RULE 1180 FENCELINE AIR MONITORING PLAN
&
QUALITY ASSURANCE / QUALITY CONTROL PROJECT PLAN

FOR

ULTRAMAR
WILMINGTON REFINERY

Revision 4
Revised: September 2025

Wilmington Refinery • Ultramar Inc., a Valero Company
2402 E. Anaheim • Wilmington, CA 90744 • Telephone (562) 491-6877

REVISION HISTORY

Original submitted to SCAQMD and partially approved March 2019

Revision No.	Date	Details	By
	Aug 2018	Plan submittal for AQMD review	T. Cheng
1	Jan 2019	Plan revision per AQMD (partial approval 03-27-2019)	T. Cheng
2	Nov 2019	Complete Plan submittal for AQMD review	T. Cheng
3	August 2024	Revised to comply with amended Rule 1180, January 5th 2024	S. McCabe
4	September 2025	Changes following AQMD comments	P. Allen

RULE 1180 FENCELINE AIR MONITORING PLAN
&
QUALITY ASSURANCE / QUALITY CONTROL PROJECT PLAN

Prepared By:

Ultramar Inc.
2402 East Anaheim Street
Wilmington, CA 90744

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. EXECUTIVE SUMMARY

Ultramar, Inc., dba Valero Wilmington Refinery ("the Refinery") was commissioned in 1969 and has had three major expansions to become a fully integrated refinery and several upgrades to meet clean-fuel standards. The facility processes a blend of crude oil, as well as unfinished feedstocks. Refined products are distributed from the facility through a network of pipelines and terminals in Southern California, Nevada, and Arizona, and then on to wholesale and retail customers.

Ultramar is located in Wilmington, California, on a compact 120-acre site 23 miles south of downtown Los Angeles. It has a total equivalency of 135,000 barrels per day (BPD). Its products include gasoline, jet fuel, diesel, propane, and coke. It is connected by pipeline to marine terminals and associated dock facilities that are used for movement and storage of crude oil and feedstocks. Products to terminals via pipeline include jet fuel, diesel fuel, decant oil, and liquefied petroleum gases (LPGs), which can also be shipped using on-site truck racks. The facility employs approximately 440 personnel.

According to the requirements of South Coast Air Quality Management District (SCAQMD) Rule 1180, refineries in SCAQMD jurisdiction must install and operate real-time fenceline air monitoring systems. The purpose of these systems is to continuously monitor air quality at or near the property boundaries of these facilities and provide the data to the public, local response agencies, and SCAQMD as expeditiously as possible. The plan must describe in detail the equipment specifications and locations to be used, procedures for maintaining such equipment and quality assuring its data, procedures for implementing the Plan, and methods for disseminating the collected data. This revised document serves as the Plan for the Ultramar facility that complies with amended Rule 1180 requirements (amended January 5, 2024), addressing the issues identified in the South Coast AQMD.

The pollutants to be monitored at the facility are summarized below in Table 1-1.

Table 1-1. Monitored Pollutants

Criteria Pollutants	Volatile Organic Compounds	Metals	Other Compounds
Sulfur Dioxide	Total VOCs (NMHC)	Cadmium	Hydrogen Sulfide
Nitrogen Dioxide	Formaldehyde	Manganese	Carbonyl Sulfide
$PM_{2.5}$	Acetaldehyde	Nickel	Ammonia
PM_{10}	Acrolein		Black Carbon
	1,3-Butadiene		Hydrogen Cyanide
	Naphthalene		Hydrogen Fluoride
	Polycyclic aromatic hydrocarbons (PAHs)		
	Styrene		
	Benzene		
	Toluene		
	Ethyl Benzene		
	m-Xylene		
	o-Xylene		
	p-Xylene		

In Section 2 of this plan, equipment locations are proposed and discussed relative to local meteorology, downwind communities, and sensitive receptors. Section 3 of this Plan concludes that Rule 1180 and the associated Refinery Fenceline Air Monitoring Plan Guidelines (Guidelines) are best satisfied through the installation of a network of monitoring instruments at critical locations around the Refinery perimeter to provide information to the surrounding community. Data dissemination plans are also discussed in detail in Section 4. The Plan's implementation schedule is provided in Section 5, and the Quality Assurance Project Plan is included in Appendix A.

2. FENCELINE AIR MONITORING COVERAGE

2.1. VICINITY CHARACTERIZATION

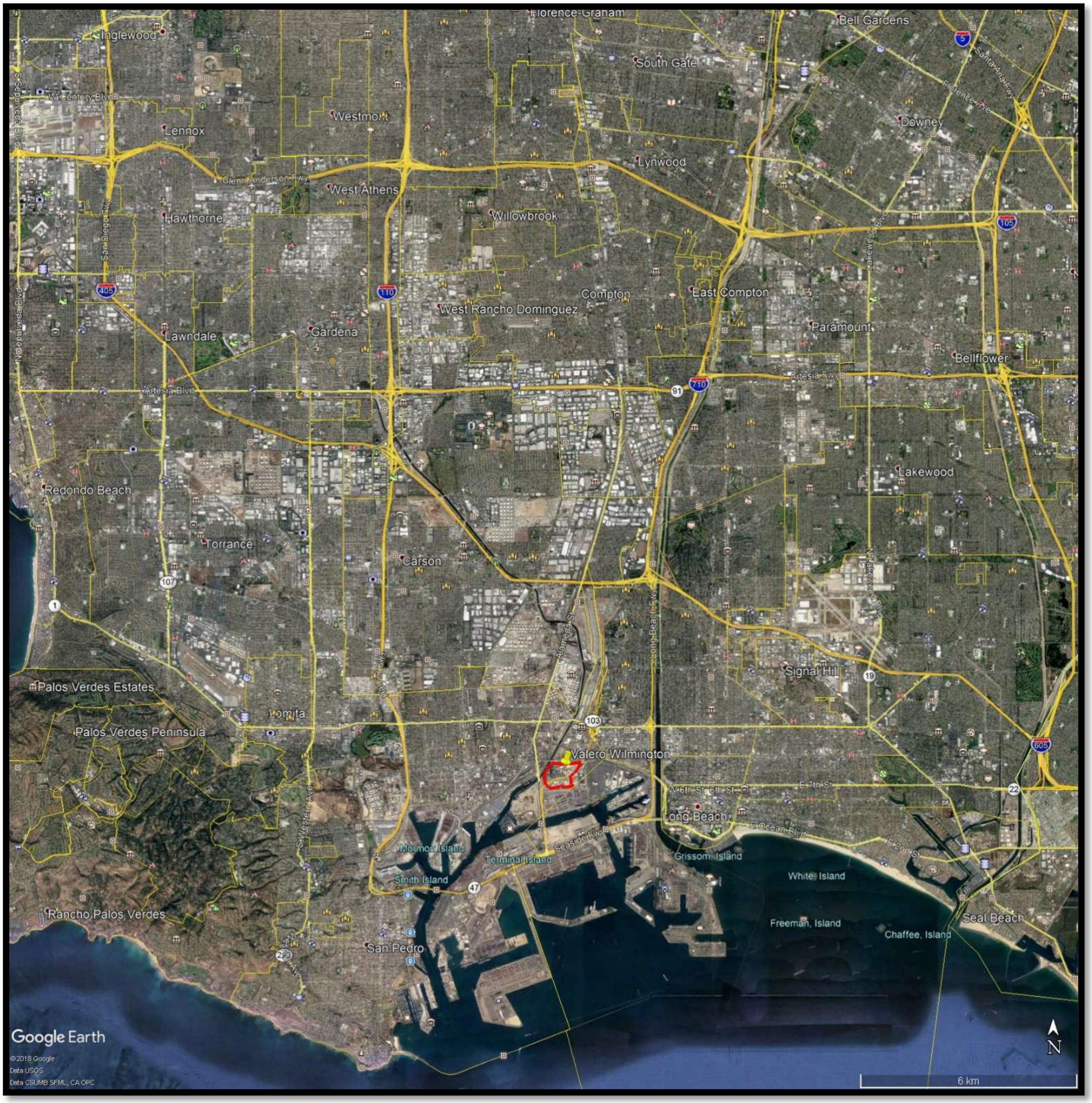
This monitoring plan details parameters related to installing and operating a real-time fenceline air monitoring system. The Refinery has reviewed information specific to the immediate area, including characterization of the area within a couple of miles of the fenceline.

2.1.1. Facility General Location

The Refinery is located at 2402 East Anaheim Street in Wilmington, California. It is located in the Greater Los Angeles Metropolitan Statistical Area and is immediately adjacent to the Ports of Los Angeles and Long Beach to the South, East, and West. It borders the Dominguez Channel at its northwest, and its northern boundary is effectively East Anaheim Street. The facility is bisected by the Terminal Island Freeway.

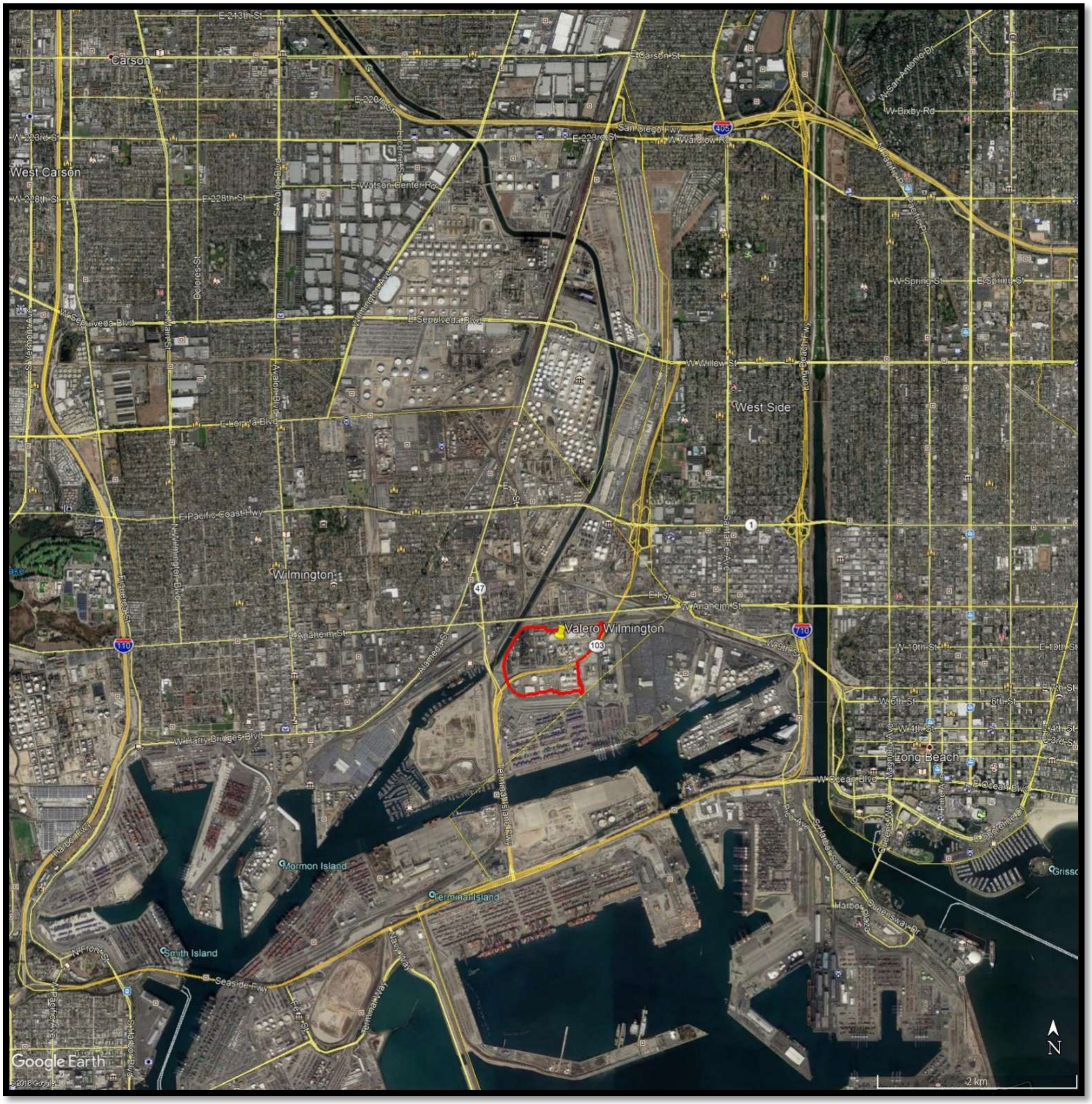
The area's terrain is characterized as a coastal plain, with low elevations (primarily less than 15 m above mean sea level) and gradual elevation changes. The facility itself is entirely within 4 m of sea level. The facility's general location is shown in Figure 2-1 and Figure 2-2, and general property boundaries are detailed in Figure 2-3.

Figure 2-1. General Vicinity- Overview



Note. The image is created from Google Earth Pro (Desktop version 7.3.2.5495).

Figure 2-2. General Vicinity-Detail



Note. The image is created from Google Earth Pro (Desktop version 7.3.2.5495).

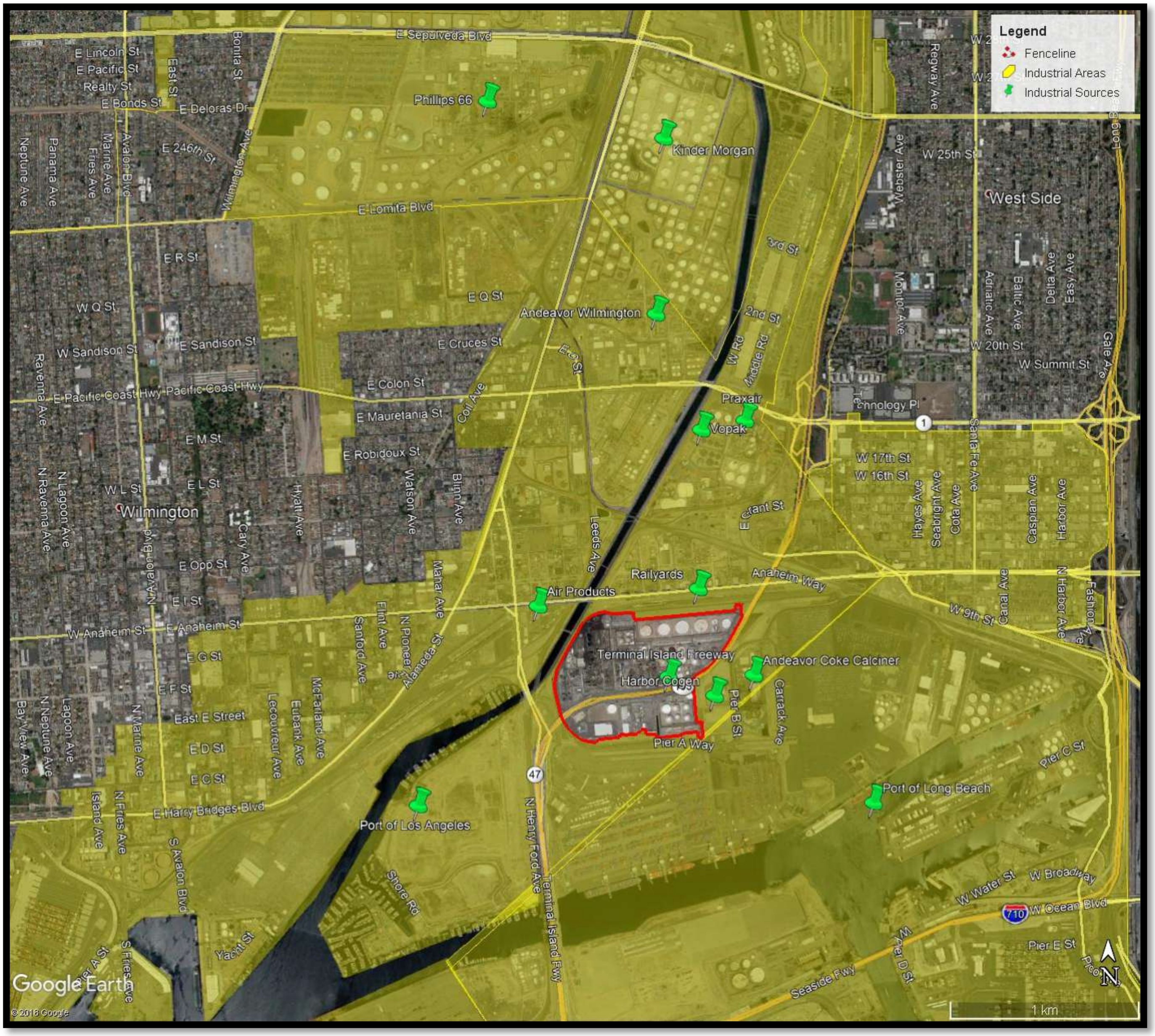
Figure 2-3. General Refinery Boundaries

Note. Refinery boundaries shown are approximate and differ due to easements with neighboring properties. The image is created from Google Earth Pro (Desktop version 7.3.2.5495). Actual property lines are not shown in the figure.

2.1.2. Surrounding Industrial Facilities

The Refinery is surrounded by industrial uses. Immediately adjacent to the Refinery are railroads to the north, south, and west; and to the east is the Terminal Island freeway, Harbor cogeneration, and Marathon calciner. Air Products is directly to the Northwest of the Refinery. To the south of the Refinery are the Port of Los Angeles and Long Beach. Further beyond the adjacent facilities are primarily industrial uses, as shown in Figure 2-4. Additionally, Table 2-1 provides general details on the industrial facilities in the area.

Figure 2-4. Nearby Sources



Note. Industrial areas shown are approximate boundaries developed from a combination of local government zoning information, general knowledge of the area, and street-level visual examination to determine the prevailing type of use of sites. Industrial site locations were determined from general area knowledge and the US EPA Envirofacts database. The image is created from Google Earth Pro (Desktop version 7.3.2.5495).

Table 2-1. Nearby Industrial Sources

Source/Type	Direction(s)	Closest Distance	Expected Pollutant Signature
Marathon/Refinery	North	590 m	Typical Refinery
Railyards	North	50 m	Formaldehyde, black carbon, nitrogen dioxide
Kinder Morgan/Terminal	North	2,200 m	Organics
Vopak/Terminal	Northeast	750 m	Organics
Praxair	Northeast	760 m	Ammonia, organics
Port of Long Beach	East to South	Contiguous to Ultramar	Formaldehyde, black carbon, nitrogen dioxide, sulfur dioxide, organics
Harbor Cogen/Heat and Power Plant	Southeast	Contiguous to Ultramar	Nitrogen dioxide
Marathon Coke Calciner	Southeast	100 m	Organics, sulfur dioxide, nitrogen dioxide, ammonia, organics, formaldehyde
Port of Los Angeles	South to Southwest	Contiguous to Ultramar	Formaldehyde, black carbon, nitrogen dioxide, sulfur dioxide, organics
Terminal Island Freeway	Bisects Facility	Contiguous to Ultramar	Formaldehyde, black carbon, nitrogen dioxide
Air Products	Northwest	150 m	Nitrogen dioxide, sulfur dioxide, organics, ammonia
Phillips 66/Refinery	Northwest	2,200 m	Typical Refinery

Note. Industrial site locations were determined from general area knowledge and the US EPA Envirofacts database.

2.1.3. Sensitive Receptors

Sensitive receptors include any residence, including private homes, condominiums, apartments, and living quarters, schools, preschools, daycare centers, and health facilities such as hospitals or retirement and nursing homes. They also include long-term care hospitals, hospices, prisons, dormitories, or similar live-in housing.

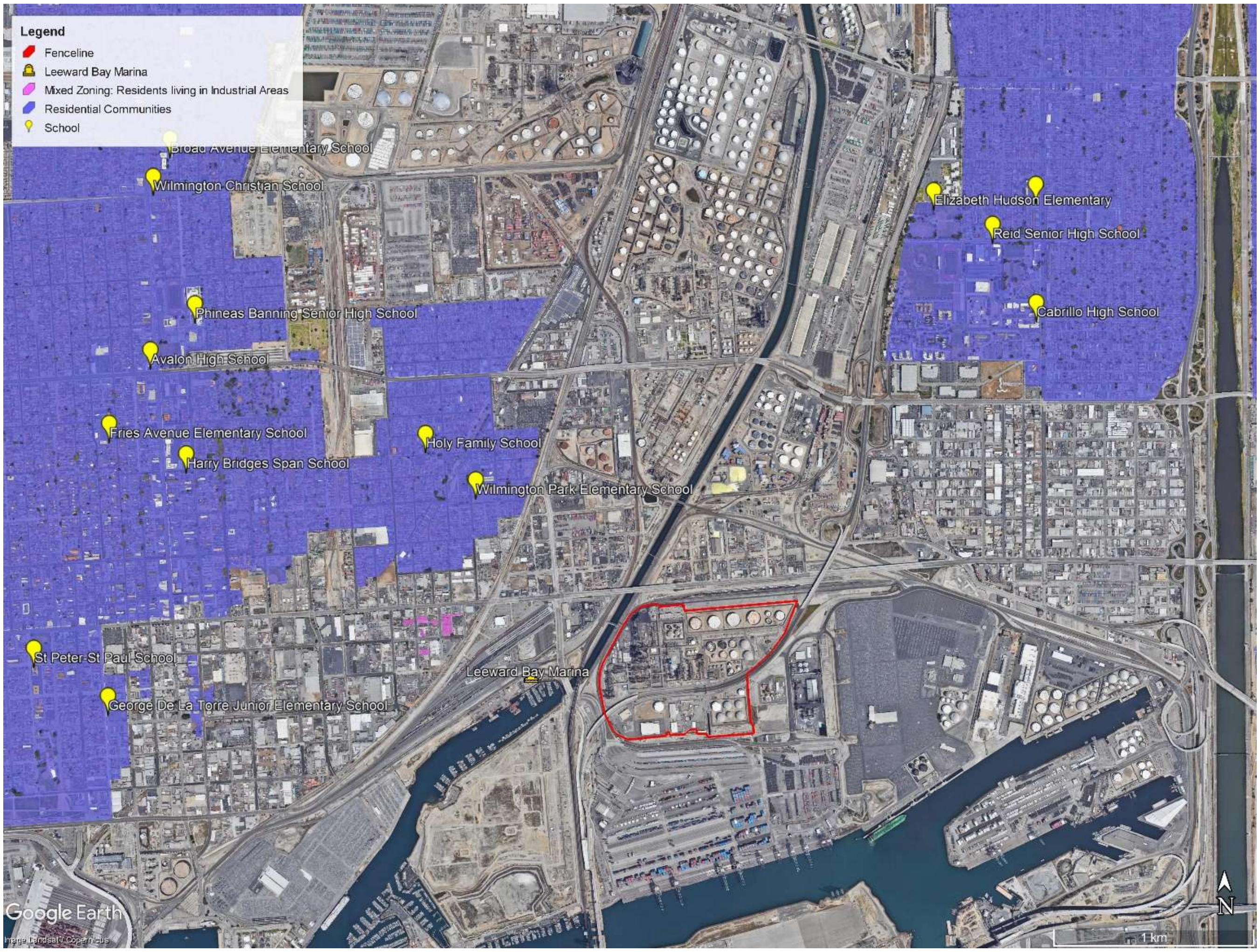
As shown in Figure 2-4, the Refinery is in a primarily industrial area with no immediate communities around the fenceline. The City of Wilmington is located to the west and northwest of the facility, and the City of Long Beach is located to the East. The closest residential community or sensitive receptor is approximately 740 meters (0.5 miles) from the northwest boundary of the Refinery. Other residential communities lie approximately 1,250 meters (0.8 miles) to the northeast of the facility at San Gabriel Avenue and Technology Place. Directly west of the Refinery, there is Leeward Bay Marina which has docked boats and potentially some live in boat uses approximately 206 meters (0.13 miles). There are a few housing structures west of the Refinery at approximately 748 meters (0.5 miles) in a mixed industrial area highlighted in Figure 2-5. There may be other residential uses in the mixed industrial area not identified on Figure 2-5.

Hospitals, daycare centers, nursing homes, and senior homes were all analyzed and were greater than 2,500 meters in distance from the refinery fenceline. The closest daycare center was Dayli USA Daycare, at 3,721 meters from the fenceline. The closest nursing home was Royal Care Skilled Nursing Center, at 4,286 meters from the fenceline. The closest hospital was Long Beach Doctors Hospital, at 3,325 meters from the fenceline. The closest senior home was Regency Palms Long Beach Assisted Living & Memorial Care – Meridian Senior Living at 3,456 meters from the fenceline. Table 2-2 and Figure 2-5 show specific sensitive receptors, which includes schools, within 2,500 m of the refinery fenceline. There may be other sensitive receptors in the mixed industrial area not identified in Figure 2-5. Further analysis was done using listed businesses from a web search in the vicinity.

Table 2-2. Nearby Sensitive Receptors (<2,500 m)

Sensitive Receptor Name	Receptor Type	Direction(s)	Closest Distance (m)
Residential Neighborhood	Resident	Northwest	740
Elizabeth Hudson Elementary School	School	Northeast	2,000
Reid Senior High School	School	Northeast	2,000
St. Lucy Catholic School	School	Northeast	2,300
Cabrillo High School	School	Northeast	1,600
George De La Torre Junior Elementary School	School	West	2,300
Wilmington Park Elementary School	School	Northwest	900
Harry Bridges Span School	School	Northwest	2,300
Holy Family School	School	Northwest	1,300

Figure 2-5. Nearby Sensitive Receptors (<2,500 m) and Residential Areas



Note. Residential areas shown are approximate boundaries developed from a combination of local government zoning information, general knowledge of the area, and street-level visual examination to determine the prevailing type of use of sites. The image is created from Google Earth Pro (Desktop version 7.3.2.5495).

2.2. METEOROLOGICAL PROFILE

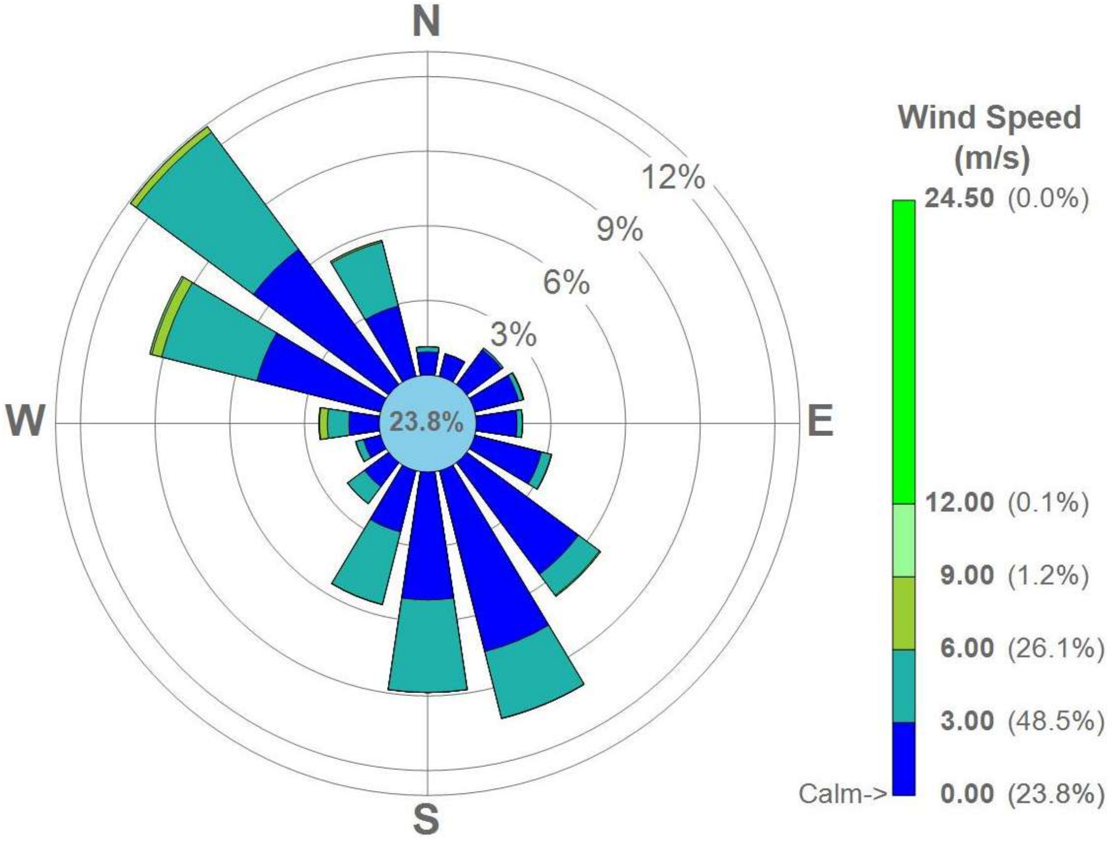
Meteorological conditions of the local and immediate area affect the concentration and location of air pollutant concentrations. The refinery has installed meteorological stations per Rule 1180 as part of this Plan. This analysis makes use of the meteorological data collected from the beginning of the installation in 2020 at the main meteorological station (location is detailed in Figure 2-10) to represent the wind pattern in the Valero Wilmington area.

The meteorological tower measures wind speed and wind direction. Wind direction and velocity are the most critical meteorological parameters to indicate impact on surrounding areas. The direction indicates the likely path of emissions, and wind speeds affect the dissipation or accumulation of emissions.

2.2.1. Wind Direction and Velocity

Wind speeds flowing at less than 3 meters per second (m/s) (6.7 miles per hour [mph]) occur 72% of the time during the approximately 3.5-year analysis period, with the highest recorded wind speed at 24.4 m/s (54.6 mph). Periods of calm, or when wind speeds are less than 1 m/s (2.2 mph), are approximately 24% of the analysis period. The predominant wind direction flows from northwest and west-northwest, with approximately 30% of the wind flowing from these directions. Wind speeds in these directions are less than 12 m/s (26.8 mph). Secondarily, the wind flows from south-southeast and south approximately 25% of the time. Wind speeds in these directions are less than 9.2 m/s 20.5 mph). The annual wind rose for meteorological years 2020 through 2023 is shown in Figure 2-6. The calm winds are represented by the percentage in the centered circle.

Figure 2-6. Onsite Annual Wind Rose



The onsite meteorological data has been further analyzed for seasonal differences. The seasonal periods used to create the wind roses are as follows:

- Winter = Beginning of December through the end of February
- Spring = Beginning of March through the end of May
- Summer = Beginning of June through the end of August
- Fall = Beginning of September through the end of November

The legend matches the annual wind rose as shown in Figure 2-6.

Seasonal wind roses are shown in Figure 2-7 and Figure 2-8. Figure 2-7 shows wind distribution during spring and summer, where the south and west-southwest sectors prevail. Figure 2-8 shows during winter months more periods of calm winds.

Figure 2-7. Seasonal Wind Rose (Spring and Summer)

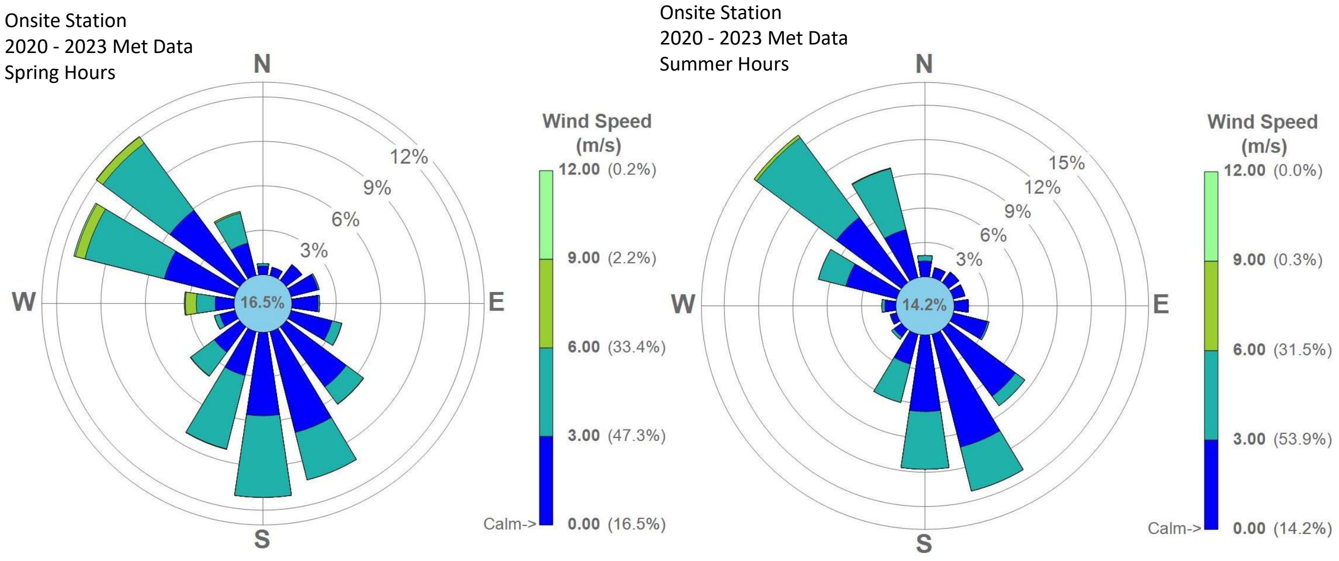


Figure 2-8. Seasonal Wind Rose (Fall and Winter)

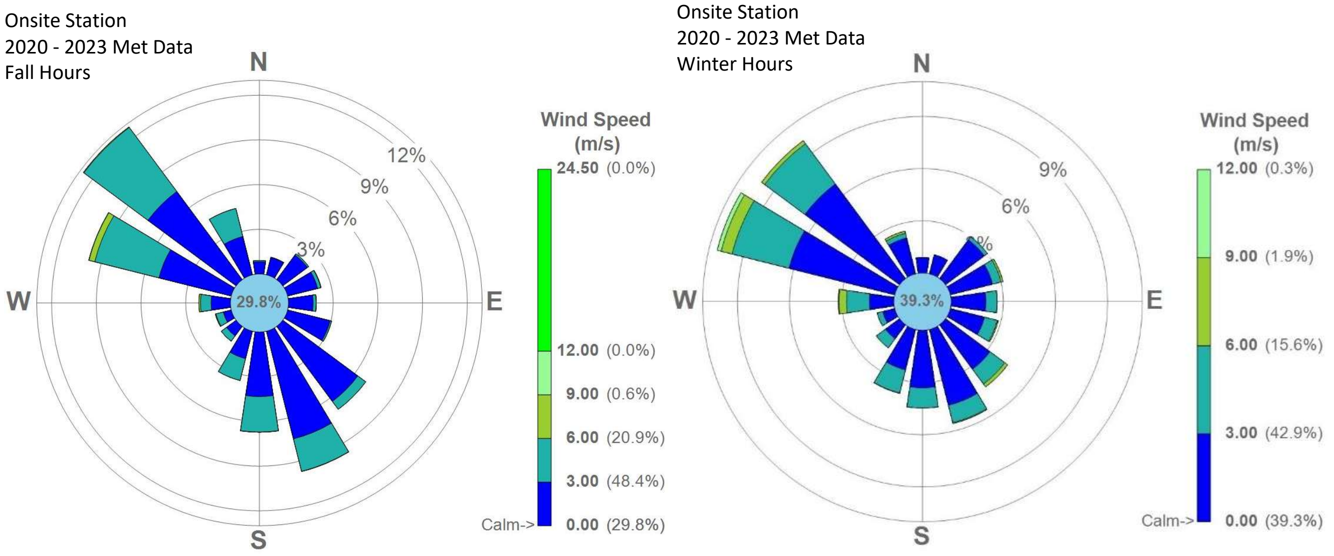
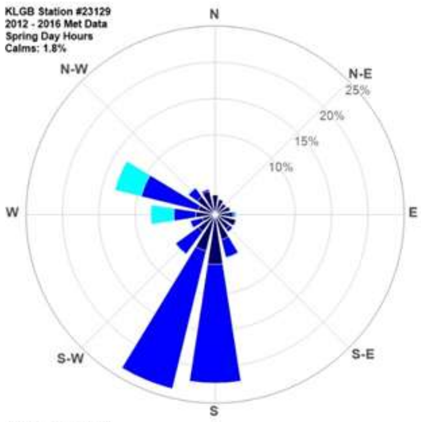
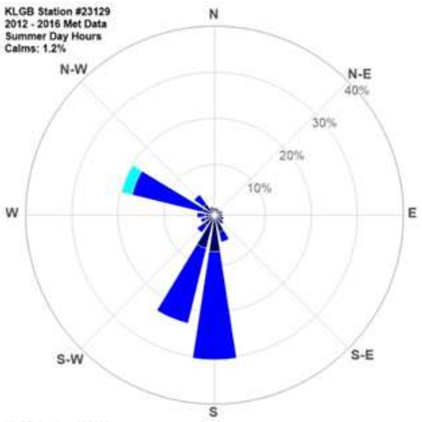


Figure 2-9. Diurnal Wind Roses

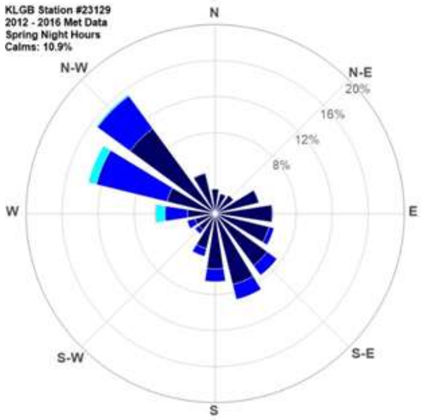
Spring Day



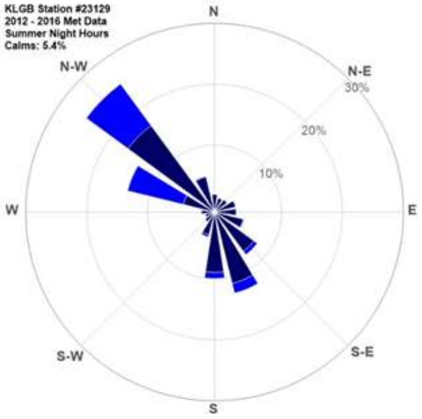
Summer Day



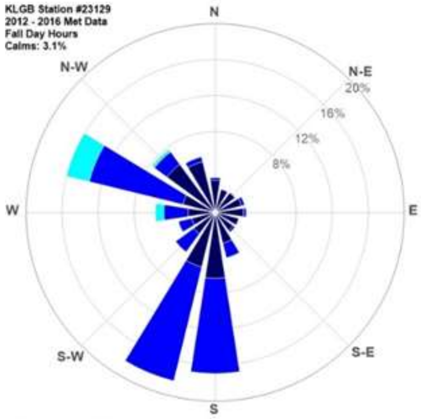
Spring Night



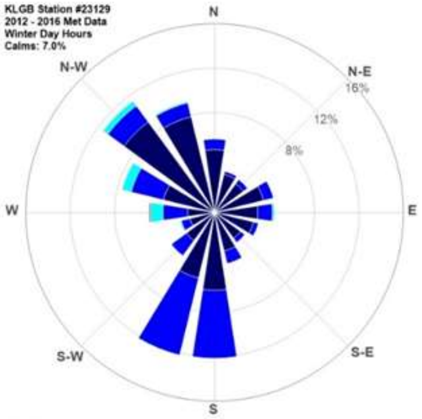
Summer Night



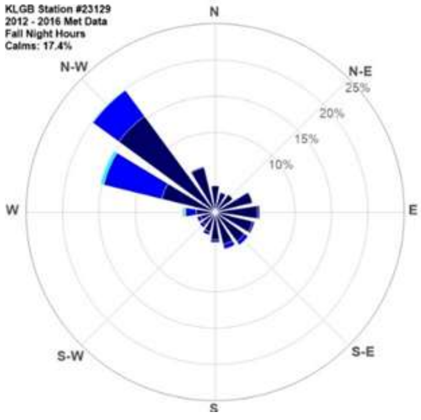
Fall Day



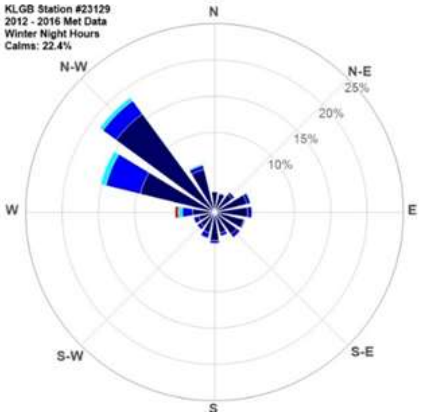
Winter Day



Fall Night



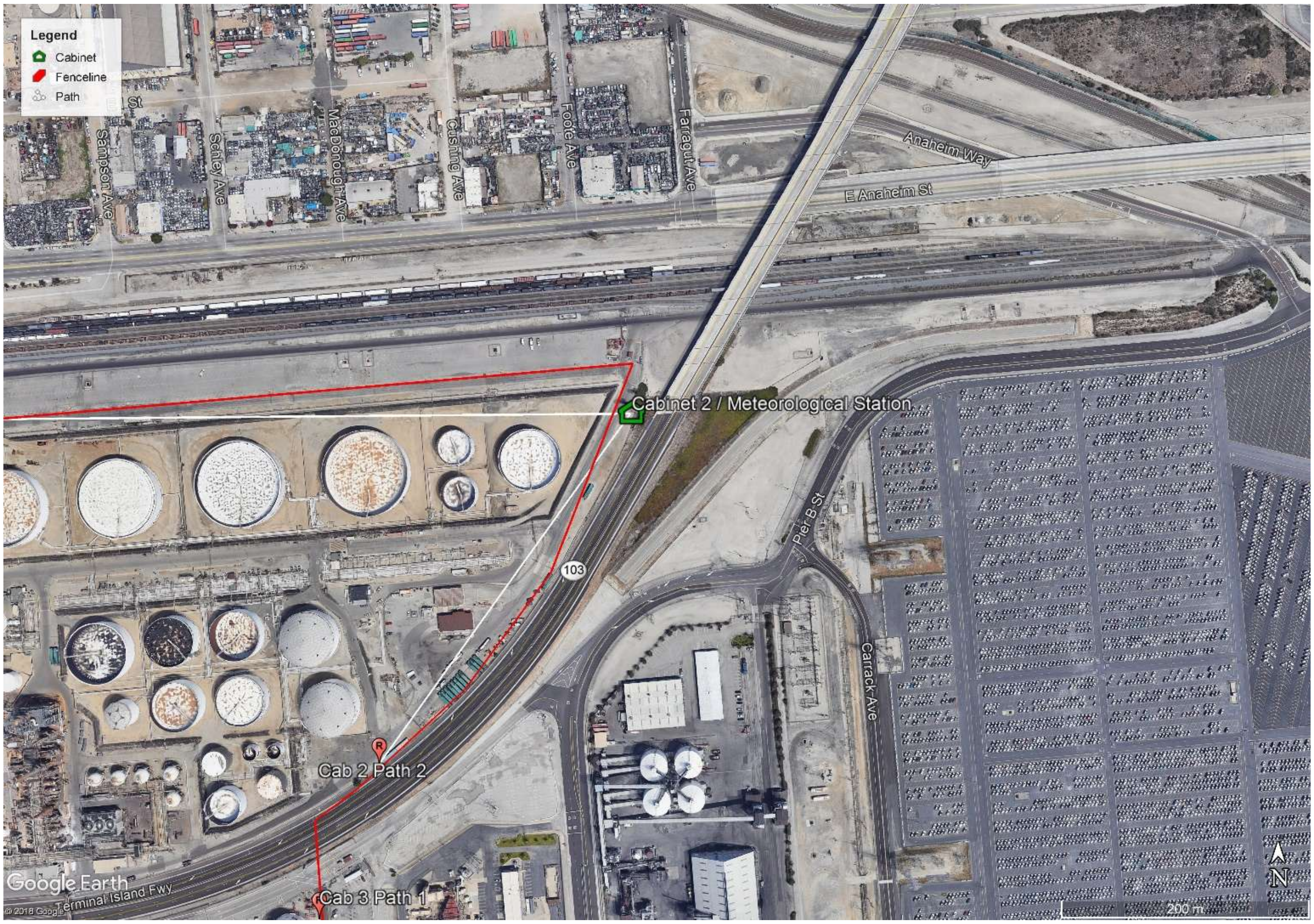
Winter Night



2.2.2. Meteorological Station

The Refinery has installed a meteorological station on the facility property that measures wind direction and wind speed. Figure 2-10 below shows the location of the station. The meteorological station's averaged data matches the time resolution of the air quality monitors. The meteorological station was sited based on the U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems, Volume IV: Meteorological Measurements. Sensor quality and the quality assurance of the instrumentation will also be determined using this document (in the appendix Quality Assurance Project Plan).

Figure 2-10. On-site Meteorological Station Location



Note. The image is created from Google Earth Pro (Desktop version 7.3.2.5495).

2.3. SOURCE CHARACTERIZATION

2.3.1. Emission Sources

Table 1-1 details the Rule 1180 pollutants emitted from the Refinery. Emission sources at the facility include combustion sources, fugitive components, cooling towers, storage tanks, flares, and loading/unloading facilities. Analysis to estimate emission sources was based on the AB2588 Health Risk Assessment (HRA) submitted in 2009 for the 2006-2007 inventory year.

Combustion sources generally show the highest concentrated emissions from individual sources. These sources are generally located north of the Terminal Island Freeway on the west side of the facility. The Refinery's tank farm is located on the east side of the facility, generally emitting smaller amounts per source of the pollutants of concern.

The plot plan of Valero Wilmington with the locations of facilities' source locations is detailed in Figure 2-11.

Sulfur dioxide and oxides of nitrogen are emitted mainly from combustion sources. As previously detailed, combustion sources are concentrated in the center of the facility. The highest concentration of nitrogen dioxide and sulfur dioxide emissions (making up over 50% of total emissions for these pollutants) is from the FCCU (Fluid Catalytic Cracking unit) stack exhaust (see source 19 in Figure 2-11). Nitrogen dioxide and sulfur dioxide are not tracked as part of the HRA. Actual emissions were reviewed using reported RECLAIM emissions data to determine the relative emissions of sources onsite. Figure 2-12 shows the relative percentages of NOx and SO_2 being emitted.

Particulate Matter (PM_{10} and $PM_{2.5}$) can be emitted from various sources, primarily combustion sources mainly in the FCCU.

Volatile Organic Compounds (Non-Methane Hydrocarbons) can be emitted from various combustion, fugitive, and tank sources.

Formaldehyde is emitted from heaters, boilers, and thermal oxidizers as a byproduct of combustion of fuel gas. The platformer heater, crude heaters, and hydrotreater heaters are the major emitting combustion sources. Engines and flares also emit formaldehyde, but in very low relative amounts, combined making up less than 3% of emissions. Figure 2-13 shows the relative percentage of formaldehyde being emitted.

Acetaldehyde is mostly emitted from heaters and boilers due to combustion. Specific heaters that are considered major sources of acetaldehyde emissions include the platformer heater, crude heaters, and coke heater. Engines and flares also emit acetaldehyde, but in very low relative amounts, combined making up less than 0.5% of emissions. Figure 2-13 shows the relative percentage of acetaldehyde being emitted.

Acrolein is emitted from stationary and mobile diesel engines due to combustion. These sources are located throughout the facility without a specifically concentrated area of emissions. Figure 2-14 shows the relative percentage of acrolein being emitted.

1,3-butadiene is almost entirely emitted from the platformer heater (99% of emissions), with very small amounts emitted from fugitives and engines. The platformer heater has three heaters emitting from a single exhaust stack (source 9&10). Figure 2-14 shows the relative percentage of these pollutants being emitted.

Naphthalene, benzene, toluene, ethylbenzene, and xylenes are aromatic hydrocarbons. These chemicals occur naturally in crude oil. Emissions from the facility are primarily due to fugitive emissions associated with crude storage and transfer. Emissions also occur from the wastewater treatment system. These chemicals occur from mobile combustion as well, so large concentrations may be measured from nearby highways, major roadways, and railroads that are not the result of Refinery operations. Due to the wide variety of emission sources, emissions are spread throughout the facility as shown in Figure 2-15, Figure 2-16, and Figure 2-17.

Polycyclic aromatic hydrocarbons (PAHs) are emitted throughout the facility, but mostly from fugitive emissions. Figure 2-15 shows the relative percentage of PAHs being emitted.

Styrene is emitted from fugitive components populated throughout the facility. Since emissions from fugitive components are from piping, valves, and other fittings, a single location of high emissions cannot be identified. Figure 2-18 shows the relative percentage of emissions from different fugitive sources. However, the image is misleading as many fugitive components are grouped together in a conservative location for HRA and modeling purposes. The Refinery's tank farm is located on the east side of the facility, generally emitting smaller amounts on a per source basis of the pollutants of concern.

Hydrogen sulfide occurs naturally in crude petroleum and is a result of the breakdown of organic matter in the absence of oxygen. Hydrogen sulfide emissions are throughout the facility being emitted from fugitive components, tanks, wastewater treatment system, and combustion sources. The largest percentage of hydrogen sulfide is emitted from the wastewater treatment system and associated fugitives and tanks located in the approximate center of the facility. Emissions from hydrogen sulfide are primarily concentrated in the northwest side of the facility as shown in Figure 2-18.

The Amine Absorber emits (source 103) 99.9% of carbonyl sulfide from the Refinery. Carbonyl sulfide is naturally occurring in crude oil. The Amine Absorber is located near the center of the facility. The remaining minor portion of carbonyl sulfide emissions from the facility are from flares. Figure 2-19 shows relative emissions of carbonyl sulfide from the facility.

Ammonia is also a naturally occurring emission from organic matter, primarily during decay. Ammonia has a pungent odor. The Refinery uses selective catalytic reduction and ammonia injection for nitrogen dioxide emission control from combustion sources; the FCCU can also use ammonia injection. Routine emissions of unreacted ammonia are regulated by permit conditions. Sources using ammonia are identified in Figure 2-19. Potential ammonia sources are concentrated towards the northwest portion of the facility.

Hydrogen cyanide is emitted in small amounts from the FCCU stack exhaust. The location of this unit is shown in Figure 2-20.

The facility uses hydrogen fluoride in the alkylation unit. Emissions of hydrogen fluoride are primarily located near the center of the facility. Figure 2-20 shows the source location.

Black carbon is emitted as fine particulate, a major component of soot. Black carbon is a product of any type of fossil fuel combustion but is more prominent in diesel engines and biomass burning. The Refinery does not participate in biomass burning. Emissions of diesel engine particulate as detailed in the HRA are being used as a surrogate to determine emission sources of black carbon. All emissions of diesel engine particulate are from the stationary and mobile diesel engines located throughout the facility, with no major concentration point Figure 2-21 shows the relative emissions of diesel engine particulate from the facility.

The metals cadmium, manganese, and nickel are emitted mainly from combustion sources. As previously detailed, combustion sources are concentrated in the center of the facility. As previously detailed, combustion sources are concentrated in the center of the facility. The highest concentration of metal emissions (making up over 23% of total emissions for these pollutants) is from the FCCU stack exhaust. Figure 2-21 and Figure 2-22 shows the relative percentage of the metals being emitted. The data for the metals emissions was based on the AB2588 Voluntary Risk Reduction Plan (VRRP) last revised in 2020 for the 2015 inventory year.

Figure 2-11. Valero Wilmington emissions sources Plot Plan

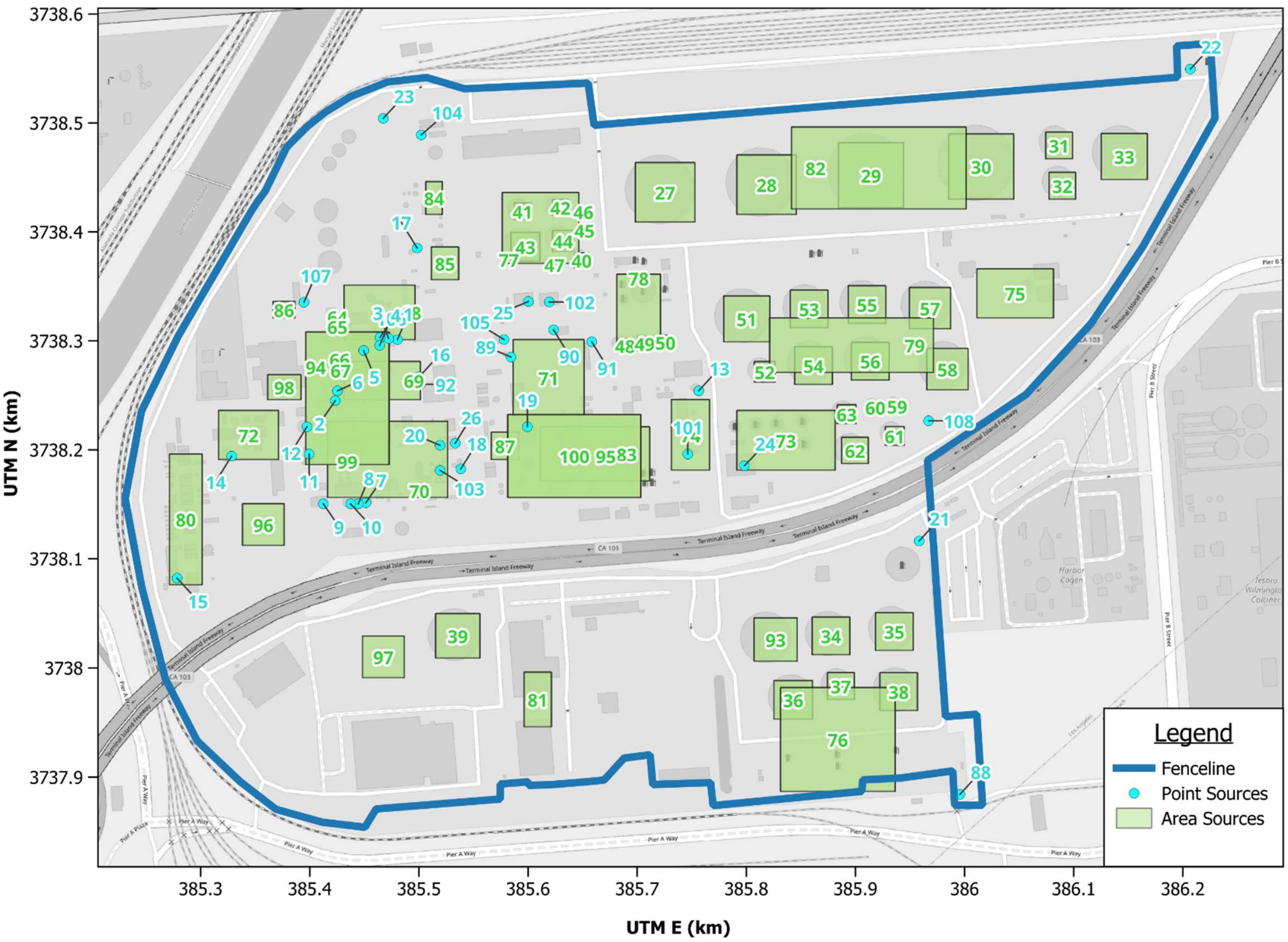


Figure 2-12. Sulfur Dioxide and Oxides of Nitrogen Relative Emissions

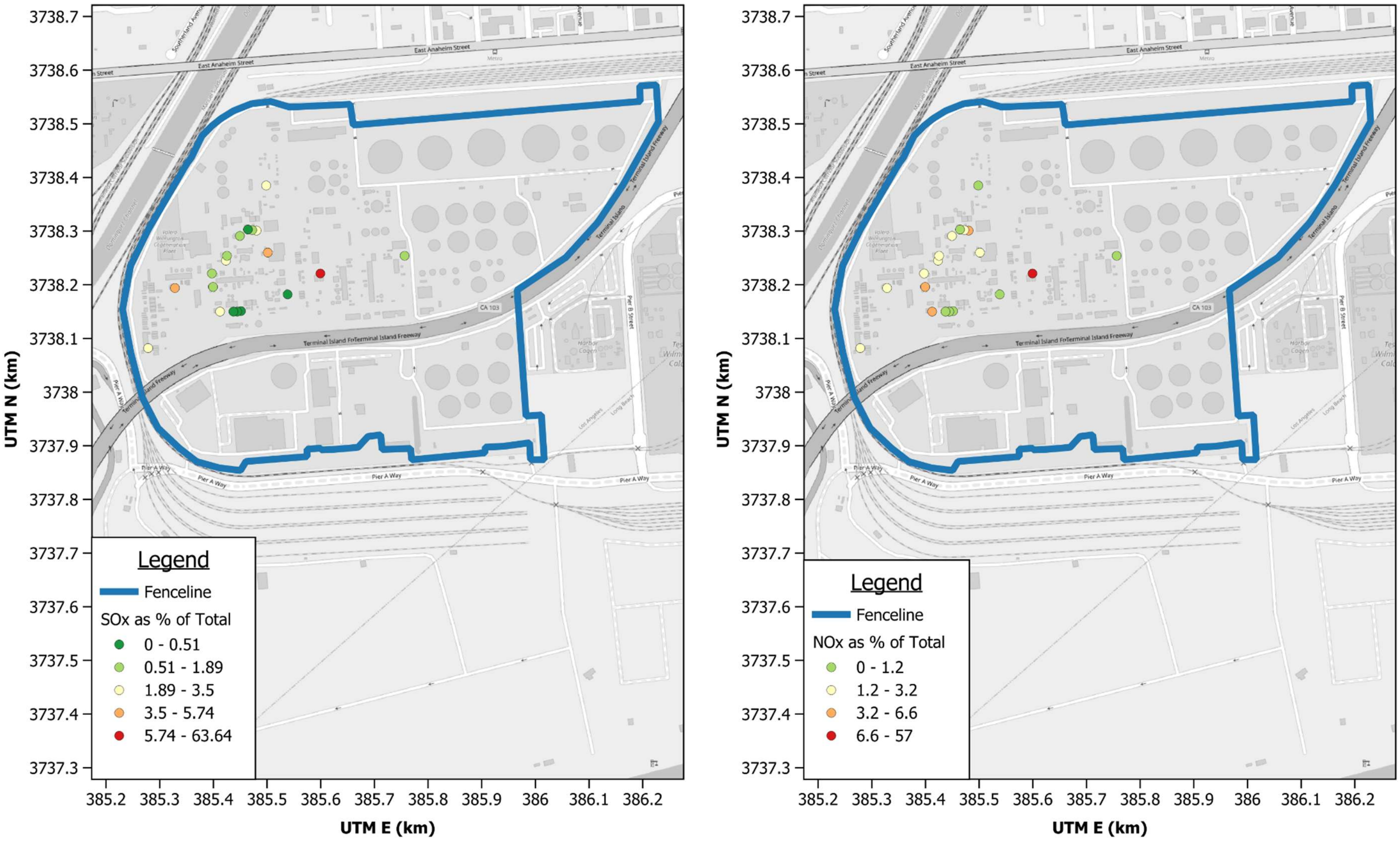


Figure 2-13. Formaldehyde & Acetaldehyde Relative Emissions

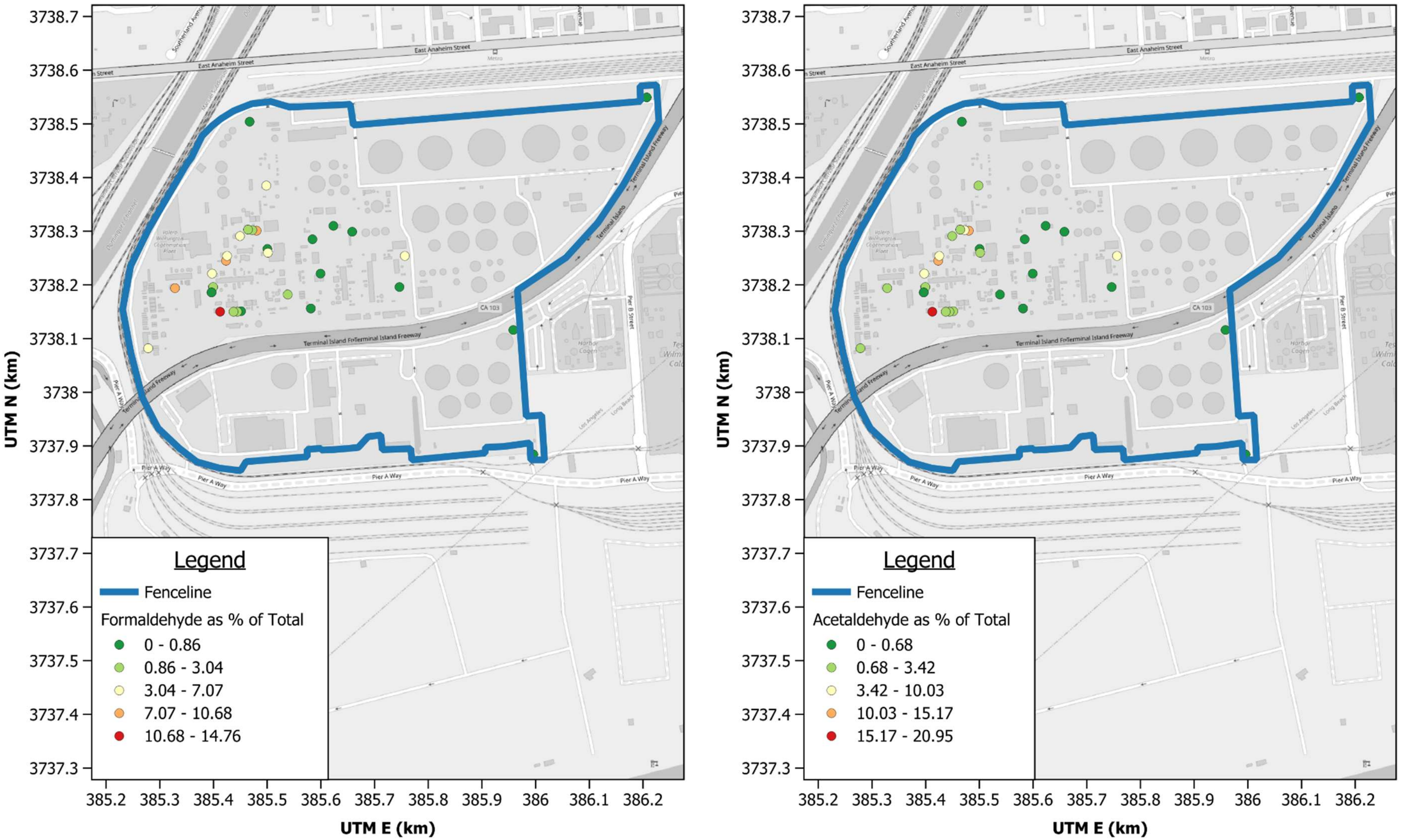


Figure 2-14. Acrolein & 1,3-Butadiene Relative Emissions

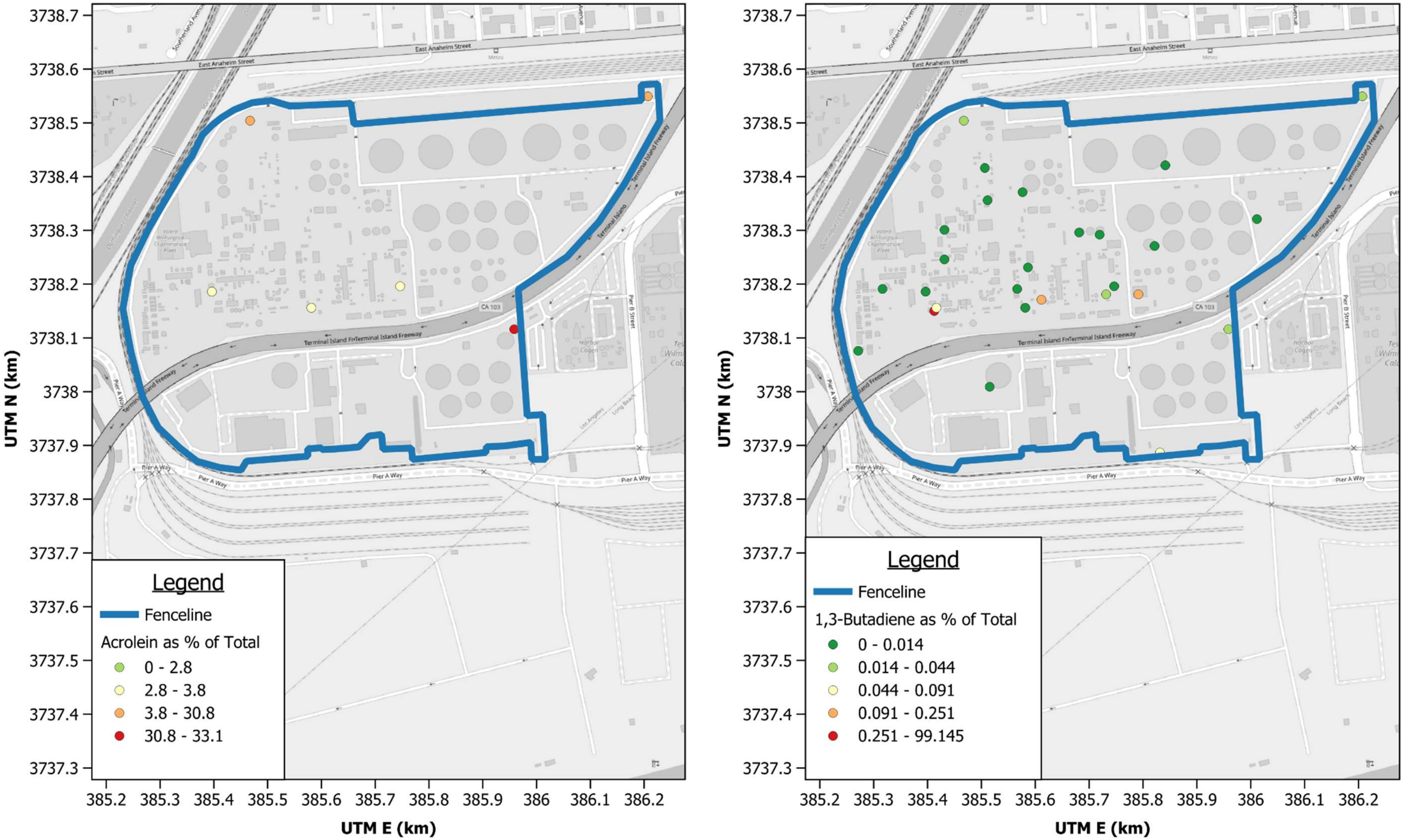


Figure 2-15. Naphthalene & Polycyclic Aromatic Hydrocarbons Relative Emissions

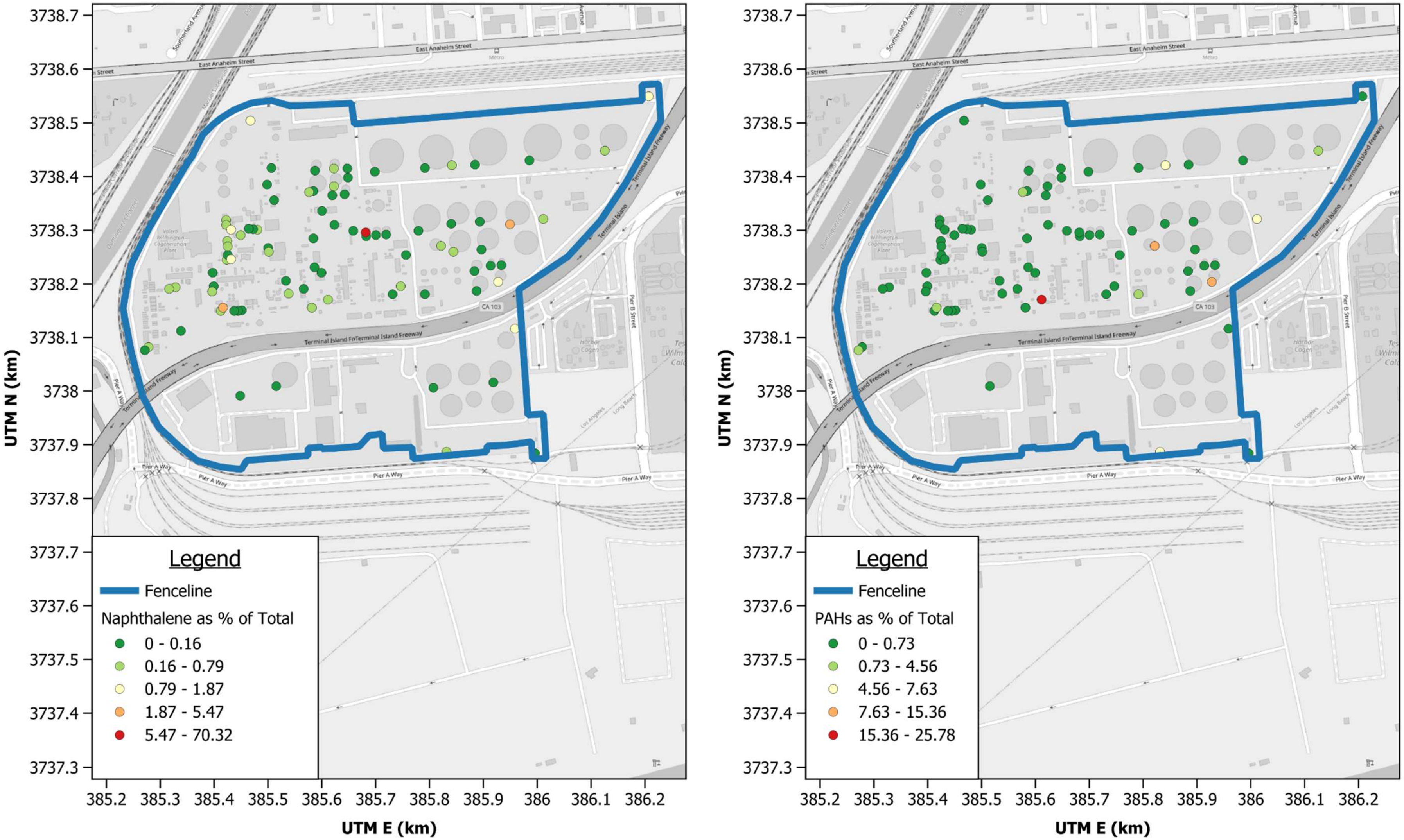


Figure 2-16. Xylene & Benzene Relative Emissions

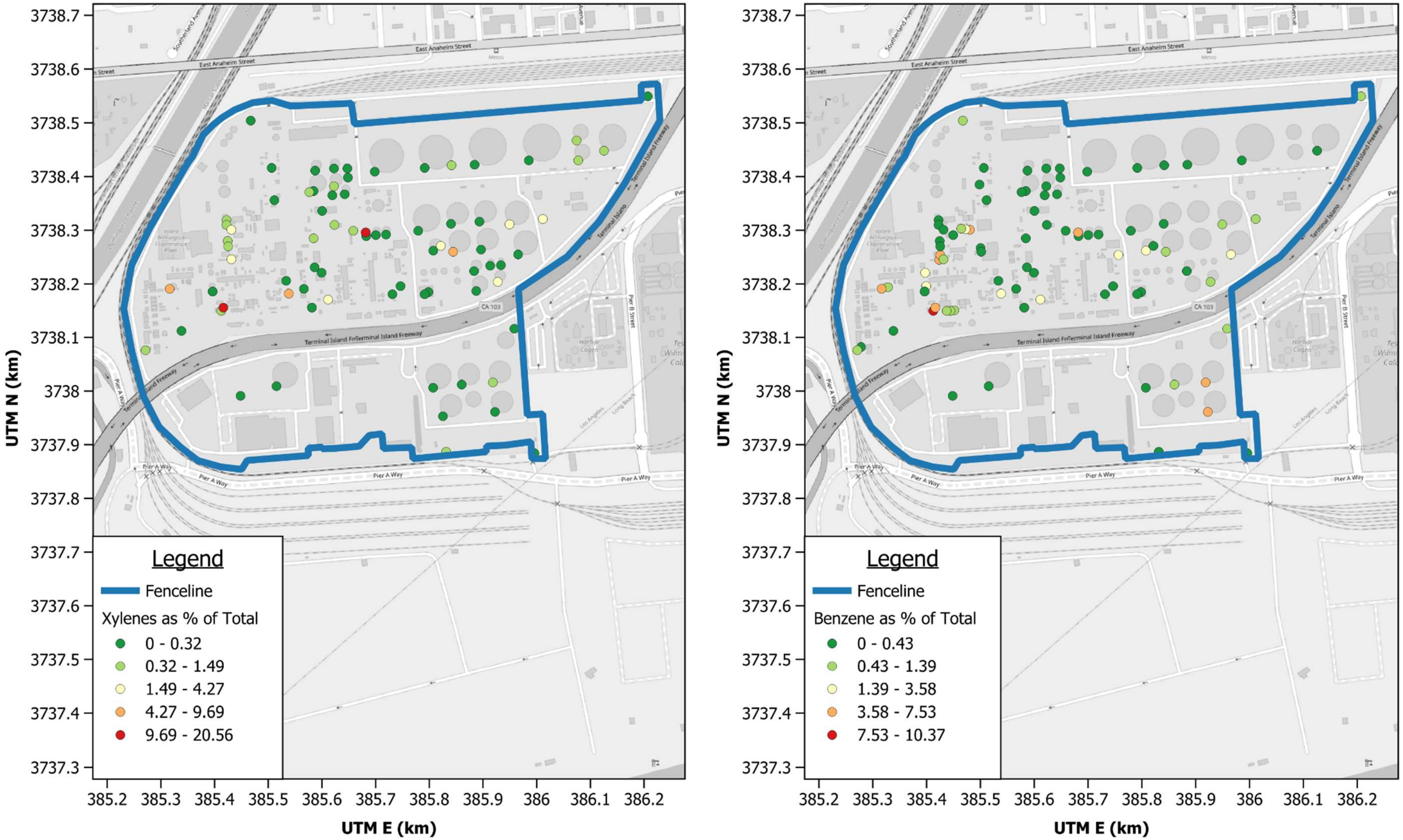


Figure 2-17. Toluene & Ethylbenzene Relative Emissions

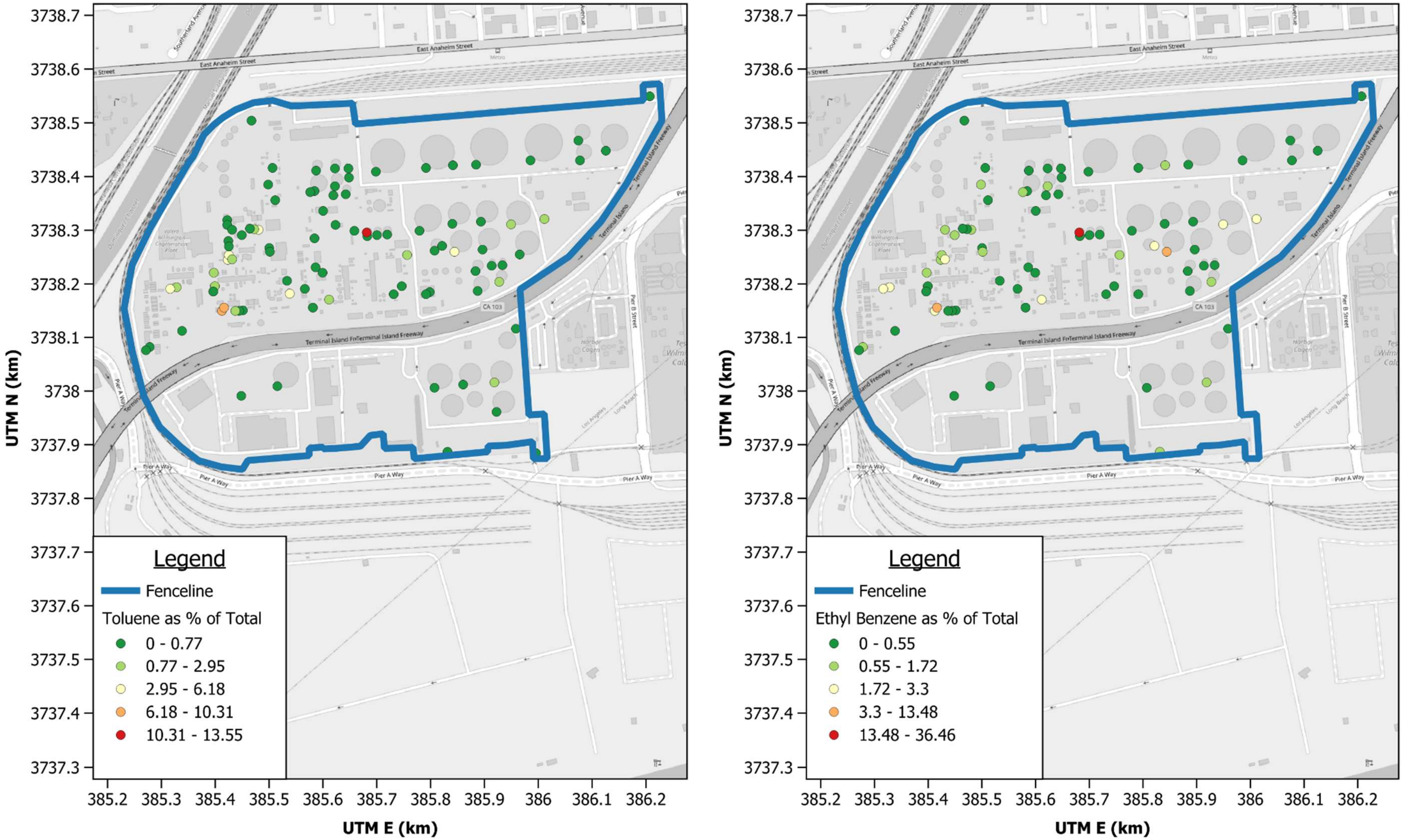


Figure 2-18. Styrene & Hydrogen Sulfide Relative Emissions

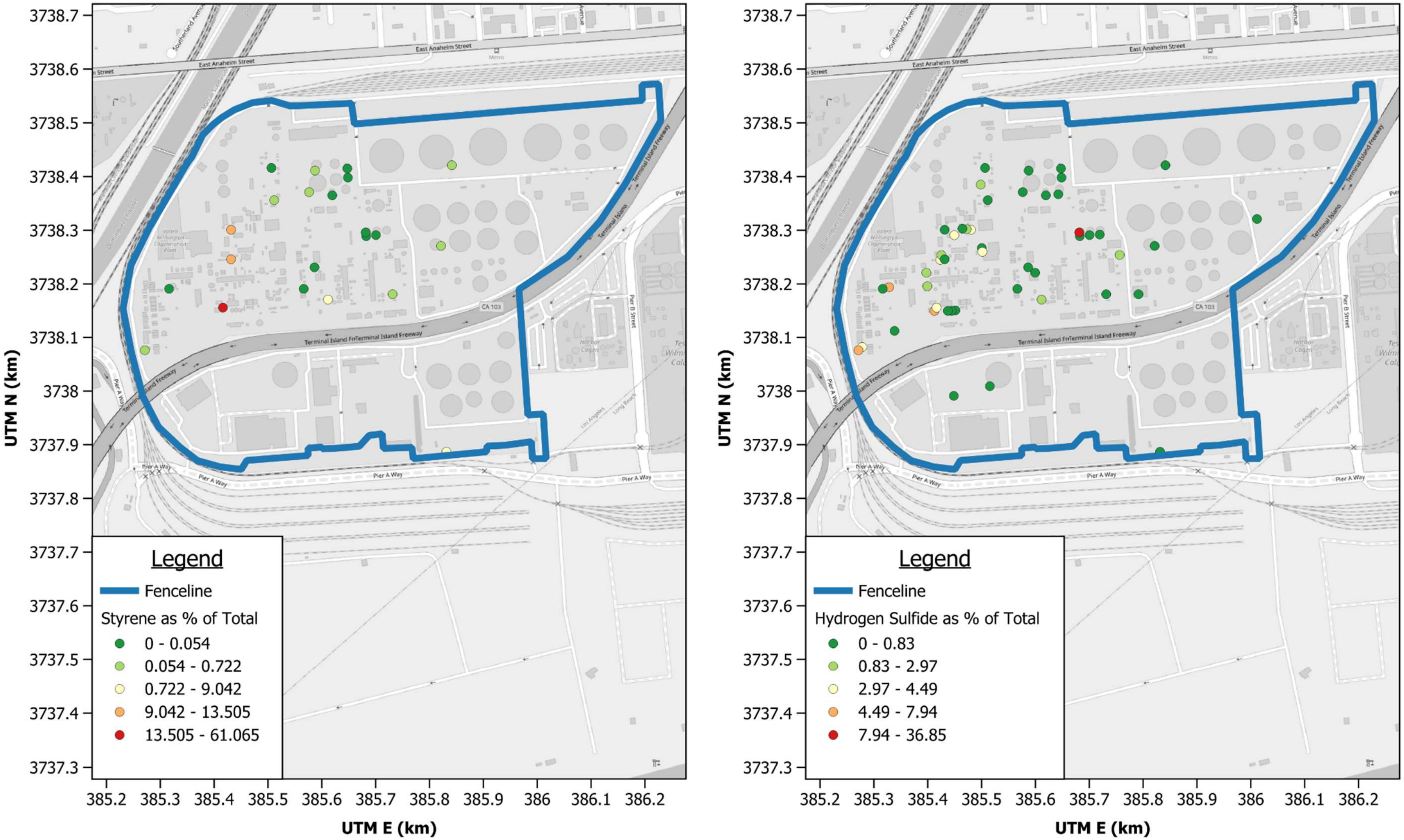


Figure 2-19. Carbonyl Sulfide & Ammonia Relative Emissions

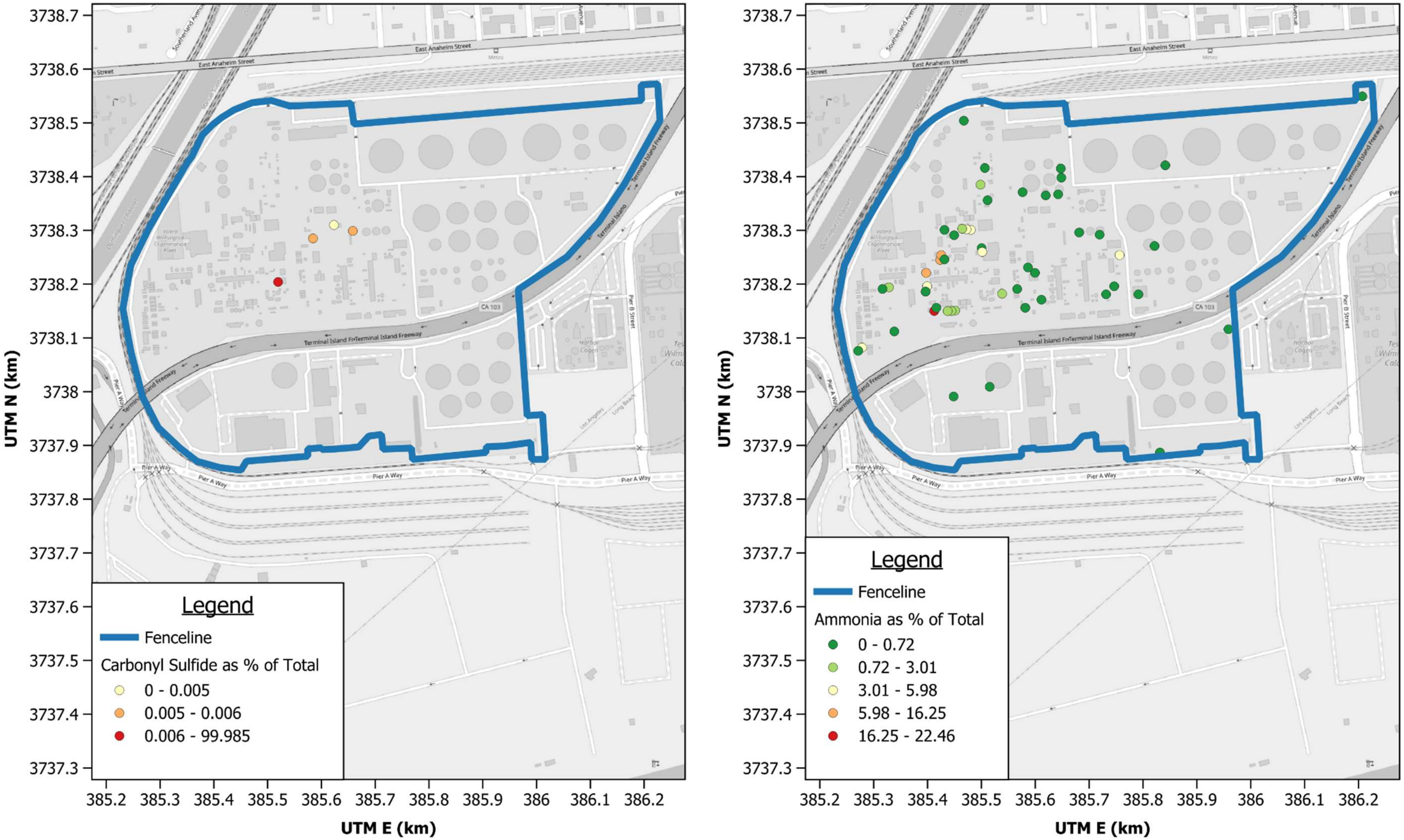


Figure 2-20. Hydrogen Fluoride & Hydrogen Cyanide Relative Emissions

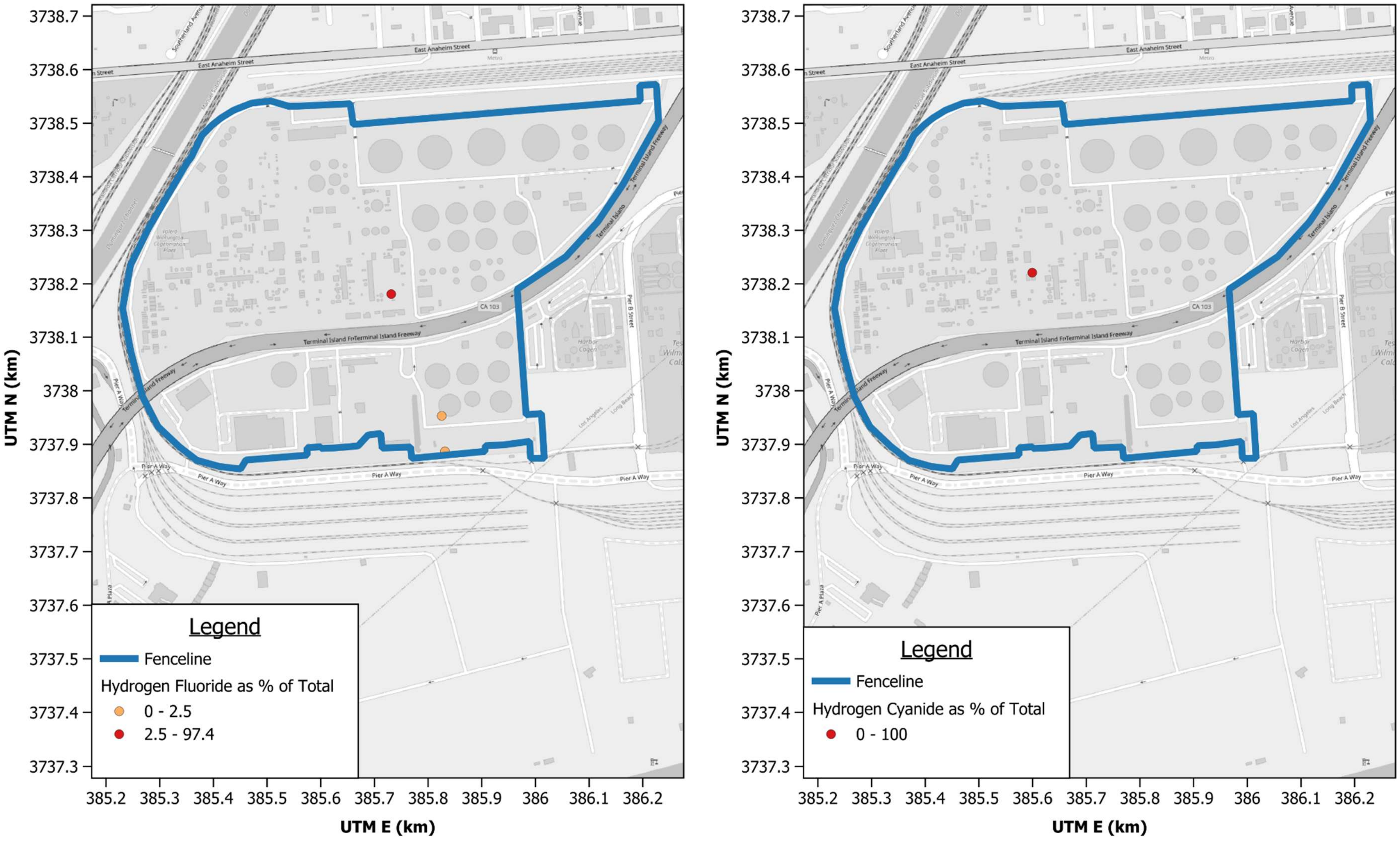


Figure 2-21. Diesel Exhaust Particulate (Black Carbon) & Nikel Relative Emissions

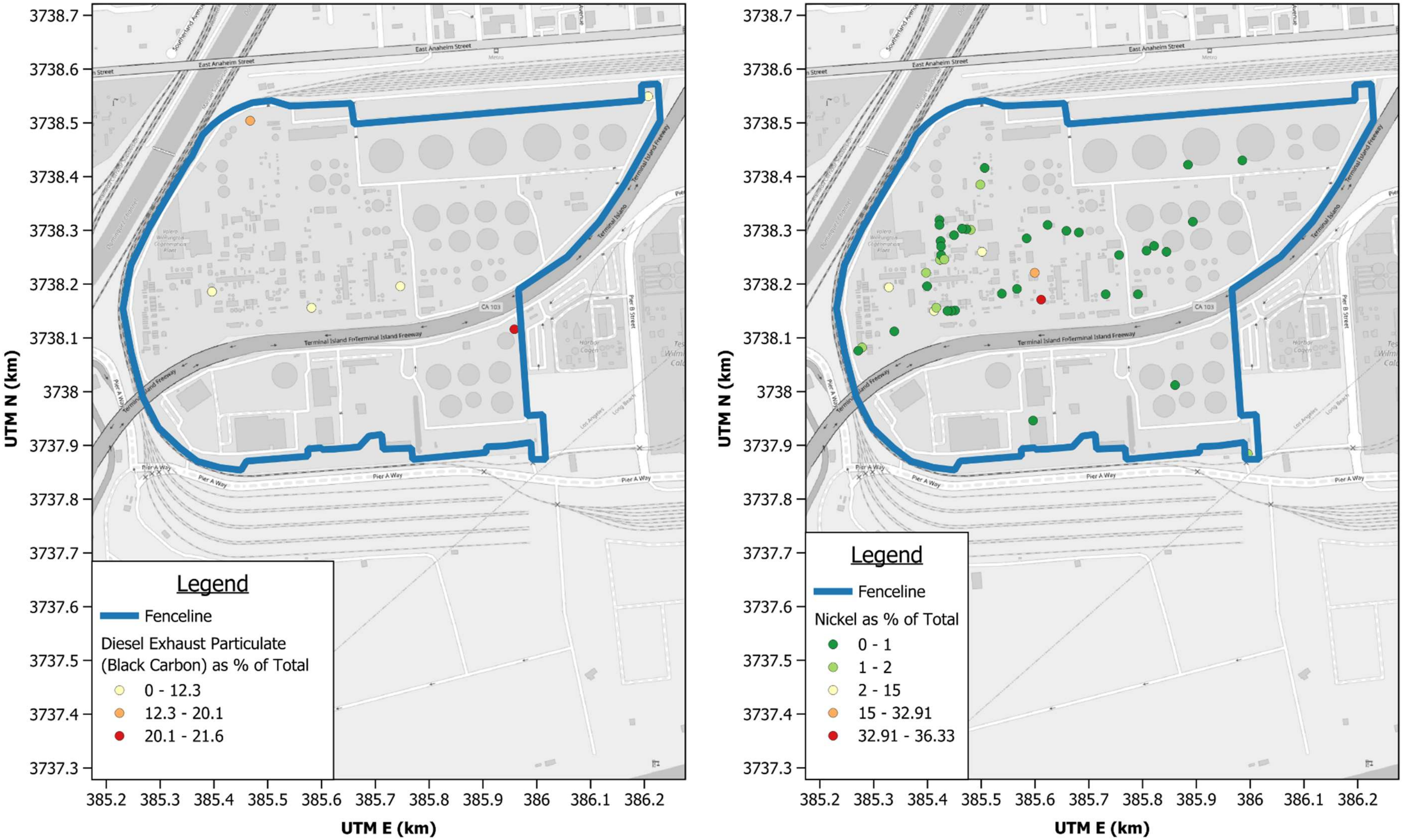
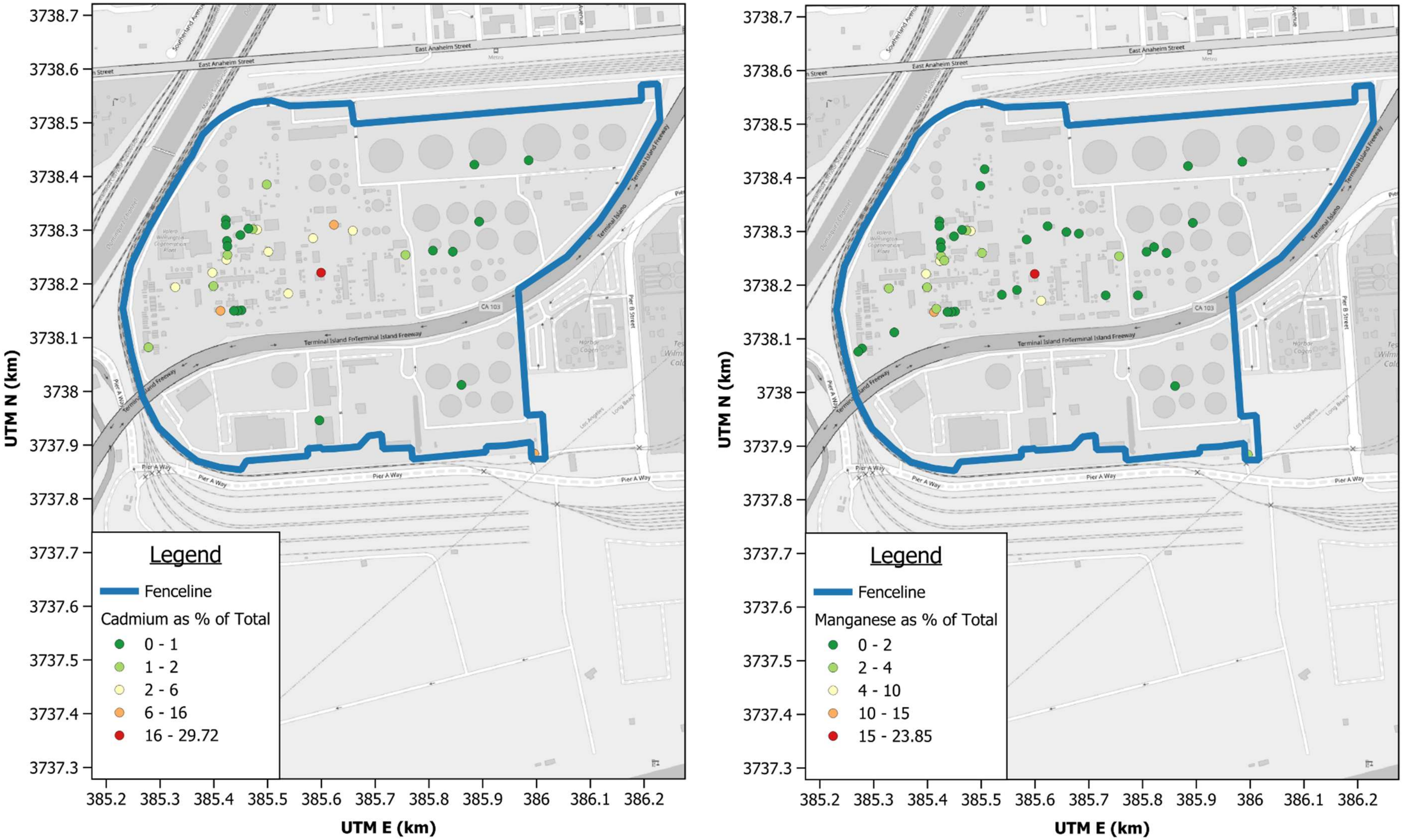


Figure 2-22. Cadmium & Manganese Relative Emissions



2.4. DISPERSION MODELING

This monitoring plan was developed based on the approved AB 2588 HRA, which was dated December 2009 and based upon the 2006-2007 inventory year. The refinery is participating in the Voluntary Risk Reduction Plan (VRRP). The emission inventory used in the VRRP from the 2015 inventory year does not show a substantial change for refinery equipment from the 2006-2007 inventory used in the approved 2009 HRA emissions. The HRA found hazard indexes for acute and chronic hazards generally did not exceed 0.5 beyond the fenceline, and in no case did they extend more than 70 m beyond the fenceline shown below in Figure 2-23. Therefore, it is reasonable to conclude from the HRA that non-cancer hazards and cancer risk are relatively well controlled.

Figure 2-23. 2009 HRA Cancer Risk Isopleths

Note. The image is created from Google Earth Pro (Desktop version 7.3.2.5495).

2.5. SAMPLING LOCATIONS

Fenceline sampling locations have been selected with a variety of goals and constraints in mind. There are numerous practical limitations that constrain fenceline monitoring location selection and are listed below:

- The required open space to install the equipment itself;
- The required open path sightlines, without permanent obstructions or excessive periodic blockage from passing traffic on the property;
- The need for power and communications lines to be installed at each sampling location;
- Avoiding sources of interference, such as abrupt changes in moisture levels that would occur if a path was sited over an intermittent steam vent, truck wash, or hydroblasting area;
- Engineering feasibility of installing suitable foundations for mounting vibration-sensitive equipment in an elevated position but in close proximity to rail lines and railcar coupling operations, which are extreme sources of vibration;
- Underground obstruction such as pipelines, sewage lines, and electrical conduit for suitable cabinet foundation and reflector locations;
- The need to site equipment and open paths on and over only Refinery-owned property, in order to avoid future path obstructions that encroach on to neighboring properties.
- Shorter paths sacrifice open path instrument sensitivity (by having higher detection limits); longer paths sacrifice the measurement's ability to suggest the source of the emission due to the increased path-length averaging, reduced signal strength, and increased water vapor interference; and
- The need for safe access to service and clean the instruments and retro-reflectors regularly.
- The prevailing winds and nearby downwind communities.

An overview of the sampling locations is shown below in Figure 2-24. The monitoring technologies proposed for each location are identified in this section and are discussed in greater technical details in Section 3.

The proposed open path lengths and locations were approved by AQMD for Sampling Systems locations 1 to 4 below. All Rule 1180 pollutants will use open-path technology except for H_2S and Particulates. The Refinery has limited open space at its fencelines, and the open space that exists is typically subject to extensive road traffic. Sightlines are obstructed by facility equipment, storage tanks, and the Terminal Island Freeway. The fencelines themselves are curved such that identifying practical unobstructed open paths (i.e., straight line of path) to be monitored has proven challenging. The open path detection capabilities for the long (>500m) open paths of C2P1 and C3P2, were found to be adequate to meet Rule 1180 requirements over the 4.5 years of operation.

AQMD requires in the amended Rule 1180 from Jan 5th, 2024, measurements of $PM_{2.5}$ & PM_{10} and metals (Cd, Mn, Mg) which require new sensors. Two new locations are proposed for these new sensors, at a new Sampling System 5 and near Sampling System 3 (this location will be tagged as 3a). These locations were chosen according to the FCCU (Fluid Catalytic Cracking unit) and ESP (Electrostatic precipitator) facilities' location and the prevailing winds (South and Northwest winds, see Section 2.2.1 above). The FCCU and ESP facilities have the most potential to emit metals and particulate emissions and are located at the center of the refinery (around source 19 in Figure 2-11). To cover the South prevailing winds, the cabinet is located on the rooftop of the administration building, 250 meters north of the FCCU and ESP (see System 5 in Section 0 below). The nearby downwind communities are Northwest to this location (see section 2.1.3). For Northwesterly prevailing winds, an open area, 500 meters Southeast of the FCCU and ESP, near Cabinet 3 was chosen for the new south cabinet (see System 3, Cabinet 3a, in Section 2.5.3 below).

The final cabinet placement will depend on constructability, city property boundaries, permits, and utilities and can vary by a few meters from the following proposed locations.

Figure 2-24. Sample Location Overview

Note. The image is created from Google Earth Pro (Desktop version 7.3).

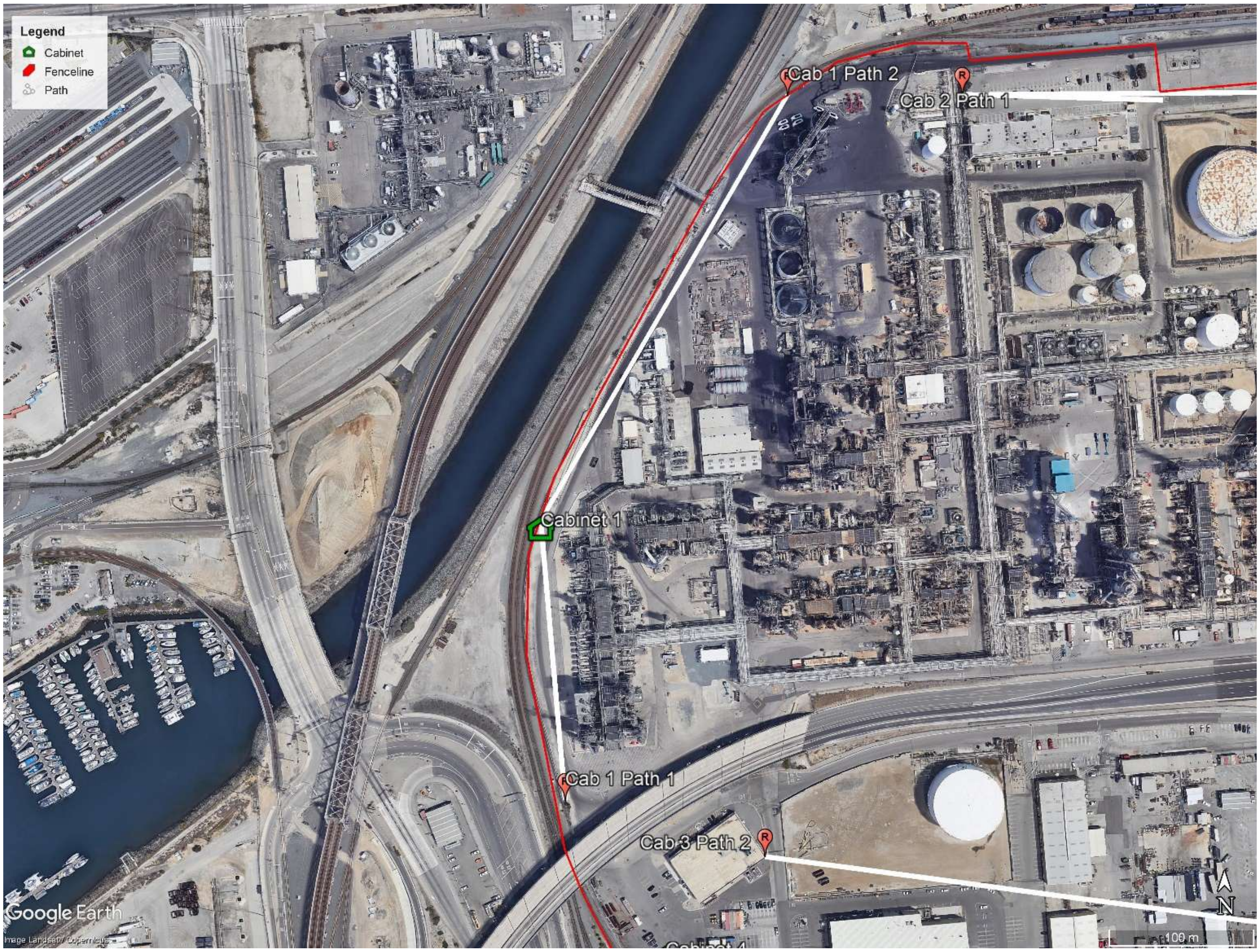
2.5.1. Sampling System 1

Sampling System 1 is comprised of Cabinet 1, Open Path 1, and Open Path 2, with path lengths of approximately 188 meters and 327 meters, respectively. The location has been sited to maximize coverage on the west, given the curved fenceline, elevated obstructions, and localized moisture sources.

Cabinet 1 will be equipped with an open-path FTIR, open-path UV-DOAS, UV fluorescence H_2S analyzer, and black carbon aethalometer. Black carbon and H_2S samples will be collected from a single point at the cabinet location.

Location information for Sampling System 1 is summarized below in Figure 2-25.

Figure 2-25. Sampling System 1 Location



Note. The image is created from Google Earth Pro (Desktop version 7.3).

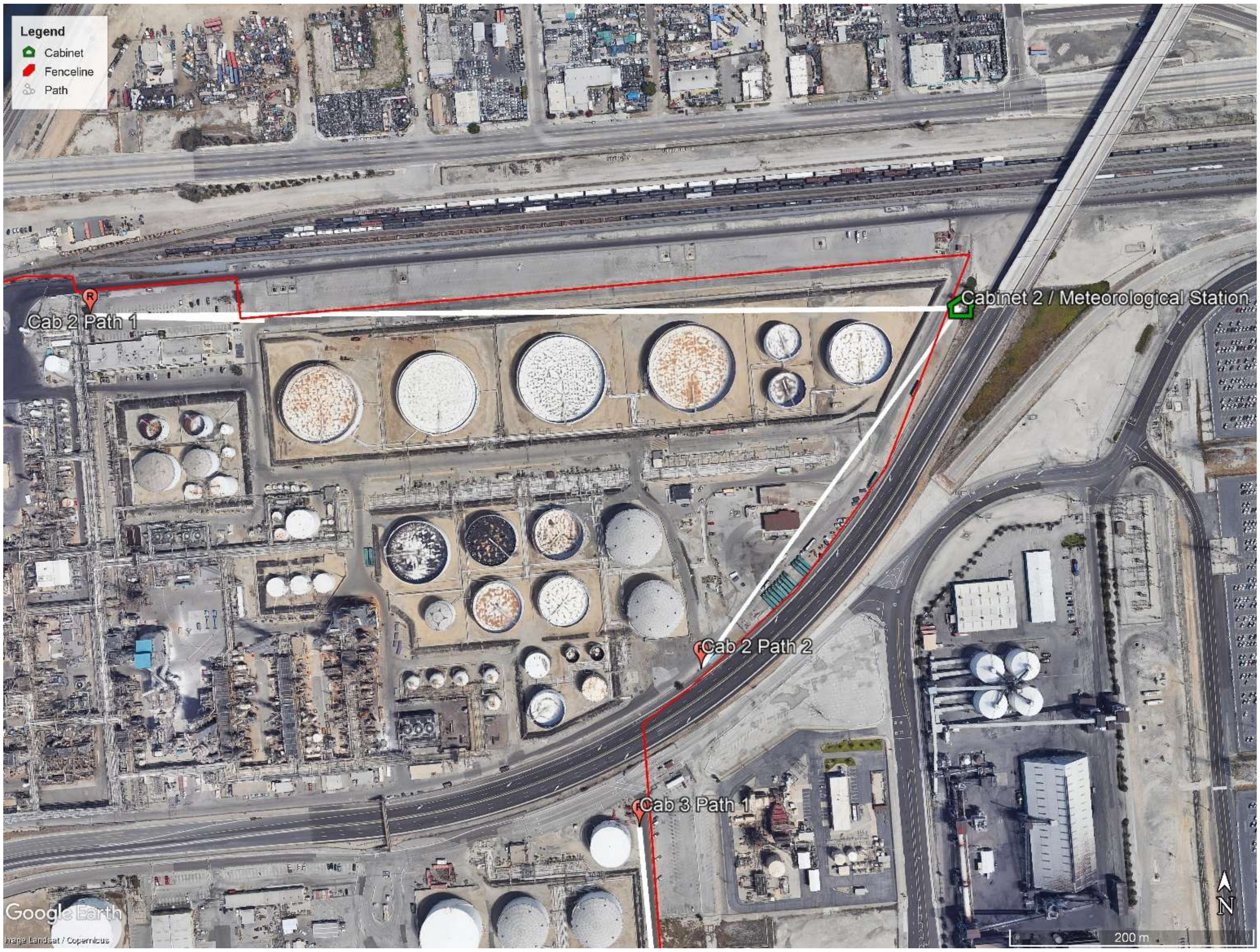
Location	UTM Easting (m)	UTM Northing (m)	Open Path (m)	Elevation (m)
Cabinet 1	385,245	3,738,210	NA	6.4
Cabinet 1 Path 1	385,259	3,738,032	188	7.6
Cabinet 1 Path 2	385,417	3,738513	327	6.5

2.5.2. Sampling System 2

Sampling System 2 is comprised of Cabinet 2, Open Path 1, and Open Path 2, with path lengths of approximately 682 and 338 meters, respectively. Cabinet 2 Path 1 is longer than ideal, but the lack of available space between hazardous areas (near the tanks) and the property line makes this unavoidable and can still fulfill the requirements.. Cabinet 2 Path 2 extends as far as possible down the curved southeast fenceline while avoiding the obstruction of an enclosed truck loading rack near its middle.

Cabinet 2 will be equipped with an open path FTIR, open path UV-DOAS, UV fluorescence H_2S analyzer, and aethalometer. Black carbon and H_2S samples will be collected from a single point at the cabinet location. Location information for Sampling System 2 is summarized below in Figure 2-26.

Figure 2-26. Sampling System 2 Location



Note. The image is created from Google Earth Pro (Desktop version 7.3).

Location	UTM Easting (m)	UTM Northing (m)	Open Path (m)	Elevation (m)
Cabinet 2	386,223	3,738,498	NA	6.4
Cabinet 2 Path 1	385,537	3,738,511	682	15.5
Cabinet 2 Path 2	386,017	3,738,229	338	7.6

2.5.3. Sampling System 3

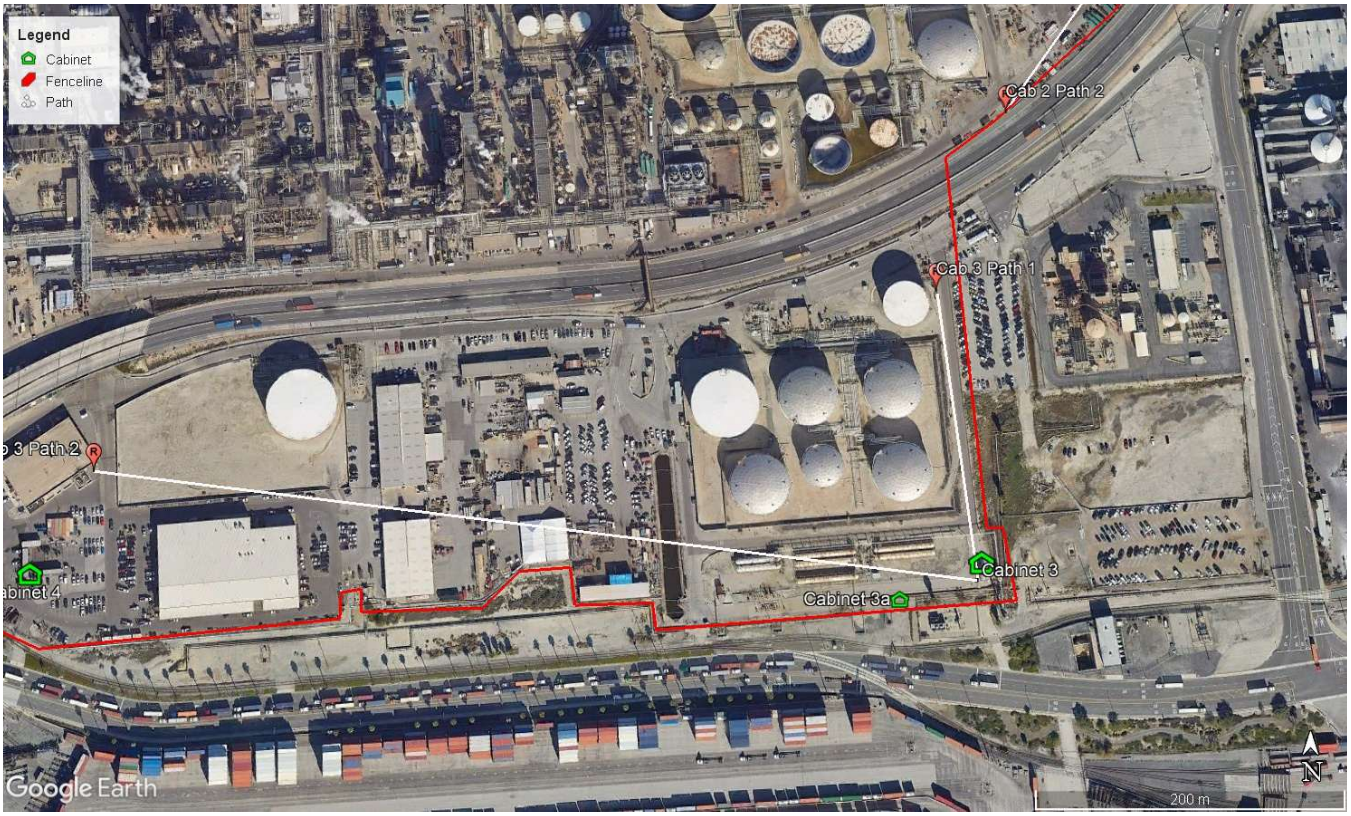
Sampling System 3 is comprised of Cabinet 3, Open Path 1, and Open Path 2, with path lengths of approximately 190 and 597 meters, respectively. Cabinet 3 Path 2 is longer than ideal for coverage of the wastewater tank on the south and can still fulfill the requirements.

Cabinet 3 will be equipped with an open path FTIR, open path UV-DOAS, UV fluorescence H_2S analyzer, and aethalometer. Black carbon and H_2S samples will be collected from a single point at the cabinet location.

Cabinet 3a will be located about 60 meters from Cabinet 3 and will be equipped with particulate $PM_{2.5}$, PM_{10}, and metal sensors.

Location information for Sampling System 3 is summarized below in Figure 2-27.

Figure 2-27. Sampling System 3 Location



Note. The image is created from Google Earth Pro (Desktop version 7.3).

Location	UTM Easting (m)	UTM Northing (m)	Open Path (m)	Elevation (m)
Cabinet 3	385,981	3,737,895	NA	6.4
Cabinet 3 Path 1	385,965	3,738,105	190	15.5
Cabinet 3 Path 2	385,963	3,738,103	597	7.6
Cabinet 3a	385,930	3,737,891	NA	0.5

2.5.4. Sampling System 4

Sampling System 4 is comprised of Cabinet 4. Cabinet 4 will be equipped with a UV fluorescence H_2S analyzer and aethalometer. Black carbon and H_2S samples will be collected from a single point at the cabinet location.

Location information for Sampling System 4 is summarized below in Figure 2-28.

Figure 2-28. Sampling System 4 Location

Note. The image is created from Google Earth Pro (Desktop version 7.3).

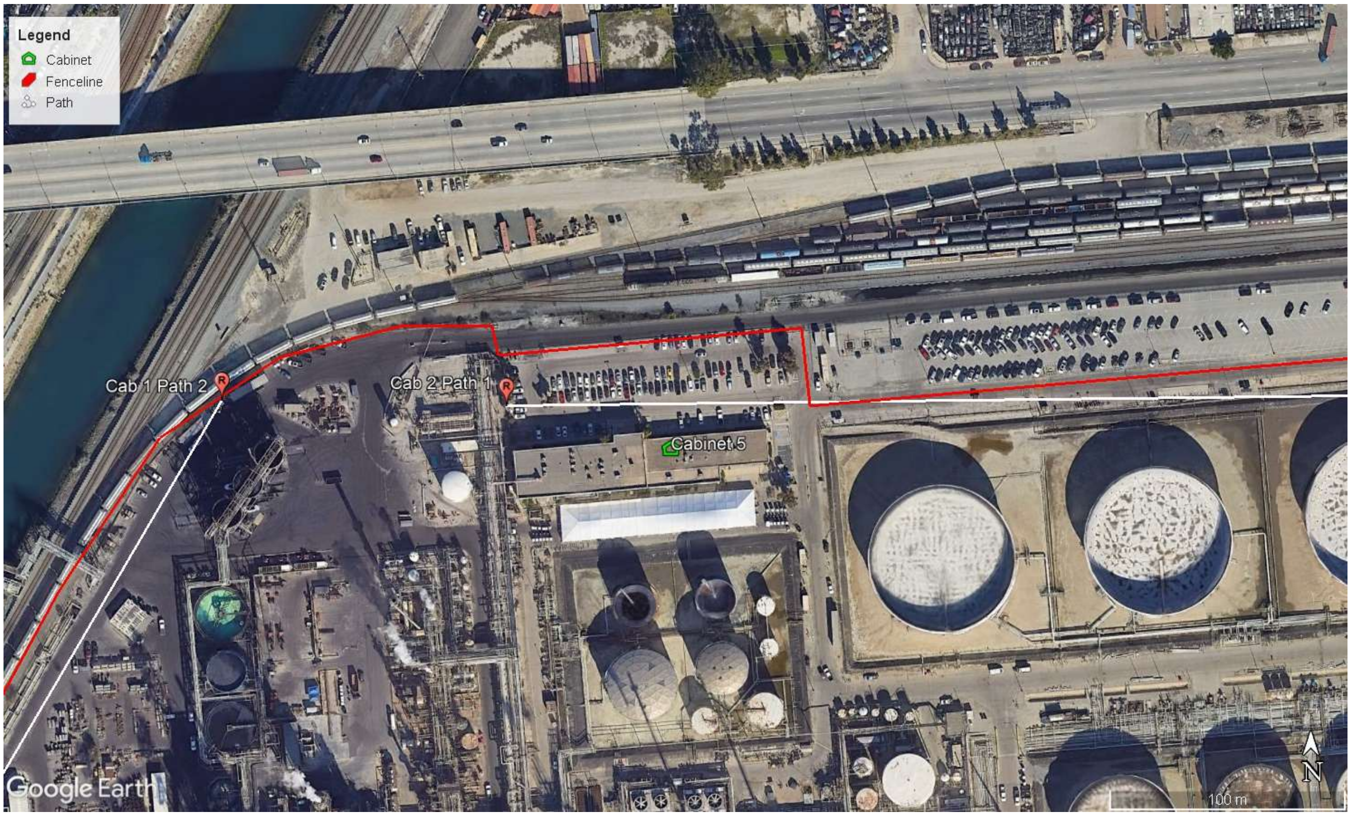
Location	UTM Easting (m)	UTM Northing (m)	Elevation (m)
Cabinet 4	385,356	3,737,911	0.0

2.5.5. Sampling System 5

Sampling System 5 consists of Cabinet 5, which will be equipped with particulate $PM_{2.5}$, PM_{10}, and metal sensors.

Location information for Sampling System 5 is summarized below in Figure 2-29.

Figure 2-29. Sampling System 5 Location



Note. The image is created from Google Earth Pro

Location	UTM Easting (m)	UTM Northing (m)	Elevation (m)
Cabinet 5	385,613	3,738,486	15

3. FENCELINE AIR MONITORING EQUIPMENT

3.1. TECHNOLOGY OVERVIEW

The Guidelines recommend the use of “open path technologies” when applicable for Rule 1180 fenceline monitoring. Open-path technology involves sending a beam of light through a linear path in space. The light interacts with the pollutants it passes through in characteristic ways that can be measured and analyzed using complex computer algorithms in order to determine the average concentration of one or more pollutants across that path. It should be noted that open path technologies are subject to “path length averaging.” In practice, they cannot distinguish between a narrow, concentrated plume and a broad, diffuse plume. Given that open-path technologies are not suitable for monitoring particulates or hydrogen sulfide in this application, point technologies must also be considered.

3.2. AQMD APPROVED TECHNOLOGIES

AQMD requires the use of open-path FTIR and UV-DOAS to measure the entire suite of Rule 1180 target compounds. H_2S is not sensitive enough in the IR or UV range to meet the notification threshold and a dedicated UV Fluorescence point analyzer is utilized. Particulates cannot be measured with spectroscopist open-path technologies. For Black Carbon, $PM_{2.5}$, and $PM_{10,}$ and the metals in Rule 1180, see the chosen point sampling technologies in Table 3-1 below. All the point monitoring are extractive technologies, they are called “extractive” in the sense that they collect a sample from a point in space and convey that sample into an instrument for analysis. Relative to open path technologies, extractive technology is the more conventional solution for monitoring ambient air, some with a longer and more established track record. Extractive technologies typically tend to follow the “one instrument per pollutant” model.

Table 3-1 lists the Rule 1180-required pollutants for the Refinery, the intended monitoring techniques, the minimum detection limits, and the maximum detection limits based on data from the current Valero installation when possible and specifications provided by instrument manufacturers. The secondary technology, shown in parentheses, is explained in the notes of the Table.

Table 3-1. Monitoring Technologies and Detection Limits

Pollutant	Monitoring Technique [1]	Actual Detection Limit [ppb] [2]	Maximum Detection Limit [ppb] [3]	Notification Threshold [ppb] [4]
Sulfur Dioxide	UV-DOAS (OP-FTIR)	0.70 (0.90)	1,900 (>1,000ppm)	75
Nitrogen Dioxide	OP-FTIR	0.80	52,000	100
Total VOCs (as Total Alkanes)[5]	OP-FTIR	0.45	114,000	730
Formaldehyde	OP-FTIR	0.20	80,000	44
Acetaldehyde	OP-FTIR	0.25	114,000	260
Acrolein	OP-FTIR	0.30	44,000	1.1
1,3-Butadiene	OP-FTIR	0.15	4,000	297
Naphthalene	OP-FTIR	0.25	340 / 7,300	NA
Styrene	OP-FTIR	0.20	57,000	5000
Benzene	UV-DOAS (OP-FTIR)	1.90 (0.80)	626 (333,000)	8
Toluene	OP-FTIR (UV-DOAS)	0.80 (1.30)	15,000 (531)	1300
Ethyl Benzene	OP-FTIR (UV-DOAS)	0.65 (10.50)	28,000 (461)	N/A
m-Xylene	OP-FTIR (UV-DOAS)	0.40 (2.05)	25,000 (461)	5000
o-Xylene	OP-FTIR (UV-DOAS)	0.65 (7.00)	10,000 (461)	5000
p-Xylene	OP-FTIR (UV-DOAS)	0.40 (0.50)	16,000 (461)	5000
Carbonyl Sulfide	OP-FTIR	0.05	7,000	270
Ammonia	OP-FTIR	0.05	66,000	4507
Hydrogen Cyanide	OP-FTIR	0.95	>1,000,000	309
Hydrogen Fluoride	OP-FTIR	0.10	16,000	289
Hydrogen Sulfide	UV Fluorescence	0.4	10,000	30
	Monitoring Technique	**Detection Limit [$\mu g/m^3$]**	**Maximum Detection Limit [$\mu g/m^3$]**	**Notification Threshold [$\mu g/m^3$] [4]**
Black Carbon	Aethalometer	0.0005	10	NA
Cd	PM-EDXRF[6]	0.012	60	NA
Mn	PM-EDXR[6]	0.00071	60	0.17 (8hr av)
Ni	PM-EDXR[6]	0.0047	60	0.2
$PM_{2.5}$	BAM	<4.8	1000	35 (24hr av)
PM_{10}	BAM	<7	1000	50 (24hr av)

Notes.

[1] The primary open path technology was chosen based on the ability to measure well below the notification threshold (threshold at least three times the lower actual DL) and above the threshold (threshold below the Maximum DL) and that no cross interference will trigger a false positive. The FTIR used at Valero Wilmington is well within these criteria for all gaseous compounds in Rule 1180. H_2S is the exception, whose detection limit is way above the notification threshold. UV-DOAS is used upon SCAQMD request and only in cases where these criteria can be met.

[2] The 1-hour actual detection limits for FTIR and UV-DOAS are based on the actual measurements by the installed units at Valero Wilmington (from the latest 2 quarterly reported Detection Limits on path C2P2, path length 336m). Since the open path detection limits are dynamic and depend on the open path itself, the specific location, and local interferences, these actual detection limits best reflect the system's ability and not the estimated detections based on lab experiments. In parentheses are the detection limits of the secondary technology.

[3] For OP FTIR and OP UV-DOAS, the range is path-dependent since the measurements are in ppb*m. The numbers stated in the tables for the maximum range are for a path of 250m for the OP FTIR, and a path of 500m for the OP UV-DOAS.

[4] Thresholds based on Rule 1180 Table 1– Air Pollutants and Notification Thresholds to be addressed by FAMPs.

[5] Because there is no open-path technology capable of measuring all NMHC, the OP FTIR technology will monitor at least C4-C8 alkanes as an indicator of NMHC concentrations.

[6] The detection limits of the metals with XRF depend on the sampling time, longer sampling times obtain smaller detection limits. The sampling time final selection will be a compromise between tape frequency exchange, sensitivity, and the delay due to analysis time. The stated DL in the table is based on a 30-minute sample but depends on the final selected sampling time.

This table and its notes are also presented in the QAPP. If there is any discrepancy between the two tables the one at the QAPP will prevail as it is a live document that can be revised as the project advances.

It should be noted that detection limits for FTIR and UV-DOAS are dependent on a large number of factors, including humidity levels, co-pollutants present in the sample, and interferents present in the sample. Minimum and maximum detection limits for these techniques will, therefore, naturally vary to a certain extent over time due to changes in these variables. It would be misleading and inaccurate to represent “hard and fast” detection limits in this context. The detection limits shown above are intended to be representative of typical system operation under normal conditions and representative path lengths.

3.2.1. Aethalometer

The aethalometer selected for black carbon measurement is a mature technology specialized for this single purpose. This unit has the advantage over competing organic carbon/elemental carbon (OC/EC) analyzers in that it is far simpler and is known to be reliable for long-term, steady-state operation in the field, having been commercialized since 1986. Additionally, the aethalometer is a continuous measurement operating at 1 Hz internal measurement frequency, easily allowing for the 5-minute data updates specified in the Guidelines. The performance of an earlier generation of aethalometer was verified under the US EPA’s Environmental Technology Verification program in 2001.[1] SCAQMD used aethalometer units to monitor black carbon in its Multiple Air Toxics Exposure Study IV (MATES IV).

3.2.1.1. Method of Operation

The unit continuously samples ambient particulate at 5 liters per minute on a Teflon-coated glass fiber filter tape. A smaller portion of the sample is directed to one spot on the filter, and a larger portion of the sample is directed to another spot on the filter. Both filter spots undergoing sampling, plus a third unsampled filter spot, are continuously monitored for optical absorbance at seven known wavelengths simultaneously. The attenuation of transmitted light at 880 nm is the characteristic absorption frequency of black carbon. The absorbance at this wavelength at three filter spots are compared mathematically to eliminate nonlinearities. The filter tape advances automatically when a loading threshold is achieved so that sampling can begin on new filter spots.

The aethalometer used in Valero Wilmington is Magee’s AE33 model.

3.2.1.2. Interferences

No interferences are known for the black carbon, apart from condensed water vapor in the sampling tubing. The entire absorbance in 880 nm is apportioned to black carbon. Water vapor is removed by a water trap, keeping the sampling tube isolated and away from the A/C.

3.2.2. UV Fluorescence Hydrogen Sulfide Monitor

The use of a conventional (point extractive) hydrogen sulfide monitor has been requested by AQMD. The UV fluorescence analyzer for supplemental hydrogen sulfide monitoring is essentially similar to conventional sulfur dioxide analyzers used in ambient and CEMS applications but is preceded by a catalytic converter set at 315 ^{o}C that converts hydrogen sulfide to sulfur dioxide while leaving other sulfur compounds unconverted.

---

[1] *Environmental Technology Verification Report: Magee Scientific Aethalometer Particulate Carbon Monitor.* Report prepared by Battelle under cooperative agreement with US Environmental Protection Agency. August 2001.

3.2.2.1. Method of Operation

The hydrogen sulfide analyzer continuously collects a sample from a single point in space and analyzes it for hydrogen sulfide content using an ultraviolet fluorescence technique. Generally, hydrogen sulfide is catalytically converted to sulfur dioxide, and then a conventional ultraviolet fluorescence sulfur dioxide measurement is made.

First, the sample passes through a particulate filter that removes particles that would otherwise dirty the instrument's optics. This filter is followed by a hydrocarbon scrubber ("kicker") to remove hydrocarbon species such as naphthalene and meta-xylene that are known to interfere with the ultraviolet measurement due to their fluorescing in ultraviolet light in a manner similar to sulfur dioxide. The sample is then passed through a chemical scrubber to remove any sulfur dioxide already present in the sample, and a molybdenum converter heated to 315 ^{o}C to catalytically oxidize hydrogen sulfide in the sample to sulfur dioxide. At this point, then, all sulfur dioxide in the sample was originally hydrogen sulfide, and no hydrogen sulfide remains. The sulfur dioxide is then passed through an optical chamber in which it is exposed to ultraviolet light from an ultraviolet lamp. The light, which is filtered to a wavelength of 214 nm, which causes individual sulfur dioxide molecules to reach an excited but unstable state; in their return to their original but stable energy state, each releases a photon of around 330 nm. By counting the individual 330 nm photons using a photomultiplier tube and relating the photon count to the sample flow rate, the concentration of hydrogen sulfide in the original sample can be determined.

The H2S analyzer used in Valero Wilmington is Teledyne's T101 model.

3.2.2.2. Interferences

Several interferences are known for this measurement technique; these are compensated for in the instrument design as follows:

- Sulfur dioxide. As the instrument's direct measurement is a sulfur dioxide measurement and the intent is to measure only sulfur dioxide that was produced by the catalytic oxidation from hydrogen sulfide, ambient sulfur dioxide is to be removed by a chemical scrubber prior to the ultraviolet fluorescence.
- Poly-nuclear aromatics. These compounds, which include xylene and naphthalene, fluoresce similarly to sulfur dioxide when exposed to ultraviolet light. To prevent these from effectively being counted as hydrogen sulfide, the instrument includes a hydrocarbon scrubber that removes them prior to ultraviolet fluorescence. The scrubber uses a semi-permeable plastic membrane, across which there is a hydrocarbon partial pressure differential. Hydrocarbons permeate through the membrane, while hydrogen sulfide and sulfur dioxide pass by unaffected.
- Nitric oxide. Nitric oxide also fluoresces similar to sulfur dioxide when excited by ultraviolet light, but the photons released by this reaction are outside of the bandwidth that can pass through the optical filter on the instrument's photomultiplier tube.
- Ozone. As ozone absorbs ultraviolet light over a broad spectrum, it could interfere with the measurement. Relative to the concentrations found in ambient air and given the very short light path between where the sulfur dioxide photon emission occurs and the photomultiplier tube, this effect is minimized.

3.2.3. Open Path FTIR

AQMD has required measurements of VOCs and other gaseous compounds by open-path (OP) FTIR. The OP-FTIR can measure any compound that is active in the IR range. The selectivity and sensitivity vary across compounds. See further Notes of Table 3-1.

3.2.3.1. Method of Operation

The interferometer portion of the instrument includes an infrared (IR) source, a beam-splitter, mirrors, a laser, and an interferometer. IR energy the source is split into two parts by the beam-splitter. One part is reflected to a fixed mirror, and the other part goes to a moving mirror. The moving mirror oscillates at a precise known frequency, timed to the precise wavelength of the laser that is used only for this purpose. The two beams of IR energy are then recombined at the beam-splitter, having traveled slightly different distances. When recombined, the waves of IR energy interact in a mix of constructive and destructive patterns; these patterns are an interference pattern or interferogram. From this point, the IR beam is sent light through an open path, typically 100-500m long, to a retro-reflector, which returns it to the instrument's detector in a slightly altered state due to its interaction with the compounds in the open path. This signal is digitized and transformed mathematically using the Fourier transform algorithm. A reference spectrum is also collected without having passed through the open path, and the two beams are compared. As infrared energy stimulates molecular vibrations, and each molecular species displays its own characteristic vibration under such stimulation, many unique compounds can be detected simultaneously using this method by comparing the patterns of the absorption spectrum to standard reference spectra that have been developed under laboratory conditions. Each concentration is simultaneously derived from the same data, as the amount of IR radiation absorbed is proportional to the concentration of the compound in the path.

The selected open-path FTIR technology is capable of recording and storing the measured spectral absorption and associated average concentrations of measured pollutants for retrospective investigation. Each interferometer would be housed in a small cabinet building, with a retro-reflector placed at the opposite end of each path.

The OP-FTIR used in Valero Wilmington is Burker's OPS model with Atmosfir's D-fenceline^{TM} as the control and analysis software. The software automatically analyzes the raw spectral data and reports 5-minute, 30-minute, or 1-hour concentrations. The raw data is archived and can be retrieved for post-processing in-depth analysis and investigations in the D-fenceline^{TM} interface.

3.2.3.2. Interferences

The technology's interferents are mostly water and carbon dioxide; as these are universally present in ambient air, the analytical software is designed to continuously measure changes of these compounds and subtract the spectral contribution due to these changes.

Cross-interferences are possible by other compounds that absorb in the same spectral window. The classical least squares (CLS) analysis is designed to account for these compounds and subtract their spectral contribution. A good design of the spectral windows should minimize cross-interferences.

3.2.4. Open Path UV-DOAS

AQMD requires the open path UV-DOAS (ultraviolet differential optical absorption spectroscopy) to be used as an Open path technology together with OP-FTIR. The UV-DOAS can measure compounds that are active in the UV range, namely contain double bonds. The selectivity and sensitivity vary between compounds. See further Notes of Table 3-1.

3.2.4.1. Method of Operation

The UV-DOAS instrument has a strong internal ultraviolet light source, typically a Xenon lamp. The selected configuration for Valero-Wilmington paths is bi-static; that is, the UV beam is emitted from the source across the open path to a receiver with an optical fiber that collects and passes the radiation to the spectrometer's detector. The light beam interacts with the chemical compounds contained in the column of air, which is the open path, and in cases where those compounds have specific absorbance signatures in the ultraviolet spectral range. The software uses least squares (LS)-fit analysis to identify and quantify the analyte compounds based on their unique absorbance signatures. Automatic software evaluates the raw spectral data and reports concentrations on a 5-minute basis. The raw data is also archived for later in-depth analysis, enabling post-measurement investigations and analysis.

The UV-DOAS that is used in Valero Wilmington is OPSIS's AR500 model.

3.2.4.2. Interferences

This measurement technique is affected by several interferences, including fog, smoke, haze, nitrogen, ozone, and, in particular, oxygen collisional complexes: O2·O2 and O2·N2. The content of oxygen complexes and ozone is not constant and varies with temperature, pressure, and chemical reactions in the open path.

Cross interference between BTEX species that absorb in the same spectral windows is possible when several species co-present. A multi-regression analysis is operated to minimize the cross-interference effect.

3.2.5. BAM Particulate Monitoring

AQMD has requested continuous monitoring of $PM_{2.5}$ and PM_{10} in the amended Rule 1180. The beta attenuation monitoring (BAM) technology is essentially indifferent to the chemical composition and shape of the PM. Therefore, its calibration is robust even in cases of biomass burning and fire events. This is an advantage, considering various sources of particulate matter can contribute to the PM fraction. This technology is widely used for ambient particulate continuous monitoring.

3.2.5.1. Method of Operation

Beta attenuation mass monitor measures the mass concentration of ambient particulate (aerosol) based on beta ray attenuation. The monitor draws air flows through a PM size-selective inlet and across a glass-fiber filter tape. The beta-ray that is emitted from a 14C isotope, traverses first across clean filter tape, then transverses the PM collected spot on the filter. The beta ray that goes through the filter tape, I_0 and I respectively, reaches a scintillation detector that measures the radiation flux (counts). The beta attenuation, $\ln\frac{I_0}{I}$, equals the aerosol mass, M (mg), multiplied by the aerosol absorption cross-section coefficient, µ (cm^2/mg), and divided by the PM spot area, S (cm^2). The absorption cross section µ is fixed and determined by factory calibration per BAM unit. It mostly depends on the mass of the absorbing species and is not affected by its chemical composition. Therefore, an accurate mass concentration is obtained for all commonly found species in ambient particulate matter such as soot, iron oxide, silica, or salt without pre-knowledge about the chemical composition of the sampled PM. PM mass concentration (mg/m^3) is derived using the flow rate and the setup sampling time. The stated detection levels require 1-hour cycle measurement including 42 minutes of sampling, and two 8-minute intervals of beta radiation detection before and after the sampling. The filter tape movements occur in the spare two minutes. This configuration meets the EPA and EU-designated $PM_{2.5}$ configuration. When running the BAM as a US-EPA designed equivalent method for PM_{10} the detector count time may be set to 4, 6, 8, or 10 minutes as long as the total measurement cycle is 1 hour.

3.2.5.2. Interferences

No interfaces are reported for that technology. As in other PM monitoring techniques, condensation of water vapor in the sampling tubing may add noise and is therefore avoided by heating the tubing near the inlet.

3.2.6. Ambient PM-Metals XRF

AQMD has requested continuous monitoring of Mn, Cd and Ni in ambient PM in the amended rule 1180. XRF spectroscopy provided robust near real-time monitoring of multiple elements.

3.2.6.1. Method of Operation

The monitor draws ambient air through a PM size-selective inlet and across a filter tape. The resulting PM deposit is then automatically advanced and analyzed by the nondestructive X-ray fluorescence (XRF) system for the multiple selected metals (up to 67 elements). The sampling and the analysis are conducted simultaneously and continuously, except for the time required to advance the tape (~20 seconds) and the time required for daily automated quality assurance (QA) checks (30 minutes). The metal mass (ng per deposited spot) is determined by energy dispersive-X-ray fluorescence (ED-XRF) spectroscopy. The sample tape passes through the block of the source detector. The source is an X-ray tube, activated by a high-voltage power supply, which emits X-ray and irradiates the deposit. In response, the external electrons in the metal atoms are temporarily excited. During the return to a lower energy level, the electrons emit energy as fluoresced photons. The photons reach a solid-state detector, are sorted by energy levels (channels) and counted. The energy level of the fluorescing X-ray is element-characteristic.

The counts per channel are normalized to tube current and live time to generate net count rates. The spectrum is a plot of intensity versus energy. The intensity of the characteristic radiation is directly proportional to the mass of each element in the sample. The measured spectrum is analyzed to quantify the contributing elements to the spectral peak intensities. A process of spectral deconvolution, based on least squares, fits multiple reference spectra stored in the instrument library to the measured spectrum. The quantitative calibration parameters uploaded to the instrument are used to convert element intensity to element mass (ng). Element-mass concentration (mg/m^3) is derived using the flow rate and the setup sampling time.

3.2.6.2. Interferences

Though the XRF is multi-component, the energy is mostly characteristic of the element; however, possible cross-interfering elements are also monitored and subtracted when detected by the analysis.

3.3. OPERATION AND MAINTENANCE REQUIREMENTS

This required element is discussed as part of the Quality Assurance Project Plan in Appendix A. The QAPP contains among other items the quality assurance procedures and equipment audits, routine maintenance schedules, data validation, and SOP for all measurement equipment.

3.4. POLLUTANT EXCLUSIONS AND SURROGATES

The Refinery proposes monitoring all Rule 1180 pollutants and all the added pollutants from the amended Rule 1180 (January 5, 2024) except for PAH, which is pending feasible approved technology.

3.5. ROUTINE MAINTENANCE AND FAILURE MANAGEMENT

Rule 1180 requires that this Plan provide plans for monitoring equipment maintenance and failure management to prevent excessive monitoring downtime. The exact routine maintenance requirements, its schedule, and the estimated downtime are incorporated into the Quality Assurance Project Plan (Appendix A to this document). The failure management and temporary measures in the event of a system failure are detailed below.

<u>Notification to SCAQMD:</u>

Routine maintenance and checks done on a daily basis will not trigger notification to 1-800-CUT-SMOG and will not trigger notification to the public or SCAQMD. Planned maintenance activities will be reported to 1-800-CUT-SMOG at least 48 hours prior (Rule 1180 (g)(1)(A)).

Unplanned equipment failure and maintenance activities will be reported to 1-800-CUT-SMOG within 2 hours of discovery (Rule 1180 (g)(1)(B)) for more than one hour failed to provide Real-Time air monitoring information. Appropriate flags will signify on the public website any data during these events.

If the failure to provide continuous real-time fenceline air monitoring data is 24 hours or longer, a written notification to the Executive Officer will be submitted. The notification will include at least: A description of actions being taken to remedy the malfunction; Estimated time needed to restore the Fenceline Air Monitoring System; and Temporary fenceline air monitoring measures being implemented until the Fenceline Air Monitoring System is restored to normal operating conditions.

If the failure to provide continuous real-time fenceline air monitoring data for more than 30 consecutive calendar days, and the Executive Officer determines and notifies Valero that a revised FAMP is required to address the downtime or malfunction, Valero will submit a revised FAMP according to the schedule in Rule 1180.

Temporary measurements and backup systems:

In any case of downtime, other monitored locations can indicate a high concentration of the same pollutant. For VOCs at a refinery, if one is high, that can also indicate a rise in the other VOC. This is the same case with particulates (PM, BC, and metals).

For downtime of more than 24 hours, the best temporary measures will be considered and implemented as soon as possible. The preferred measure will be one that can be integrated into the continuous real-time D-fenceline^{TM} system, ensuring that data continues to flow in real-time to the public site, this will be noted in the Quarterly report. If real-time data flow is not possible, the data will be reported in the quarterly report with the final concentrations.

If only sensors are down, this is the order of preferred backups:

- Using existing monitors - in case of UVDOAS is down the FTIR of the same path can be a backup in minimum times, this is also the case for UVDOAS as a backup for FTIR for relevant compounds only. For wind data, the backup monitor is automatically reported (from C3 location). The data will be transmitted to the public site.

- The use of a spare analyzer or rented analyzer – initiate a replacement as soon as possible for the failed sensor with a sensor of the same unit. The data will be transmitted to the public site.

Table 3-2 summarized the preferred backup monitors and indicators for each technology.

In case of an outage of the entire system, the use of point sampling or mobile sensors will be considered. The locations of the samples will consider the wind directions and at least two locations of downwind and upwind will be used.

Table 3-2 Backup Monitoring Plan

Sensor	Preferred backup for a downtime of more than 24 hours	Indicators
Teledyne T101	A Spare analyzer	
OPSIS UVDOAS AR500	FTIR	VOC from FTIR
Bruker OPS FTIR	Rental upon availability / UVDOAS for relevant compounds	Benzene from UVDOAS
Wind RMYoung	Backup sensor	Long Beach Airport - National Weather Service station
Mage AE33	Rental upon availability	$PM_{2.5}$
BAM $PM_{2.5}$	Rental upon availability	BC, PM_{10}, Metals
BAM PM_{10}	Rental upon availability	BC, $PM_{2.5}$, Metals
PM-EDXF	Rental upon availability	BC, PM_{10}, $PM_{2.5}$

4. DATA MANAGEMENT AND PRESENTATION

Data management provides validation to the data transmitted to the public and is described in the section 4.4 below. Public communications regarding data collected by the fenceline monitoring program will be tailored to its audience, striving to present technical information in a clear and understandable format to the general public and to comply with the Rule requirements, details are in the following sections. Where feasible, project data will be disseminated in both English and Spanish. Where Spanish versions are not available, the Spanish-speaking public will be directed to a Spanish-speaking contact that Ultramar will make available to answer questions and explain at a later time.

4.1. DATA DISPLAY WEBSITE

The public website will be designed to clearly communicate collected data in a manner that the general public can understand. Data will be presented on the public website in near real-time. An accompanying discussion will be provided to relay the purpose and context of the measurements. When pollutant concentrations are discussed, they will be related to published standard reference levels for comparable averaging intervals, including the Federal National Ambient Air Quality Standards (NAAQS) and California Office of Environmental Health Hazard Assessment_(OEHHA) Reference Exposure Levels (REL).

Background information on each of the pollutants and associated health risks will also be provided. OEHHA/NAAQS links will be posted for each individual compound.

The public website will also include links to educational resources describing the fenceline monitoring program's objectives. These resources will discuss the technologies being used and provide an introduction to the pollutants being measured.

Preliminary data will be available to the public for viewing and a download option upon opt-in subscription. Data will be presented in geospatial, trend line, and tabular formats. All near real-time data will be marked as preliminary, having undergone only basic automated quality assurance checks, with a statement that the data will undergo additional quality assurance later and may be revised in the quarterly reports.

Quarterly reports will be available 60 days after the end of the quarter, along with the final concentrations after final review. Both hourly and 5-minute measurements (when feasible) will be available for download in an Excel format upon opt-in subscription, under the “Report” tab in the public website.

Reports and final concentrations will also be disseminated to South Coast AQMD in an approved format.

The information on the Public Website will include at least the following:

- Educational material that describes the objectives and capabilities of the fenceline air monitoring system.
- A description of all pollutants measured including a description of background levels for all pollutants measured and provide context to levels measured at the fenceline.
- Hyperlinks to relevant sources of information, including OEHHA/NAAQS for each individual pollutant
- A means for the public to provide comments and feedback with contact details for Valero to respond.
- A description of all measurement techniques.
- Real time measurements for 1hr, 8hr and 24 hr averages and 5min average when feasible.
- Real time measurements for wind speed and wind direction.
- Data in table and in Graph format.
- Definition of each data quality flag

- Quarterly reports
- The most recently approved, or partially approved, FAMP (and associated QAPP), and the approval status of each section will be clearly labeled.
- Independent audit reports, including corrective action plans if applicable
- Specific cause analysis for exceedance the health threshold event
- At least five years of historical concentration data of all air pollutants measured on the fenceline air monitoring system, including data quality flags; and at least five years of wind speed and wind direction data. Final concentrations for the last 5 years will be available in Excel format under the Final Quarterly Concentration Reports.
- Preliminary data for up until the last uploaded final concentration can be downloaded via the Concentration Report tab.

Details and examples are also present in the QAPP (Appendix A to this Document).

4.2. PUBLIC NOTIFICATION SYSTEM

The Guidelines specify that the data display website should offer opt-in notifications to allow interested members of the public to subscribe to specific notifications from the reporting system. The reporting system details will follow Rule 1180 guidelines. The notification program intends to ensure that the public is alerted when concentrations at the fenceline reach the notification threshold.

Notifications for concentration reaching the health threshold will be displayed on the public website and will be delivered to the opt-in subscribers by email or text of their choice. Maintenance, downtime, and publishing a Quarterly report are notified to the public on the website.

Exceeding Concentration Notification:

A notification message will be sent to all opt-in subscribers automatically upon detecting an exceeding concentration above the threshold, and no later than 15 minutes after. The notification thresholds are summarized in Table 4-1, following Rule 1180.

A follow-up notification will also be sent when the concentration keeps rising above the follow-up notification thresholds, which are the multiplication of the notification threshold by 2, 4, 8, 16, and 256 (following the equation in the Rule: Follow-up Notification Threshold = Applicable Notification Threshold × 2^X, where X = 1, 2, 3, 4, and 8)

Any exceeding event will have a unique identification number that will be posted on each notification accordingly.

Every exceeding notification, either the first one or the follow-up notification, will contain: the unique identification number; the facility name; the location, site, date, and time of the exceedance; the air pollutant name, concentration measured, and the Notification Threshold; and a link to the OEHHA Air Chemical database website for the specific air pollutant.

A resolve notification for the exceeding event will be sent to the opt-in subscribed users when the concentration of the pollutant in the same location is below the notification threshold for 30 minutes straight.

The resolved notification will contain: the corresponding unique identification number; the maximum concentration detected during the exceeding period (using the same averaging time as the Notification Threshold); and the duration for which the Notification Threshold was exceeded.

If the fenceline notification was sent in error, an email will be sent to opt-in subscribers with an explanation as to the cause of the erroneous fenceline notification.

Table 4-1. Notification Thresholds

Air Pollutants	Health Standard-Based Notification Threshold (ppb)	Information-Based Notification Threshold (ppb)
Criteria Air Pollutants		
Sulfur Dioxide	75	N/A
Oxides of Nitrogen	100	N/A
Particulate Matter		
$PM_{2.5}$	35 µg/m^3 (24-hr avg.)	N/A
PM_{10}	50 µg/m^3 (24-hr avg.)	N/A
Volatile Organic Compounds		
Total VOCs (Non-Methane Hydrocarbons)	N/A	730
Formaldehyde	44	N/A
Acetaldehyde	260	N/A
Acrolein	1.1	N/A
1,3 Butadiene	297	
Naphthalene	N/A	N/A
Polycyclic aromatic hydrocarbons (PAHs)	N/A	N/A
Styrene	5000	N/A
Benzene	8	N/A
Toluene	1300	N/A
Ethylbenzene	N/A	N/A
Xylenes	5000	N/A
Metals		
Cadmium	N/A	N/A
Manganese	0.17 µg/m^3 (8-hr avg.)	N/A
Nickel	0.2 µg/m^3	N/A
Other Compounds		
Hydrogen Sulfide	30	N/A
Carbonyl Sulfide	270	N/A
Ammonia	4507	N/A
Black Carbon	N/A	N/A
Hydrogen Cyanide	309	N/A
Hydrogen Fluoride	289	N/A

* Notification Thresholds are based on 1-hour averaging time unless otherwise noted.

4.3. REPORTS

4.3.1. Specific Cause Analysis

For every concentration exceeding the threshold event, a root cause analysis investigation will promptly start (no more than 24 hours of discovery) to discover the specific cause of the exceeding.

The first examination will determine if the concentration is valid. If it is false, a notification will be sent to South Coast AQMD and the Public with an explanation of the false reading. If the concentration is valid, an investigation into the source of the emission will be initiated, combining wind direction information with trends in other locations. If the source is determined to be outside the refinery, South Coast AQMD will be informed via 1-800-CUT-SMOG on the basis of such determination and the suspected off-site source.

If it is determined that the source is within the refinery, an in-depth investigation will be initiated, including monitoring suspected facilities with visual inspections and if needed optical gas imaging, leak inspection, or mobile monitoring. Once the source has been identified, corrective action to stop the exceedance or prevent a similar exceedance will be initiated within 24 hours.

A Specific Cause Analysis Report will be submitted to the Executive Officer and published on the public website within 14 calendar days of the identification of the source. The report will include at least the cause and duration of the air pollutant emissions; the source of air pollutant emissions and the methodology used to determine it; mitigation and corrective actions that were taken or will be taken to stop the exceedance and/or to prevent a similar recurrence (and in case it will take more than 14 days, explanation why); and any monitoring data requested by the Executive Officer.

Within 14 days of the corrective action, reinspection of the source will be initiated to assess its effectiveness in reducing or eliminating the emission source. A report will be submitted to the Executive Officer and will be available on the website within 28 days.

In a case where three exceeding events for the same air pollutant by the same monitor within the same calendar year indicate the same cause (or indicate the cause cannot be determined), a Specific Cause Analysis from a Qualified Independent Party with relevant technical expertise will be initiated.

Note: As per the Rule, when the same air pollutant is measured above the applicable Notification Threshold within a seven-calendar-day period, that will be considered one exceeding event.

4.3.2. Quarterly Reports

Quarterly reports will be prepared to summarize the collected data after full quality assurance checking has been completed. The quality assurance at this level is detailed in the QAPP (Appendix A to this document).

The quarterly reports will follow Rule 1180 and guidelines and will contain:

- Summary of the air pollutant concentrations ;
- Data processing calculations;
- Summary of calibration data;
- Description of data completeness, accuracy, and precision;
- Quality assurance/quality control measures;
- Instrument maintenance and performance checks;
- Any instance when an air pollutant was measured above a Notification Threshold;
- Any instance when a Fenceline Air Monitoring System downtime or malfunction required notification to the Executive Officer; and
- Review and resolve any Data Quality Flags and finalize the data.

The quarterly reports will be made available on the public website with the final concentration 60 days after the end of the Quarter.

4.4. DATA MANAGEMENT

All data, both raw and quality assured, and including open path spectral data, will be retained on file at the facility for at least 5 years from the date of collection. Quality assurance flags and chain of custody information regarding any edits or invalidation will be retained in order to preserve an understanding of the reason and person or automated process responsible for each such change.

Reports, forms, logs, and test documentation are all considered part of data management and will be retained for at least 5 years.

An independent Audit by a third party will be conducted and shall be completed by January 1, 2029, and every 3 years after that, and will follow the format that will be published by South Coast AQMD during 2025.

Data management and data validations are specified in depth in the QAPP (appendix A to this Document).

5. IMPLEMENTATION SCHEDULE

Table 5-1 shows the project implementation schedule. Cabinet 1, 2, 3 and 4 are fully equipped from 2020 following Rule 1180 requirements. Scheduling for the additional compounds per the changes of the Jan 5th, 2024, Rule version is detailed in Table 5-1. The addition of Naphthalene needs no implementation. Cabinets 3a & 5 with $PM_{2.5}$, PM_{10} and metals analyzers will be implemented 15 months from approved FAMP.

Table 5-1. Project Implementation Schedule

Project Scope	Estimated Schedule
Received partial approval of fenceline monitoring plan from SCAQMD	3/27/2019
Cabinet 2 & Cabinet 2 Path 2 (Prioritize)	1/1/2020
Public website online	1/1/2020
Cabinet 1, 3, & 4 + All Reflectors	3/27/2020
Sending FAMP to SCAQMD	8/5/2024
Received approval of FAMP from SCAQMD	X/X/2024
Cabinets 5 & 3a installation	15 months after FAMP approval or partial approval

APPENDIX A: QUALITY ASSURANCE PROJECT PLAN

The Quality Assurance Project Plan (QAPP) is attached in a separate file.