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VALERO ENERGY

BENICIA REFINERY PARTICULATE RELEASE

Benicia, CA

March 25, 2019

Project #111391

1.0 Introduction

On March 23, 2019 Valero Energy requested that CTEH® conduct air monitoring in the surrounding community after a release of particulate matter from the Benicia Refinery in Benicia California. CTEH® arrived on-site on March 24, 2019 and began air monitoring operations. Activities were comprised of real-time air monitoring.

This report summarizes air monitoring data collected from March 24, 2019 13:47 PDT to March 25, 2019 06:30 PDT.

2.0 Air Monitoring and Sampling Methods

CTEH® developed and implemented an air sampling and analysis work plan (SAP) to document and quantify the release of fugitive emissions from the flue gas scrubber. All instrumentation was calibrated at least once per day or per manufacturer's recommendations. Target analytes were measured as, carbon monoxide (CO), 2.5-micron particulate matter ($PM_{2.5}$), and 10-micron particulate matter (PM_{10}) using handheld instruments such as RAE Systems MultiRAEs, TSI SidePak™ AM510/AM520 Aerosol Monitors, TSI DustTrak™ Aerosol Monitors, and Gastec GV-100 pumps with chemical-specific colorimetric detection tubes.

Hand-held air monitoring consisted of roaming air monitoring in the surrounding community. All hand-held air monitoring was conducted in the breathing zone.

3.0 Air Monitoring Results

Figures 1 – 5 in **Attachment A** depicts the site location and hand-held monitoring locations for this reporting period.

Table 1 summarizes the results for community hand-held air monitoring readings.

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

Analyte	Instrument	# Readings	# Detections	Range
Carbon Monoxide	Gastec 1LC	14	0	< 0.5 ppm
PM_{10}	AM510/AM520/DustTrak	95	95	0.006 - 0.015 mg/m3
$PM_{2.5}$	AM510/AM520/DustTrak	88	88	0.006 - 0.012 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.

4.0 Weather Conditions

Figure 8 in attachment C contains meteorological data and a wind rose depicting wind speed and direction for this reporting period. Data was acquired from California Irrigation Management System (CIMIS) meteorological station #170 located in Concord to the southeast of the Benicia Refinery.

Attachment A

CTEH Air Sampling and Monitoring Locations

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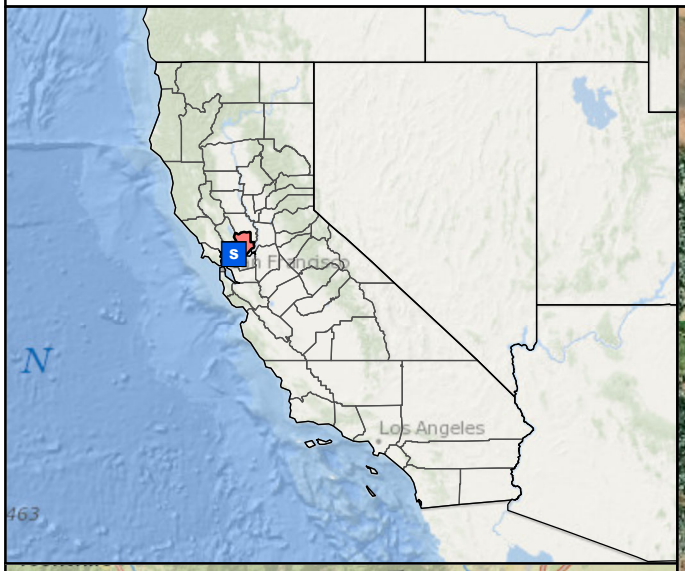
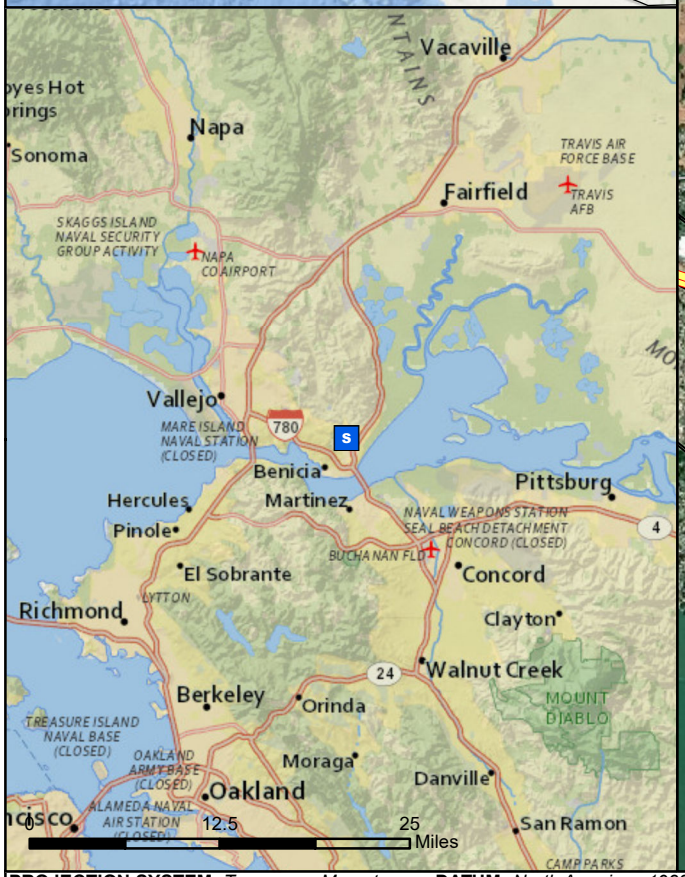
Figure 1: Incident Location

Benicia Refinery Particulate Release

0 0.25 0.5 1 Miles

Project: 111391
Client: Valero Energy
City: Benicia, CA
County: Solano





PROJECTION SYSTEM: *Transverse Mercator* **DATUM:** *North American 1983* **LAST UPDATED:** *3/25/2019 10:49:29 AM*

Figure 2: Hand-Held Real-Time Monitoring Locations

Benicia Refinery Particulate Release

0 1,000 2,000 Feet

Project: 111391
Client: Valero Energy
City: Benicia, AR
County: Solano

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *3/25/2019 11:53:08 AM*

Figure 3: Hand-Held Real-Time Monitoring Locations (PM_{10})

Benicia Refinery Particulate Release

0 1,000 2,000 Feet

Project: 111391
Client: Valero Energy
City: Benicia, AR
County: Solano

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *3/25/2019 11:48:44 AM*

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Figure 4: Hand-Held Real-Time Monitoring Locations ($PM_{2.5}$)

Benicia Refinery Particulate Release

0 1,000 2,000 Feet

Project: 111391
Client: Valero Energy
City: Benicia, AR
County: Solano

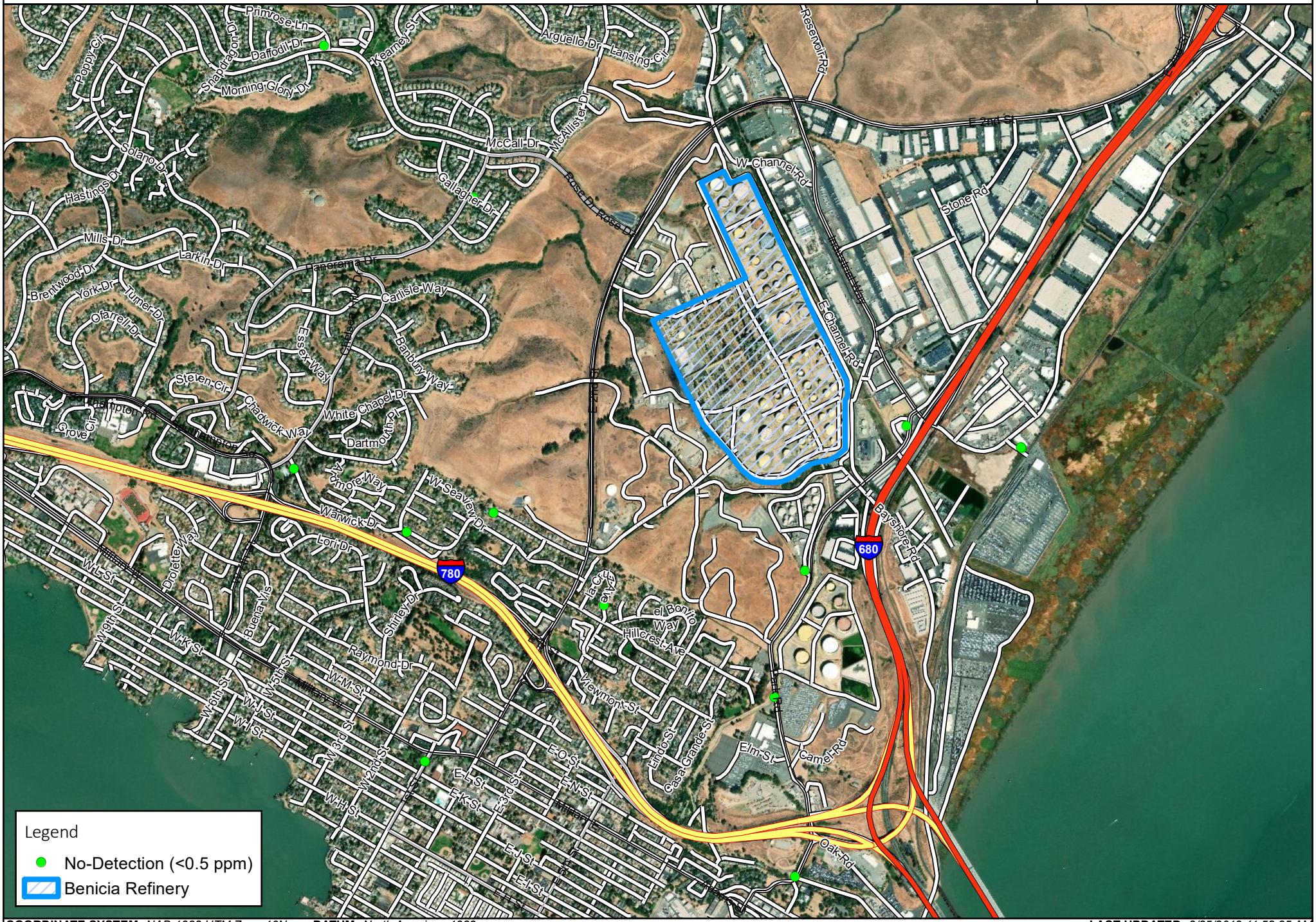
COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* DATUM: *North American 1983* LAST UPDATED: *3/25/2019 11:52:47 AM*

Figure 5: Hand-Held Real-Time Monitoring Locations (CO)

Benicia Refinery Particulate Release

0 1,000 2,000 Feet

Project: 111391
Client: Valero Energy
City: Benicia, AR
County: Solano



COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *3/25/2019 11:58:25 AM*

Attachment B

Directional Averages

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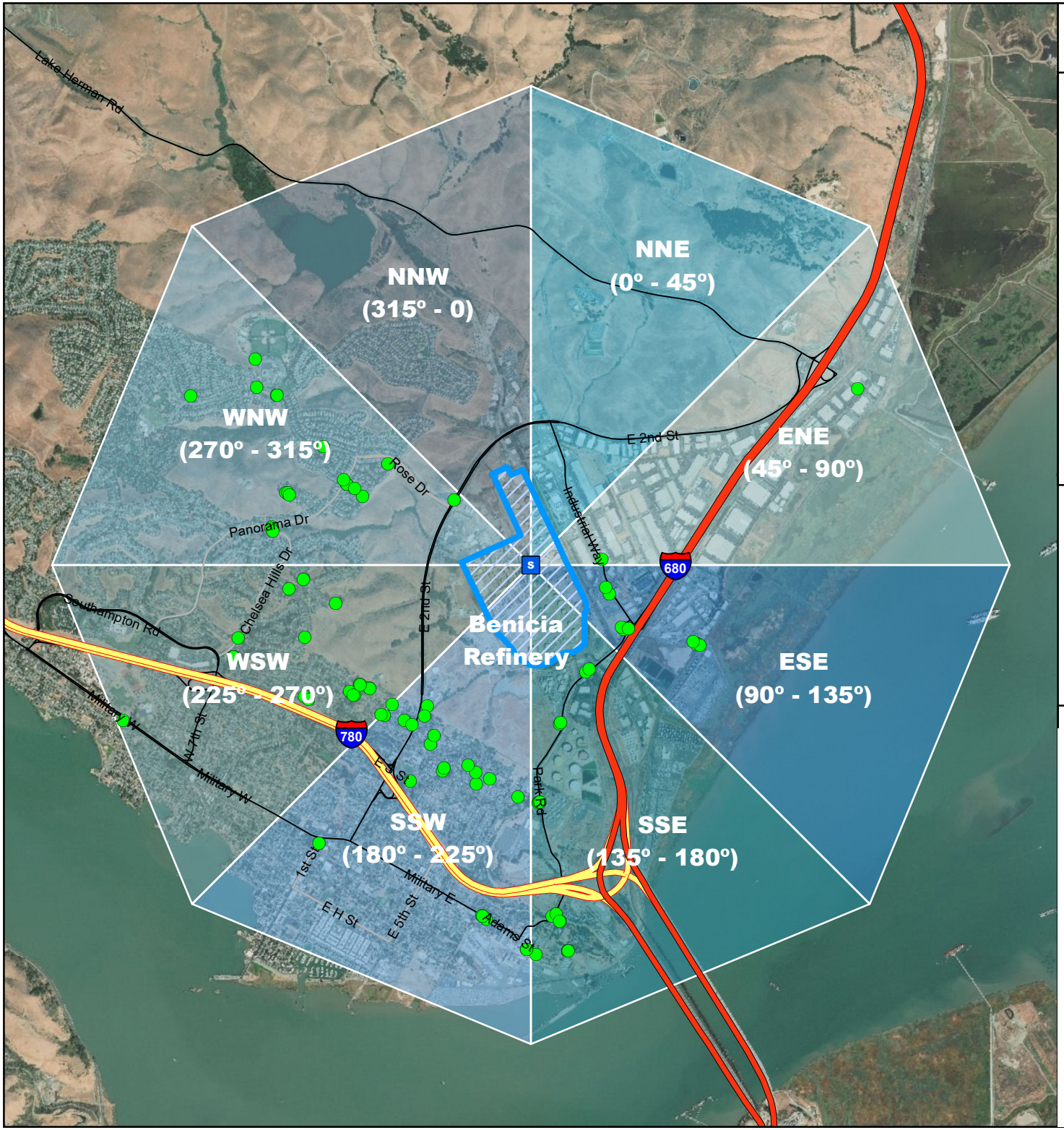

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$PM_{2.5}$ Directional Averages

Benicia Refinery Particulate Release

$PM_{2.5}$ Avg. for 24 Hour Period
March 24 06:00 - March 25 06:00[1]

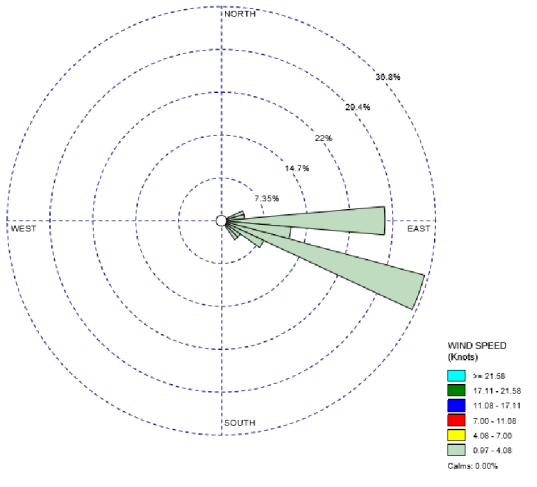
Direction	# Readings	# Detections	Avg (mg/m³)	Range (mg/m³)	AQI Category Equivalent
ENE	2	2	0.007	0.007 - 0.007	Good
ESE	10	10	0.008	0.006 - 0.009	Good
SSE	15	15	0.0082	0.007 - 0.009	Good
SSW	22	22	0.00809	0.006 - 0.012	Good
WNW	19	19	0.00679	0.006 - 0.008	Good
WSW	20	20	0.0075	0.006 - 0.009	Good

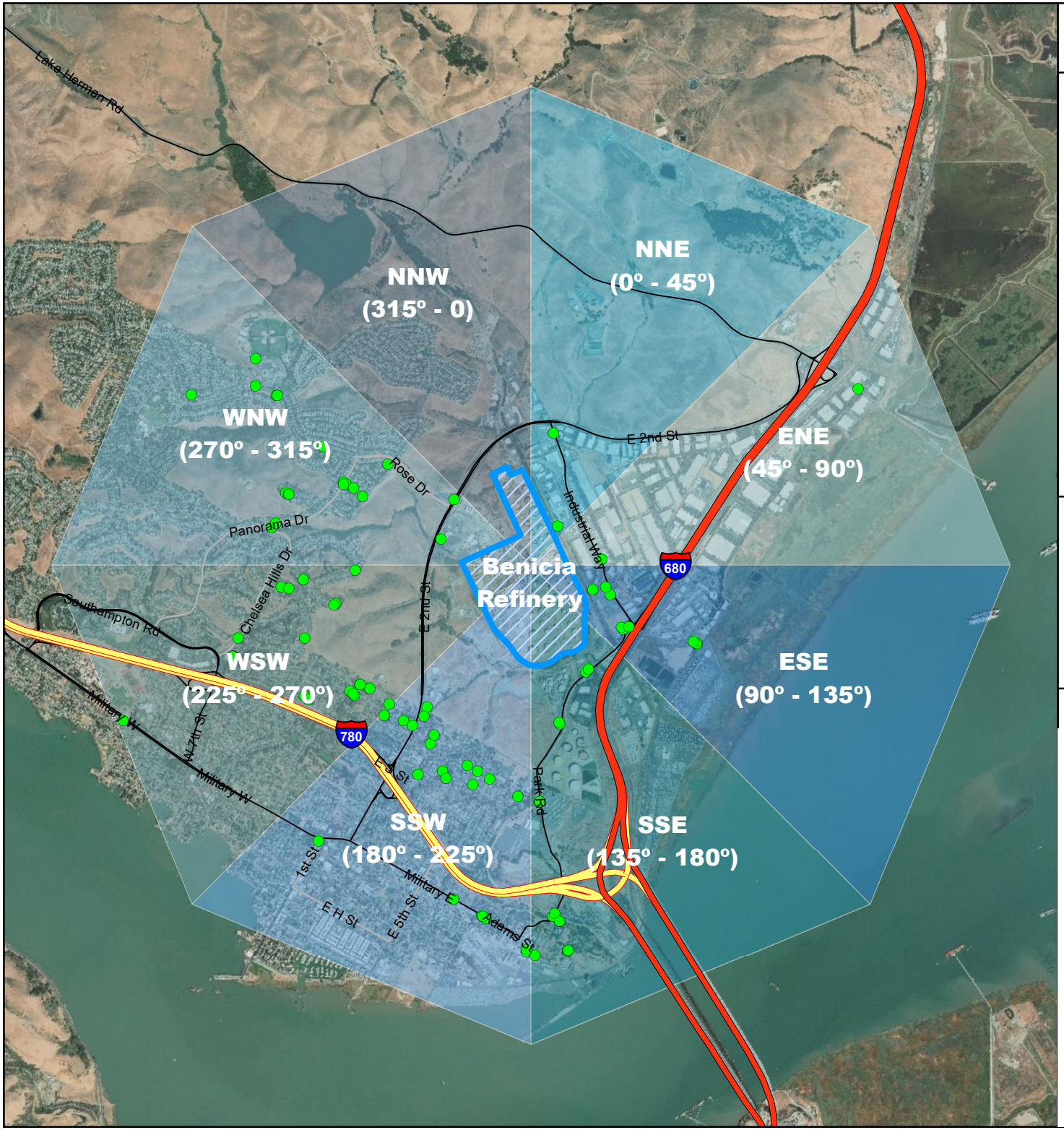
[1]*The EPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS.*

Benicia Refinery

Monitoring Direction

ENE NNW WNW
ESE SSE WSW
NNE SSW





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PM_{10} Directional Averages

Benicia Refinery Particulate Release

PM_{10} Avg. for 24 Hour Period
March 24 00:00 - March 25 06:00[1]

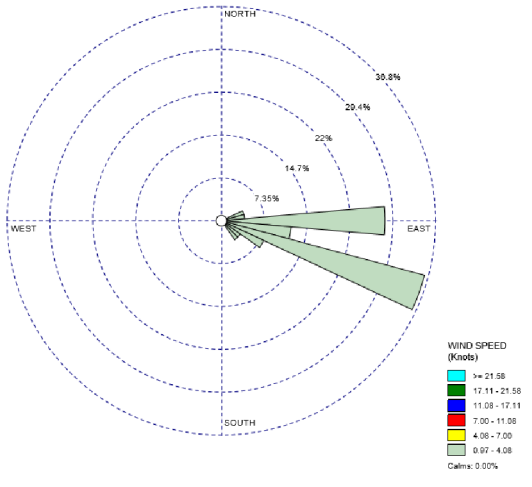
Direction	# Readings	# Detections	Avg (mg/m³)	Range (mg/m³)	AQI Category Equivalent
ENE	2	2	0.009	0.009 - 0.009	Good
ESE	8	8	0.00975	0.006 - 0.013	Good
NNE	2	2	0.0085	0.008 - 0.009	Good
SSE	13	13	0.01	0.008 - 0.012	Good
SSW	10	10	0.0108	0.008 - 0.015	Good
WNW	15	15	0.0094	0.007 - 0.012	Good
WSW	13	13	0.00969	0.007 - 0.013	Good

[1]*The EPA 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.*

Benicia Refinery

Monitoring Direction

ENE NNW WNW
ESE SSE WSW
NNE SSW



Attachment C

Meteorological Conditions

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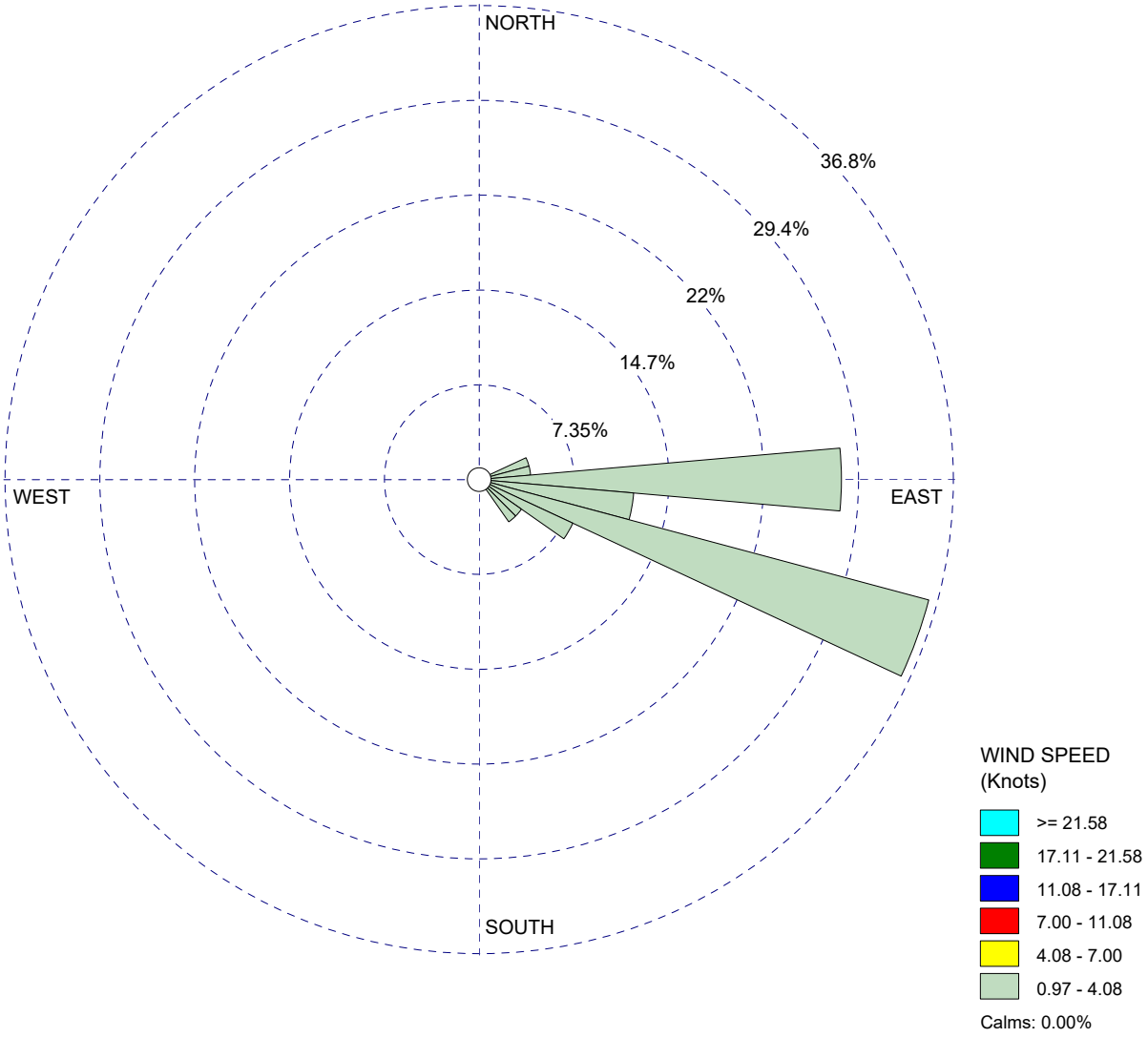
WIND ROSE PLOT:

Station #CIMIS

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 3/24/2019 - 06:00 **End Date: 3/25/2019 - 06:00**	MODELER:	
	CALM WINDS: **0.00%**	TOTAL COUNT: **25 hrs.**	
	AVG. WIND SPEED: **2.24 Knots**	DATE: **3/25/2019**	PROJECT NO.: **111391**