PM attribute is unique to a given source

- CTEH observed what was occurring at the time of sampling to put the data in context

- Some insight is offered from monitoring results pre- and post-refinery startup

Monitoring Results while Refinery S/D

Table 1: Preliminary Community Real-Time Air Monitoring Summary

May 1, 2019 06:49 PDT to May 2, 2019 06:30 PDT

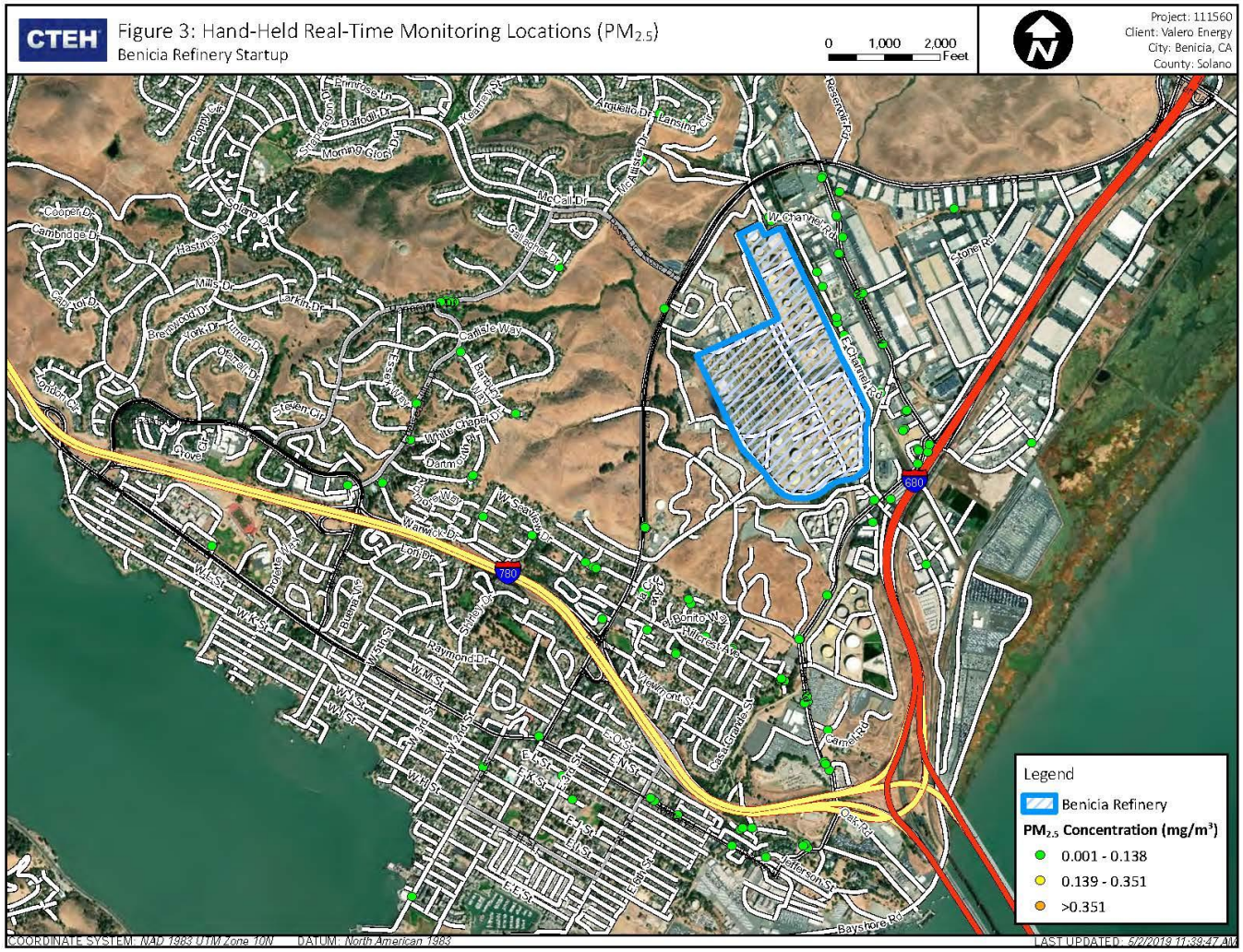
Analyte	Instrument	# Readings	# Detections	Range
Benzene	UltraRAE	122	0	< 0.025 ppm
Carbon Monoxide	MultiRAE	127	4	2 - 15 ppm
NO_2	Gastec Tube #9L	4	0	< 0.1 ppm
	MultiRAE	125	0	< 0.1 ppm
$PM_{2.5}$	AM510/AM520/DustTrak	125	125	0.003 - 0.100 mg/m^3
SO_2	MultiRAE	125	0	< 0.1 ppm
Toluene	Gastec #122	65	0	< 1 ppm
VOCs	MultiRAE	125	5	0.1 - 0.2 ppm
Xylene	Gastec #123	65	0	< 1 ppm

[1]Maximum detections preceded by the "<" symbol are considered non-detections below the limit of detection (LoD) value to the right.

Pre-startup monitoring results show similar PM2.5 results to when refinery is operating. Carbon Monoxide from non-refinery sources was detected.

Valero

Monitoring Results while Refinery S/D



Air Monitoring Conclusions

- Ambient air monitoring can reliably measure emissions from area sources when concentrations are above detection limits
- Attributing emissions to individual sources is difficult unless a source has a unique emissions fingerprint
- Comparing spot readings to Air Quality Indexes or longer-term exposure thresholds is not recommended by air quality agencies, but it does provide some context
- The community of Benicia has background (continuous) emissions well below levels of concern whether the refinery is operating or not (similar concentrations observed during periods of shutdown and startup)
- CTEH toxicologist characterized Benicia's air quality as "enviable" based on his extensive sampling/analytical experience across the country.