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THE SCIENCE OF READY℠

VALERO ENERGY

BENICIA REFINERY PARTICULATE RELEASE

Benicia, CA

March 20, 2019

Project #111342

1.0 Introduction

On March 13, 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 13, 2019 and began air monitoring operations. Activities were comprised of real-time air monitoring and analytical air sampling.

This report summarizes air monitoring data collected from March 19, 2019 06:30 PDT to March 20s, 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), nitrogen dioxide (NO_2), 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.

Analytical air samples were deployed in the breathing zone at six locations through the community. Each station consisted of SKC active sampling pump equipped with mixed cellulose ester (MCE) filter media suitable for collection of metals.

All samples will be sent to an accredited laboratory for analysis in accordance with NIOSH Method 7303. **Figure 7** in **Attachment A** depicts these analytical air sampling locations.

3.0 Air Monitoring Results

Figures 1 – 6 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	MultiRAE	66	0	< 1 ppm
NO_2	MultiRAE	66	1	0.1 ppm
PM_{10}	AM510/AM520/DustTrak	65	65	0.004 - 0.080 mg/m3
$PM_{2.5}$	AM510/AM520/DustTrak	66	66	0.006 – 0.043 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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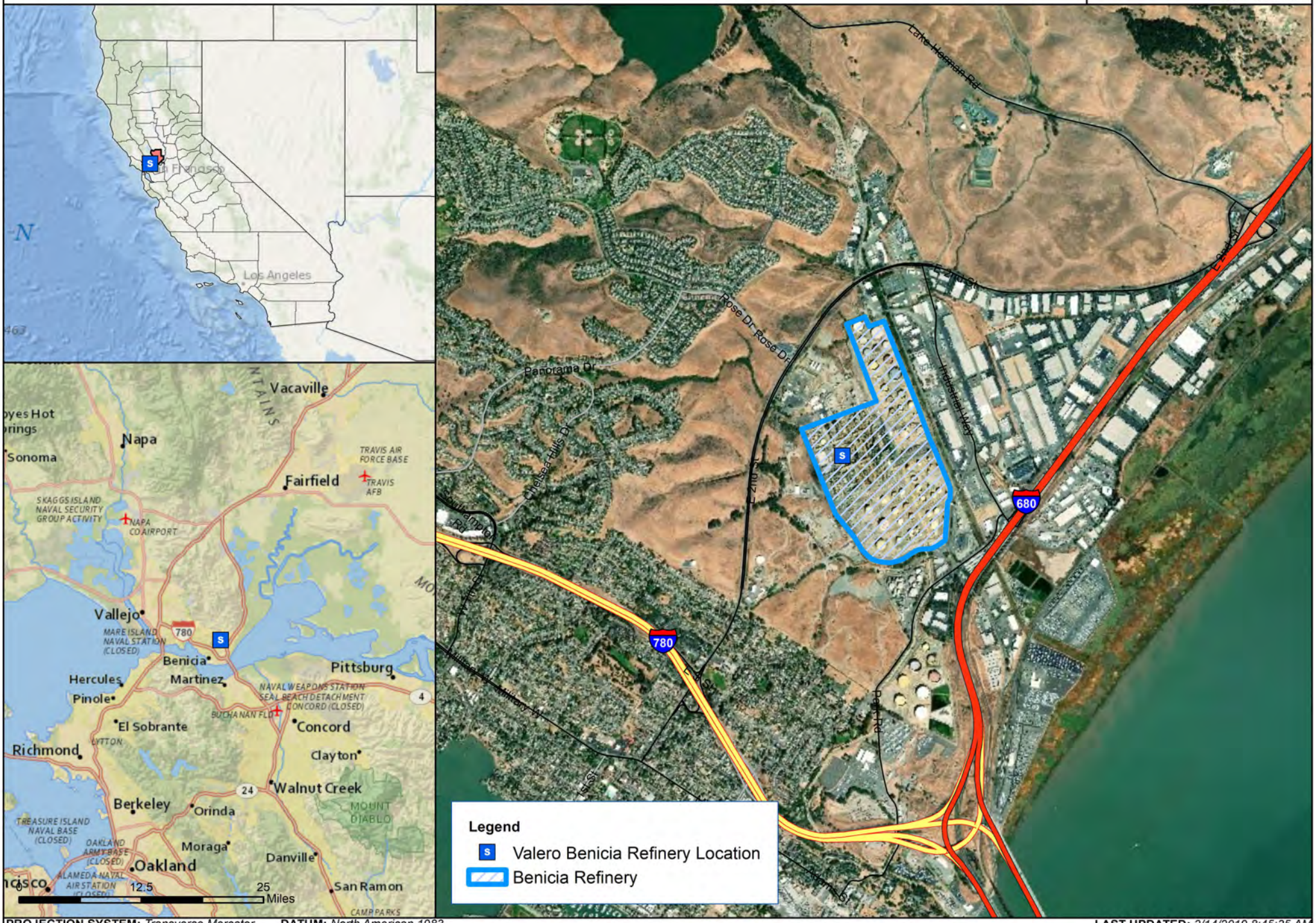
Figure 1: Incident Location

Benicia Refinery Particulate Release

0 0.25 0.5 1 Miles

Project: 111342
Client: Valero Energy
City: Benicia, CA
County: Solano



PROJECTION SYSTEM: *Transverse Mercator* DATUM: *North American 1983*

LAST UPDATED: *3/14/2019 8:45:35 AM*

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Figure 2: Hand-Held Real-Time Monitoring Locations

Benicia Refinery Particulate Release

0 1,000 2,000 Feet

Project: 111342
Client: Valero Energy
City: Benicia, AR
County: Solano

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* DATUM: *North American 1983*

LAST UPDATED: *3/20/2019 9:33:13 AM*

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

Benicia Refinery Particulate Release

0 1,000 2,000 Feet

Project: 111342
Client: Valero Energy
City: Benicia, AR
County: Solano

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* DATUM: *North American 1983* LAST UPDATED: *3/20/2019 9:33:50 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

N

Project: 111342
Client: Valero Energy
City: Benicia, AR
County: Solano

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* DATUM: *North American 1983* LAST UPDATED: *3/20/2019 9:34:38 AM*

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

Benicia Refinery Particulate Release

0 1,000 2,000 Feet

Project: 111342
Client: Valero Energy
City: Benicia, AR
County: Solano

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* DATUM: *North American 1983* LAST UPDATED: *3/20/2019 9:35:21 AM*

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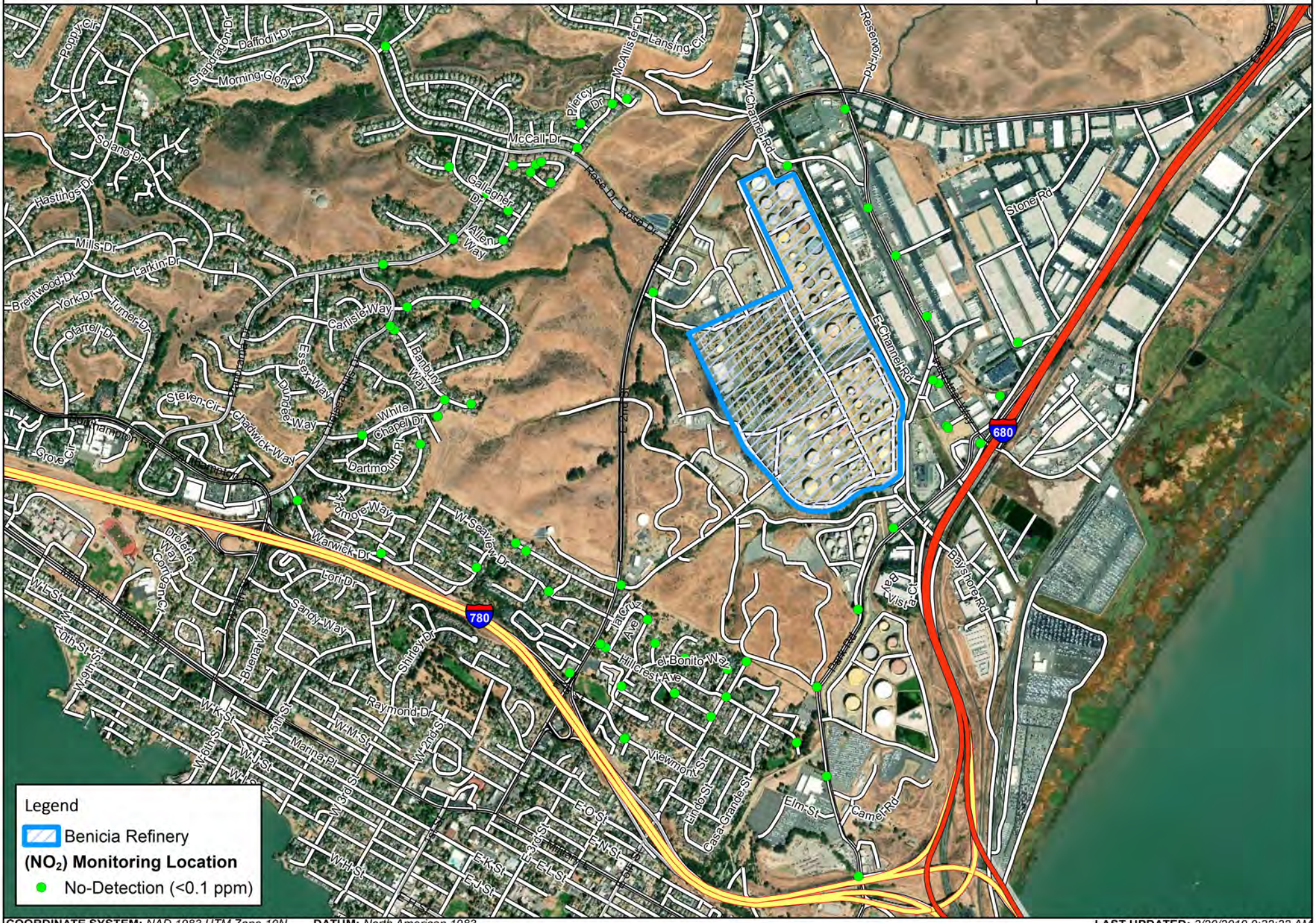
Figure 6: Hand-Held Real-Time Monitoring Locations (NO_2)

Benicia Refinery Particulate Release

0 1,000 2,000 Feet

Project: 111342
Client: Valero Energy
City: Benicia, AR
County: Solano



Legend

Benicia Refinery

(NO_2) Monitoring Location

No-Detection (<0.1 ppm)

COORDINATE SYSTEM: *NAD 1983 UTM Zone 10N* **DATUM:** *North American 1983* **LAST UPDATED:** *3/20/2019 9:32:32 AM*

Attachment B

Directional Averages

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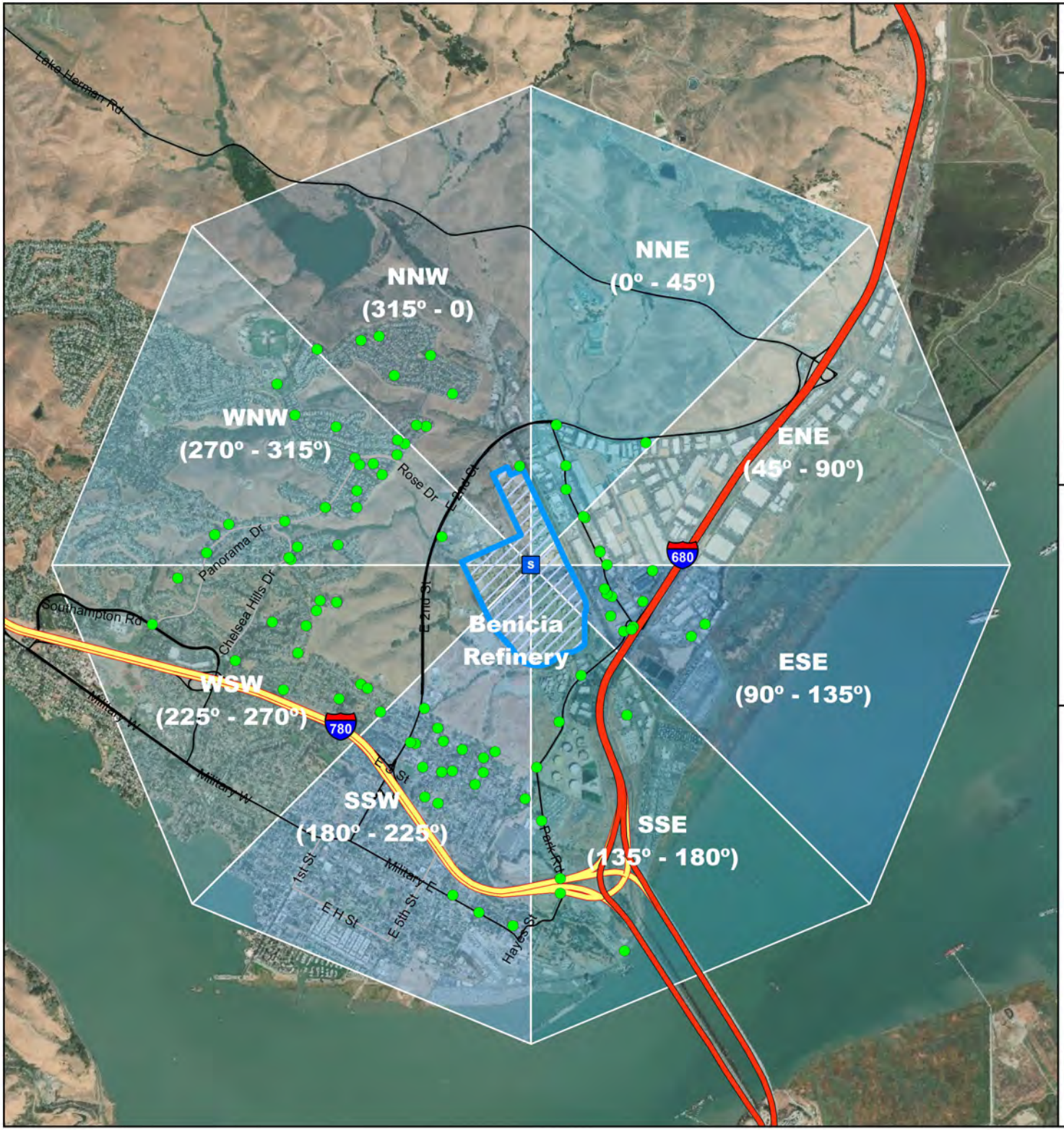

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$PM_{2.5}$ Directional Averages

Benicia Refinery Particulate Release

$PM_{2.5}$ Avg. for 24 Hour Period March 19 00:00 - March 20 00:00[1]

Direction	# Readings	# Detections	Avg (mg/m³)	Range (mg/m³)	AQI Category Equivalent
ENE	5	5	0.0268	0.014 - 0.061	Moderate
ESE	12	12	0.0378	0.009 - 0.082	Moderate
NNE	4	4	0.0228	0.008 - 0.046	Moderate
NNW	9	9	0.0164	0.013 - 0.024	Moderate
SSE	8	8	0.0361	0.006 - 0.086	Moderate
SSW	19	19	0.0343	0.008 - 0.101	Moderate
WNW	23	23	0.015	0.007 - 0.022	Moderate
WSW	14	14	0.0185	0.007 - 0.043	Moderate

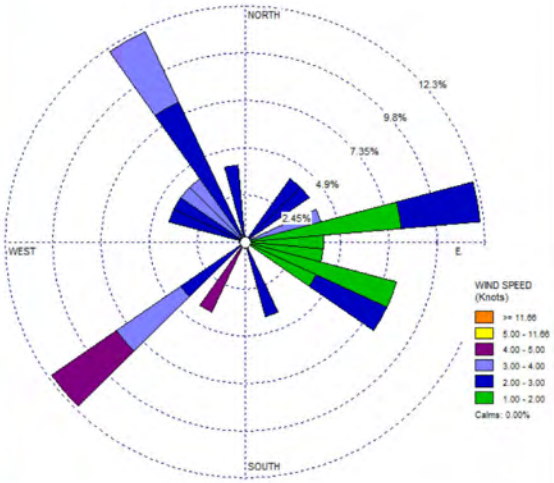
[1]*The EPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations,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

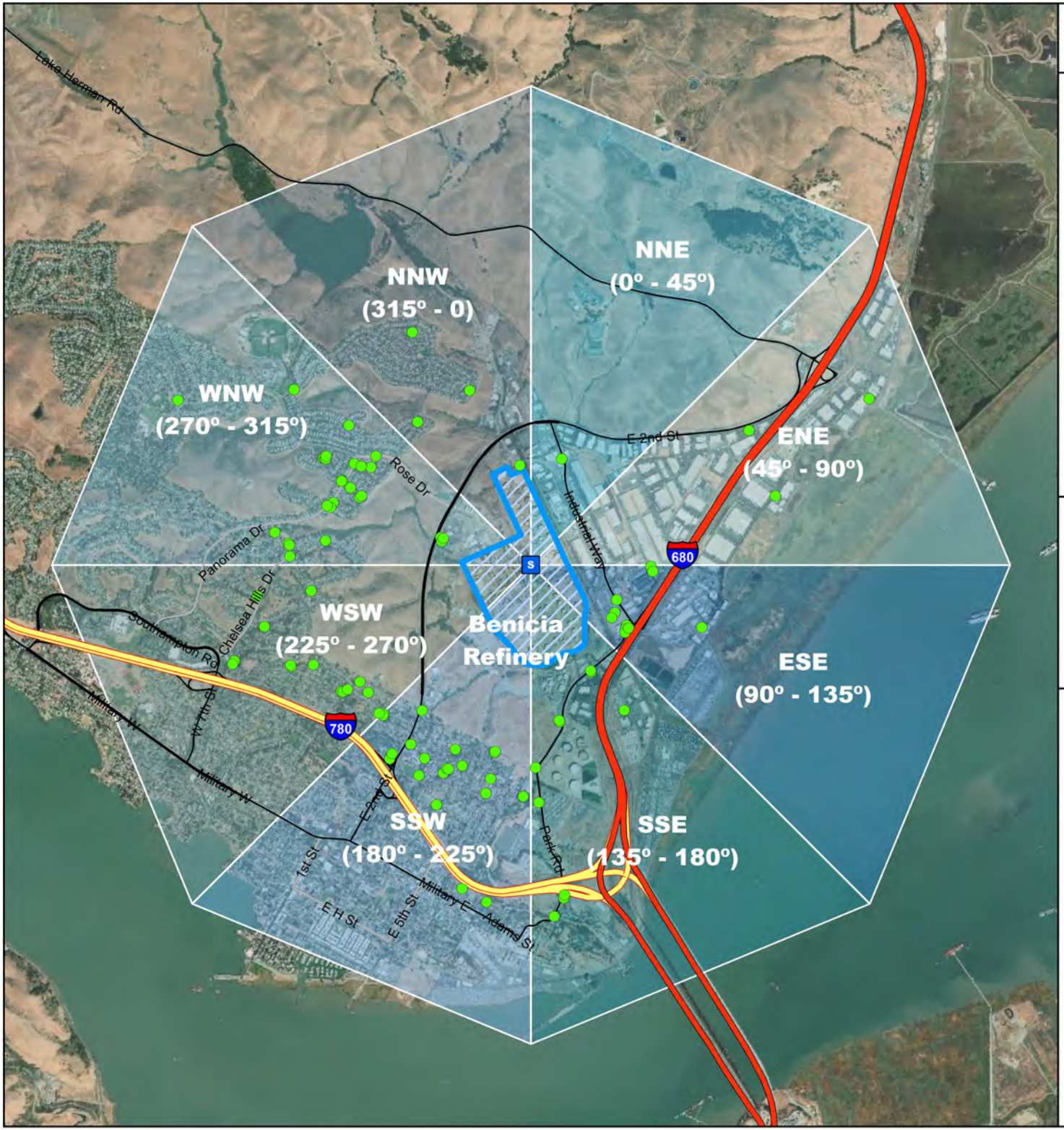
Benicia Refinery

$PM_{2.5}$ Real-Time Monitoring Location

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 19 00:00 - March 20 00:00[1]

Direction	# Readings	# Detections	Avg (mg/m³)	Range (mg/m³)	AQI Category Equivalent
ENE	5	5	0.0214	0.018 - 0.027	Good
ESE	10	9	0.0219	0.013 - 0.032	Good
NNE	4	4	0.0168	0.009 - 0.02	Good
NNW	9	9	0.0179	0.013 - 0.024	Good
SSE	8	8	0.0215	0.006 - 0.038	Good
SSW	18	18	0.0286	0.008 - 0.08	Good
WNW	23	22	0.0169	0.004 - 0.029	Good
WSW	14	14	0.0169	0.007 - 0.043	Good

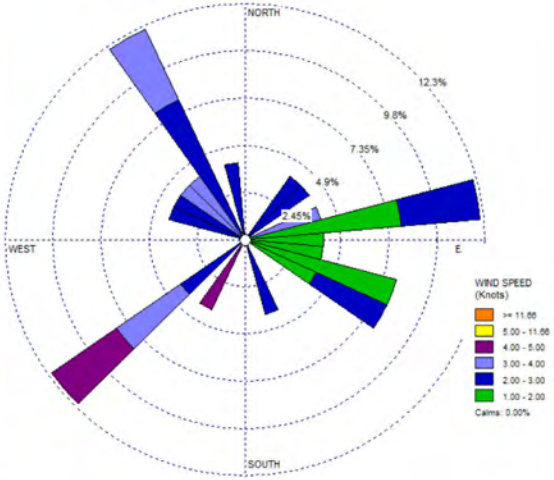
[1]The EPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations,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

Benicia Refinery

PM_{10} Real-Time Monitoring Location

Monitoring Direction

ENE, NNW, WNW, ESE, SSE, WSW, NNE, SSW



Attachment C

Meteorological Conditions

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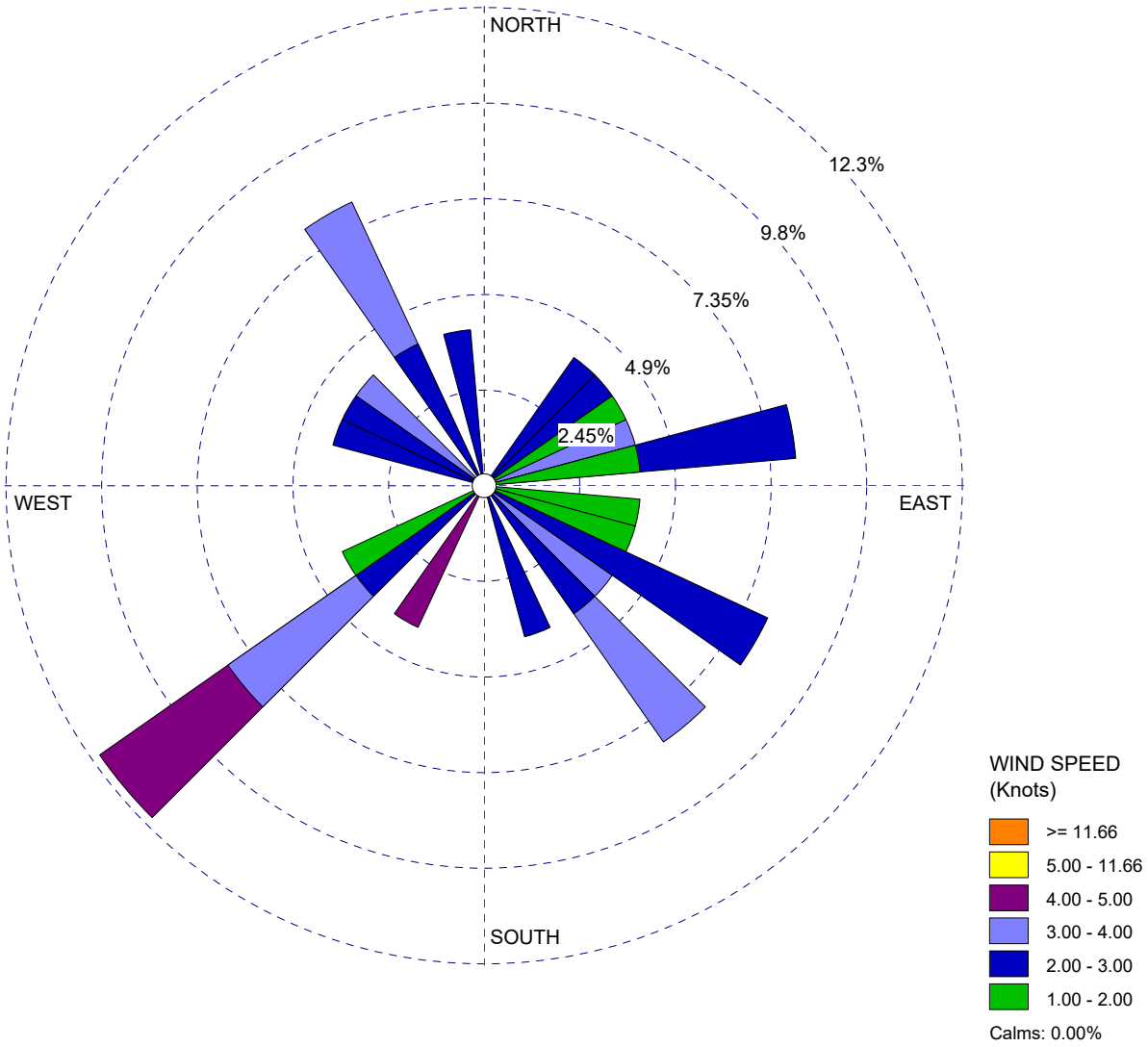
WIND ROSE PLOT:

Station #CIMIS

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 3/19/2019 - 06:00 **End Date: 3/20/2019 - 06:00**	MODELER:	
	CALM WINDS: **0.00%**	TOTAL COUNT: **25 hrs.**	
	AVG. WIND SPEED: **2.20 Knots**	DATE: **3/20/2019**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software