Rule 1180 Fenceline Air Monitoring Plan

Ultramar, Inc.
Facility ID: 800026

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1. EXECUTIVE SUMMARY

Ultramar, Inc., dba Valero Wilmington 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 California and foreign crude oil, as well as unfinished feedstocks from local and foreign sources. Refined products are distributed from the facility through a network of third-party 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 California Air Resources Board (CARB) gasoline, jet fuel, ultra-low-sulfur diesel (ULSD), CARB 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 including jet fuel, diesel fuel, light cycle oil, fluidized catalytic cracker slurry oil, and liquefied petroleum gases (LPGs) 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.

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	Other Compounds
Sulfur Dioxide	Total VOCs (NMHC)	Hydrogen Sulfide
Nitrogen Dioxide	Formaldehyde	Carbonyl Sulfide
	Acetaldehyde	Ammonia
	Acrolein	Black Carbon
	1,3-Butadiene	Hydrogen Cyanide
	Styrene	Hydrogen Fluoride
	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 installed 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 as Appendix A.

2. FENCELINE AIR MONITORING COVERAGE

2.1. VICINITY CHARACTERIZATION

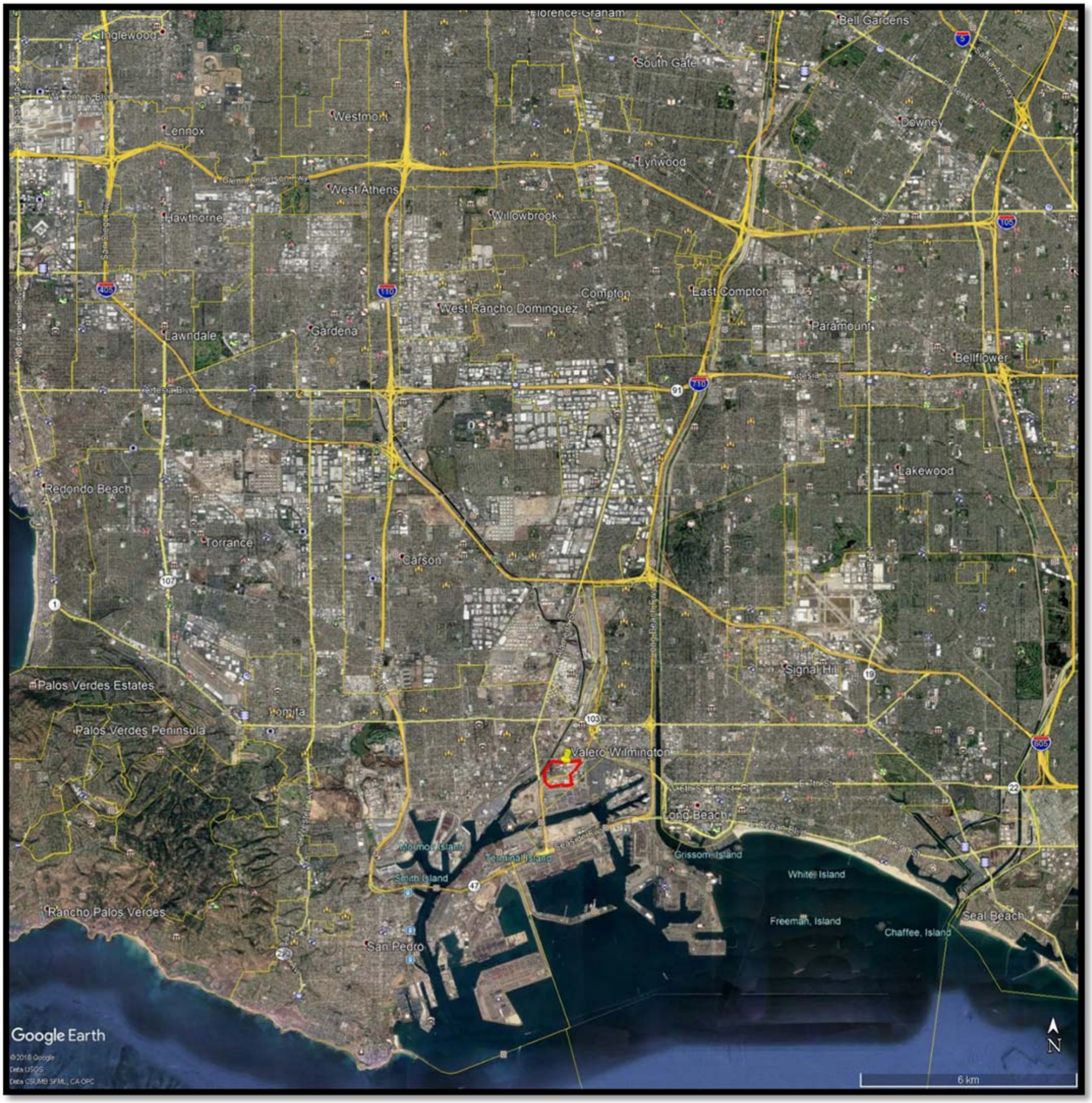
This monitoring plan details parameters related to the installation and operations of a real-time fenceline air monitoring system. The Refinery has reviewed information specific to the immediate area, including characterization of the area within a couple miles of the fenceline.

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.

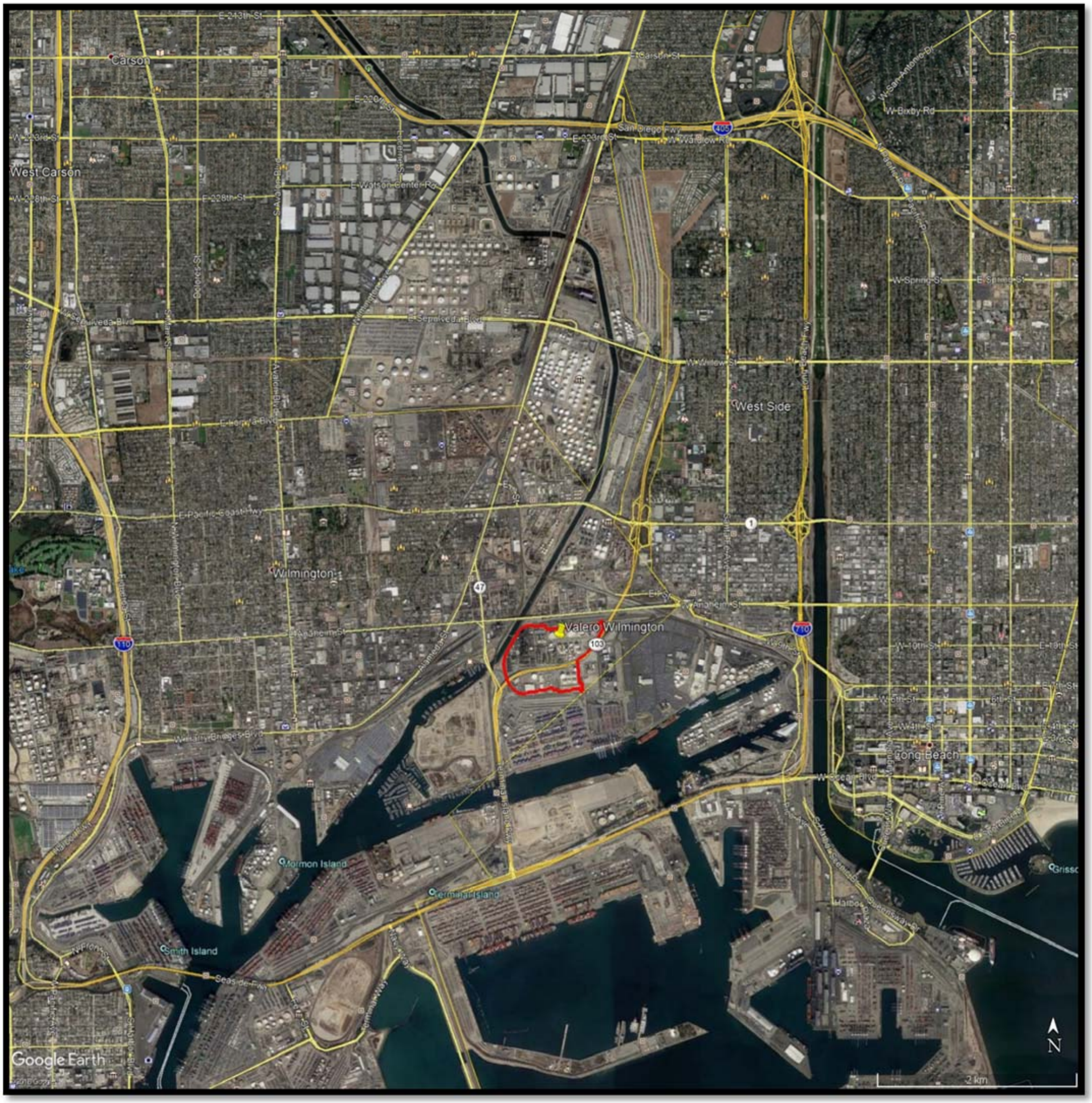
The area's terrain is characterized as a coastal plain, with low elevations (primarily less than 15 m above mean sea level) and gradual elevation changes. The facility itself is entirely within 4 m of sea level. The facility's general location is shown in Figure 2-1 and Figure 2-2, and general property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

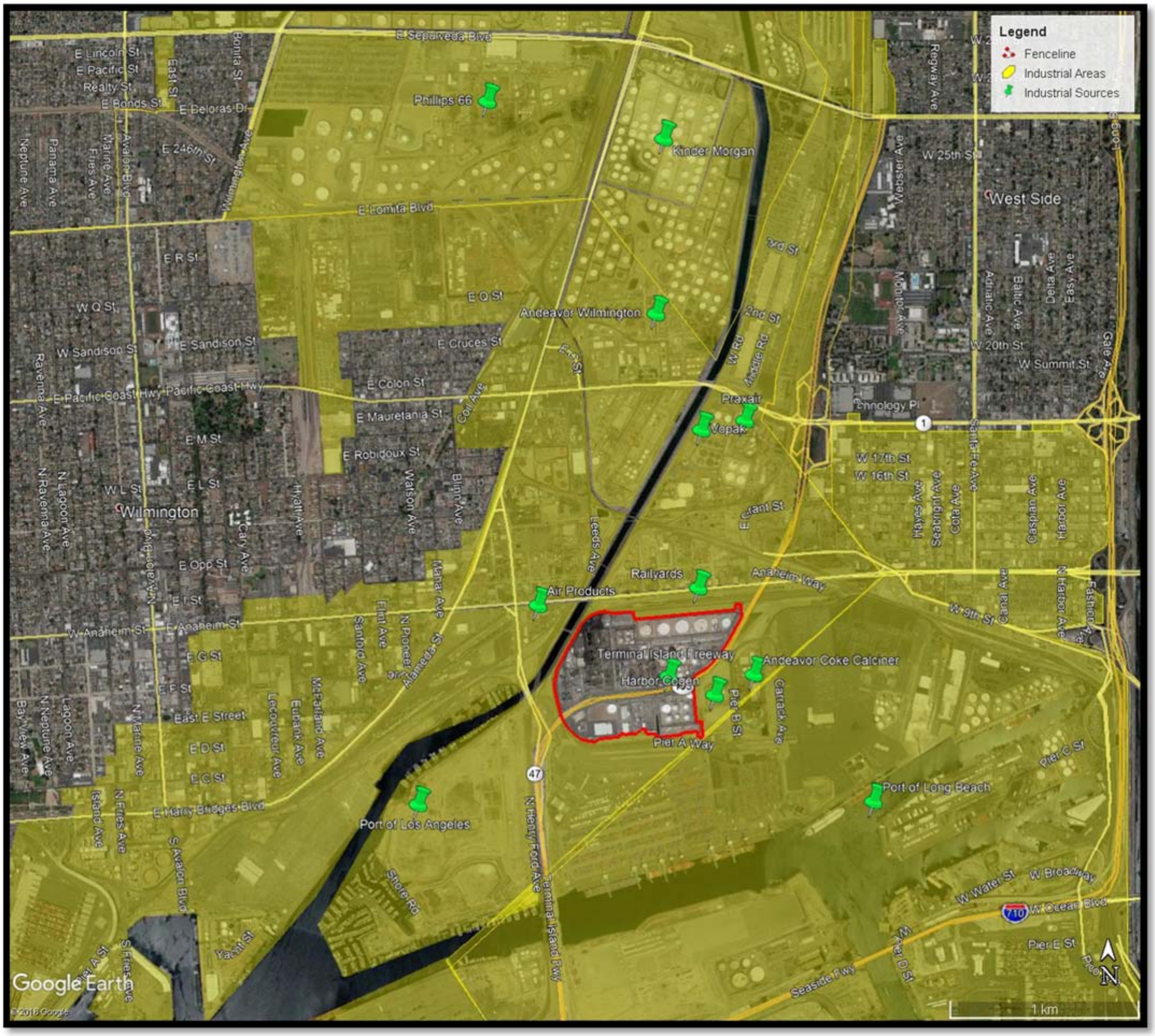
Figure 2-3. General Refinery Boundaries

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 on 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 numerous other 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 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 US EPA Envirofacts database.

2.1.3. Communities

As shown in Figure 2-4, the Refinery is in an 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 uses are approximately 740 meters (0.5 miles) from the northwest boundary of the Refinery. Additional residential receptors lie approximately 1,250 meters (0.8 miles) to the northeast of the facility at San Gabriel Avenue and Technology Place.

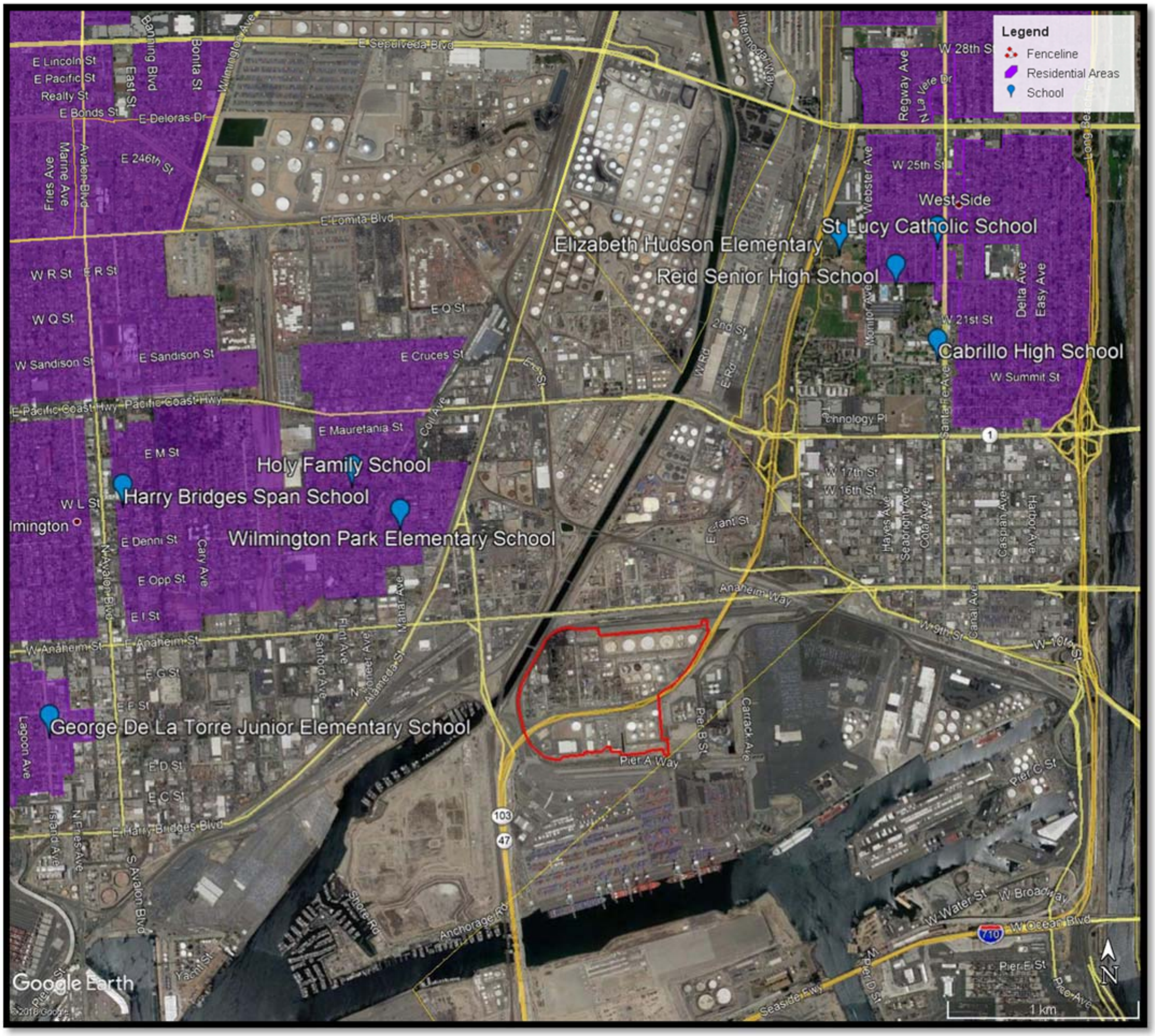
2.1.3.1. Sensitive Receptors

Table 2-2 and Figure 2-5 show specific sensitive receptors, which includes schools, within 2,500 m of the Refinery.

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

Receptor	Direction(s)	Closest Distance (m)
Elizabeth Hudson Elementary School	Northeast	2,000
Reid Senior High School	Northeast	2,000
St. Lucy Catholic School	Northeast	2,300
Cabrillo High School	Northeast	1,600
George De La Torre Junior Elementary School	West	2,300
Wilmington Park Elementary School	Northwest	900
Harry Bridges Span School	Northwest	2,300
Holy Family 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 will install a Rule 1180-compliant meteorological station as part of this Plan. This analysis makes use of the nearest available National Weather Service station- Long Beach Airport (KLGB).

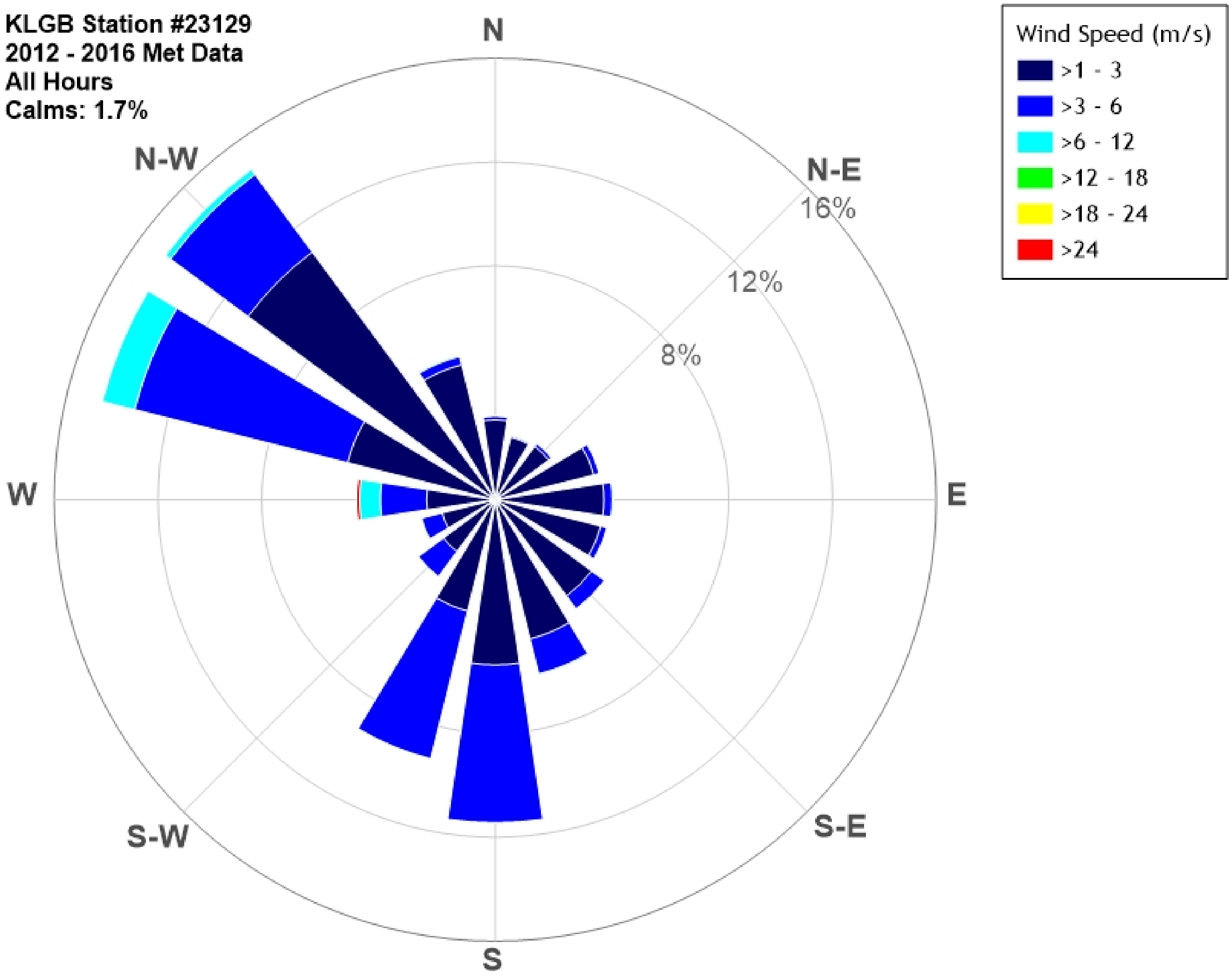
The Long Beach Airport meteorological tower measures wind speed, wind direction, temperature, humidity, and solar radiation. Wind direction and velocity are the most critical meteorological parameters to indicate impact on surrounding areas. The direction indicates the likely path of emissions and wind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

Humidity, specifically high humidity in combination with high temperature, has more of an impact on instrumentation than measured concentrations. Temperature, relative humidity, and solar radiation (a parameter used to determine cloud cover) affect the mixing height of pollutants in the atmosphere. This is indicative of the distance emissions will travel. These parameters are not being analyzed in this report as these monitors are being placed at the facility fenceline and therefore are primarily impacted by wind velocity and direction.

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 66% of the time during the five year analysis period with the highest recorded wind speed at 17.26 m/s (38.6 mph). Periods of calm, or when wind speeds are less than 1 m/s (2.2 mph), are approximately 1.7% 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 and west-southwest approximately 20% of the time. Wind speeds in these directions are less than 6 m/s (13.4 mph). The KLGB annual wind rose for meteorological years 2012 through 2016 is shown in Figure 2-6.

Figure 2-6. KLGB Annual Wind Rose



The meteorological data has also been analyzed for diurnal and seasonal period differences. Diurnal periods are characterized by solar radiation, another parameter measured by the meteorological tower. The hours of daytime will be different depending on the season. When no sun (solar radiation) is present this is the nighttime period. 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.

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

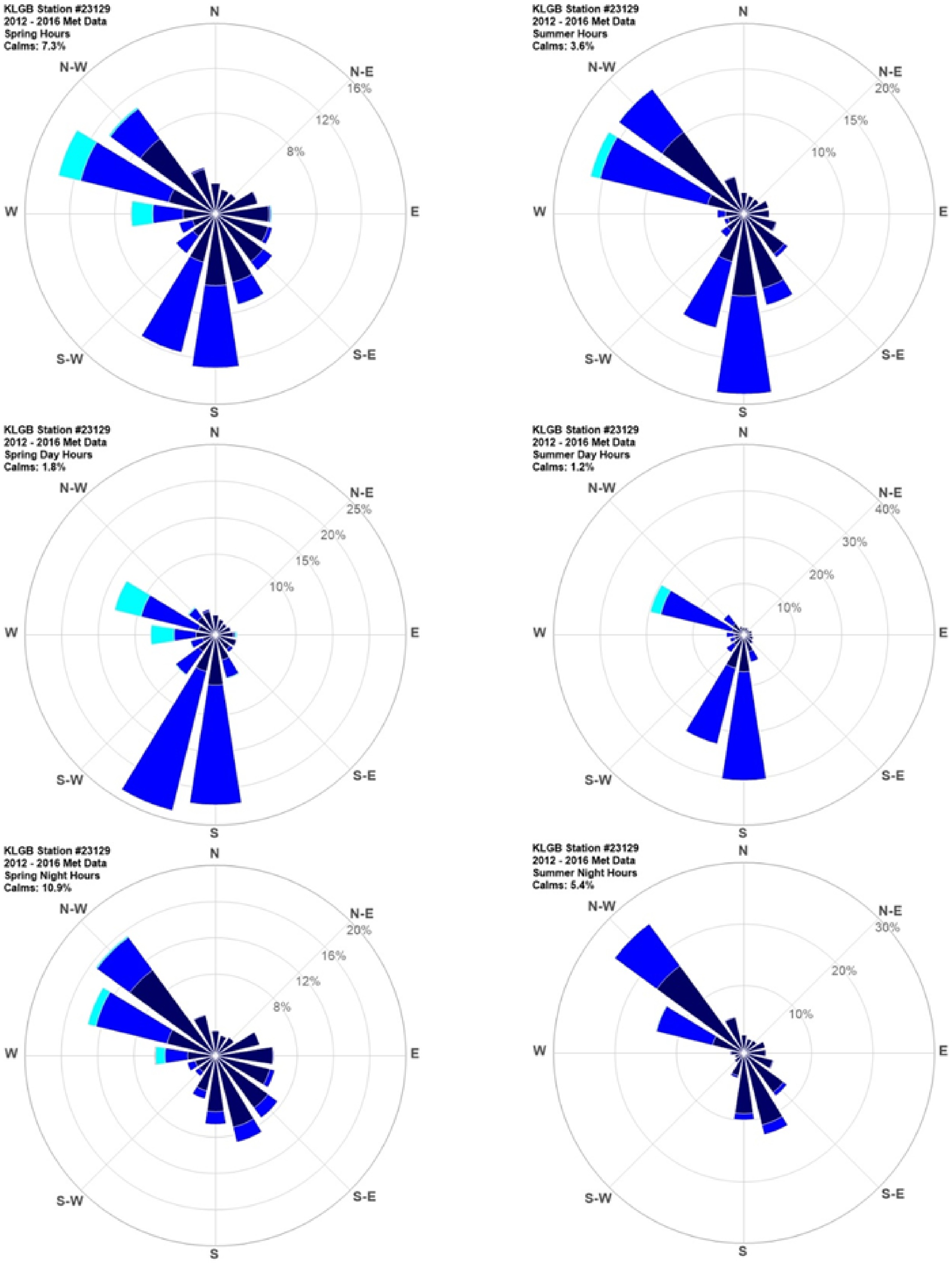


Figure 2-8. Diurnal and Seasonal Wind Rose (Fall and Winter)

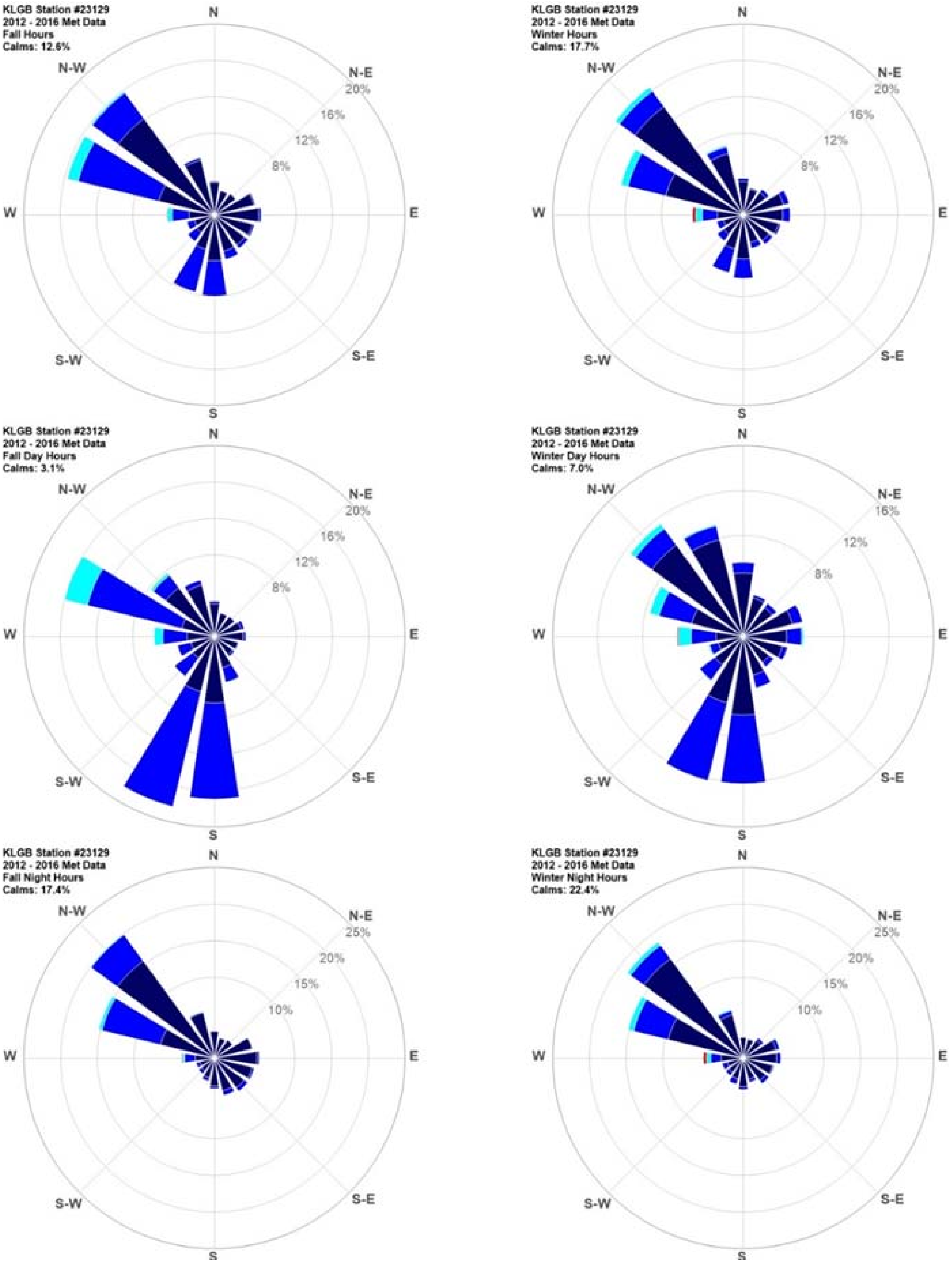


Figure 2-6 shows that wind flowing from the northwest and west-northwest toward the ocean is the predominant wind direction throughout the year. Figure 2-7 and Figure 2-8 show wind direction and speed during different diurnal and seasonal periods. Figure 2-7 shows during the spring and summer months, there is more wind flow from the south and west-southwest direction. During daylight hours, winds are from the south and west-southwest. Figure 2-8 shows during winter months and during night hours year round, there are more periods of calm.

2.2.2. Meteorological Station

The refinery will install a meteorological station on the facility property that measures wind direction and wind speed. Figure 2-9 below shows the proposed location. The meteorological station will match the time resolution of the air quality monitors. The meteorological station will be 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.

Figure 2-9. Proposed 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. For the purposes of this review, benzene, toluene, ethylbenzene, and all isomers of xylene have been grouped together for this discussion as BTEX. Emission sources at the facility include combustion sources, fugitive components, cooling towers, storage tanks, flares, and loading/unloading facilities. Analysis of 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 on a per source basis of the pollutants of concern.

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 2-10 shows the relative percentage of formaldehyde being emitted.

Acetaldehyde is also 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 2-10 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.

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 have three heaters emitting from a single exhaust stack. Figure 2-11 shows the relative percentage of these pollutants 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 2-12 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.

The group of pollutants known as BTEX, are aromatic hydrocarbons. BTEX occurs 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. BTEX occurs 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, BTEX emissions are spread throughout the facility as shown in Figure 2-12.

Hydrogen sulfide occurs naturally in crude petroleum and is a result of the breakdown of organic matter in the absence of oxygen. As detailed with BTEX, 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 2-13.

The Amine Absorber emits 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 2-13 shows relative emissions of carbonyl sulfide from the facility.

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 2-14 shows the relative emissions of diesel engine particulate from the facility.

Hydrogen cyanide is emitted in small amounts from the FCCU stack exhaust. The location of this unit is shown in Figure 2-14.

Nitrogen dioxide and sulfur dioxide are also 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 stack exhaust. 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. The specific location of the FCCU is shown in Figure 2-14.

The facility uses hydrogen fluoride in the alkylation unit. Emissions of hydrogen fluoride are primarily located near the center of the facility. Figure 2-15 shows the source location.

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 equipment; the FCCU can also use ammonia injection. Routine emissions of unreacted ammonia are regulated by permit conditions. Sources using ammonia are identified in Figure 2-15. Potential ammonia sources are concentrated towards the northwest portion of the facility.

Figure 2-10. Formaldehyde and Acetaldehyde Relative Emissions

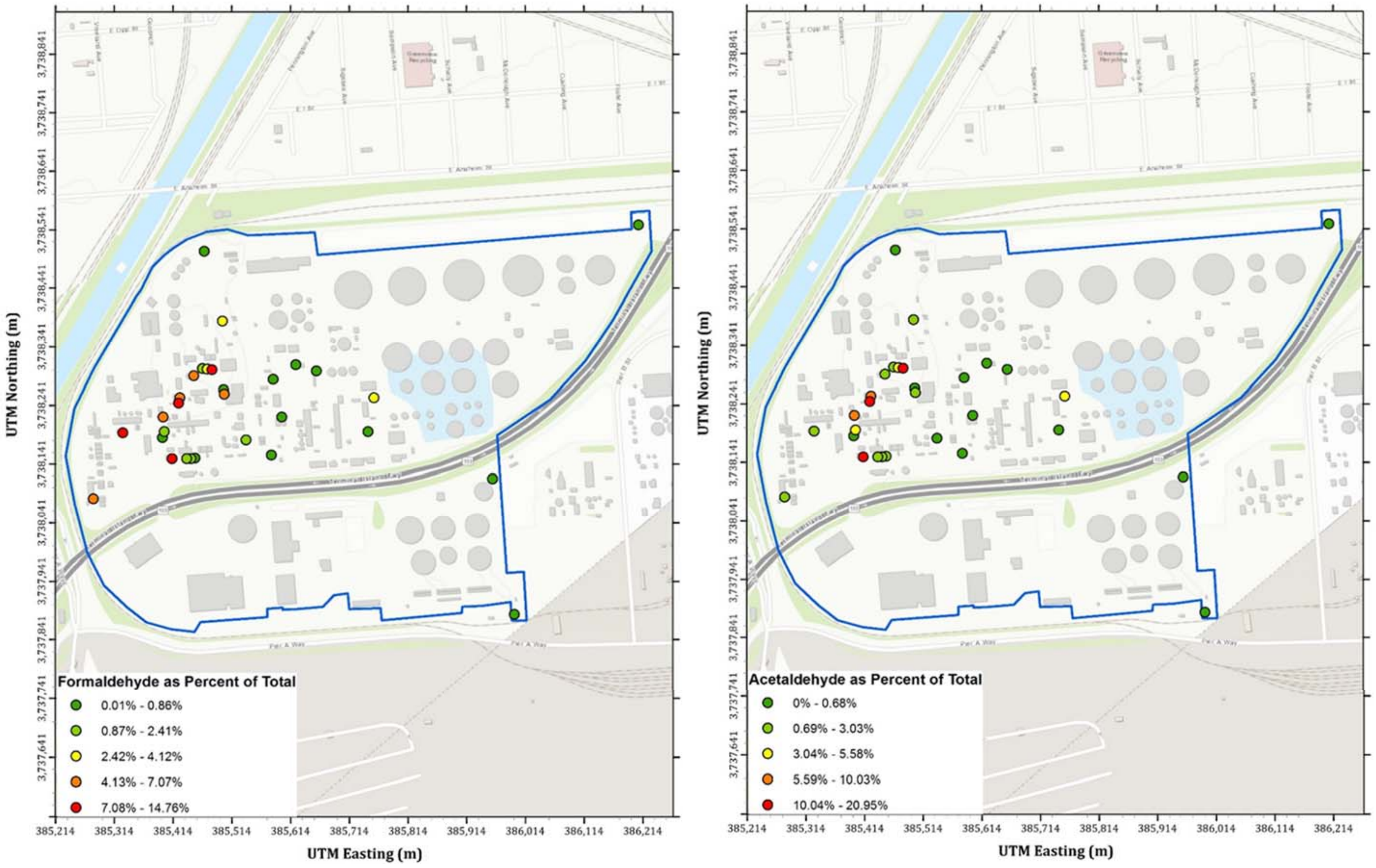


Figure 2-11. Acrolein and 1,3-Butadiene Relative Emissions

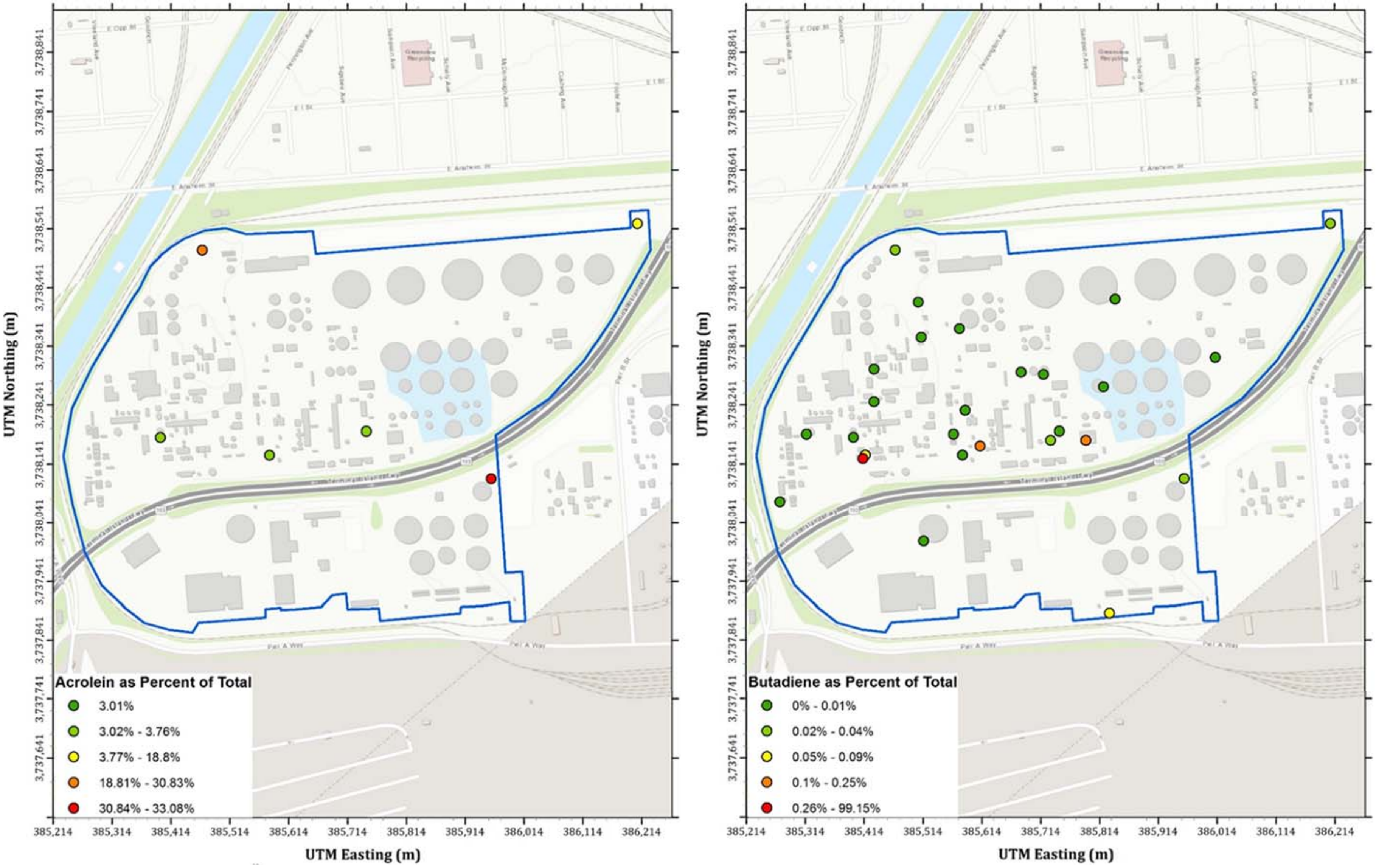


Figure 2-12. Styrene and BTEX Relative Emissions

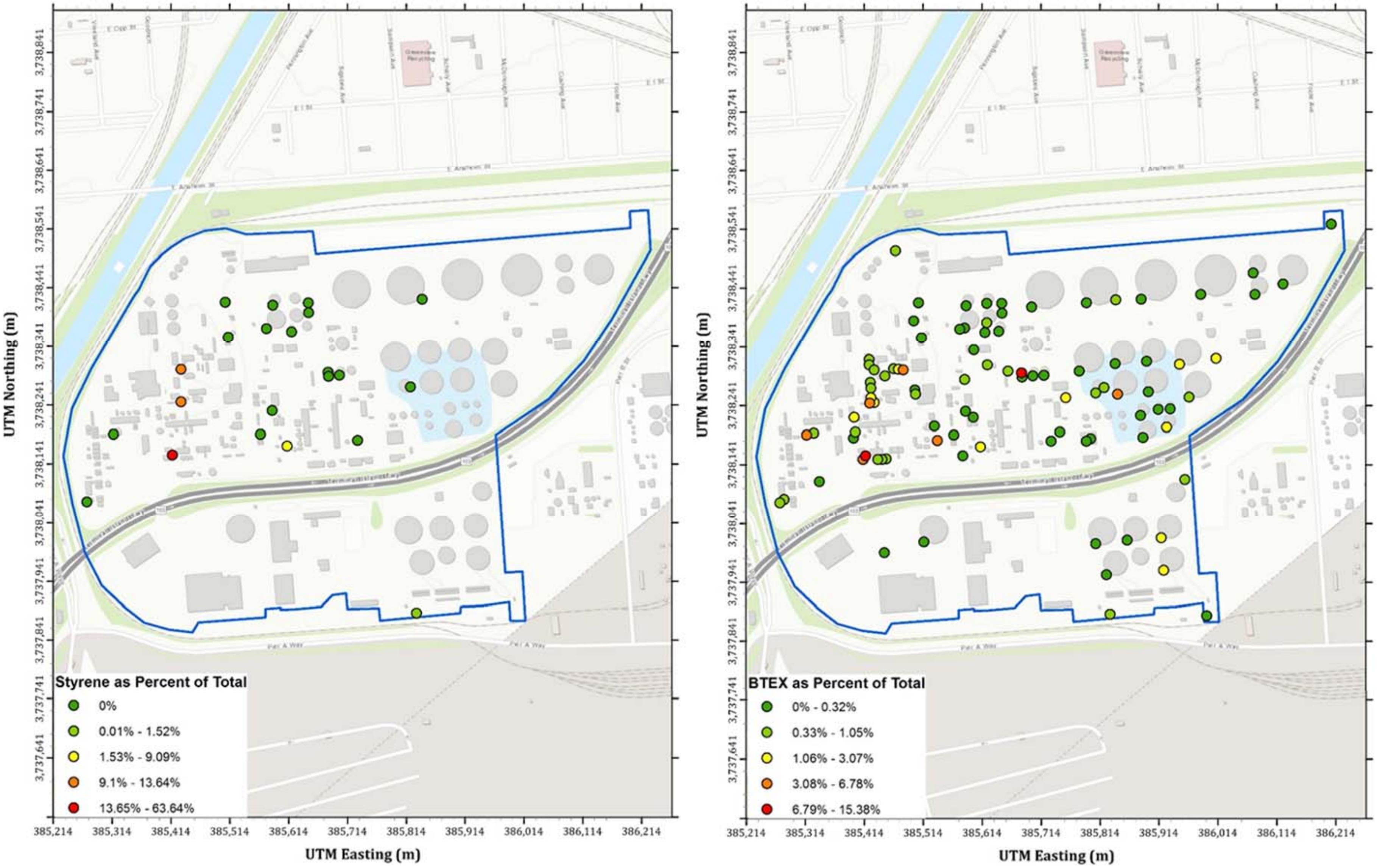


Figure 2-13. Hydrogen Sulfide and Carbonyl Sulfide Relative Emissions

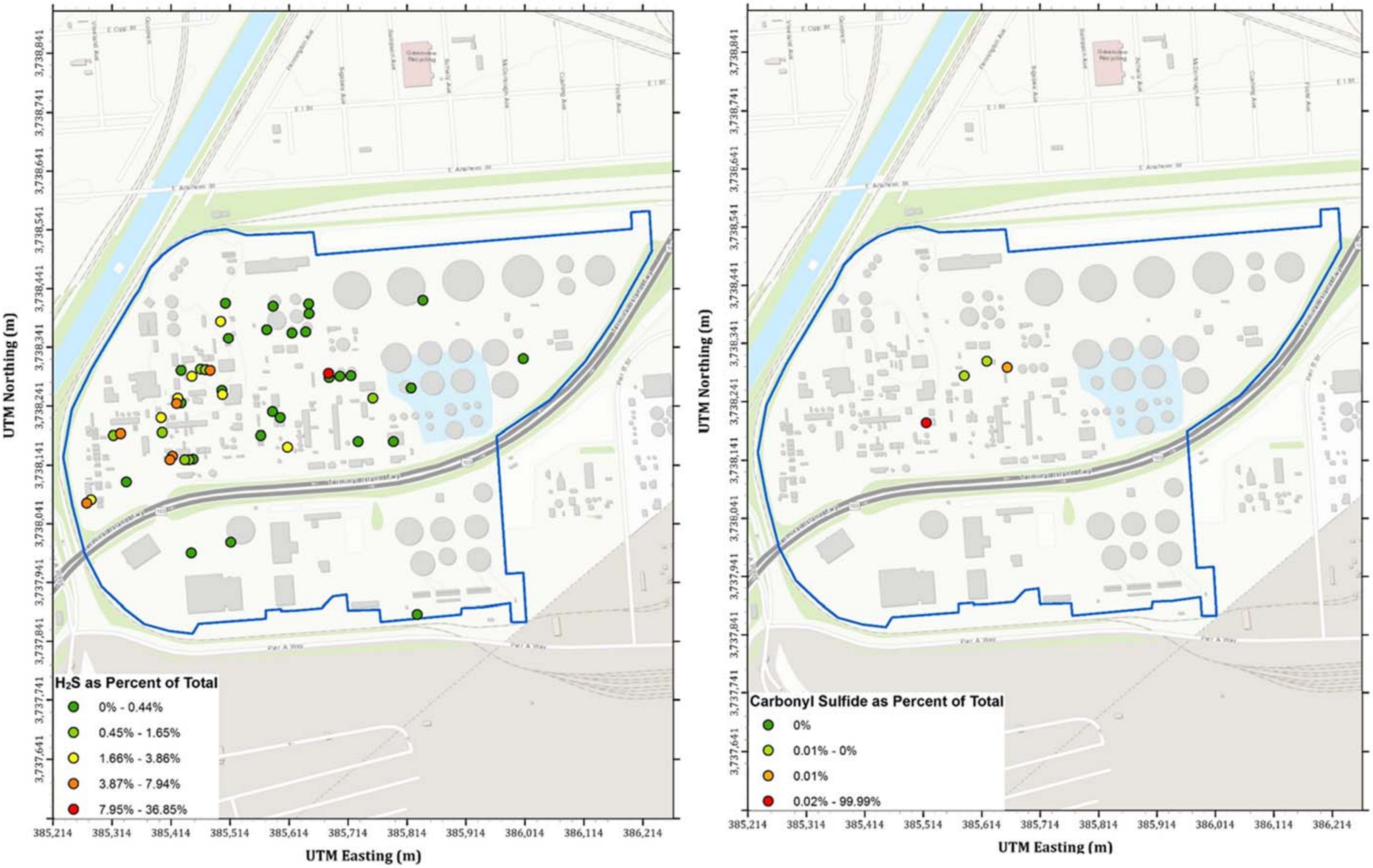


Figure 2-14. Diesel Exhaust Particulate and Cyanide Compounds Relative Emissions

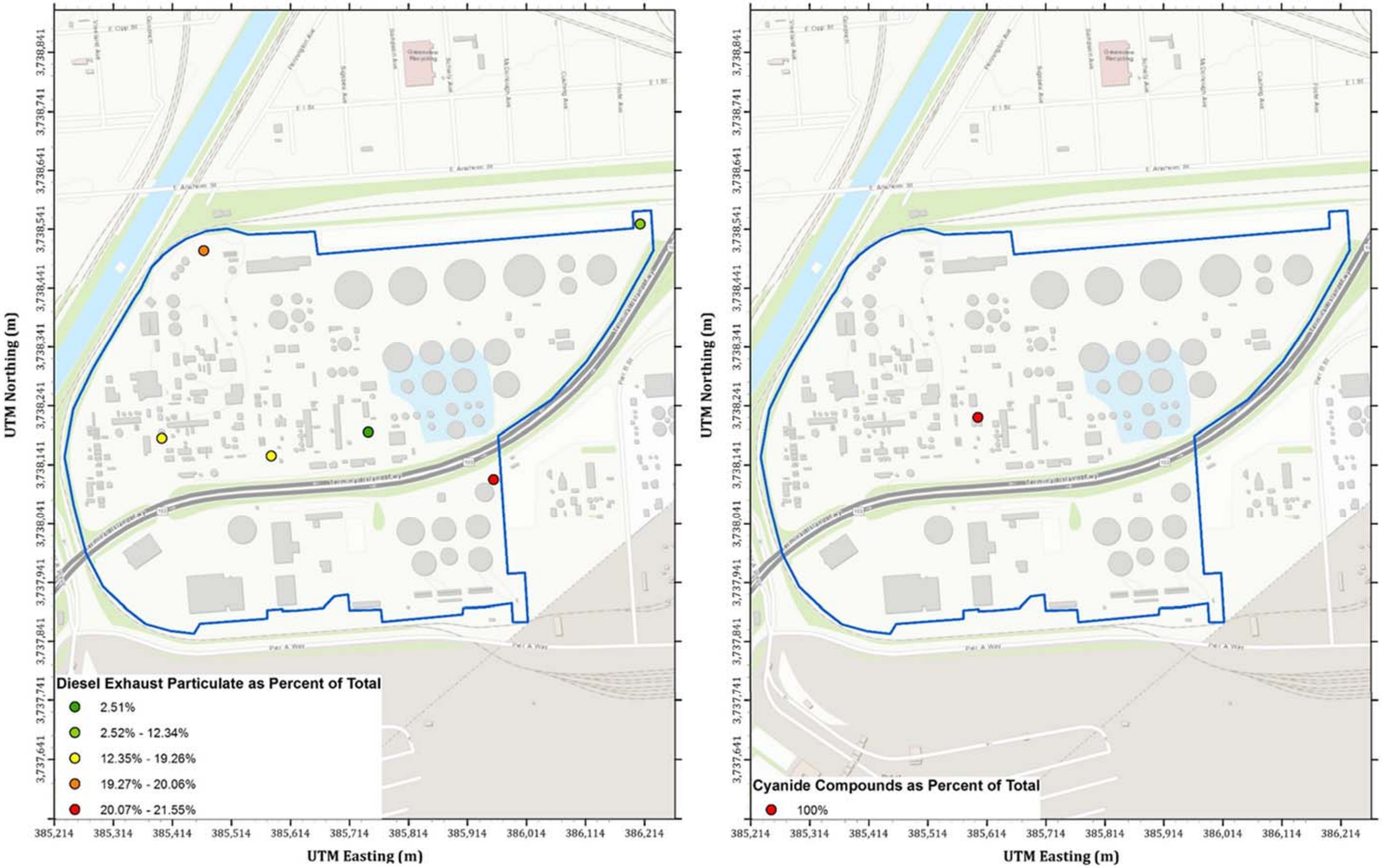
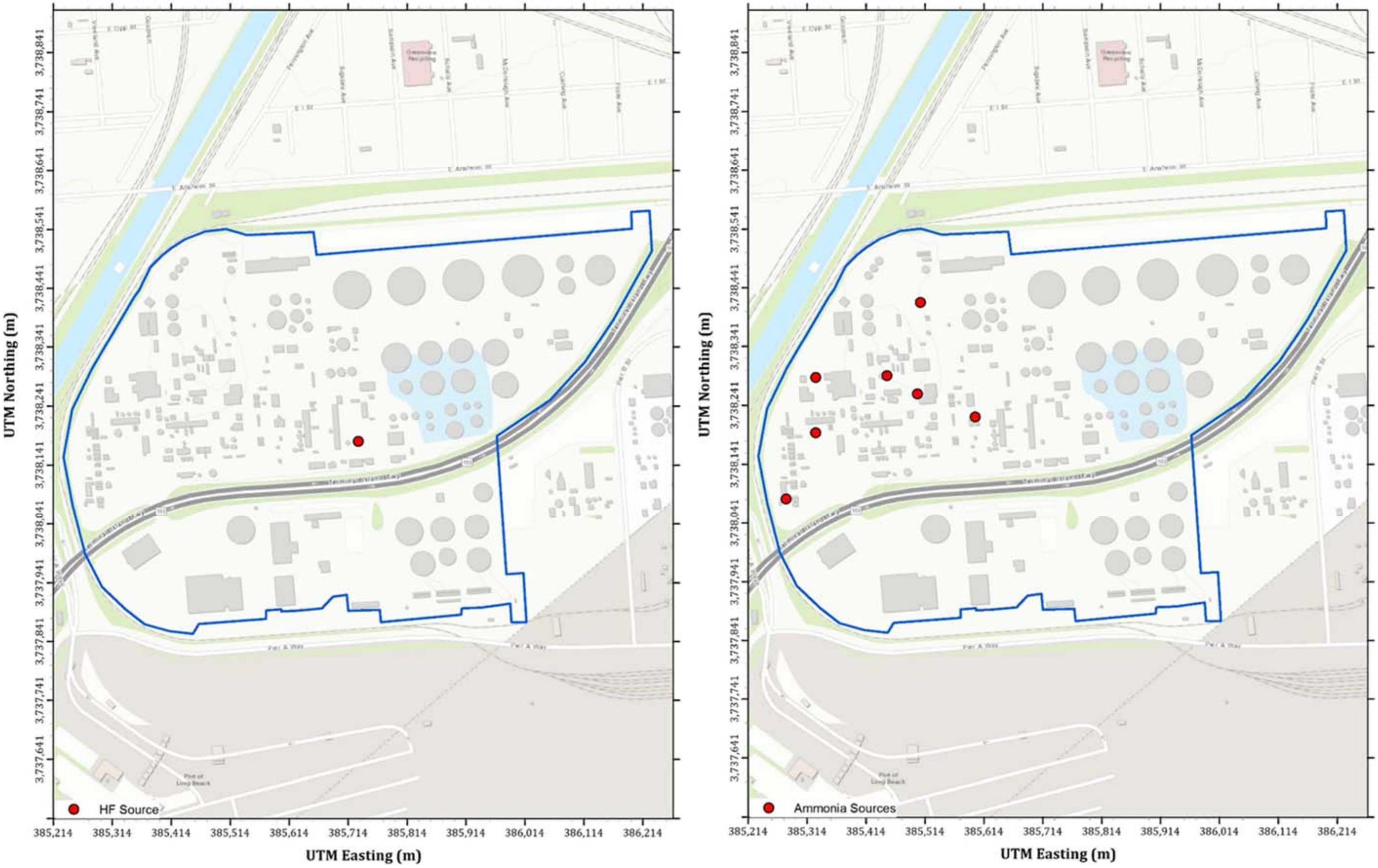


Figure 2-15. Hydrogen Fluoride and Ammonia Emissions



2.4. DISPERSION MODELING

This monitoring plan was developed based on the AB 2588 HRA, which was dated December 2009 and based upon the 2006-2007 inventory year. 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 show below in Figure 2-16. Therefore, it is reasonable to conclude from the HRA that non-cancer hazards and cancer risk are relatively well controlled.

Figure 2-16. 2009 HRA Cancer Risk Isopleths

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

2.5. PRE-EXISTING MONITORING

The Refinery already operates a variety of monitoring systems and programs that are not related to Rule 1180 requirements. The Rule 1180 fenceline monitoring program will be independent of the existing monitoring activities.

2.5.1. Continuous Emission Monitoring Systems

The Refinery operates Continuous Emission Monitoring Systems (CEMS) on the exhaust of various process unit exhausts in accordance with its permit requirements. These CEMS are certified for use in SCAQMD's RECLAIM program, and comply with District and Federal requirements for continuous emission monitoring at process units of these types. CEMS is the "gold standard" for monitoring emissions from point sources at refinery exhaust stacks.

Table 2-3. Continuous Emission Monitoring Systems

Source Equipment	ID No.	Pollutants Monitored by CEMS
Crude Heater	D3	NO_x, SO_2[1], CO[2]
Crude Heater	D6	NO_x, SO_2[1], CO[2]
Vacuum Feed Heater	D8	NO_x, SO_2[1], CO[2]
Vacuum Feed Heater	D9	SO_2[1]
Delayed Coking Heater	D12	NO_x, SO_2[1], CO[2]
Delayed Coking Heater	D22	NO_x, SO_2[1], CO[2]
FCC Regenerator	D36	NO_x, SO_2, CO[2], Opacity[3]
Gas Oil Hydrotreating Heater	D52	NO_x, SO_2[1], CO[2]
Gas Oil Hydrotreating Heater	D53	NO_x, SO_2[1], CO[2]
Olefin Hydrotreating Heater	D59	SO_2[1]
Olefin Hydrotreating Heater	D60	SO_2[1]
Gas Oil Hydrodesulfurization Heater	D768	NO_x, SO_2[1], CO[2]
Hydrotreating Heater	D429/D430	NO_x, SO_2[1], CO[2]
Platformer Heater	D73	SO_2[1]
Platformer Heater	D74	NO_x, SO_2[1], CO[2]
Alkylation Heater	D98	NO_x, SO_2[1], CO[2]
Tail Gas Standby Thermal Oxidizer	C1260	NO_x, SO_2[1], CO[2]
Tail Gas Unit Amine Absorber	D148	H_2S[4]
Tail Gas Unit Amine Absorber	D142	H_2S[4]
Boiler	D378	NO_x, SO_2[1], CO[2]
Boiler	D1550	NO_x, SO_2[1], CO[2]
Gas Turbine	D1669	CO[2], NO_x

Notes.

[1] Facility has a continuous sulfur analyzer to monitor the sulfur content of the fuel gas, which is equivalent to a CEMS for SO_x or SO_2 for fuel-burning equipment such as this.

[2] Monitored as a proxy for organic Hazardous Air Pollutants (HAPs), which include the Rule 1180 pollutants formaldehyde, acetaldehyde, acrolein, 1,3-butadiene, styrene, benzene, toluene, ethyl benzene, m-xylene, o-xylene, and p-xylene.

[3] Opacity is an indicator for particulate emission levels and in this case is also considered an indicator for metal HAP emissions.

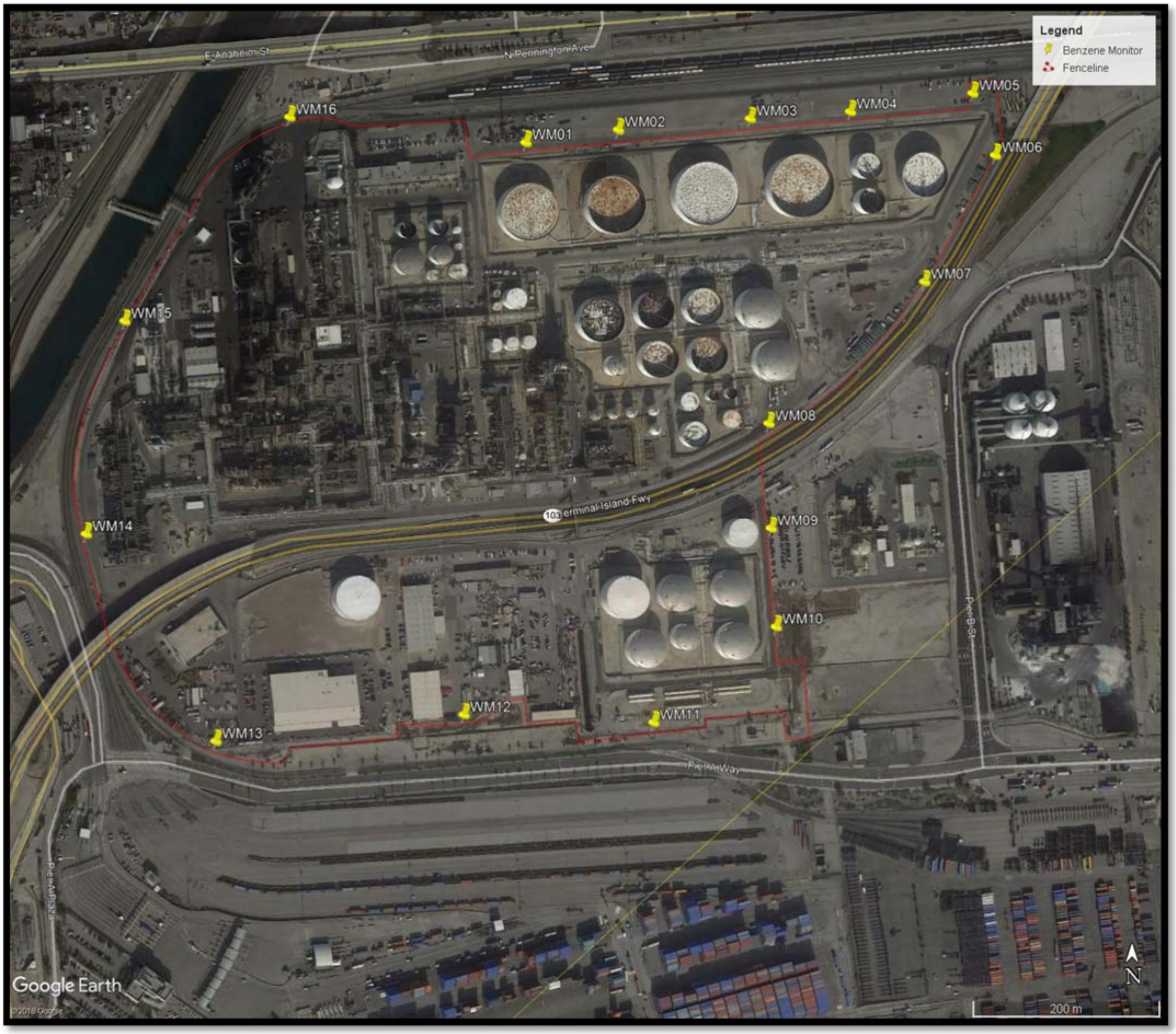
[4] In addition to Hydrogen sulfide, other reduced sulfur compounds are being monitored.

2.5.2. Nonpoint Organics Monitoring

The Refinery operates a Leak Detection And Repair (LDAR) program in accordance with numerous District and Federal regulations. LDAR is intended to lead to the detection and repair of equipment leaks by requiring refineries to follow specific quarterly leak monitoring practices and to promptly repair leaks once detected. In every calendar quarter, Refinery staff inspect pumps, valves, and connections in organic liquid service by checking it for organic vapors using a handheld analyzer/instrument. This leads to a total of about 170,000 components inspected per quarter and 700,000 inspected per year. When the LDAR program was introduced, US EPA estimated that it would reduce emissions from refinery equipment leaks by 63%.

The Refinery has begun fenceline monitoring of benzene according to the requirements of 40 CFR 63, Subpart CC (National Emission Standards for Hazardous Air Pollutants from Petroleum Refineries). The monitoring network design is per EPA Method 325A, and the sampling itself is per EPA Method 325B. Generally, the monitoring network is designed to monitor for chronic off-site benzene exposure through the use of sorbent tubes placed around the facility perimeter. The sampling period for each sorbent tube is bi-weekly. Corrective action is required if the annual average concentration equals or exceeds 9 $\mu g/m^3$ (2.8 ppb_v). As the compliance date for this requirement was January 30, 2018, a limited amount of data has been collected. As of December 2018, however, no sorbent tube samples had benzene concentrations at or above the action level. The layout of the benzene fenceline monitoring network is shown below in Figure 2-17.

Figure 2-17. Existing Benzene Fenceline Monitoring



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

2.5.3. Other Distributed Monitoring

The Refinery has other monitoring in place for pollutants such as hydrogen sulfide (H_2S), hydrofluoric acid (HF), carbon monoxide (CO), and hydrogen cyanide (HCN). For H_2S, there are numerous point sensors located on process units throughout the refinery. Additionally, every person on refinery property (except non-classified areas) must wear a portable H_2S sensor that is programmed to alarm when levels around that person are above 10 ppm. All alarms on both sensor types are investigated and corrected immediately. For HF, there are point sensors around the perimeter of the alkylation unit, where HF is used. These sensors continuously monitor for HF and trigger an alarm if detected. The HF monitoring system has a direct connection to SCAQMD such that the agency is immediately and automatically notified if an HF alarm has been triggered.

The Refinery's odor control program includes a hotline to its neighbors to call to report odors. Odor complaints are immediately investigated by onsite personnel that are dispatched to the area of the complaint and the facility's perimeter. The Refinery first responders attempt to identify and locate the odor in question. They monitor the areas being investigated using portable multi-gas monitors that can measure H_2S, Benzene, CO, HCN, LEL, and oxygen.

Additionally, the Refinery operates other monitoring equipment that ensures that its equipment, including emissions control equipment, operates properly and is not emitting beyond allowed limits. For example, its flares have sensors that are continuously monitored to ensure that the flares are properly operating and a flame is present at all times to destroy organics that are present in the gas stream when vented to the flare.

2.6. SAMPLING LOCATIONS

Fenceline sampling locations have been selected with a variety of goals and constraints in mind. There are numerous practical limitations 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;
- 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 proposed open path lengths are preliminary from initial siting assessments. Final open path lengths and shelter placement will be dependent on constructability, city property boundaries, building permits, and utilities. Sample heights will be approximately 5-15 meters to avoid potential obstructions of the proposed open path lengths.

All Rule 1180 pollutants will use open path technology with the exception of H_2S and Black Carbon. 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.

An overview of the AQMD approved sampling locations are shown below in Figure 2-18. The monitoring technologies proposed for each location are identified in this Section, and are discussed in greater technical details in Section 3.

Figure 2-18. Sample Location Overview

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

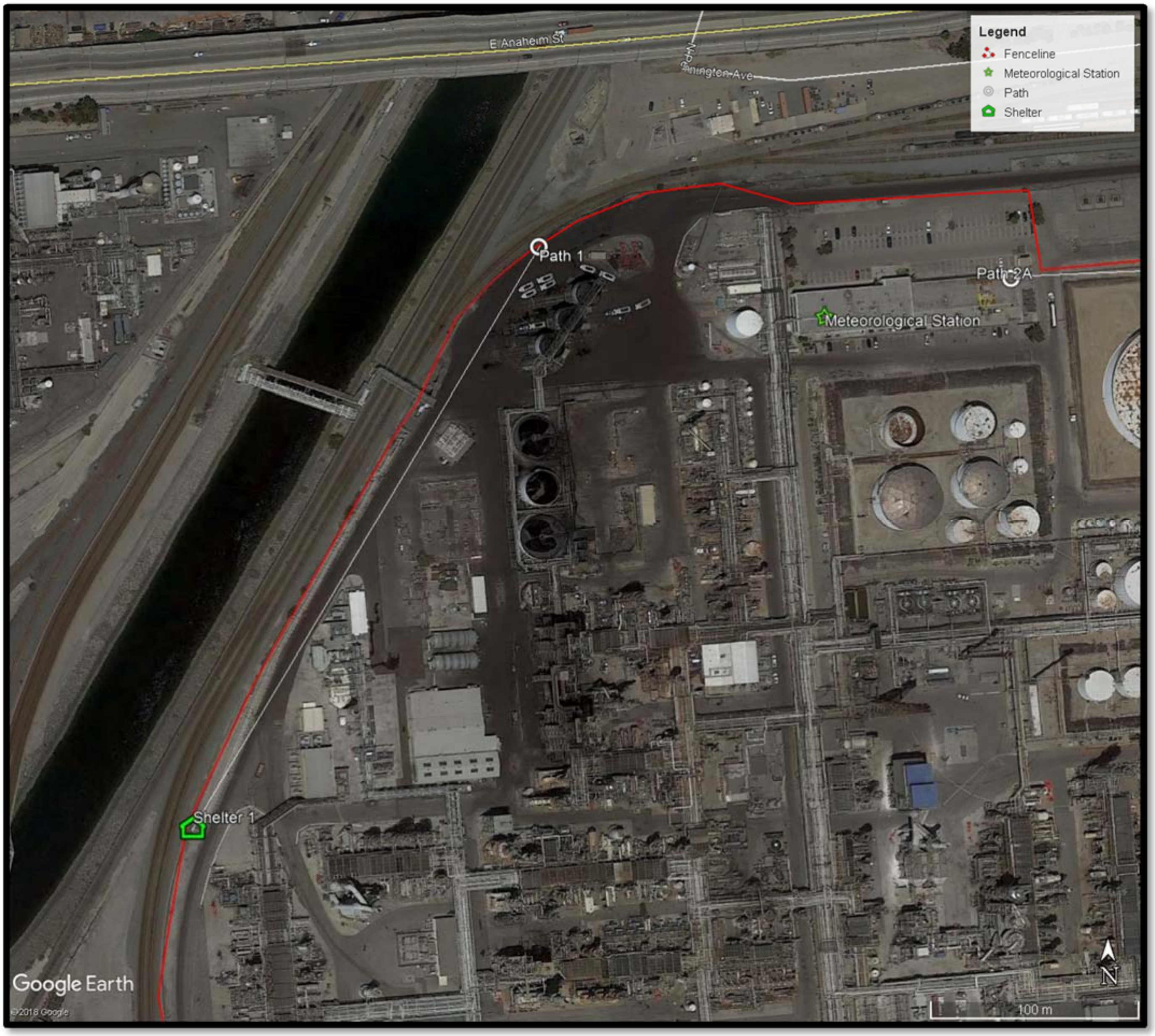
2.6.1. Sampling System 1

Sampling System 1 is comprised of Shelter 1 and Open Path 1, with path length of approximately 328 meters. The proposed location has been sited to maximize coverage on the northwest, given the curved fenceline, elevated obstructions, and localized moisture sources. The shelter is positioned at the south end of this path due to the lack of available open space at the north end of the path.

Shelter 1 will be equipped with an open path FTIR, open path UV-DOAS, UV fluorescence H_2S analyzer, and aethalometer. Aethalometer and H_2S samples will be collected from a single point at the shelter location.

Location information for Sampling System 1 is summarized below in Figure 2-19.

Figure 2-19. Sampling System 1 Location



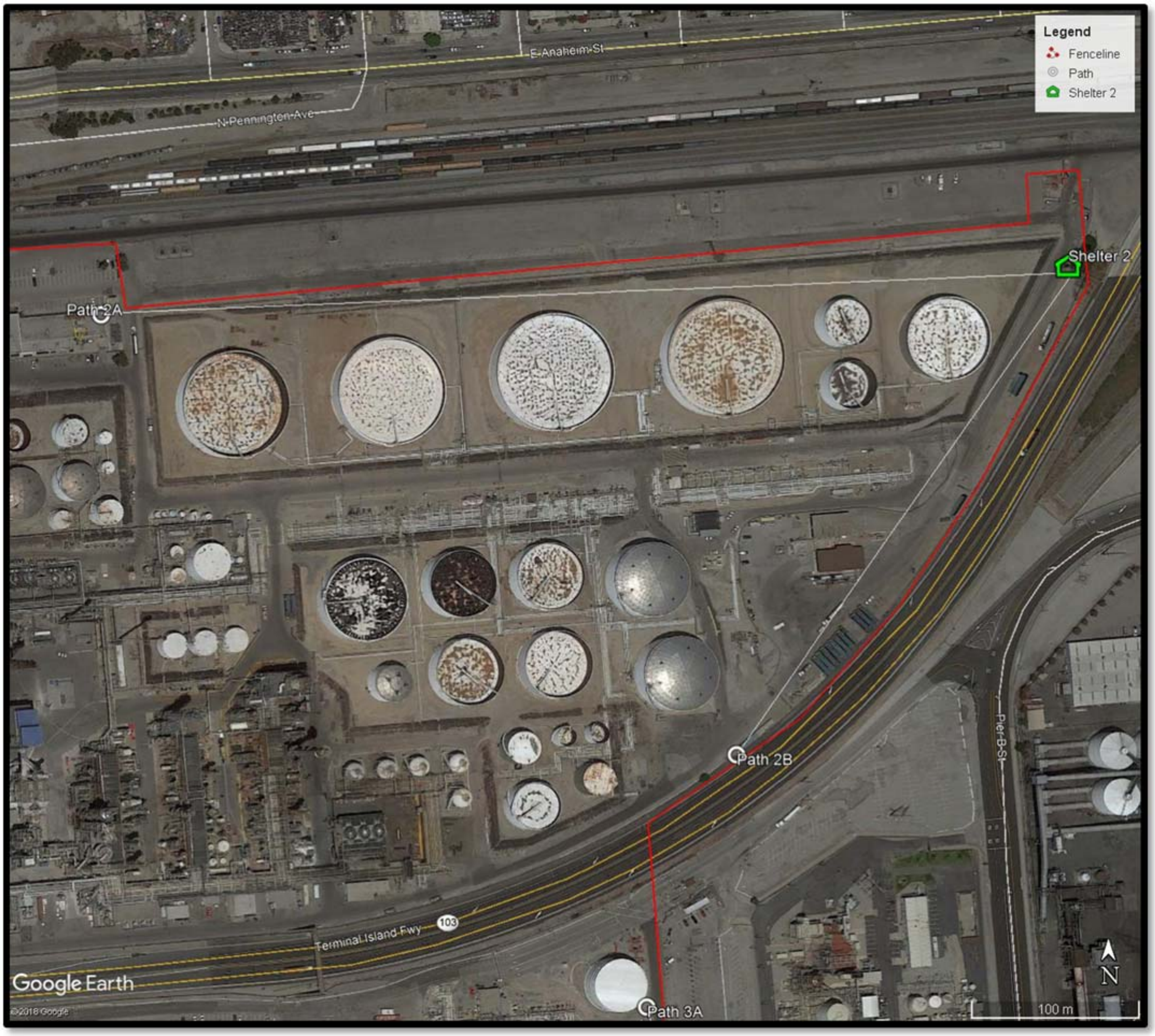
Note. The image is created from Google Earth Pro (Desktop version 7.3.2.5495).

2.6.2. Sampling System 2

Sampling System 2 is comprised of Shelter 2 and Open Paths 2A and 2B, with path lengths of approximately 571 and 344 meters, respectively. Open Path 2A is longer than ideal, but the lack of available space between hazardous areas (near the tanks) and the property line make this an unavoidable compromise. Open Path 2B extends as far as possible down the curved southeast fenceline while avoiding the obstruction of an enclosed truck loading rack near its middle.

Shelter 2 will be equipped with an open path FTIR, open path UV-DOAS, UV fluorescence H_2S analyzer, and aethalometer. Aethalometer and H_2S samples will be collected from a single point at the shelter location. Location information for Sampling System 2 is summarized below in Figure 2-20.

Figure 2-20. Sampling System 2 Location



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

2.6.3. Sampling System 3

Sampling System 3 is comprised of Shelter 3 and Open Paths 3A and 3B, with path lengths of approximately 170 and 348 meters, respectively. Shelter 3 will be equipped with an open path FTIR, open path UV-DOAS, UV fluorescence H_2S analyzer, and aethalometer. Aethalometer and H_2S samples will be collected from a single point at the shelter location.

Location information for Sampling System 3 is summarized below in Figure 2-21.

Figure 2-21. Sampling System 3 Location

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

3. FENCELINE AIR MONITORING EQUIPMENT

3.1. TECHNOLOGY OVERVIEW

The Guidelines recommend the use of "open path technologies" be used, 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 the open path technologies are not suitable for monitoring black carbon or hydrogen sulfide in this application, extractive technologies must also be considered. These 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, with a longer and more established track record. Extractive technologies typically tend to follow the "one instrument per pollutant" model.

3.2. AQMD APPROVED TECHNOLOGIES

AQMD has required the use of FTIR and UV-DOAS for measuring the entire suite of Rule 1180 target compounds. Black carbon cannot be measured with FTIR or UV-DOAS, so aethalometers will be used for this purpose. For hydrogen sulfide, dedicated UV-Fluorescence analyzers using will be utilized.

Table 3-1 below lists the Rule 1180-required pollutants for the Refinery, the intended monitoring techniques, the minimum detection limits, and the maximum detection limits based on specifications provided by instrument manufacturers.

Table 3-1. Monitoring Technologies and Typical Detection Limits

Pollutant	Monitoring Technique	Min. 5-minute Detection Limit (ppb)	Maximum Detection Limit (ppb)[2]
Sulfur Dioxide	UV-DOAS	2.3	750
Nitrogen Dioxide	FTIR	10	$0.1x10^9$
Total VOCs (C2-C5 NMHC)[1]	FTIR	3.0	$0.1x10^9$
Formaldehyde	FTIR	2.0	$0.1x10^9$
Acetaldehyde	FTIR	15	$0.1x10^9$
Acrolein	FTIR	3.0	$0.1x10^9$
1,3-Butadiene	FTIR	3.1	$0.1x10^9$
Styrene	FTIR	5.0	$0.1x10^9$
Benzene	UV-DOAS	0.90	616
Toluene	UV-DOAS	2.8	37,500
Ethyl Benzene	UV-DOAS	1.1	75,000
m-Xylene	UV-DOAS	1.1	9,000
o-Xylene	UV-DOAS	12.6	9,000
p-Xylene	UV-DOAS	0.80	9,000
Hydrogen Sulfide	UV Fluorescence	2	10,000
Carbonyl Sulfide	FTIR	2.0	$0.1x10^9$
Ammonia	FTIR	1.0	$0.1x10^9$
Black Carbon	Aethalometer	N/A	100 µg/m^3
Hydrogen Cyanide	FTIR	23	$0.1x10^9$
Hydrogen Fluoride	FTIR	3.0	$0.1x10^9$

Notes.

[1] As there is no open path technology capable of measuring all NMHC, it is proposed to use open path FTIR technology to monitor at least C2-C5 alkanes as an indicator of NMHC concentrations. Depending on final vendor selection, the range may be extended up to C2-C12 alkanes.

[2] Unit is expressed in parts per billion (ppb) by volume except for Black Carbon (particulate matter) of which unit is expressed as microgram per cubic meter (µg/m^3)

It should be noted that detection limits for FTIR and UV-DOAS are dependent on a large 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, and may also vary dependent on final equipment manufacturer selection.

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 US EPA’s Environmental Technology

Verification program in 2001.[1] SCAQMD used aethalometers for black carbon monitoring 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.

3.2.1.2. Interferences

Dependent on final equipment manufacturer selection.

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 ºC that converts hydrogen sulfide to sulfur dioxide while leaving other sulfur compounds unconverted.

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 ºC 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.

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[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.

3.2.2.2. 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 the 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 requested that open-path FTIR be installed.

3.2.3.1. Method of Operation

The interferometer portion of the instrument includes an infrared (IR) source, beam-splitter, mirrors, a laser, and 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 of 100-500m length, 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. The concentration of each 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 shelter building, with a retro-reflector placed at the opposite end of each path. The Refinery may elect to place interferometer on a robotic auto-positioner that allows it to monitor two paths on a time-shared basis. The advantages of this approach versus using a single interferometer per path is still being evaluated from an engineering perspective. Either approach will allow for achieving the goals of this Plan.

3.2.3.2. Interferences

The technology's interferents are water and carbon dioxide; as these are universally present in ambient air, the analytical software is designed to continuously measure and help compensate for these compounds. Although automatic software evaluates the raw spectral data and reports concentrations on a 5-minute and 30-minute or 1-hour basis, the raw data is also archived for later in-depth analysis. This allows for spot-checking the software and for any in-depth investigations that may be found necessary.

3.2.4. Open Path UV-DOAS

AQMD has required the open path UV-DOAS (ultraviolet differential optical absorption spectroscopy) be used. Although it cannot detect as many compounds as FTIR, it may be more sensitive for BTEX compounds.

3.2.4.1. Method of Operation

The UV-DOAS instrument has a strong internal source of ultraviolet light, which is typically a Xenon lamp. This light is projected as a beam across an open path to a retro-reflector array; the beam is passed back to the instrument's detector from the retro-reflector. The light beam interacts with the chemical compounds contained in the column of air that is the open path, and in cases where those compounds have specific absorbance patterns in ultraviolet light, the light is subtly altered by that interaction. The software uses one of several mathematical best-fit analyses, depending on the manufacturer, to compare the sample's absorption spectrum of the light to reference spectra files that were developed in a laboratory. Additional software processing may be used to reduce the amount of noise in the signal. The Beer-Lambert Law is then used to convert that data to gas concentrations across the path.[2,3] Depending on final manufacturer selection and engineering considerations, the Refinery may use a single instrument per path, or connect multiple paths to a single instrument in a multiplex arrangement. In such an arrangement, fiber-optic cables are used to connect a single instrument to one stationary telescope per path. Either approach will allow for achieving the goals of this Plan.

3.2.4.2. Interferences

There are several interferences for this measurement technique, including fog, smoke, haze, nitrogen, ozone, and oxygen. Although 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. This allows for spot-checking the software and for any in-depth investigations that may be found necessary.

3.3. OPERATION AND MAINTENANCE REQUIREMENTS

This required element will be discussed as part of the Quality Assurance Project Plan in Appendix A.

3.4. POLLUTANT EXCLUSIONS AND SURROGATES

The Refinery proposes monitoring all Rule 1180 pollutants.

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[2] *EPA Handbook: Optical Remote Sensing for Measurement and Monitoring of Emissions Flux*. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Air Quality Analysis Division, Measurement Technology Group, December 2011.

[3] Platt, U., Stutz, J. Differential Optical Absorption Spectroscopy: Principles and Applications. Springer-Verlag Berlin Heidelberg, 2008.

3.5. ROUTINE MAINTENANCE AND FAILURE MANAGEMENT

Rule 1180 requires that this Plan provide plans for monitoring equipment maintenance, and failures will be managed to prevent excessive monitoring downtime. The exact preventative maintenance requirements and timelines will be determined at such time as final equipment manufacturer selection has been completed; that information will be incorporated into the Quality Assurance Project Plan.

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)). Appropriate flags will signify on the website of any data during these events.

The required FTIR and UV-DOAS will be installed on all proposed fenceline paths, each will serve as a backup system for each other if one system is down for longer than 24 hours. If both FTIR and UV-DOAS instruments cannot be on line for more than 336 hours, passive sampling will be deployed in its place at the shelter locations for the majority of the pollutants.

Long Beach Airport National Weather Service Station (KLGB) will act as the backup monitoring system if the onsite meteorological station is down for more than 96 hours.

Back up monitoring data will be displayed on the public website after final data review and also made available in the quarterly reports.

4. DATA MANAGEMENT AND PRESENTATION

Public communications regarding data collected by the fenceline monitoring program will be tailored to its audience, striving to present technical information in a format that is clear and understandable to the general public. Context, including information on nearby sources of the same pollutants, will be provided to facilitate interpretation of the data and its limitations. The public will be able to leave comments and feedback through the web site and via email. 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 website will be designed to clearly communicate collected data in a manner that the general public can understand. Data will be presented on the web site in real time. 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:

- California Office of Environmental Health Hazard Assessment (OEHHA) Reference Exposure Levels (REL),
- Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL)
- Federal National Ambient Air Quality Standards (NAAQS),
- California Ambient Air Quality Standards (CAAQS), and
- Concentrations observed at various locations in the air basin during the MATES IV study.

Background information on the pollutants and health risks associated with each will also be provided. Data will be presented in geospatial, trend line, and tabular format. All 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.

The web site will also include or link to educational materials describing the objectives of the fenceline monitoring program. These materials will discuss the technologies being used for the fenceline monitoring program and provide an introduction to the pollutants being measured.

Discussion of quality control procedures and flags will be provided. Raw data will be available to AQMD personnel upon final quality assurance checks by the Refinery. Site visitors will be directed to the quarterly reports, which will also be disseminated on the same site, for final quality-assured data.

4.2. PUBLIC NOTIFICATION SYSTEM

The Guidelines specify that the data display website should offer opt-in notifications to allow for interested members of the public to subscribe to specific notifications from the reporting system. The reporting system will offer the following opt-in notification capabilities:

- Release of new data, such as quarterly reports.
- Concentrations above Table 4-1 notification thresholds. Chronic or carcinogenic thresholds will be discussed in the quarterly reports once annual data is available, and will not be addressed by the opt-in notification system.
- Fenceline monitoring system status, such as equipment downtime and maintenance activities.

All system notifications will be displayed on the website and will be delivered to the opt-in subscribers by email in their choice of English or Spanish. Messages will be sent promptly upon detection of the triggering condition (e.g. a threshold at the fenceline) in order to fulfill the goal of the Guidelines that the notifications allow for the public to consider further actions to protect their health. The proposed notification thresholds are summarized in Table 4-1 below.

Table 4-1. Notification Thresholds

Pollutant	Published Acute REL (ppm)[1]	Threshold (ppm, 1-hour average)[2]
Criteria Pollutants		
Sulfur Dioxide	0.248	26
Nitrogen Dioxide	0.246	32.4
Volatile Organic Compounds		
Total VOCs (C2-C5 NMHC)	N/A	N/A
Formaldehyde	0.044	5.7
Acetaldehyde	0.26	33.7
Acrolein	0.0011	0.1
1,3-Butadiene	0.29	37.6
Styrene	4.93	639.9
Benzene	0.0083	1.1
Toluene	9.6	1246
Ethyl Benzene	33	4280
Total Xylenes	5	649
Other Compounds		
Hydrogen Sulfide	0.03	3.9
Carbonyl Sulfide	0.26	33.7
Ammonia	4.5	584.1
Black Carbon	0.01 µg/m³	1.3 µg/m³
Hydrogen Cyanide	0.3	38.9
Hydrogen Fluoride	0.29	37.6

Notes.

[1] Published acute standard from EPA and OEHHA thresholds converted to ppm
x/Q for Long Beach (Rule 1401 Guidance Table 7.1)
Fenceline ppm = (x/Q @750) / (x/Q @25m) * (Sensitive Receptor ppm)

[2] Threshold calculated at fenceline (25 meters)

The intent of the notification program is to ensure that the public is alerted when concentrations at the residential and sensitive receptors reach the applicable health standards.

Rule 1401 Guidance Table 7.1 was used as the basis for the notification thresholds. This methodology was used since there are no residential or sensitive receptors at the fenceline of the Refinery and offer a better representation of the data versus the exposure levels to the public. The published Acute RELs were used from EPA and OEHHA thresholds in parts per million (ppm). The closest downwind residential area of approximately 750 m was used at 25 m of the Refinery fenceline. Notifications threshold data will display the calculated 1-hour rolling weighted average at the Refinery fenceline relative to the closest residential and sensitive receptors.

4.3. QUARTERLY REPORTS

Quarterly reports will be prepared to summarize the collected data after full quality assurance checking has been completed. These reports will summarize final concentrations and monitor up-time, and will include a discussion of data adjustments made as part of quality assurance procedures. The reports will relate the collected concentration data to relevant health standards as described in Section 4.1, but will also relate collected concentration data to chronic exposure standards once a full year of data is available. The quarterly reports will be made available on the web site in English. Additionally, in order to allow for involvement of members of the public that may not have access to the Internet, printed copies of periodic reports will be made available to the local library for public review:

Wilmington Library
1300 N. Avalon Boulevard
Wilmington, CA 90744

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.

5. IMPLEMENTATION SCHEDULE

A large amount of work remains to be done to implement Rule 1180 requirements at the Refinery. Rule 1180 provides a one-year deadline for each refinery to have its fenceline monitoring systems online and producing data after the date the Monitoring Plan is approved. This aggressive schedule will require rapid, coordinated action in order for the facility to finalize the engineering of the systems, finalize vendor selection, prepare and issue purchase orders, and complete the installation and commissioning. Additionally, there is expected to be significant lag time between order placement and order receipt, as nearly all equipment used in this type of program is manufactured to order. Exact implementation schedule milestones will be determined relative to the date of approval of the Monitoring Plan.

APPENDIX A: QUALITY ASSURANCE PROJECT PLAN

1. QUALITY ASSURANCE PROJECT PLAN

A Quality Assurance Project Plan (QAPP) will be developed for SCAQMD review and approval. The QAPP will describe in comprehensive detail all necessary quality assurance/quality control and other technical activities that will be implemented to ensure the results of the monitoring program will satisfy the stated performance criteria.

In order to perform sampling and analysis operations consistently, standard operating procedures (SOPs) will be prepared for the Refinery monitoring network and will be included as part of the QAPP. SOPs are written documents that detail the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and are officially approved as the method for performing routine and repetitive tasks.

The required elements and format specifications for the QAPP are detailed in EPA's Guidance for Quality Assurance Project Plans EPA QA/G-5 (EPA, 2002) and SCAQMD's Rule 1180 Refinery Fenceline Air Monitoring Plan Guidelines (SCAQMD, December 2017). The core of the QAPP (excluding the SOPs) is divided into four basic element groups: 1) project management, 2) data generation and acquisition, 3) assessment and oversight, and 4) data validation and usability activities. Each element group is subsequently divided into elements covering various topics. The list of elements that will be included into the QAPP are presented in Table 1.

Table 1: QAPP Elements

Group 1. Project Management	Group 2. Data Generation and Acquisition	Group 3. Assessment and Oversight	Group 4. Data Validation and Usability
1. Title and Approval Sheet	10. Network Description	20. Assessments and Response Actions	22. Data Review, Verification, and Validation
2. Table of Contents	11. Sampling Methods	21. Reports to Management	23. Verification and Validation Methods
3. Distribution List	12. Sample Handling and Custody		24. Reconciliation with User Requirements
4. Project/Task Organization	13. Analytical Methods		
5. Problem Definition and Background	14. Quality Control		
6. Project/Task Description	15. Instrument/ Equipment Testing, Inspection, and Maintenance		
7. Quality Objectives and Criteria	16. Instrument/ Equipment Calibration and Frequency		
8. Training	17. Inspection/ Acceptance of Supplies and Consumables		
9. Documentation and Records	18. Non-direct Measurements		
	19. Data Management		

Each group of the QAPP describe the objectives of the specific monitoring study and the procedures to be followed to achieve those objectives. A simplified list of questions that will be addressed in each group and detailed in the QAPP are presented below.

In Group 1, Project Management will address the following questions:

1. Who will be involved in the project?
2. What are the roles and responsibilities of all key members of the project?
3. What is the environmental problem to be investigated?
4. What is the background history of the problem?
5. What is the monitoring objective?
6. What are the pertinent work activities for this project?
7. What regulatory standards are pertinent?
8. How will the data be used?
9. What decisions will be made with the data?
10. What type, quantity and quality of data are needed to support scientifically sound decisions?
11. How will training be provided, tracked, and documented?
12. What records will be maintained, how will they be stored and retained?

In Group 2, Data Generation and Acquisition, the following questions will be addressed:

1. What is the sampling design and what is the rationale behind it?
2. What sample collection methods will be used?
3. What are the quality control activities to be performed to assure that representative samples are collected?
4. What field and laboratory analytical procedures will be used?
5. How are samples handled in the field, during transport, and at the laboratory?
6. What quality control activities will be performed to assure accurate, precise and sensitive data are collected?
7. What equipment testing and maintenance activities will be performed?
8. Traceability of calibration equipment?
9. How are critical supplies and consumables identified and tracked?
10. How will the data be collected and managed?

In Group 3, Assessment and Oversight, the following questions will be addressed:

1. Are project goals and objectives being conducted as described in the QAPP?
2. What assessments will be being performed?
3. What interim and final reports will be generated and provided to management and data users?

Lastly, in Group 4, Data Validation and Usability, the following questions will be addressed:

1. How are the individual data collection tasks being checked and are being completed correctly?
2. How will individual sample results be determined to be acceptable or unacceptable based on QC data?
3. How were the limitations on the use of a data set determined?
4. How is the entire set of project data assessed to determine whether the data are “good” enough to use in making project decisions and drawing conclusions?

The necessary practices and procedures of the following EPA documents will be observed in the Refinery QAPP:

- Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. II: Ambient Air Quality Monitoring Program, EPA-454/B-17-001, January 2017;
- Quality Assurance Handbook for Air Pollution Measurement Systems, Vol. IV: Meteorological Measurements March 2008; and
- Meteorological Monitoring Guidance for Regulatory Modeling Applications EPA-454/R-99-005.

To fulfill the requirements of the Rule 1180 Monitoring Plan Guidelines, the QAPP will specifically address the following SCAQMD requirements:

- Multi-level data validation (e.g. Level 0, Level 1, Level 2, etc.) conducted by multiple parties
- Independent audit oversight of the monitoring program, including SCAQMD audits

In order to perform sampling and analysis operations consistently, standard operating procedures (SOPs) will be prepared for the Refinery monitoring network and will be included as part of the QAPP. SOPs are written documents that detail the method for an operation, analysis, or action with thoroughly prescribed techniques and steps and are officially approved as the method for performing routine and repetitive tasks. SOPs will ensure consistent performance with organizational practices, serve as training aids, provide ready reference and documentation of proper procedures, reduce work effort, reduce error occurrences in data, and improve data comparability, credibility, and defensibility. Each SOP will be sufficiently clear and written in a step-by-step format to be readily understood by a person knowledgeable in the general concept of the procedure.

Elements that may be included in the SOPs are:

- Scope & Applicability
- Summary of Method
- Health & Safety Warnings
- Interferences
- Apparatus & Materials
- Instrument or Method Calibration
- Sample Collection
- Handling and Preservation Sample Preparation & Analysis
- Troubleshooting
- Data Acquisition, Calculations & Data Reduction
- Data Management & Records Management
- Data Validation Table (predetermined criteria that defines limits to determine collected data quality)

The QAPP and all SOPs will be submitted to the Refinery and SCAQMD after the Fenceline Monitoring Plan has been approved and final equipment selection has been completed. Both the QAPP and SOPs will be living documents that will be updated, revised, and submitted to Refinery and SCAQMD for approval on an as-needed basis to comply with the latest equipment operation methods and in response to experienced gained during field operation of the particular equipment selected.