Air Monitoring Plan for the Tesoro Refining & Marketing Company, LLC Martinez Renewable Fuels Facility in Martinez, California

Submitted by Martinez Renewable Fuels Facility
Martinez, California

July 3, 2025

This document contains blank pages to accommodate two-sided printing.

Air Monitoring Plan for the Tesoro Refining & Marketing Company, LLC Martinez Renewable Fuels Facility in Martinez, California

Submitted by

Anne Partmann

Martinez Renewable Fuels Facility
150 Solano Way
Martinez, CA 94553
https://www.marathonmartinezrenewables.com/

Air Monitoring Plan

July 3, 2025

Prepared in consultation with Sonoma Technology

Contents

Figures

Tables

Version History

Version Number	Date	Description of Change
1	September 7, 2017	Initial AMP submittal to BAAQMD.
2	June 1, 2022	Updated QAPP submittal to BAAQMD – includes addition of open-path H_2S measurement technology and data quality objectives.
3 (rescinded)	~~December 1, 2022~~	~~Updated AMP and QAPP submittal to BAAQMD – includes revisions pursuant to AQMD review and comments.~~
4	February 17, 2023	Resubmittal of December version – includes updates and revisions following revised TDLAS specifications issued by BAAQMD in December 2022.
5	September 5, 2023	Revised in response to July 19, 2023, feedback from BAAQMD
6	February 21, 2024	Revised in response to October 19, 2023, feedback from BAAQMD
7	October 31, 2024	Resubmittal of February 21, 2024, version following feedback from BAAQMD
8	July 3, 2025	Revised in response to June 12, 2025, feedback from BAAQMD

1. Introduction

Fenceline concentrations of certain compounds are monitored at the Martinez Renewable Fuels Facility (Martinez Renewables or Martinez Facility) in Martinez, CA, by Tesoro Refining & Marketing Company LLC, in compliance with the Bay Area Air Quality Management District's (BAAQMD) Regulation 12, Rule 15 (Rule 12-15). The monitoring program follows a facility-specific air monitoring plan (AMP) consistent with the BAAQMD's Air Monitoring Guidelines for Petroleum Refineries.[1,2] Rule 12-15 requires refineries to monitor multiple species in a manner that achieves a minimum detection limit (MDL) in the parts-per-billion (ppb) concentration range, using measurement technology such as "open-path" or an equivalently sufficient method, with all data reported to the public.[1] Rule 12-15 requires monitoring for concentrations of benzene, toluene, ethylbenzene, xylenes (BTEX), and hydrogen sulfide (H_2S). In addition, sulfur dioxide (SO_2), alkanes, 1,3-butadiene, other organics, and ammonia (NH_3) were considered for measurement. This Monitoring Plan was approved in June 2018, with conditions to: (1) update the Quality Assurance Project Plan (QAPP, located in **Appendix A**) and (2) select H_2S monitoring technology. On October 6, 2021, BAAQMD provided updated requirements for refineries to conduct additional H_2S monitoring along refinery fenceline paths and implement this enhanced monitoring by January 1, 2023. These requirements were met and the Martinez Facility notified BAAQMD within seven days of the H_2S systems becoming fully operational. BAAQMD issued updated specifications on December 22, 2022. The Martinez Facility's response to the updated specifications was submitted on February 23, 2022. This version of the monitoring plan addresses written and verbal feedback from BAAQMD received on July 19, 2023, October 19, 2023, between June and October 2024, and June 12, 2025.

1.1 Plan Summary

1.1.1 General Principles of Proposed Measurement Techniques

The Martinez Facility monitors concentrations of the aforementioned compounds using open-path instruments placed at or near the refinery's property fencelines. Open-path instruments operate based on the following principles of physics:

- Each gas species absorbs light energy at characteristic wavelengths; thus, a target gaseous species can be specifically identified by monitoring for light absorption at a specific wavelength.

[1] Petroleum Refining Emission Tracking (Rule 12-15; approved by the BAAQMD on April 20, 2016).
[2] Bay Area Air Quality Management BAAQMD (2016) Air Monitoring Guidelines for Petroleum Refineries. April 2016. Available at baaqmd.gov/~/media/files/planning-and-research/public-hearings/2016/9-14-and-12-15/042016-hearing/1215-amg-041416-pdf.pdf?la=en.

- The extent of light absorption is proportional to the path-average concentration of the target gaseous species. The greater the absorption, the higher the concentration.

Open-path instruments transmit light or infrared energy across a long open path. Energy absorption relates to the average concentration of gases of interest along the path, according to the Beer-Lambert absorption law. Individual gases absorb most effectively at characteristic wavelengths; therefore, measurements of energy absorption at specific wavelengths can be used to infer path-average concentrations for species of interest. The transmitted energy signal is typically either detected remotely by a targeted detector or reflected for detection elsewhere. Often a combined transmitter-detector unit is positioned at one end of a path, and a retroreflector—a type of mirror with a geometric shape that gathers and re-focuses the transmitted energy—is positioned at the other end of the path. The retroreflector returns the transmitted energy to the transmitter-detector unit for detection. Figure 1 illustrates the basic concepts of open-path measurements.

Note that open-path instruments are not able to distinguish between a widely dispersed, low-concentration plume and a narrow, high-concentration plume. Rather, the instruments detect average concentrations across the entire distance from the transmitter to the detector (or the distance from the transmitter-detector to a retroreflector, and back again). Periods of poor visibility due to weather-related conditions (e.g., fog) are known to interfere with open-path measurements. Rule 12-15 anticipates some data loss due to poor visibility and allows for such data loss if supported by visibility measurements. The Refinery will monitor visibility using a standard light-scattering device to identify periods of poor visibility that may cause data loss.

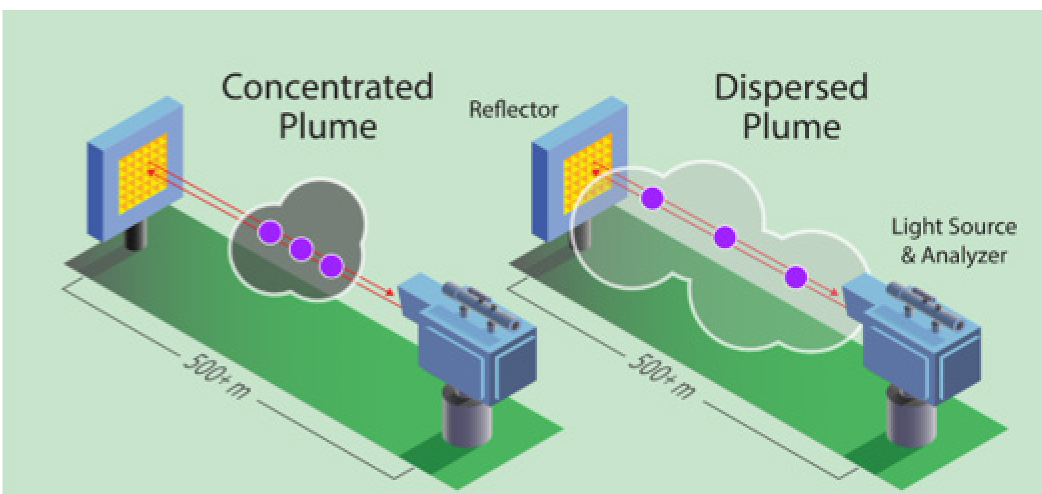

Figure 1. Schematic illustrating the basic premise for open-path instrument operation.

1.1.2 Measurement Sites

The Martinez Facility monitors concentrations across four open paths (Figure 2). The Facility selected these locations after consideration of dominant wind patterns, sources of potential air emissions on the refinery property, nearby local receptors, and logistical feasibility (Section 2). Transmitter-detectors are located at sites 1S-A, 2E-A, 3N-A, and 4N-A, and retroreflectors are placed at sites at 1N-R, 2W-R, 3S-R, and 4S-R. A summary of the exact shelter coordinates, elevation (analyzer and retroreflector), and optical path lengths is provided in Table 1.

Figure 2. Open-path monitoring sites for the Martinez Facility. The four paths are labeled 1N-1S, 2E-2W, 3N-3S, and 4N-4S, with 'A' and 'R' denoting whether the site is the location of an analyzer or reflector, respectively.

Table 1. Summary of each open-path system (analyzer and retroreflector) at the Martinez Facility, including geographic coordinates, path length, and shelter elevation above ground level (AGL).

Path No.	Path Length	GPS Coordinates	Equipment	Elevation AGL (ft)
1 (East)	654 m	38.0226437, -122.0432505	UV-DOAS Analyzer	7
			TDLAS Analyzer	7.5
			FTIR Analyzer	6.5
		38.0286053, -122.0414416	UV-DOAS Reflector	13
			TDLAS Reflector	18
			FTIR Reflector	10
2 (Southeast)	484 m	38.0105084, -122.048323	UV-DOAS Analyzer	7
			TDLAS Analyzer	7
		38.0101376, -122.0540906	UV-DOAS Reflector	13
			TDLAS Reflector	18
3 (Southwest)	598 m	38.0120123, -122.06357	UV-DOAS Analyzer	7
			TDLAS Analyzer	7
		38.007080, -122.060473	UV-DOAS Reflector	12
			TDLAS Reflector	18
4 (West)	571 m	38.0208706, -122.0690485	UV-DOAS Analyzer	7
			TDLAS Analyzer	7.5
			FTIR Analyzer	6.5
		38.0161463, -122.0671891	UV-DOAS Reflector	18
			TDLAS Reflector	13
			FTIR Reflector	10

The following provides an explanation of the Martinez Facility's rationale for selecting the open-path monitoring locations identified in Figure 2. Additional information is provided in Section 2.2.

- Path 1 is positioned between the Facility's main processing block and the community of Clyde. Clyde is further than 1 mile from the eastern fenceline and even further from any emission sources, and therefore Rule 12-15 requirements do not apply. However, the Martinez Facility considers that the community is directly east and downwind from the Facility's main processing block during wind conditions that are predominate in the region (i.e., winds blowing from the west to the east). Thus, the Martinez Facility included monitoring on Path 1.

- Path 2 is positioned between the Facility's main processing block, storage tanks, and the occupied areas of Concord towards the southeast: the Concord-Northwood residential community, the Sun Terrace neighborhood, and a zone of light industry and office parks that border the southern and eastern sides of the Mallard Reservoir. While wind blowing from the refinery in this direction is not frequent, the Martinez Facility recognized that these receptor areas are close to the Facility and established monitoring on Path 2.
- Paths 3 and 4 provide coverage when winds blow from northeast to southwest. Northeasterly winds are infrequent; however, they occasionally occur during winter.
  - Path 3 lies between a battery of crude oil storage tanks and residential neighborhoods of Martinez off North Blum Road.
  - Path 4 lies between the refinery's main center of processing operations and the Vine Hill neighborhood of Martinez.

A visibility monitor is located on the Path 2 instrument shelter.

1.1.3 Parameters and/or Species Measured

Species that are measured include BTEX, 1,3-butadiene, hexane, SO_2, and NH_3. Open-path H_2S measurements were added along the fenceline paths starting January 1, 2023, and are temporarily used for informational purposes only, pending deployment of more precise point monitors. Other species were ruled out based on an understanding of the operations and materials existing at the Martinez Facility. H_2S and BTEX emissions are distributed across the refinery property, and concentrations of BTEX and H_2S are currently measured along all four refinery fenceline paths. Sources of NH_3 and 1,3-butadiene are present only near the refinery's main processing block; therefore, given the annual and seasonal wind patterns, these species are measured only along Paths 1 and 4. Hexane, which serves as a surrogate for alkane emissions, is also measured along Paths 1 and 4 because hexane measurements will be available from the same instruments used to measure NH_3 and 1,3-butadiene.

1.1.4 Instrument Selection and Configuration

BTEX and SO_2 are measured by Ultraviolet-Differential Optical Absorption Spectroscopy *(*UV-DOAS*)* with a xenon light source. NH_3 and 1,3-butadiene are measured with Fourier Transform Infrared spectroscopy (FTIR) instruments. H_2S is temporarily measured by monostatic Tunable Diode Laser Absorption Spectroscopy (TDLAS) instruments for informational purposes only, pending deployment of more precise point monitors. To the extent practicable, instruments have been installed and are operated as follows:

- Instruments are mounted in a monostatic configuration, which means the light source and analyzer detector point at a retroreflector array that is approximately 300-700 meters away. The light is reflected off of the array and back to the detector for analysis.
- Instruments generally are elevated about 5 ft above ground level (AGL).
- Instruments are configured and operated following manufacturers specifications, including necessary bump tests and calibration checks. A bump test challenges an instrument using known gas concentrations to confirm accurate instrument response.
- Instruments are operated with the goal of achieving a minimum of 75% completeness on an hourly basis, 90% of the time based on annual quarters. Appropriate completeness criteria are calculated after removing time periods when atmospheric conditions prevented measurement.
- Measurements are collected at a time resolution of less than 5 minutes and averaged to 5-min and 1-hr values for reporting (based on clock hours). Rolling hourly averages are used for data display to the public website and comparison to health thresholds.

1.1.5 Data Analysis and Reporting

Data collected by the fenceline monitors is transmitted to a website where near-real-time measurements can be viewed by the public. Prior to display on this website, data generated by the fenceline monitors undergo review throughout the measurement and reporting process. Included in this process are automated quality assurance/quality control (QA/QC) checks, as well as more detailed reviews conducted by trained data analysts (more details on data review processes are provided in Section D.2 of the QAPP). Under normal circumstances, a 5-min average measurement will appear on the website within 10–15 minutes of the end of the measurement period. However, the data upload may be impacted by internet traffic. A rolling 1-hr average of the 5-min data for each gas is also reported on the website to allow for comparisons to health thresholds. Additionally, the website contains a mechanism for collecting public feedback.

Final data sets are compiled quarterly and will be provided to the BAAQMD no later than 60 days after the end of each calendar quarter. Data deliveries are consistent with BAAQMD guidance and additional details are provided in Section C.2 of the QAPP. The refinery will make data available to BAAQMD upon request prior to report submittal. All open-path UV-DOAS, FTIR, and H_2S raw spectral data will be saved as single files and made available to BAAQMD upon request. BAAQMD may make publicly available any of the data routinely submitted in a quarterly report.

All data collected as part of the fenceline monitoring system is retained for a period of 5 years, consistent with Rule 12-15-502.

2. Monitoring Plan Design Considerations

The Martinez Facility's Monitoring Plan was developed in consideration of the following elements.

- Rule 12-15 and related BAAQMD guidance documents.
- Monitoring objectives, which were established in consideration of Rule 12-15 and related guidance.
- The findings of a preliminary scoping study, which involved assessments of the geographic setting around the Martinez Facility and meteorological conditions that impact the area. The preliminary scoping study is discussed in Section 2.2.
- Technical and engineering feasibility related to available monitoring technologies and instrument siting.
- Data management and QA/QC requirements.

Details on each of these elements are provided in the following subsections.

2.1 Key Elements of Rule 12-15 and Guidance

According to the Guidance Document,[3] the main goals of fenceline monitoring are to:

- "Provide continuous air quality concentration information on a short enough time scale to address changes in fence-line concentrations of compounds associated with refinery operations;
- "Provide data of sufficient accuracy to identify when concentrations of compounds associated with refinery operations are elevated as compared to other monitoring locations throughout the Bay Area;
- "Potentially aid in identifying corrective actions that will lower emissions."

Key guidance for designing a monitoring plan to meet these goals is summarized below. The Martinez Facility monitoring program achieves the goals listed above and meets the following provisions:

[3] Bay Area Air Quality Management BAAQMD (2016) Air Monitoring Guidelines for Petroleum Refineries. April 2016. Available at baaqmd.gov/~/media/files/planning-and-research/public-hearings/2016/9-14-and-12-15/042016-hearing/1215-amg-041416-pdf.pdf?la=en.

- Conduct "fenceline" measurements of BTEX and H_2S and consider measuring other compounds, including SO_2, alkanes, 1,3-butadiene, other organics, and NH_3. The term "fenceline" in the guidance refers to a general boundary between refinery property and areas outside the refinery property, not necessarily to an actual fence.
- Conduct measurements in areas where emissions from the refinery could impact populated areas on a frequent basis. Specifically,
  – "Measurements must cover populated areas within one mile of the refinery fence-line likely to be affected when the annual mean wind direction lies in an arc within 22.5 degrees of a direct line from source to receptors 10 percent of the time, or greater, based on the most representative meteorological measurements for sources likely to emit the compounds listed above at the refinery."
  – In addition, "Meteorological measurements should also be used and addressed in the Monitoring Plan to ensure proper siting of fence-line systems, looking at long-term measurements such as annual average wind rose, but also taking into account more seasonal and recurring short term meteorological events."
- Provide measurements of species at the ppb level or as technology allows.
- Conduct measurements using open-path instruments or an appropriate alternative.
- Provide rationale for the species to be measured and not measured.
- Provide rationale for the locations for the measurements.
- Provide rationale for the instruments to be used.
- Collect measurements every 5 minutes.
- Process and display data in near-real time to a public website.
- Meet data recovery and completeness criteria.
- Develop a QAPP for the measurement program and follow the QAPP.

2.2 Preliminary Scoping Study

2.2.1 Geographic Study Setting

The Martinez Facility is located east of the City of Martinez and north of the City of Concord in Contra Costa County, CA (**Figure 3**). Refinery operations occupy approximately 2,200 acres, including a 50-acre main block of processing operations, with the center of the facility located approximately at 38.025° latitude, -122.063° longitude (**Figure 4**). The area surrounding the refinery includes:

- **North** – Wetlands, the Point Edith Wildlife Area, and Suisun Bay sit to the north of the refinery. There are no receptors within one mile of the Facility in this direction. The Valero Refinery is about three miles north of Martinez Renewables across the Suisun Bay.
- **West** – The Martinez Refining Company is about two miles west of the Facility. The Vine Hill and Blum Road neighborhoods of Martinez are the nearest residential areas to the west and portions of these areas are within 1 mile of the refinery. Low coastal hills rise to elevations of 400 to 600 feet within 5 miles west of the refinery.
- **South** – Highway 4 passes by directly south of the Facility. Toward the southeast, the Concord-Northwood residential community and the Sun Terrace neighborhood are the nearest residential areas, and a zone of light industry and office parks sits just south of the Mallard Reservoir.
- **East** – Low coastal hills rise to elevations of 400 to 600 feet within 2.5 miles east of the Facility. Areas east of the refinery include former and current military lands, but aside from the community of Clyde (slightly beyond 1 mile east of the refinery), the lands within 5 miles to the east are only lightly populated.

The nearby populated public areas represent air quality “receptors” that may at times sit downwind from the Facility. The positions of these receptors received careful consideration during the design of the Monitoring Plan.

The Martinez Facility also maintains an auxiliary tank battery and a marine unloading terminal just west of the south end of the Benicia-Martinez Bridge across the Carquinez Strait, about 2.8 miles west of the refinery. Potential receptors near this facility were also considered for the Monitoring Plan.

Figure 3. Geographic setting of the Martinez Facility.

Figure 4. Layout of the Martinez Facility.

2.2.2 Local Meteorology

Contracted meteorologists reviewed the refinery's routinely collected surface wind measurements in the context of expert knowledge of the Bay Area regional wind patterns. The Martinez Facility is positioned in a wind flow corridor between the San Francisco Bay and the Sacramento Valley. Wind flow through the corridor is driven by seasonally variable regional temperature gradients and large-scale meteorological systems. Figure 5 illustrates the predominant wind flow patterns: (1) winds occasionally blowing from the south (most often occurring during winter storms); (2) winds blowing from northeast to southwest (regional offshore flow, most often occurring in winter); (3) winds blowing from the northwest and west to southeast (onshore flow, most often occurring in spring, summer, and early fall).[4]

[4] Seasons were defined as follows: winter is December, January, February; spring is March, April, May; summer is June, July, August; and fall is September, October, November.

Figure 5. Typical wind flows influencing the Martinez Facility.

Radial histograms (wind roses) were prepared to determine the frequencies of wind speeds and directions as directed by Rule 12-15 Guidance (i.e., annual mean wind direction distributed by 22.5-degree arcs) and for other relevant data groupings (e.g., seasonal, monthly, and/or narrower arcs). Using data from 2011 through 2016, Figure 6 provides the annual wind roses recorded from the refinery's meteorological station, while Figure 7 provides seasonal wind roses. Key findings are summarized as follows:

- Onshore winds – westerly winds (from west to east) occur with frequencies greater than 10% on an annual basis. Winds from these directions are most common in spring, summer, and early fall. The town of Clyde would be downwind of westerly wind flow, but is located more than one mile away from the facility's process operations.
- Southerly winds – winds blowing from south to north occur about 10% of the time on an annual basis. However, there are no receptors downwind of southerly wind flow.
- Offshore winds – northeasterly winds do not occur with a frequency greater than 10% on an annual basis, but do occur with a frequency greater than 10% during the winter season. The Vine Hill and north Blum Road neighborhoods of Martinez are the nearest residential areas to the west and are within one mile of the fenceline.

- **Southeasterly winds** – southeasterly winds (winds blowing from southeast to the northwest) do not occur with a frequency greater than 10% on an annual basis, but do occur more than 10% of the time during the winter; however, there are no receptors within one mile of the refinery that would be downwind of southeasterly flows.
- **Other winds** – winds from other directions occur with lower frequencies, whether data are grouped annually, monthly, or seasonally. While winds blowing from approximately northwest to southeast are very infrequent, the Concord-Northwood residential community, the Sun Terrace neighborhood, and a zone of light industry and office parks next to the Mallard Reservoir are downwind and within one mile of the fenceline under these conditions.

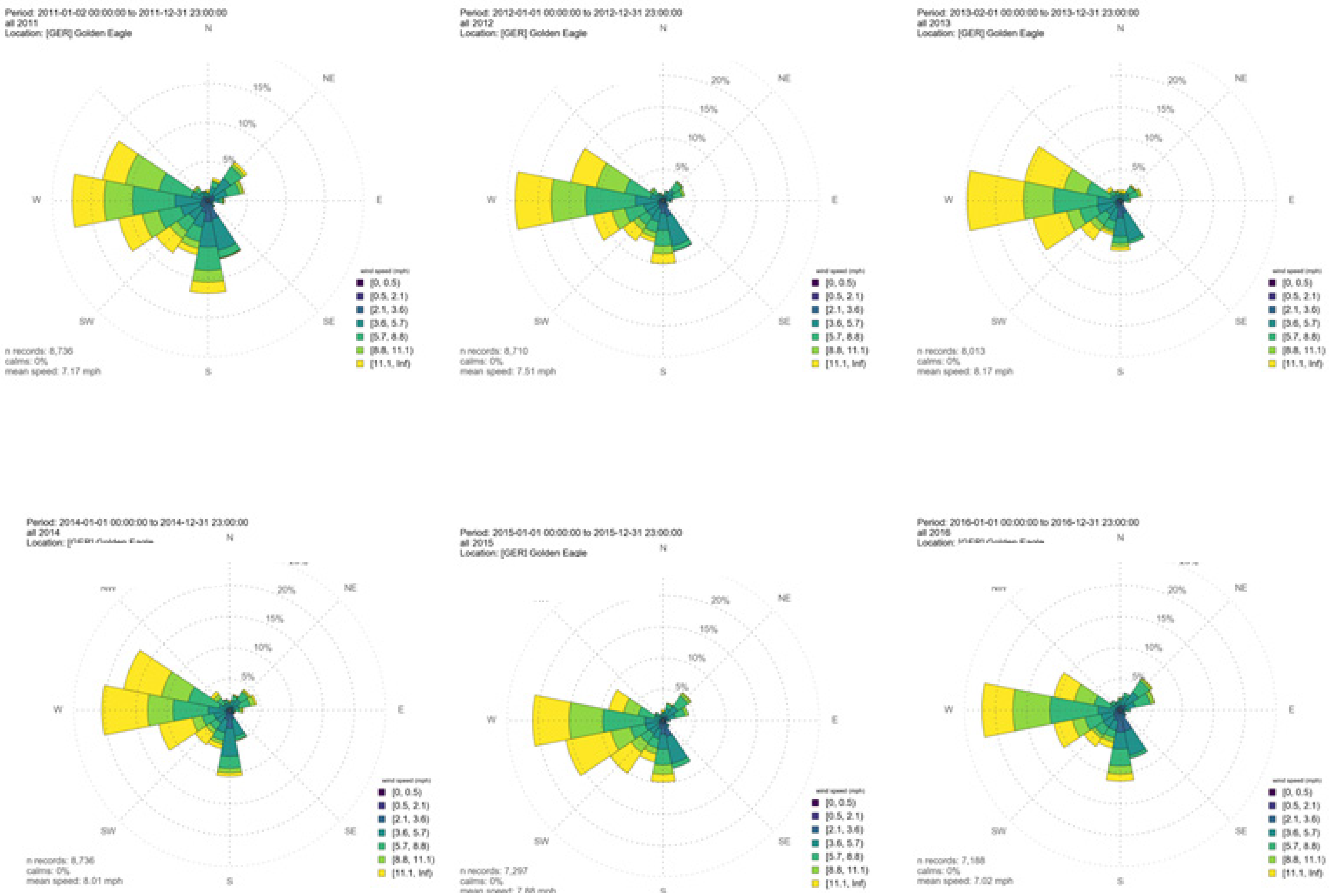

Figure 6. Annual wind roses plotted from the Martinez Facility's surface meteorological station, from 2011-2016 (top left to bottom right).

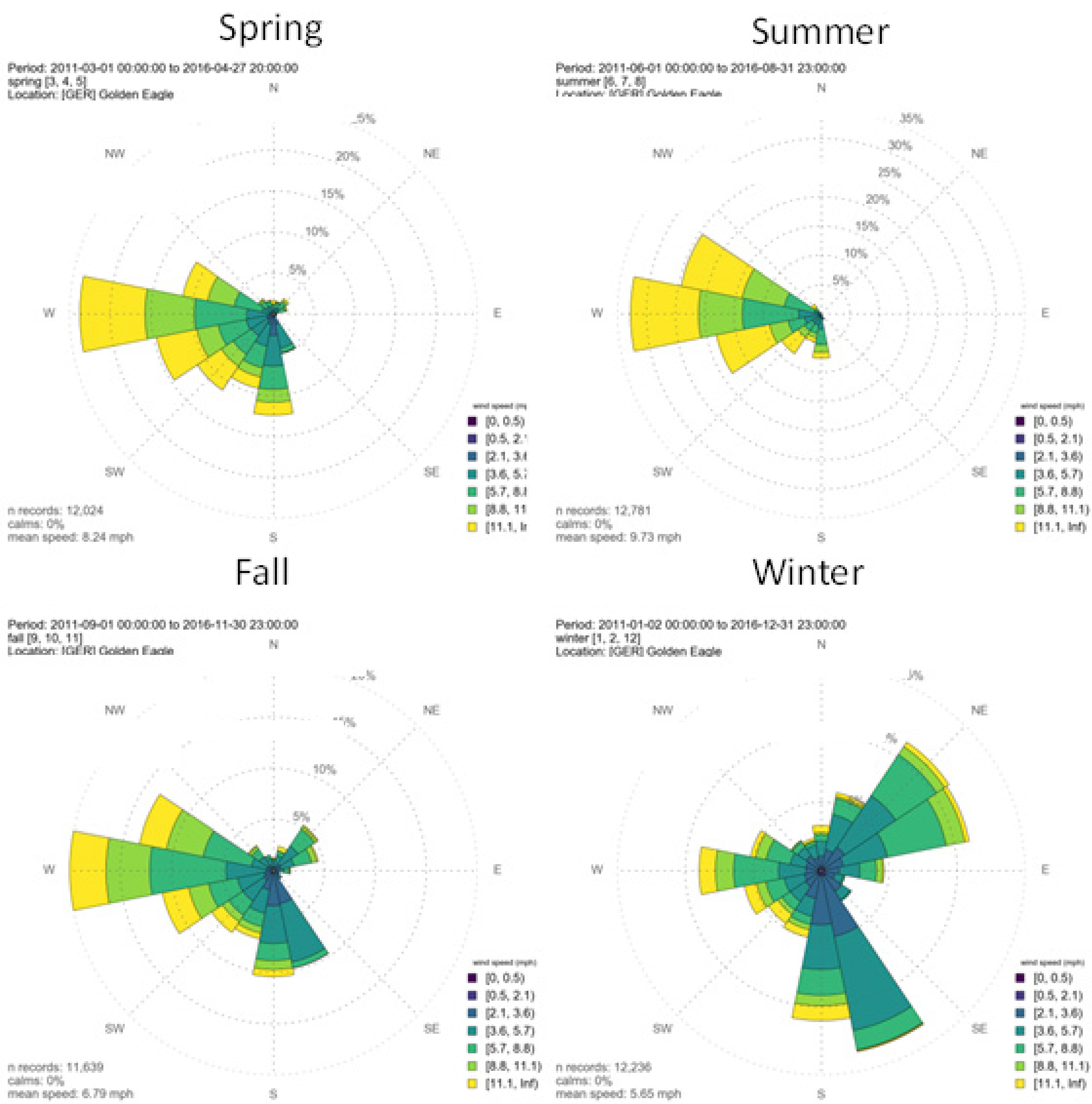

Figure 7. Seasonal wind roses plotted from the Martinez Facility's surface meteorological station from spring, summer, fall, and winter of 2011 through 2016.

To better identify and illustrate the areas located downwind from the refinery during onshore and offshore winds, maps highlighting these areas were created (Figures 8 and 9). The edges of the refinery boundaries were coupled with leeward projections of onshore and offshore winds to highlight any areas sitting downwind from the Martinez Facility during the wind conditions of interest. In addition, the outline of the refinery boundary was projected outwards to a distance of one mile. The illustrations confirm the above findings and show that:

- During infrequent offshore winds, portions of Martinez are downwind, but only a few Martinez neighborhoods are within one mile.
- During infrequent northwesterly winds, a few neighborhoods of Concord sit within one mile downwind of the refinery.
- During dominant westerly winds, the community of Clyde is downwind, but more than one mile downwind of refinery process areas.

In consideration of the above, general paths for monitoring were considered and are shown in Figures 8 and 9 as black bold lines. These general paths were then refined based on detailed wind data, population areas, and emission locations to develop the final monitoring paths shown in Figure 2.

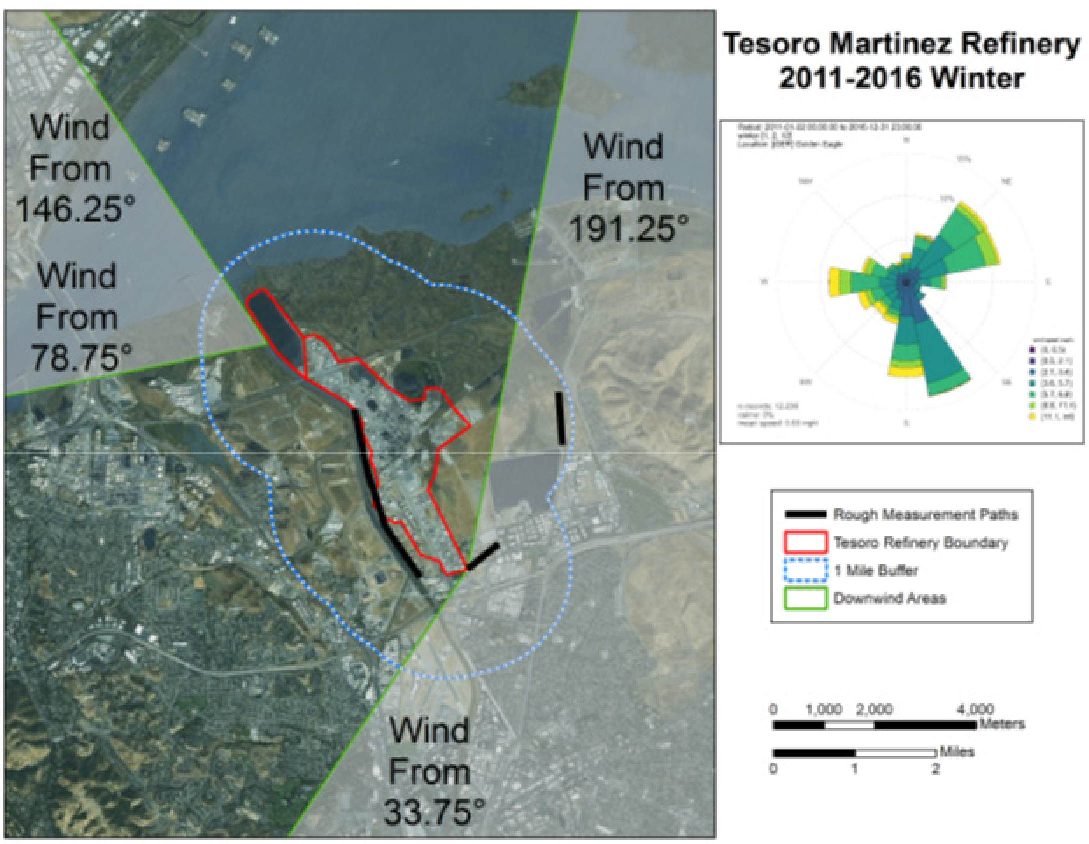

Figure 8. Areas downwind of the Martinez Facility property boundaries during infrequent offshore and southerly winds. Black lines are the initial monitoring paths that were considered.

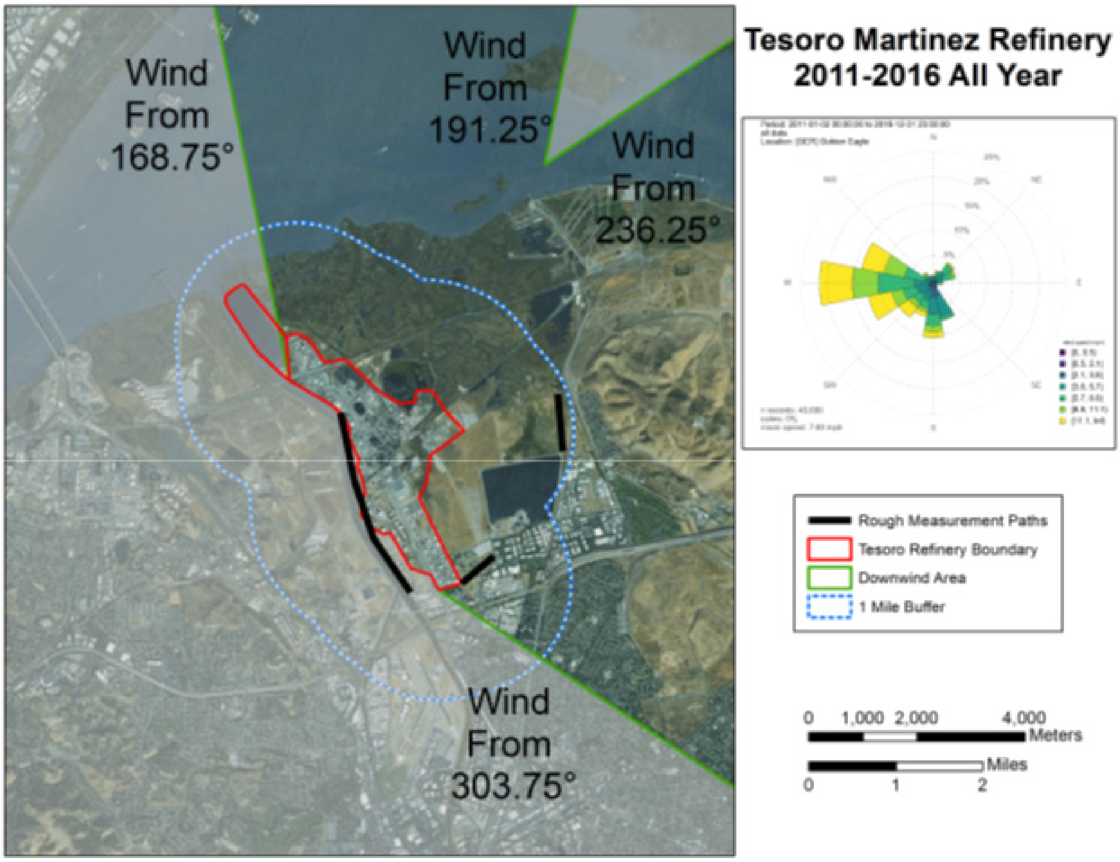

Figure 9. Areas downwind of the Martinez Facility property boundaries during onshore winds. Black lines are the initial monitoring paths that were considered.

As shown in Figure 2, monitoring Path 1 upwind of Clyde addresses scenarios of onshore winds. Monitoring Path 2 addresses the few neighborhoods of Concord that are located to the south within one mile downwind of the Facility.

Optimally, the refinery had hoped that Path 2 would cover the very southern end of the facility; however, the location was not logistically feasible for a number of reasons, including the presence of large trees and several public baseball fields. Although Path 2 is north of a few storage tanks, these tanks contain diesel, which is a finished product that is inherently low in emissions: it has very low vapor pressure and only trace amounts of BTEX, H_2S, and other compounds of relevance to this rule. The gap in monitoring between Paths 1 and 2 exists because there are no nearby populated areas downwind of the refinery in this direction; thus, measurements are not needed.

To further refine the paths west of the refinery, one-mile pie segments that encompass the northeasterly wind segments were created and overlaid at various points on the western refinery boundary (Figure 10). Based on this analysis, monitoring Paths 3 and 4 capture the needed monitoring paths for areas west of the refinery.

A small gap necessarily exists between Paths 3 and 4 because of steep terrain to the west, making it logistically infeasible to monitor between these two paths.

While not required by Rule 12-15 because there is no population downwind within a mile of the refinery, consideration was given to extending Path 4 north by a few hundred yards. However, due to terrain, infrastructure, and trees, it is not feasible to extend the monitoring path north. Importantly, any emissions leaving the refinery from this area are very unlikely to impact populated areas because winds from the northeast to the southwest are infrequent. Furthermore, given the terrain and distances from the refinery to populated areas, any emissions that moved toward the southwest would be well-diluted.

Similar illustrations were prepared for the Martinez Facility's auxiliary tank battery near the Martinez-Benicia Bridge (Figure 11). Figure 11 shows one-mile pie segments that encompass the northeasterly wind segments. The transparent pie segment uses wind data from the meteorological station located in the main refinery area. The green pie segments illustrate the probable wind pattern in this area as the winds follow the terrain through Carquinez Strait. As observed in Figure 11, there are no downwind areas of concern near the Martinez Facility's auxiliary tank battery; thus, there is no open-path monitoring in this area.

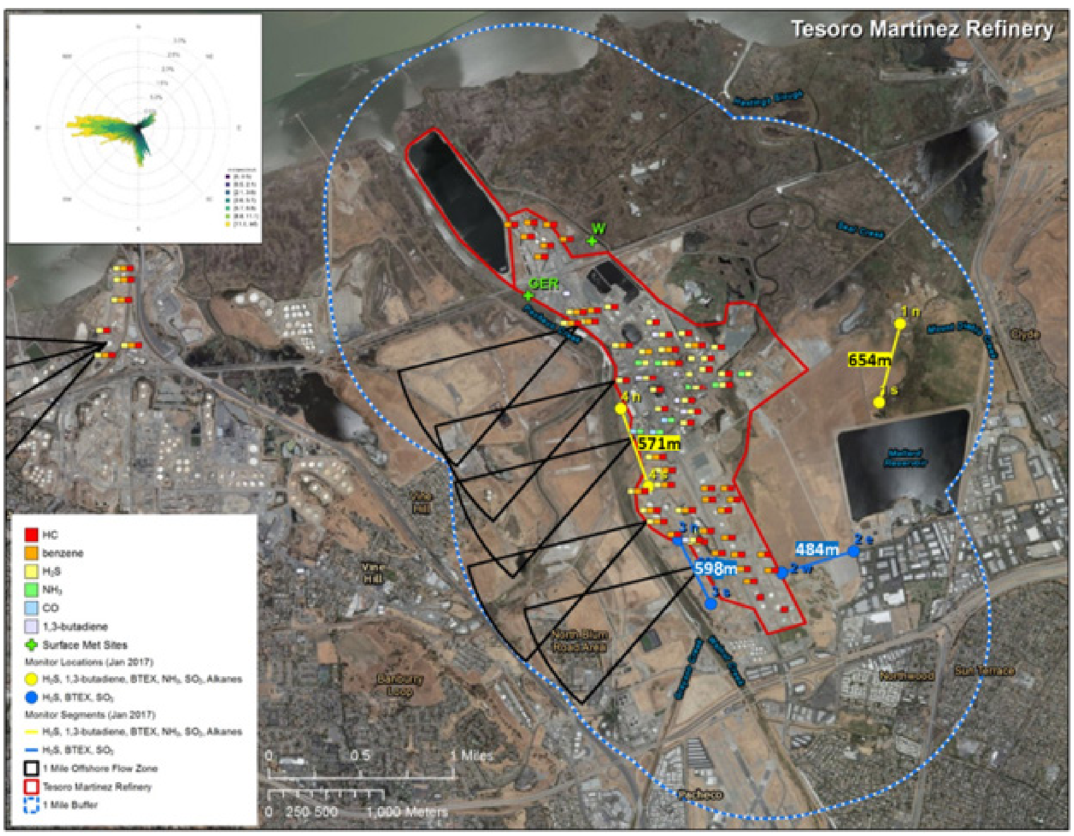

Figure 10. Open-path monitoring sites for the Martinez Facility. Four paths are labeled 1n-1s, 2e-2w, 3n-3s, and 4n-4s. Analyzers are located at sites 1s, 2e, 3n, and 4n, while reflectors are located at sites 1n, 2w, 3s, and 4s. The annual wind rose is shown in the top left.

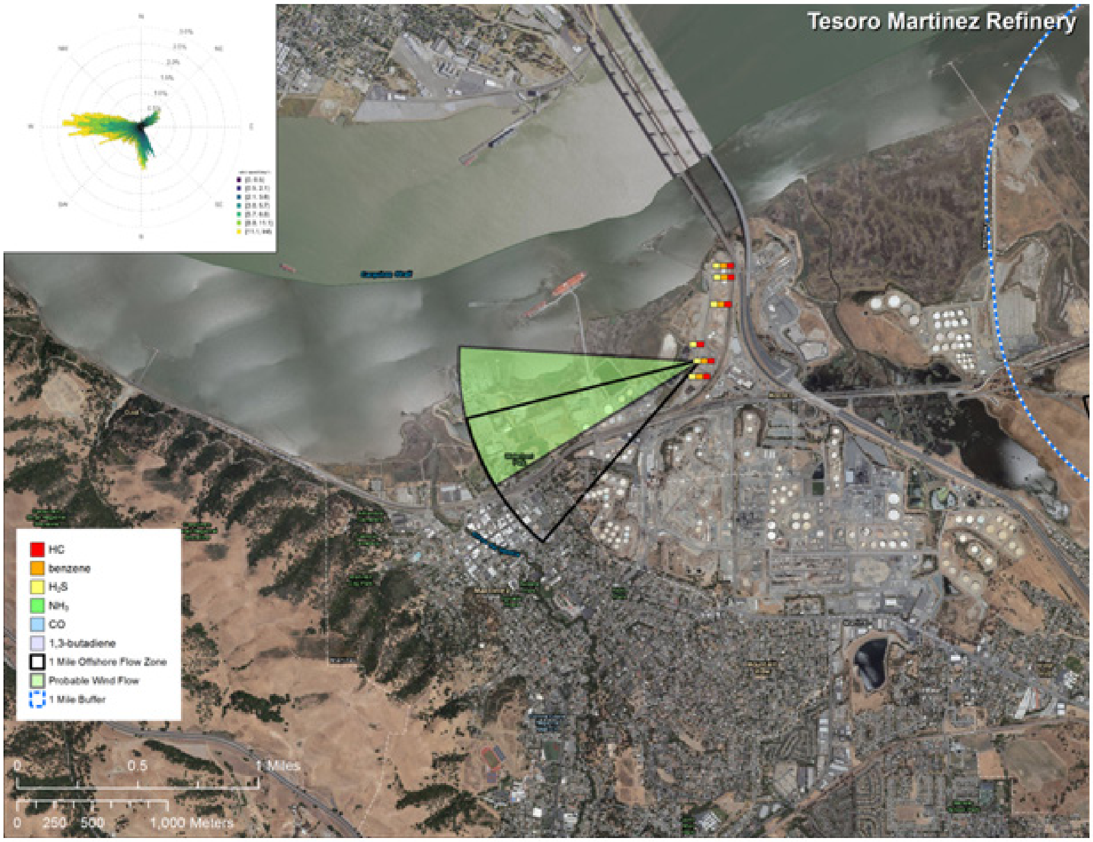

Figure 11. Areas downwind of the Martinez Facility's auxiliary tank battery during offshore flow.

2.3 Instrument Selection

The Martinez Facility served as a petroleum refinery producing fuel products—primarily gasoline, diesel, liquefied petroleum gas (LPG), residual fuel oils, and petroleum coke—through distillation of crude oil, including cracking, alkylation, and reforming processes. The facility also has a chemical plant, where salable sulfuric acids, molten sulfur, and liquid ammonia are produced. In consideration of the refinery's products, processes, and potential emissions sources, the rationales summarized in Table 2 were applied to determine which species would be proposed for inclusion in the Monitoring Plan. Literature reviews, site surveys, and interviews with instrument manufacturers were performed to determine the instruments needed to meet Rule 12-15 requirements. Both fixed-site and open-path instruments were investigated. Based on the distances that need to be covered by measurements (hundreds of meters), data time-resolution requirements (5 minutes), and current measurement technology, various open-path instruments were selected to best measure the target species.

Table 2. Summary of rationale supporting selection of species for inclusion in the Monitoring Plan.

Pollutant	Required by the BAAQMD	To Be Measured (paths)	Instrument(s)	Rationale for Inclusion or Exclusion if Not Required
Benzene	Yes	Yes (1,2,3,4)	UV-DOAS with Xenon	Required
Toluene	Yes	Yes (1,2,3,4)	UV-DOAS with Xenon	Required
Ethylbenzene	Yes	Yes (1,2,3,4)	UV-DOAS with Xenon	Required
Xylenes	Yes	Yes (1,2,3,4)	UV-DOAS with Xenon	Required
H_2S	Yes	Yes (1,2,3,4)	TDLAS	Temporary informational monitoring[a]
SO_2	No, if justified	Yes (1,2,3,4)	UV-DOAS with Xenon	Included
NH_3	No, if justified	Yes (1,4)	FTIR	Impact unlikely other than on Paths 1 and 4 because NH_3 is only located in the main processing area.
1,3-butadiene	No, if justified	Yes (1,4)	FTIR	Although not needed due to coincident with benzene and low concentrations, will report 1,3-butadiene, since FTIRs will be implemented for NH_3.
Alkanes	No, if justified	Yes (1,4)	FTIR	Will report hexane since FTIRs will be implemented for NH_3 and hexane is a reasonable surrogate for alkanes. On paths without FTIR, benzene will be measured and is a good surrogate for hexane except for diesel tanks. For diesel tanks, any emissions would be negligible due to low vapor pressure.
Other organics	No, if justified	No	N/A	Benzene measurement is reasonable surrogate.

[a] H_2S concentrations will temporarily be detected and quantified for informational purposes only using an open-path TDLAS air monitoring system, pending deployment of more precise point monitors.

Along all paths, BTEX and SO_2 are measured using a monostatic UV-DOAS with a xenon light source. The xenon light is used to achieve the desired MDLs for BTEX compounds and collect measurements over paths that are about 300 to 700 meters long. H_2S is temporarily measured using monostatic TDLAS instruments as of January 1, 2023, for informational monitoring purposes only, pending deployment of more precise point monitors. The basic principle of TDLAS is to measure the absorption of a single absorption line for the target species. A tunable diode laser can emit light over a small range of very specific wavelengths, which allows spectral measurement over a narrow range to minimize interference. In theory, one can monitor H_2S using UV-DOAS, but its absorption spectra overlaps with BTEX and can generate false positives. While FTIR technology was considered for measurements of BTEX and H_2S, instrument manufacturers informed Tesoro that FTIR is not suitable for these species because of poor detection limits and overlap in absorption with other species (such as carbon dioxide with benzene). NH_3, 1,3 butadiene, and alkanes are measured using FTIR monitors.

MDLs and upper detection limits (UDLs) are the lowest and highest concentrations of each species that can be measured by each instrument and sampling path. Additional details, including estimated values at each sampling path as reported by instrument manufacturers, are provided in Section B.2 of the QAPP.

Detection limits are presented in Section B.2 of the QAPP as approximate values based on the theoretical capabilities of the instruments. Actual MDLs can change depending on atmospheric or operational conditions. For the Unisearch TDLAS, a real-time MDL is calculated continuously in real time using the standard deviation of the last seven 5-min average concentration values containing no measurable analyte (as determined by the correlation coefficient). The MDL is defined as twice this standard deviation and is determined by the analyzer software and reported alongside every 5-min average concentration value on the public-facing website.

Monostatic instruments have been selected to reduce the need for substantial power at the mirror sites and improve minimum detection limits by increasing effective path lengths. Thus, substantial power, communications, and shelter are required at the light-source/detector end of the monitoring path only. Limited power is needed for the retroreflectors, which need to be aligned at the other end of the path for maximum performance and should be cleaned regularly. An example of a UV-DOAS analyzer and receiver in a shelter is shown in **Figure 12**, and a retroreflector is shown in **Figure 13.**

Figure 12. A UV-DOAS analyzer.

Figure 13. A UV-DOAS retroreflector.

2.4 Data Analysis

2.4.1 Completeness

BAAQMD guidance for open-path measurement data recovery is that instrumentation must meet a minimum of 75% completeness on an hourly basis, 90% of the time based on annual quarters. Because open-path measurements are affected by atmospheric conditions that create low-visibility (such as dense fog), invalid data during low-visibility conditions do not count against completeness requirements. Visibility measurements are made at least every 5 minutes to coincide with the open-path measurements.

Data completeness is assessed by reviewing the data flags assigned for each 5-min average data point. A 1-hr average data point (based on clock hours) will be considered incomplete if (1) more than 25% of the 5-min average data points within the averaging window are missing or do not meet acceptance criteria, and (2) low-visibility atmospheric conditions beyond the control of the refinery do not exist. Quarterly completeness is assessed as the number of complete hours with respect to the number of hours expected in the calendar quarter. A detailed description of data completeness is in Section A.7 of the QAPP.

Other factors that affect data availability include instrument bump tests (approximately every month for a few hours), routine maintenance (e.g., replacement of analyzer consumables or annual checks), and emergency or unplanned maintenance. In the event that an analyzer is offline for an extended period of time, repairs are made as quickly as possible. A spare analyzer, if available, may be installed while repairs occur. Regular maintenance and careful, responsive operation will minimize instrument downtime.

2.4.2 Quality Assurance/Quality Control

A key goal of the QA/QC plan is to ensure high-quality data that are representative and defensible. Clear definitions and procedures for QA/QC are also necessary to inform the public on why some data are missing, suspect, or invalid. Data review processes are detailed in Section D of the QAPP, as well as the standard operating procedure (SOP) for Data Validation (Attachment 5 to the QAPP).

3. Routine Operations

For this monitoring program, 4 UV-DOAS analyzers, 2 FTIR analyzers, and 1 visibility sensor were originally installed, and 4 TDLAS analyzers were added as of January 1, 2023. Instrument operations, routine maintenance and bump tests (monthly, quarterly, or annual), and daily checks work to ensure that data are flowing consistently. Additional details are included throughout the QAPP, and individual instrument SOPs are provided as Attachments 1-4 to the QAPP.

3.1 Instrument Operations

System status indicators will alert data reviewers to operational issues. A comprehensive summary of status indicators and data flagging is included in Section D.2 of the QAPP. Sonoma Technology's after-hours on-call staff additionally respond to alerts for operational issues, as discussed in Section B.6 of the QAPP. Routine maintenance activities and schedules are detailed in Section B.6 of the QAPP and in the instrument SOPs provided as Attachments 1–4 to the QAPP.

3.2 Data Management

A Data Acquisition System (DAS) or data logger at each sampling site performs basic QC and averages raw analyzer data to 5-min resolution. Data are then transmitted to Sonoma Technology's Data Management System (DMS), where a robust automated quality control (AutoQC) logic assigns data flags in real time based on instrument diagnostics and local meteorological measurements. These preliminary data are displayed on the public website, usually within approximately 10–15 minutes of collection. Additional details regarding data flow and QC processes are described in Sections B.10 and D.2 of the QAPP, as well as the SOP for Data Validation (Attachment 5 to the QAPP).

3.2.1 Public Website Display

Preliminary data collected by the fenceline monitoring network are displayed on a public website in real time. Key components of the public website include visual display of real-time and historical data, contextual information for the public to build understanding surrounding displayed concentrations, and a feedback mechanism.

The public website includes time series plots and map marker visualizations of preliminary 5-min and rolling hourly concentration values in real time. Data quality information is also included, and is described further in the SOP for Data Verification and Validation (Attachment 5 to the QAPP). An image of the Martinez Renewables public website is shown in **Figure 14**.

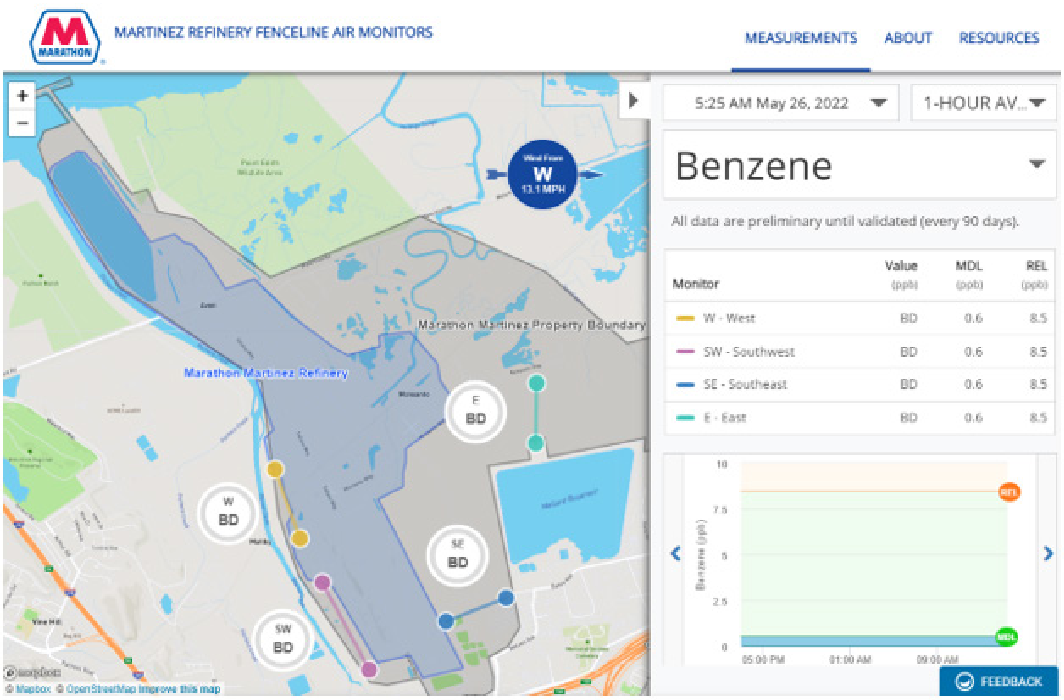

Figure 14. Screenshot of the Martinez fenceline monitoring public-facing web page.

The data collected are high time resolution, spatially variable, and chemically complex. To provide context to this complex data set for the public, the following information is included through a combination of links, graphics, or captions:

- Information about the species measured and the measurement techniques.
- Discussion of levels of concern, with links to third-party sources, such as the Office of Environmental Health Hazard Assessment (OEHHA) website, on the health effects of each species.
- Discussion of non-refinery sources that could affect the measured concentrations.
- Definitions for abbreviations.
- Discussion of data below MDL.
- Definition of data flags and their meaning.
- Frequently asked questions (FAQs).

To facilitate public feedback, a feedback mechanism is provided on the web page. This allows users to submit questions or comments about the website. An email is delivered to a Martinez Facility contact and the website host, who are responsible for deciding how to respond to the public comments. The emails received through the website are archived. Although not all comments have to be addressed, they can be made available to BAAQMD upon request.

Appendix A: Quality Assurance Project Plan

Quality Assurance Project Plan for the Tesoro Refining & Marketing Co., LLC, Martinez Renewable Fuels Facility in Martinez, CA.