



# Air Monitoring Five-Year Assessment

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# Overview of 5-Year Network Assessment

## Introduction

On October 17, 2006 the U.S. Environmental Protection Agency (EPA) finalized an amendment to the ambient air monitoring regulations to require State and local monitoring agencies to conduct a network assessment once every five years [40 CFR 58.10(d)]. A copy of this 5-year assessment, along with a revised annual network plan, must be submitted to the Regional Administrator. The first assessment is due July 1, 2010.

The purpose of the assessment is to determine if the network meets the monitoring objectives defined in 40 CFR Part 58 Appendix D, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and whether new technologies are appropriate for incorporation into the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For PM<sub>2.5</sub>, the assessment also must identify needed changes to population-oriented sites.

## Background

The Bay Area Air Quality Management District (Air District) is the public agency responsible for air quality management in nine Bay Area counties: Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, southwestern Solano, and southern Sonoma. The Air District operates air monitoring stations in each of these nine counties. The Air District has been measuring air quality in the San Francisco Bay Area since 1957. In 2009 there were 22 permanent stations in the Air District air monitoring network, plus one permanent station operated by the California Air Resources Board at Point Reyes, that measure at least one criteria pollutant (O<sub>3</sub>, CO, NO<sub>2</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, and PM<sub>10</sub>). The Air District also operates two permanent stations which only measure H<sub>2</sub>S, a non-criteria pollutant. Monitoring for lead is expected to begin in 2011 after EPA finalizes its new regulation on lead.

In addition to the 24 permanent stations in the Bay Area, the Air District also performs short term monitoring at other sites. For example, in 2009, the Air District operated a re-locatable air quality monitoring trailer at Berkeley and a monitoring shelter at Cupertino. Temporary sites are not included in the 5-year assessment as they are moved every year or two.

For some pollutants, EPA requires a minimum number of monitors, usually based on population density. Those pollutants include O<sub>3</sub>, NO<sub>2</sub>, PM<sub>2.5</sub>, SO<sub>2</sub>, and PM<sub>10</sub>. No minimum CO monitoring is required for the State Implementation Plan (SIP) or Maintenance Plan. Monitoring requirements for lead are expected to be issued in the fall of 2010. The State has no minimum monitoring requirements for criteria pollutants.

## **Purpose of Monitoring**

The purposes of the Air District monitoring network are:

- To provide air pollution data to the general public in a timely manner.
- To support compliance with California and national ambient air quality standards (NAAQS). When sites do not meet the standards, attainment plans are developed to attain the standards.
- To support air pollution research studies.

To meet its monitoring objectives the Air District monitoring network collects ambient air data at locations with a variety of monitoring site types. These site types, as defined in 40 CFR Part 58 Appendix D, Table D-1, are intended to characterize air pollution levels in areas of high pollution, high population, transported air pollution, and air pollution near specific sources. Figure 1 shows the current Bay Area monitoring network superimposed on a map showing population density. Most of the air monitoring stations are located in the populated areas of the Bay Area.

Ambient air monitoring at Air District stations is intended to meet one or more of the following monitoring objectives:

- A determination of typical concentrations in areas of high population density.
- A determination of the highest concentrations expected to occur in the area covered by the network.
- A determination of impacts from significant sources.
- A determination of general background concentration levels.
- A determination of the extent of regional pollutant transport.

### Population Oriented

As the primary purpose of air quality standards is to protect the public health, air monitoring stations have been placed in areas with high population density to determine the air pollution levels to which the majority of the population is exposed. In most cases these are within the largest cities of each county. To be consistent with EPA's list of Site Types in Table D-1 of 40 CFR Part 58 Appendix D, the term "population orientated" will be used in place of "typical concentrations in areas of high population density", for clarity in this monitoring objective.

### Highest Concentration

EPA regulations require that air quality in areas where the public has access be reduced to levels below the national ambient air standards. Consequently, monitoring must also be done at locations expected to have the highest concentrations, even if populations are sparse in that area. High concentrations may be found close to major sources, or further downwind if pollutants are emitted from tall stacks. High concentrations may also be found at distant downwind locations when the pollutants such as ozone or secondary particulate matter are a result of chemical reactions in the atmosphere.

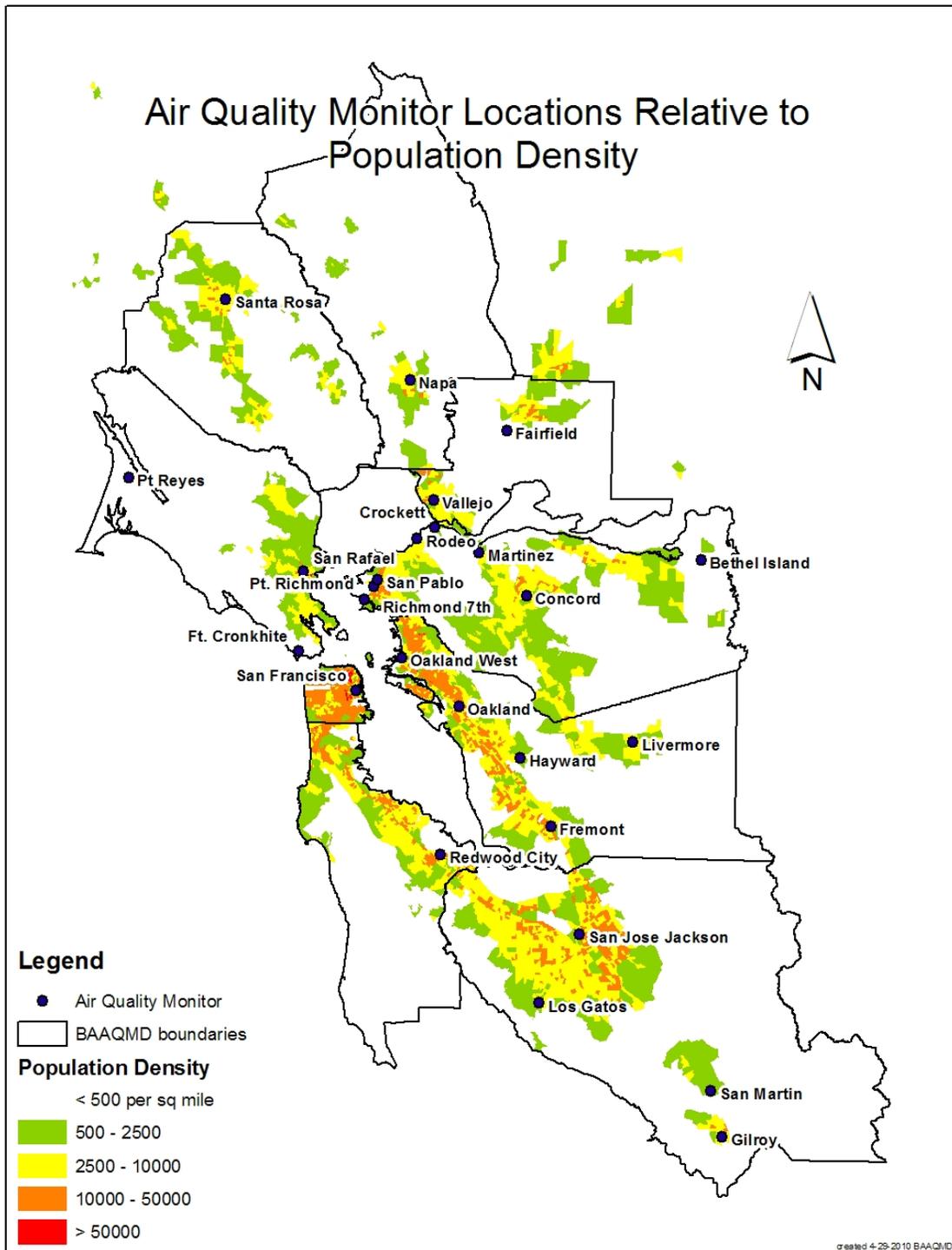


Figure 1. Map of Air District Monitoring Stations and Bay Area Population.

### Source Impact

There are five refineries within the Air District: Chevron, Shell, Tesoro, ConocoPhillips, and Valero. Because these sources have the potential to emit significant amounts of SO<sub>2</sub> and H<sub>2</sub>S, the Air District operates SO<sub>2</sub> and H<sub>2</sub>S monitoring stations near these sources. The Port of Oakland also can be a significant source of particulates, carbon monoxide, and toxics and the Oakland West air monitoring station is located downwind of the Port to measure pollution impacts on West Oakland.

### General Background

The Air District operates stations in areas that have no significant emissions from mobile, area, or industrial sources. At these sites, the measured concentrations reflect the transported air quality levels from upwind areas. When designing control strategies to reduce pollution levels, it is important to know if areas outside the boundaries of the Air District are contributing to high pollutant levels within the Air District. Where there are no significant emission sources upwind of a site, then the site is considered to be a general background site.

### Regional Transport

The Air District shares a common boundary with six other air districts: Monterey Bay Unified Air Pollution Control District (APCD), San Joaquin Valley APCD, Sacramento Metropolitan AQMD, Yolo-Solano AQMD, Lake County AQMD, and Northern Sonoma County APCD. When upwind areas have significant air pollution sources, pollutants transported into the Bay Area may result in overall higher air pollution levels within the Bay Area. The Air District operates monitoring sites near the borders of the Air District to measure the pollution concentrations transported into and out of the Bay Area Air District.

## **Criteria for Assessment**

This assessment rates the importance of all criteria-pollutant monitors operated by the Air District. Criteria pollutants monitored are carbon monoxide, ozone, nitrogen dioxide, sulfur dioxide, PM<sub>10</sub>, and PM<sub>2.5</sub>. Lead is currently not being monitored but monitors will be operated after final regulations are issued by EPA in late 2010. In this assessment, monitors are designated as high, medium, or low in importance. These evaluations are based on how well the monitor helps meet the monitoring objectives defined in 40 CFR Part 58 Appendix D, and how well the monitor meets the monitoring objectives of the Air District. The assessment also suggests whether new monitoring sites are needed. Specific criteria used to assess the need for monitoring are based on the following:

- Meeting the minimum number of monitors as required by EPA.
- Maintaining a full station (all criteria plus toxics pollutants) in each of the nine Bay Area counties.
- Maintaining a full station in each of the 3 major Bay Area cities: Oakland, San Francisco, and San Jose.
- Locating a monitor at the expected maximum concentration for each pollutant.
- Locating monitors to determine background or transported pollutant levels.
- Operating fewer monitors for pollutants in attainment of the NAAQS.
- Operating more monitors for non-attainment pollutants (O<sub>3</sub> and PM<sub>2.5</sub>).
- Operating fewer monitors for sites that are highly correlated.

# Criteria Pollutants Assessment

## Carbon Monoxide Monitoring

The Air District currently operates 13 permanent carbon monoxide (CO) monitors in its network. Carbon monoxide had been a problem in the past before lower tailpipe emission standards were enacted by California and national governmental agencies. The Air District has not exceeded the 1-hr CO standard since 1967, and has not exceeded the 8-hour national carbon monoxide standard since 1991. Carbon monoxide levels have continued to decrease since then to levels that are now less than 1/3 of the national standards at all locations in the Bay Area.

Figure 2 shows the current locations of carbon monoxide monitors. The stations are superimposed on a gridded carbon monoxide emission map. It shows that the stations are generally located in areas of significant CO emissions. Bethel Island, a background concentration site, can be seen in an area of low CO emissions.

EPA has no minimum requirements for the number of CO monitoring sites, and there are no monitors required for Air District SIP or Maintenance Plans. However, because the Air District will be operating an NCore site in San Jose beginning in January 2011, there is a requirement for a trace-level CO monitor at the San Jose station.

Table 1 lists the stations currently measuring carbon monoxide in the Bay Area by County. It also lists the monitoring objectives and the carbon monoxide design values for each site. The last column rates the importance of the data measured at the site in meeting the Air District's monitoring objectives.

The San Jose CO monitor is rated high because it is required as a part of NCore, is located in one of the three major cities in the Bay Area, and because it often has the highest carbon monoxide concentrations in the Bay Area (but still well below national CO standards).

In addition to the San Jose site, the Air District desires to operate at least one carbon monoxide monitor in each of the other nine Bay Area counties. Many of these monitors are rated medium because concentrations are low and there is no requirement to operate them. Currently only two counties have more than one CO monitor – Alameda and Contra Costa.

Alameda has three CO monitoring sites – Oakland, Oakland West, and Fremont. Oakland is rated high because Oakland is a major city in the Bay Area. Oakland West is rated high because it is a source-oriented site downwind of the Port of Oakland and Hwy 880. Fremont is another population oriented monitoring site, and since its design value is low and similar to other sites, it is rated low in importance.

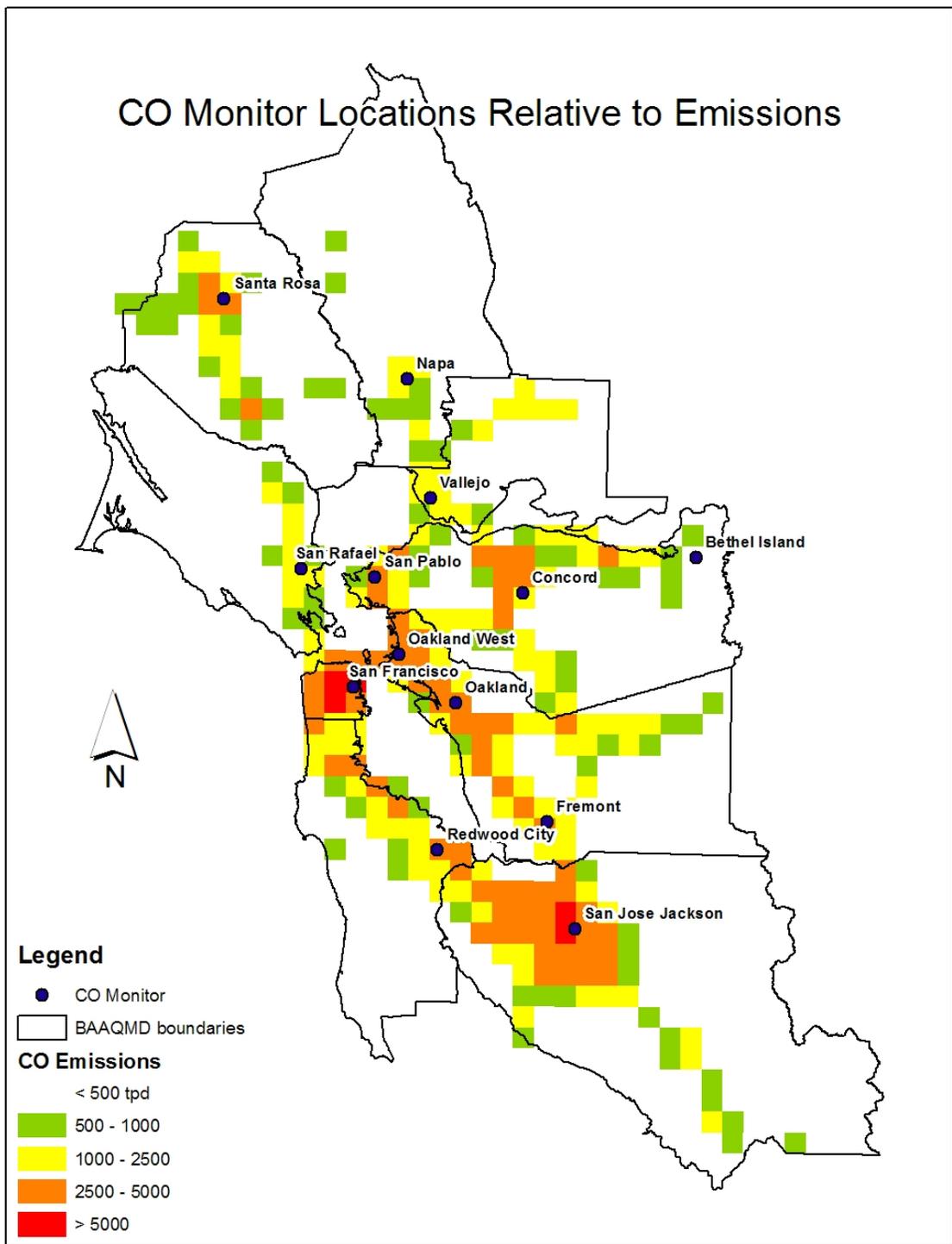


Figure 2. Map of Air District Carbon Monoxide Monitoring Stations and CO emissions.

Table 1. List of Permanent Carbon Monoxide Monitor Locations in 2009.

Station	County	Monitoring Objective	1-hr CO Design Value <sup>1</sup> (ppm)	8-hr CO Design Value <sup>2</sup> (ppm)	Assigned Value from Assessment
Fremont	Alameda	Population Oriented	2	1	Low
Oakland	Alameda	Population Oriented	3	2	High
Oakland West	Alameda	Source Oriented	3	2	High
Bethel Island	Contra Costa	Background	1	1	High
Concord	Contra Costa	Population Oriented	2	1	Medium
San Pablo	Contra Costa	Population Oriented	2	1	Low
San Rafael	Marin	Population Oriented	2	1	Medium
Napa	Napa	Population Oriented	2	1	Medium
San Francisco	San Francisco	Population Oriented	2	2	Medium
Redwood City	San Mateo	Population Oriented	3	2	Medium
San Jose	Santa Clara	NCore & Highest Concentration	3	2	High
Vallejo	Solano	Population Oriented	3	2	Medium
Santa Rosa	Sonoma	Population Oriented	2	1	Medium

<sup>1</sup> Design values at or below the national CO 1-hour standard of 35 ppm meet the standard.

<sup>2</sup> Design values at or below the national CO 8-hour standard of 9 ppm meet the standard.

Contra Costa County has three CO monitoring sites – Bethel Island, Concord, and San Pablo. The carbon monoxide monitor at Concord is rate medium because Concord is the largest city in Contra Costa with a large traffic volume nearby. Bethel Island is rated high because it is a carbon monoxide background location. San Pablo is another population oriented monitoring site, and since its design value is low and similar to other sites, it is rated low in importance.

## Ozone Monitoring

The Air District currently operates 18 permanent ozone (O<sub>3</sub>) monitors in its network. Although ozone levels have dropped significantly since the 1960s, exceedances of the national 8-hour ozone standard and the California 1-hour and 8-hours standards occur almost every year within the Bay Area. Because ozone is formed as a result of chemical reactions in the atmosphere, the highest ozone concentrations are usually found at distant downwind locations from oxides of nitrogen (NO<sub>x</sub>) and non-methane organic carbon (NMOC) precursor pollutant emissions. Consequently, the highest concentrations in the Bay Area are usually at downwind locations in the East Bay, in Livermore, Concord, Fairfield, and Bethel Island; and in the South Bay, in San Martin and Gilroy.

Figure 3 shows the current Bay Area ozone monitoring stations. The stations are superimposed on a color-coded map showing ozone concentrations on a high-ozone day. There are a number of wind patterns on hot days which can produce high ozone concentrations. The most common summertime wind pattern in the Bay Area is a delayed afternoon sea breeze that carries precursor pollutants to the eastern part of the Air District, as is depicted in the figure. This pattern produces high ozone levels at the eastern region of the Bay Area. Ozone monitors have been placed at Bethel Island, Livermore, Concord, and Fairfield to measure these high levels. The modeling-map also suggests there may be a high ozone area south of Bethel Island where there is currently no monitor.

Another common wind pattern transports ozone precursors southward into the southern Santa Clara Valley, which results in elevated ozone concentrations at San Martin and Gilroy. Occasionally a very light wind pattern occurs, which results in high ozone concentrations close to source areas near the bay, generally at San Jose, Los Gatos, Fremont, Napa, and Hayward.

The number of EPA-required ozone monitors is based on the Metropolitan Statistical Area (MSA) population and design value; as specified in Table D-2 of 40 CFR Part 58, Appendix D – SLAMS Minimum O<sub>3</sub> Monitoring Requirements. Ozone design values are a calculated concentration which is used for comparison with the national standard to determine the attainment status of an area for that pollutant (see footnote no.1 in Table 2). Table 2 shows that the Air District monitoring network meets or exceeds the ozone minimum monitoring requirements. No additional monitors have been required in the SIP or Maintenance Plan for ozone. However, there is an additional EPA requirement that an ozone monitor be located at the San Jose NCore station.

Because the meteorological conditions that result in ozone levels exceeding the national standard occur over a wide area, ozone levels are highly correlated at many Bay Area ozone stations. These conditions are strong sunlight, hot temperatures, and light winds. Table 3 lists correlations between ozone monitors having a high correlation in 2008 ( $r^2 \geq 0.75$ , this assessment's definition of a high correlation). Sites with lower correlations are not shown. When two stations are highly correlated, they produce similar data and one of them may be discontinued with minimal information loss. Table 3 also lists the Average Relative Difference between the two stations, on a scale of 0 to 1. It is determined by taking the mean

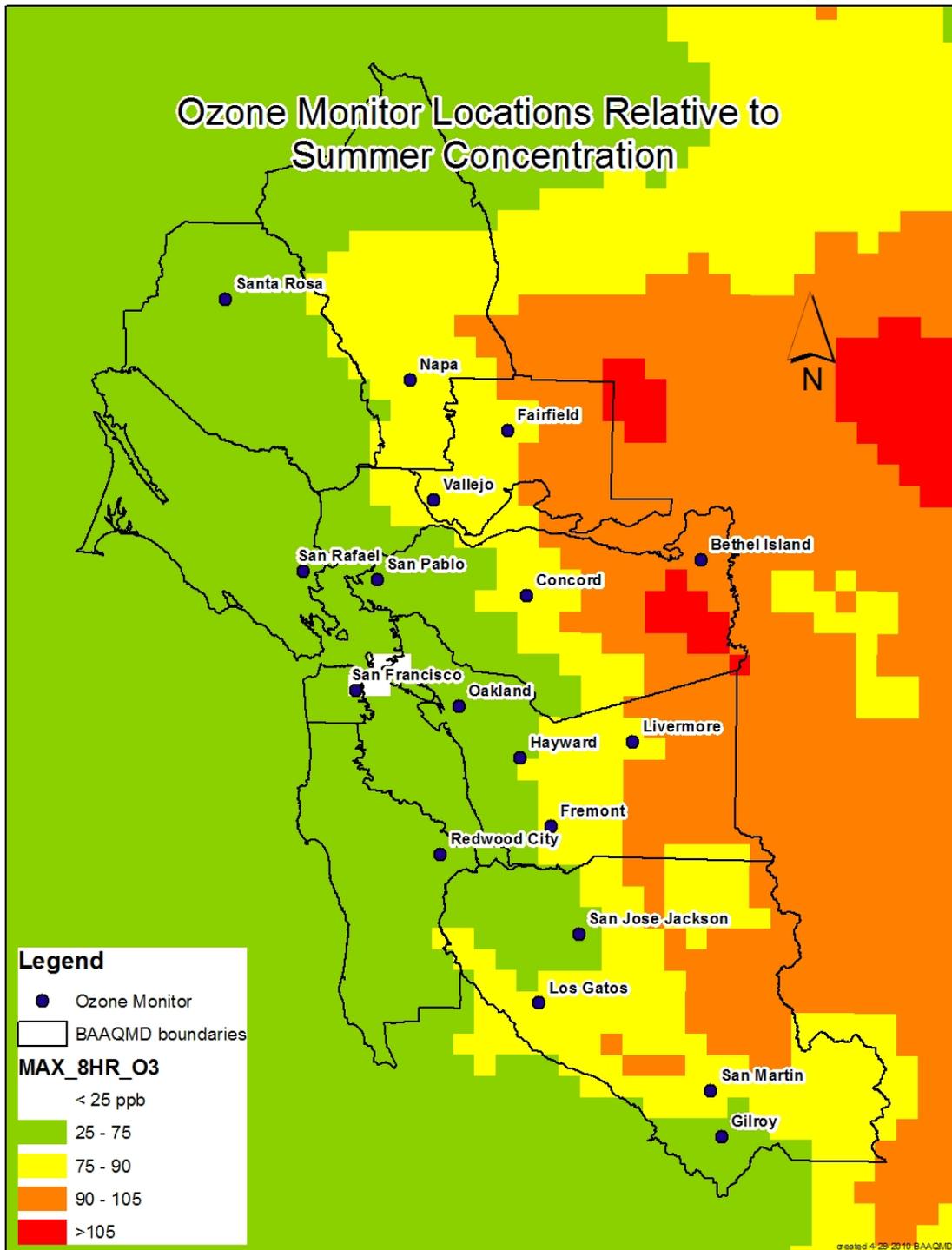


Figure 3. Map of Air District Ozone Monitoring Stations and typical maximum ozone levels on a high ozone day.

Table 2. Minimum Monitoring Requirements for Ozone SLAMS Sites.

MSA	County	Population in millions 2009	8-hour Design Value <sup>1</sup> (ppb) 2009	Number of Monitors Required	Number of Monitors Active
San Francisco-Oakland-Fremont	SF, Marin, Alameda, San Mateo, Contra Costa	4.32	78	3	10
San Jose-Sunnyvale-Santa Clara	Santa Clara, San Benito	1.84	72	2	6 <sup>2</sup>
Santa Rosa-Petaluma	Sonoma	0.47	52	1	1
Vallejo-Fairfield	Solano	0.41	67	2	3 <sup>3</sup>
Napa	Napa	0.13	61	1	1

<sup>1</sup> Design values are calculated at each monitoring site by taking the 3-year mean of the 4<sup>th</sup> highest 8-hour concentration. The design values shown for each MSA in this table are the highest design value of monitors in the MSA that are within the boundaries of the BAAQMD. Design values at or below the 0.075 ppm National Ambient Air Quality 8-hour Ozone Standard meet the standard.

<sup>2</sup> One of the monitors is located in Hollister in San Benito County and is operated by the Monterey Bay Unified Air Pollution Control District. Another monitor is located in Pinnacles National Monument and is operated by the National Park Service.

<sup>3</sup> One of the monitors is located in Vacaville in Solano County and is operated by the Yolo-Solano Air Pollution Control District.

Table 3. Ozone Stations Having Correlations  $\geq 0.75$  in 2008.

County	Station 1	Station 2	Avg Relative Diff (0 to 1)	Distance (km)	Correlation R-squared
Alameda	Fremont	Hayward	0.07	14	0.90
	Fremont	San Jose	0.11	22	0.88
	Fremont	Vallejo	0.10	67	0.80
	Hayward	Fremont	0.07	14	0.90
	Hayward	San Jose	0.09	36	0.85
	Hayward	Vallejo	0.08	53	0.82
	Hayward	Napa	0.09	76	0.80
	Hayward	Fairfield	0.12	63	0.79
	Livermore	Concord	0.07	35	0.90
	Livermore	Los Gatos	0.11	54	0.84
	Livermore	Fairfield	0.14	65	0.77
	Livermore	Bethel Island	0.12	38	0.77
	Oakland	San Pablo	0.10	29	0.81
Contra Costa	Bethel Island	Concord	0.11	35	0.82
	Bethel Island	Livermore	0.12	38	0.77
	Concord	Livermore	0.07	35	0.90
	Concord	Bethel Island	0.11	35	0.82
	Concord	Fairfield	0.12	32	0.79

Table 3 continued. Ozone Stations Having Correlations  $\geq 0.75$  in 2008.

County	Station 1	Station 2	Avg Relative Diff (0 to 1)	Distance (km)	Correlation R-squared
Contra Costa	Concord	Los Gatos	0.11	78	0.78
	San Pablo	Oakland	0.10	29	0.81
	San Pablo	San Rafael	0.10	14	0.80
	San Pablo	San Francisco	0.09	22	0.80
	San Pablo	Redwood City	0.11	54	0.77
Marin	San Rafael	Vallejo	0.18	28	0.83
	San Rafael	Redwood City	0.10	61	0.80
	San Rafael	San Pablo	0.10	14	0.80
Napa	Napa	Fairfield	0.07	21	0.91
	Napa	Vallejo	0.07	24	0.89
	Napa	Hayward	0.09	76	0.80
	Napa	San Jose	0.10	112	0.75
San Francisco	San Francisco	San Pablo	0.09	22	0.80
San Mateo	Redwood City	San Rafael	0.10	61	0.80
	Redwood City	San Pablo	0.11	54	0.77
Santa Clara	Gilroy	San Martin	0.37	9	0.86
	Gilroy	Hollister	0.57	26	0.77
	Los Gatos	San Jose	0.10	15	0.86
	Los Gatos	Livermore	0.11	54	0.84
	Los Gatos	Concord	0.11	78	0.78
	Los Gatos	Fairfield	0.11	111	0.75
	San Jose	Fremont	0.11	22	0.88
	San Jose	Los Gatos	0.10	15	0.86
	San Jose	Hayward	0.09	36	0.85
	San Jose	Fairfield	0.10	98	0.78
	San Jose	Vallejo	0.11	89	0.76
	San Jose	Napa	0.10	112	0.75
Solano	Fairfield	Napa	0.07	21	0.91
	Fairfield	Concord	0.12	32	0.79
	Fairfield	Hayward	0.12	63	0.79
	Fairfield	San Jose	0.10	98	0.78
	Fairfield	Vallejo	0.11	20	0.78
	Fairfield	Livermore	0.14	65	0.77
	Fairfield	Los Gatos	0.11	111	0.75
	Vallejo	Napa	0.07	24	0.89
	Vallejo	San Rafael	0.18	28	0.83
	Vallejo	Hayward	0.08	53	0.82
	Vallejo	Fremont	0.10	67	0.80
	Vallejo	Fairfield	0.11	20	0.78
	Vallejo	San Jose	0.11	89	0.76

of the absolute value difference between concentrations at the two sites and dividing by the average difference. Site pairs with a lower relative difference are more similar to each other than pairs with a larger difference. The next column lists the distance between sites in kilometers.

Table 4 lists the Bay Area stations currently measuring ozone by county. It also lists the monitoring objectives and the ozone design values for each site. The last column rates the importance of the data measured at the site in meeting both the Air District's and EPA's monitoring objectives.

Table 4. List of Permanent Ozone Monitor Locations in 2009.

Station	County	Monitoring Objective	8-hr Design Value <sup>1</sup> (ppb)	Assigned Value from Assessment
Fremont	Alameda	Population Oriented	61	Low
Hayward	Alameda	Population Oriented	64	Medium
Livermore	Alameda	Population Oriented & Highest Concentration	78	High
Oakland	Alameda	Population Oriented	57	High
Bethel Island	Contra Costa	Transport & Highest Concentration	74	High
Concord	Contra Costa	Population Oriented & Highest Concentration	74	High
San Pablo	Contra Costa	Population Oriented	50	Low
San Rafael	Marin	Population Oriented	52	High
Napa	Napa	Population Oriented	61	High
San Francisco	San Francisco	Population Oriented	48	High
Redwood City	San Mateo	Population Oriented	56	High
Gilroy	Santa Clara	Population Oriented & Highest Concentration	70	High
Los Gatos	Santa Clara	Population Oriented	70	High
San Jose	Santa Clara	NCore	62	High
San Martin	Santa Clara	Highest Concentration	72	High
Fairfield	Solano	Transport & Highest Concentration	67	High
Vallejo	Solano	Population Oriented	61	Medium
Santa Rosa	Sonoma	Population Oriented	52	High

<sup>1</sup> Design values at or below the national Ozone standard of 75 ppb meet the standard.

The importance of each ozone monitor is related to:

- EPA minimum monitoring requirements.
- Demonstration of attainment of air quality standards.
- Proximity of the site to other sites.
- The monitoring purpose.
- The number of monitors in a county.
- Data correlation to neighboring sites.
- The size of the population in the surrounding area.

The Air District desires to operate at least one ozone monitor in each of the nine Bay Area counties. There are five counties with only one monitor: San Francisco, San Mateo, Marin, Sonoma, and Napa. These monitors are highly rated because 8-hour ozone levels are higher than one half of the national standard (currently 75 ppb), and they are the only measurements in those counties. The monitors in Napa and Sonoma Counties are also needed to meet the MSA minimum monitoring requirements, listed in Table 2.

Alameda County has four ozone monitors. Livermore is rated high because it has a design value above the national standard. Oakland is rated high because it is a major city in the Bay Area and it is not well correlated with Livermore ( $r^2=0.16$ ). Hayward and Fremont sites are well correlated with each other, having an ( $r^2=0.90$ , see Table 3), and are located near each other. Thus, one monitor could be used to represent the entire Hayward-Fremont area. In addition, both Fremont and Hayward are well correlated with San Jose,  $r^2 = 0.88$  and  $0.85$  respectively, suggesting San Jose ozone measurements could reasonably represent those areas as well. Neither Fremont nor Hayward has design values close to the standard, and the locations do not have any major importance, so both could be rated low if San Jose ozone measurements are substituted. However, Hayward ozone measurements are used as input to the daily ozone forecast model. Consequently, Hayward is rated as medium, and Fremont is rated as low.

Contra Costa County has three ozone monitoring sites. Bethel Island and Concord are rated high because their design values are very close to the national standard, and both are likely to exceed the new proposed ozone standard expected to be finalized in the fall of 2010 (the new standard is expected to be in the range of 0.60 ppm to 0.70 ppm). These sites are also important because Bethel Island is a site located to measure pollutants into and out of the Central Valley, and Concord is the largest city in Contra Costa County. San Pablo is rated low because its design value is low and it is well correlated with Oakland ( $r^2=0.81$ ).

EPA requires that the Santa Clara and San Benito MSA have at least 2 monitors. Monterey Bay Unified APCD already operates one ozone monitor in San Benito County at Hollister. As long as they continue to operate it, EPA requires that the BAAQMD operate only one ozone monitor in Santa Clara County. Currently, Santa Clara County has four ozone monitoring sites. The San Jose station is in one of the 3 major cities of the Bay Area, and is an NCore site. Gilroy, Los Gatos, and San Martin monitors have design values below the current national standard, but are likely to equal or exceed the new proposed ozone standard. The correlation between the San Jose and Los Gatos monitors, and between the San Martin and Gilroy monitors, is high (0.86 for each). However, even though correlations are high for these sites, there are some days when ozone exceedances occur at only one of the four sites, due to localized sea breeze patterns. Thus, all four sites are rated high.

Solano County is in the Vallejo-Fairfield MSA, and must have two monitors to meet EPA ozone monitoring requirements. Yolo-Solano APCD operates one ozone monitor in Vacaville. The EPA requirement will be met as long as the Air District operates at least one other monitor. Currently the BAAQMD operates two ozone monitoring sites in Solano County, Vallejo and Fairfield. Both sites have recorded ozone exceedances in the past three

years. Fairfield is rated high because it is an ozone transport site. Vallejo is rated medium because it is highly correlated with Napa ( $r^2=0.89$ ), and a number of other sites.

## Nitrogen Dioxide Monitoring

The Air District currently operates 15 permanent nitrogen dioxide monitors in its network. Nitrogen dioxide (NO<sub>2</sub>) monitors also measure nitrogen oxide (NO), and the sum of NO<sub>2</sub> and NO, called NO<sub>x</sub>. NO/NO<sub>2</sub> measurements have been made in the Bay Area since the 1960s, and NO<sub>2</sub> levels have never exceeded the national 24-hour standard. There is currently no California or national nitrogen oxide (NO) standard. In February 2010, EPA promulgated a new 1-hour NO<sub>2</sub> standard, and a review of Bay Area historical data have shown that the new standard was last exceeded in 2006 at the San Francisco station (with 0.107 ppm). NO and NO<sub>2</sub> are formed from vehicle, power plant and other industrial emissions, and contribute to the formation of ozone and fine particulate.

Figure 4 shows the current locations of nitrogen dioxide monitors. The stations are superimposed on a gridded NO<sub>x</sub> emission map. NO<sub>x</sub> is used in place of NO<sub>2</sub> because the amount of NO<sub>x</sub> is better quantifiable and because NO and NO<sub>2</sub> concentrations change throughout the day depending upon the amount of sunlight, the ambient temperature, and the concentration of oxidizing pollutants available in the air. The map shows that the stations are generally located in areas of high NO<sub>x</sub> emissions. Bethel Island, a site located to measure transported pollutants, is in an area of low NO<sub>x</sub> emissions.

By 2013, the new regulations require the Air District to operate two additional population-oriented monitors and three roadside monitors located within 50 meters of major freeways. The new monitoring requirements are based on Bay Area population and traffic counts. Monitoring requirement details are listed in Table 5. No additional monitors are required for the SIP or Maintenance Plans because the Air District has never been designated as non-attainment for NO<sub>2</sub>.

Table 6 lists the stations currently measuring nitrogen dioxide in the Bay Area in each county. It also lists the monitoring objectives and the NO<sub>2</sub> design values for each site. The last column rates the importance of the data measured at the site in meeting Air District and EPA monitoring objectives.

The Air District desires to operate at least one NO<sub>2</sub> monitor in each of the nine Bay Area counties. There are seven counties with only one monitor: San Francisco, San Mateo, Marin, Sonoma, Santa Clara, Solano, and Napa. Five of these, San Mateo, Marin, Sonoma, Solano, and Napa are rated medium in importance because NO<sub>2</sub> levels are only about one half of the 1-hour national standard, and less than a quarter of the national annual standard.

The monitor at San Francisco is rated high because San Francisco is one of the three major cities in the Bay Area. The monitor at San Jose is rated high because it is one of the three major cities in the Bay Area; it is required as part of NCore monitoring, and it meets the minimum monitoring requirements for Santa Clara County under the new EPA NO<sub>2</sub> regulations.

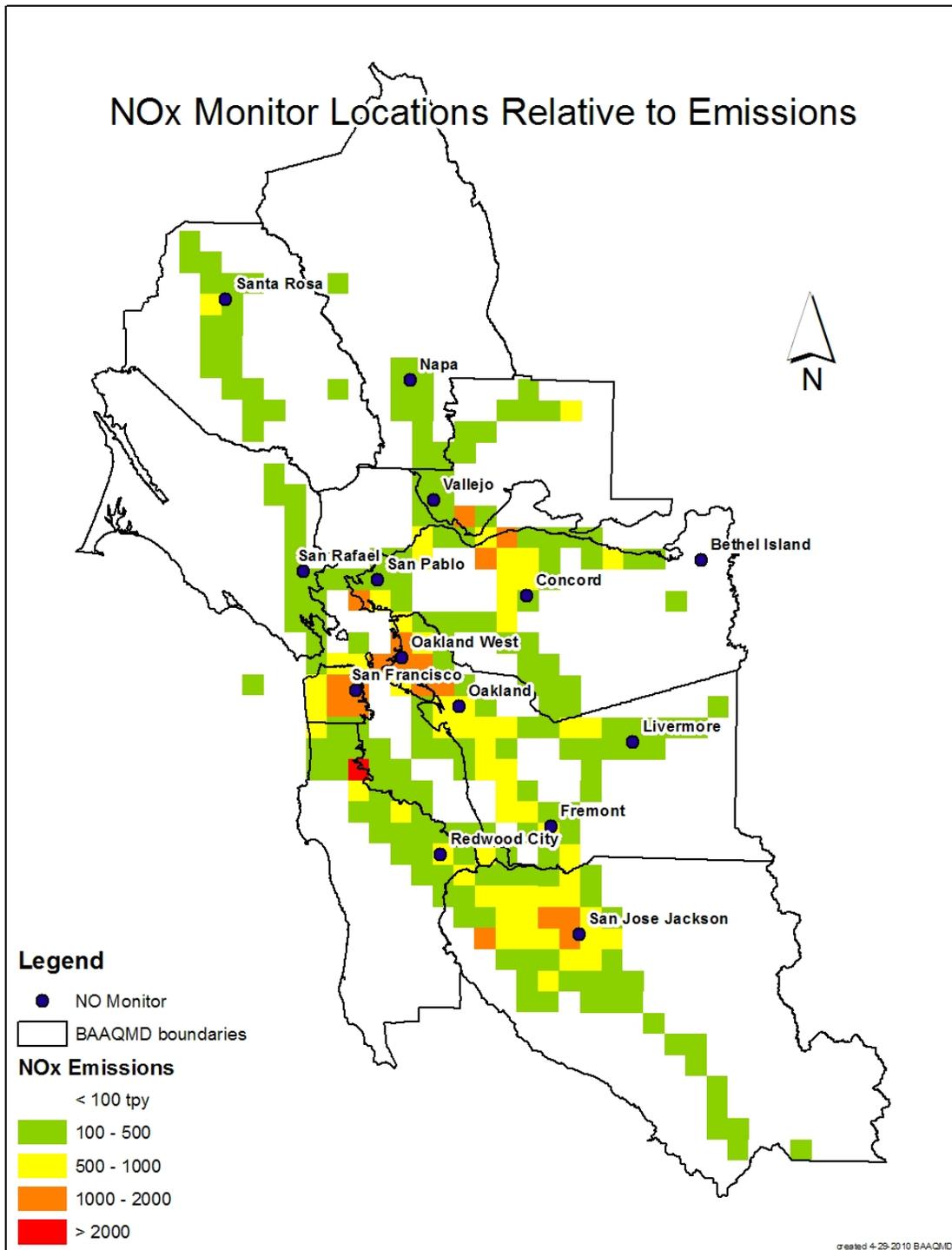


Figure 4. Map of Air District Nitrogen Dioxide Monitoring Stations and NO<sub>x</sub> emissions.

Table 5. Minimum Monitoring Requirements for NO<sub>2</sub> SLAMS Sites in 2013.

MSA	County	Population in millions 2009	Annual Design Value <sup>1</sup> (ppb) 2009	24-hour Design Value <sup>2</sup> (ppb) 2009	Area-wide Monitors Required	Area-wide Monitors Active
					Roadside Monitors Required	Roadside Monitors Active
SF-Oakland-Fremont	SF, San Mateo, Alameda, Marin, Contra Costa	4.32	16	54	1	10
					2	0
San Jose-Sunnyvale-Santa Clara	Santa Clara, San Benito	1.84	15	53	1	1
					1	0
Santa Rosa-Petaluma	Sonoma	0.47	9	38	0	1
					0	0
Vallejo-Fairfield	Solano	0.41	10	42	0	1
					0	0
Napa	Napa	0.13	10	39	0	1
					0	0

<sup>1</sup> Annual design values are determined for each monitoring site by calculating the arithmetic average of all of the reported 1-hour values for the most current year. The design values shown for each MSA in this table are the highest design value of monitors in the MSA that are within the boundaries of the BAAQMD. Design values at or below the national NO<sub>2</sub> annual standard of 53 ppb meet the standard.

<sup>2</sup> Daily design values are calculated at each monitoring site by taking the 3-year mean of the 8<sup>th</sup> highest daily maximum 1-hour concentration. The design values shown for each MSA in this table are the highest design value of monitors in the MSA that are within the boundaries of the BAAQMD. Design values at or below the national NO<sub>2</sub> 1-hour standard of 100 ppb meet the standard.

Alameda County has four nitrogen dioxide monitors. Livermore is rated high because ozone exceedances occur and NO/NO<sub>2</sub> data are needed for modeling and analysis as ozone precursors. Oakland is rated high because it is one of the major cities in the Bay Area. Oakland West is rated high because it is a source-oriented site. Fremont is rated low because there is no particular need for the monitor, and the design value is well below national air quality standards.

Contra Costa County has three nitrogen dioxide monitoring sites. Bethel Island and Concord are rated high because NO/NO<sub>2</sub> data are needed for modeling and analysis of ozone exceedances. Bethel Island is also important for measuring NO<sub>x</sub> transport to and from neighboring air districts. San Pablo is rated low because there is no specific need for the data, and NO<sub>2</sub> design values are low.

Table 6. List of Permanent Nitrogen Dioxide Monitor Locations in 2009.

Station	County	Monitoring Objective	1-hour Design Value <sup>1</sup> (ppb)	Annual Design Value <sup>2</sup> (ppb)	Assigned Value from Assessment
Fremont	Alameda	Population Oriented	47	13	Low
Livermore	Alameda	Population Oriented	47	12	High
Oakland	Alameda	Population Oriented	52	14	High
Oakland West	Alameda	Source Oriented	49	16	High
Bethel Island	Contra Costa	Transport & Backgrnd	31	6	High
Concord	Contra Costa	Population Oriented	37	9	Medium
San Pablo	Contra Costa	Population Oriented	44	12	Low
San Rafael	Marin	Population Oriented	45	12	Medium
Napa	Napa	Population Oriented	39	10	Medium
San Francisco	San Francisco	Population Oriented	54	15	High
Redwood City	San Mateo	Population Oriented	46	12	Medium
San Jose	Santa Clara	NCore	53	15	High
Vallejo	Solano	Population Oriented	42	10	Medium
Santa Rosa	Sonoma	Population Oriented	38	9	Medium

<sup>1</sup> Design values at or below the national NO<sub>2</sub> 1-hour standard of 100 ppb meet the standard.

<sup>2</sup> Design values at or below the national NO<sub>2</sub> annual standard of 53 ppb meet the standard.

The new NO<sub>2</sub> regulations require three roadside monitors by 2013. The Air District is currently studying optimal locations for these new monitors. Roadside monitors are classified as microscale monitoring, and will not be considered representative of areas where the general population live and work which are neighborhood or urban scale measurements. Consequently, roadside monitoring will not affect the importance rating of monitors located at the permanent Air District stations.

## **Sulfur Dioxide Monitoring**

The Air District currently operates nine permanent sulfur dioxide monitors (SO<sub>2</sub>) in its network. SO<sub>2</sub> measurements have been made in the Bay Area since 1969, and during that time SO<sub>2</sub> levels have never exceeded the national 24-hour or the national annual standard. In June 2010, EPA revised the primary SO<sub>2</sub> standard by establishing a new 1-hour standard at a level of 75 ppb, and revoking the two existing 24-hour and annual primary standards. SO<sub>2</sub> also contributes to the formation of fine particulate pollution.

Figure 5 shows the current locations of sulfur dioxide monitors. The stations are superimposed on a gridded SO<sub>2</sub> emission map. The map shows areas off the coast and on the San Francisco Bay with SO<sub>2</sub> emissions. These emissions are from ships. The Oakland West SO<sub>2</sub> monitor is located downwind of the Port of Oakland to measure SO<sub>2</sub> from shipping. The other major source of SO<sub>2</sub> emissions are Bay Area refineries owned by Chevron, Shell, Tesoro, Valero, and ConocoPhillips. Most of the remaining monitors are located near these refineries. One other SO<sub>2</sub> monitor is located at the San Jose NCore site, a requirement of 40 CFR Part 58. Bethel Island also has an SO<sub>2</sub> monitor to measure background levels and pollutant transport to and from neighboring air districts.

The Air District already meets the minimum number of SO<sub>2</sub> monitors under the new monitoring requirements. See Table 7 for monitoring requirement details. No additional monitors are required for SIP or Maintenance Plans, because the Air District has never been designated as non-attainment for SO<sub>2</sub>, and no SIP or Maintenance Plans have been prepared for SO<sub>2</sub>.

Table 8 lists the stations currently measuring sulfur dioxide in the Bay Area in each county. It also lists the monitoring objectives and the SO<sub>2</sub> design values based on the new 1-hour standard for each site. It shows that current design values are significantly below the 75 ppb 1-hour SO<sub>2</sub> national standard, and therefore the Bay Area will be in attainment of the new SO<sub>2</sub> standard. The last column rates the importance of the data measured at the site in meeting both the Air District's and EPA's monitoring objectives.

Unlike other pollutants, SO<sub>2</sub> concentrations are normally measured near sources. Counties without sources usually have concentrations near background levels. Under the EPA regulations, the Air District is only required to operate three SO<sub>2</sub> monitors, two in the San Francisco-Oakland-Fremont MSA, and one in San Jose-Sunnyvale-Santa Clara MSA. The Air District currently operates a required NCore SO<sub>2</sub> monitor at San Jose, which also satisfies the San Jose-Sunnyvale-Santa Clara MSA requirement. This monitor is rated high.

The only SO<sub>2</sub> monitor in Alameda County is at the Oakland West monitoring station. These measurements are rated high due to the proximity of shipping lanes and the Port of Oakland.

Contra Costa County has six SO<sub>2</sub> monitors. Three monitors are rated high: Concord which is downwind of the Tesoro Refinery, Crockett which is downwind of the ConocoPhillips Refinery, and Martinez which is downwind of the Shell Refinery. These three monitors exceed the two-monitor requirement for the San Francisco-Oakland-Fremont MSA.

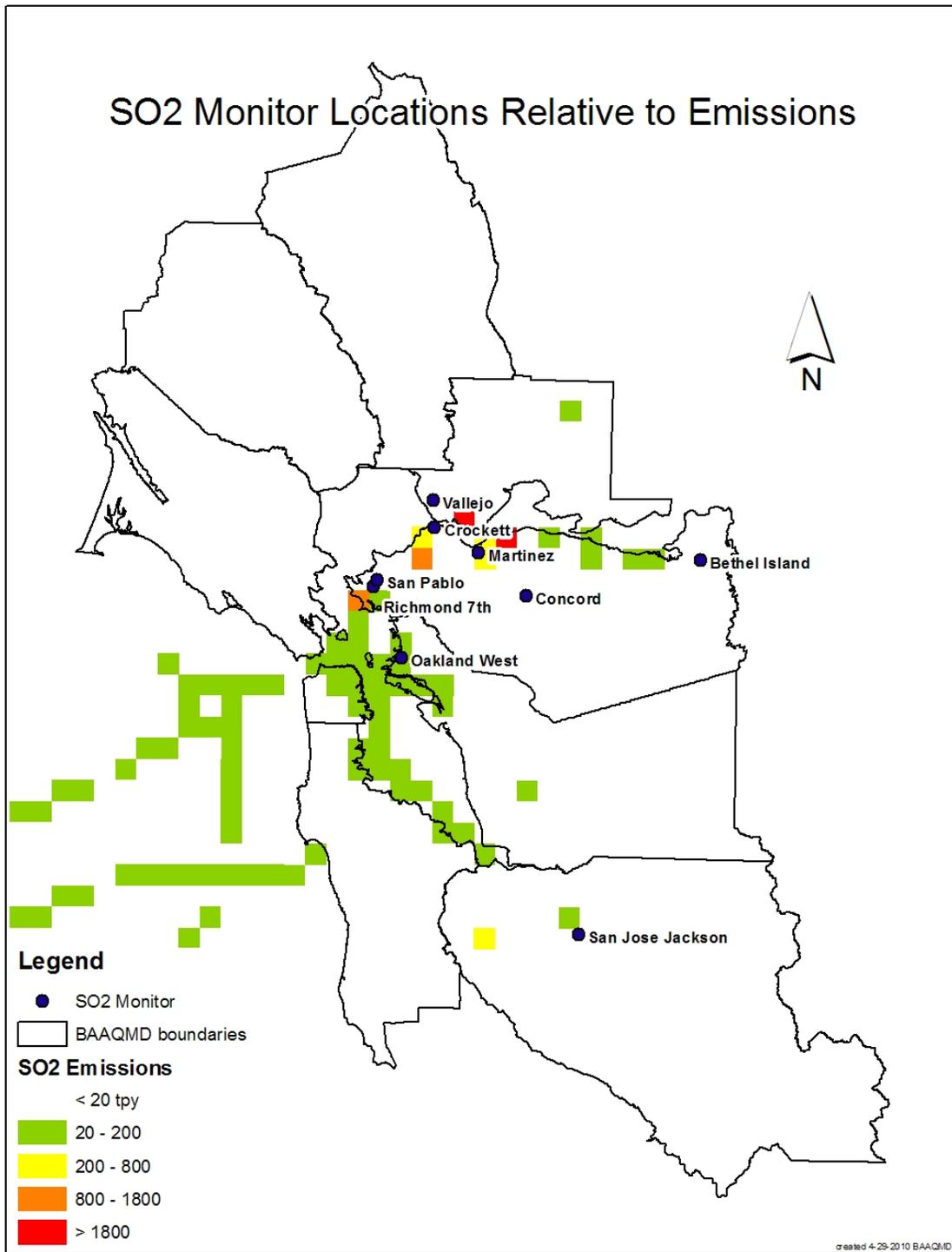


Figure 5. Map of Air District Sulfur Dioxide Monitoring Stations and SO<sub>2</sub> emissions.

Table 7. Minimum Monitoring Requirements for SO<sub>2</sub> SLAMS Sites in 2013.

MSA	County	Number of Monitors Required	Number of Monitors Active
San Francisco-Oakland-Fremont	SF, San Mateo, Alameda, Marin, Contra Costa	2	7 <sup>1</sup>
San Jose-Sunnyvale-Santa Clara	Santa Clara, San Benito	1	1
Santa Rosa-Petaluma	Sonoma	0	0
Vallejo-Fairfield	Solano	0	1
Napa	Napa	0	0

<sup>1</sup> The seven monitors include the permanent Crockett monitor which does not meet certain SLAMS siting criteria and is designated as an SPM monitor.

Table 8. List of Permanent Sulfur Dioxide Monitor Locations in 2009.

Station	County	Monitoring Objective	1-hour Design Value <sup>1</sup> (ppb)	Assigned Value from Assessment
Oakland West	Alameda	Source Oriented	13	High
Bethel Island	Contra Costa	Transport & Backgrnd	8	Medium
Concord	Contra Costa	Population Oriented	14	High
Crockett	Contra Costa	Source Oriented	25	High
Martinez	Contra Costa	Source Oriented	18	High
Richmond 7 <sup>th</sup>	Contra Costa	Source Oriented	18	High/Low
San Pablo	Contra Costa	Source Oriented	14	High/Low
San Jose	Santa Clara	NCore	5	High
Vallejo	Solano	Source Oriented	8	Medium

<sup>1</sup> Design values at or below the national SO<sub>2</sub> 1-hour standard of 75 ppb meet the standard.

There are three other sites in Contra Costa County. The San Pablo and the Richmond 7<sup>th</sup> monitoring sites are downwind of Chevron Refinery. These sites are close to each other (one mile apart). One site should be rated high and the other low because of their proximity and similar low design values. The Bethel Island monitor is rated medium in importance because it provides background SO<sub>2</sub> concentration data.

The Solano County monitor in Vallejo is 5.4 miles downwind of the Valero Refinery on east wind days and is rated medium because of its distance from the refinery.

## PM<sub>10</sub> Monitoring

The Air District currently operates seven permanent PM<sub>10</sub> monitors in its network. The highest Bay Area PM<sub>10</sub> levels in the last three years are about half of the 150 µg/m<sup>3</sup> national 24-hour standard. The last exceedances of the 24-hour national standard were in 1991 at Livermore and San Jose. The Air District also analyzes PM<sub>10</sub> filters to determine ambient levels of anions and cations, and organic carbon/elemental carbon.

Figure 6 shows the current Bay Area PM<sub>10</sub> monitoring stations. The stations are superimposed on a gridded PM<sub>10</sub> emission map. It shows that the stations are generally located in areas of high PM<sub>10</sub> emissions. Bethel Island, a background/transport site, is located in an area of low PM<sub>10</sub> emissions.

The number of required PM<sub>10</sub> monitors for each MSA in the Bay Area is determined by its population and design value, as specified in Table D-4 of Appendix D to 40 CFR Part 58 – PM<sub>10</sub> Minimum Monitoring Requirements. PM<sub>10</sub> design values are a calculated concentration (see footnote no.1 below in Table 9) which are used to determine the PM<sub>10</sub> attainment status of an area. Table 9 shows that the Air District monitoring network meets or exceeds the PM<sub>10</sub> minimum monitoring requirements. No additional monitors are required for the SIP or Maintenance Plan because the Bay Area has never been designated as non-attainment for PM<sub>10</sub>, and no SIP or Maintenance Plans have been prepared for PM<sub>10</sub>.

Table 9. Minimum Monitoring Requirements for PM<sub>10</sub> SLAMS Sites.

MSA	County	Population in millions 2009	Max 24 hr Value µg/m <sup>3</sup> (2007-09)	Number of Monitors Required	Number of Monitors Active
San Francisco-Oakland-Fremont	SF, San Mateo, Alameda, Marin, Contra Costa	4.32	78.2	2	5
San Jose-Sunnyvale-Santa Clara	Santa Clara, San Benito	1.84	72.9	2	2 <sup>2</sup>
Santa Rosa-Petaluma	Sonoma	0.47	None <sup>3</sup>	0	0
Vallejo-Fairfield	Solano	0.41	None <sup>3</sup>	0	0
Napa	Napa	0.13	51.7	0	1

<sup>1</sup> For PM<sub>10</sub>, the design value is defined as the expected number of exceedances per year, which is calculated by averaging the number of exceedances for the past 3 years. Since there were no exceedances in the past 3 years, the PM<sub>10</sub> design value is zero for all MSA's within the Bay Area Air Quality Management District. The 24-hour standard (150 µg/m<sup>3</sup>) is attained when the design value is less than or equal to one. Instead of the PM<sub>10</sub> design value, the number shown in this column is the highest 24-hour PM<sub>10</sub> concentration in 2007-2009.

<sup>2</sup> One of the monitors is located in Hollister in San Benito County and is operated by the Monterey Bay Unified Air Pollution Control District.

<sup>3</sup> There are no FRM or FEM PM<sub>10</sub> monitors in this MSA.

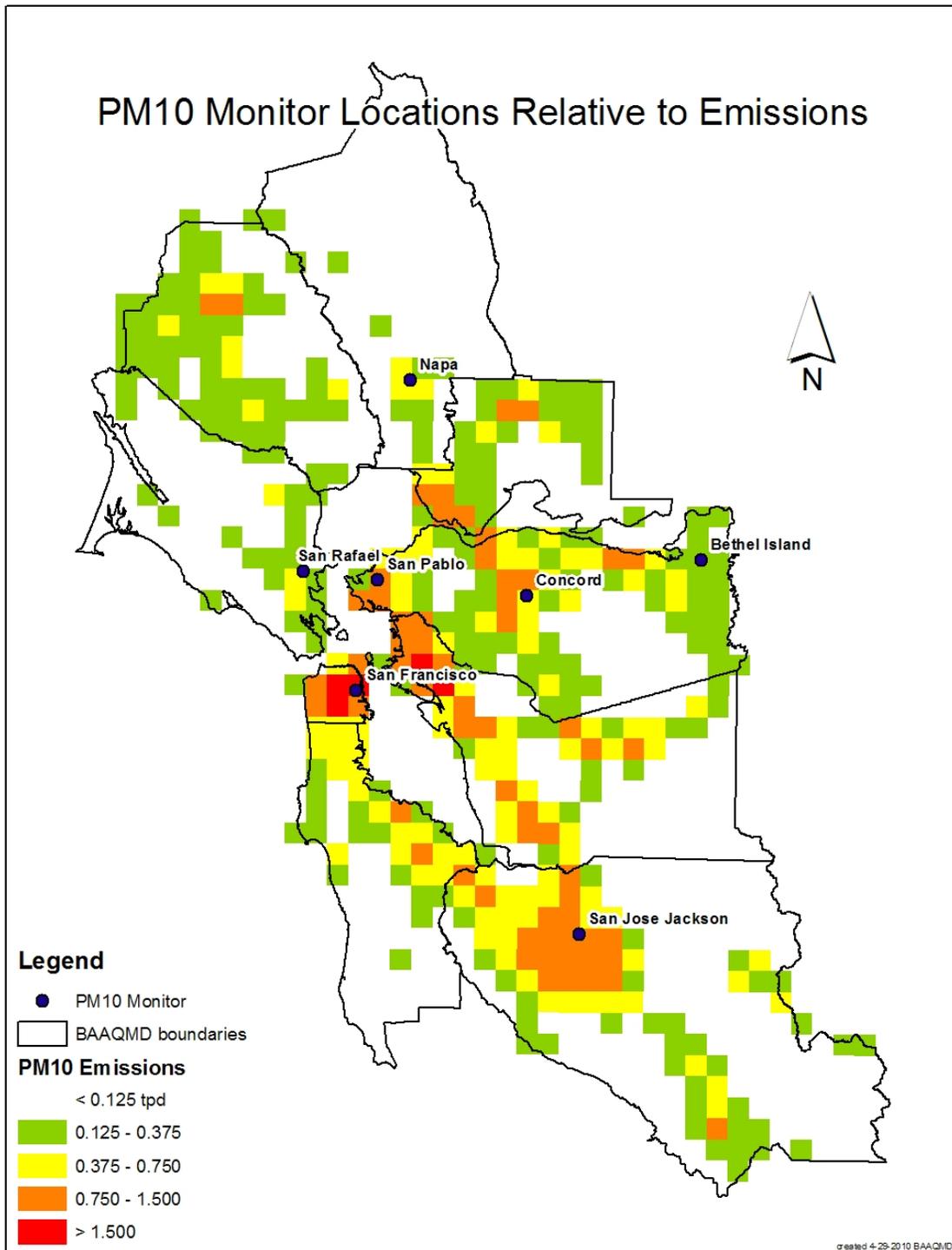


Figure 6. Map of Air District PM<sub>10</sub> Monitoring Stations and PM<sub>10</sub> emissions.

Because PM<sub>10</sub> levels are one-half or less of the national standard, there is no need to measure PM<sub>10</sub> in every county. Instead, monitoring resources have been put into sampling for fine particulate sampling (PM<sub>2.5</sub>) because the Bay Area is not in attainment of the 24-hour PM<sub>2.5</sub> national standard, and because the fine particles have more serious health impacts.

Table 10 shows correlations between the Bay Area PM<sub>10</sub> monitors for 2008. The table shows PM<sub>10</sub> correlations to be lower than the ozone correlations in Table 3. This suggests that PM<sub>10</sub> is more of a local problem, while ozone is more of an area-wide problem. The only sites with a high correlation are San Francisco and San Pablo, with an  $r^2=0.88$ . Table 10 also lists the Average Relative Difference between each two stations, on a scale of 0 to 1. It is determined by taking the mean of the absolute value difference between concentrations at the two sites and dividing by the average difference. Site pairs with a lower relative difference are more similar to each other than pairs with a larger difference. The next column lists the distance between sites in kilometers.

Table 11 lists the stations currently measuring PM<sub>10</sub> in the Bay Area along with monitoring objective and the maximum 24-hour value ( $\mu\text{g}/\text{m}^3$ ) from 2007-09 for each site. The last column rates the importance of the data measured at the site in meeting the Air District and EPA monitoring objectives.

Under EPA regulations, the Air District is required to operate two PM<sub>10</sub> monitors in the San Francisco-Oakland-Fremont MSA. Currently there are five PM<sub>10</sub> monitors within the MSA which includes Contra Costa, Marin, and San Francisco Counties. Bethel Island, Concord, and San Rafael are rated medium because none are measuring high PM<sub>10</sub> concentrations. San Francisco is rated high because it is located in one of the three major Bay Area cities, and because it is highly correlated with San Pablo ( $r^2=0.88$ ), shown in Table 10. San Pablo is rated low because its PM<sub>10</sub> values are low and the data are highly correlated with San Francisco data.

The Air District operates one PM<sub>10</sub> monitor in Napa County. There is no requirement for PM<sub>10</sub> monitoring in Napa County, and the concentrations are not particularly high, so it is rated as medium.

There is currently no PM<sub>10</sub> monitoring in Alameda County. The PM<sub>10</sub> emissions map suggests that due to high PM<sub>10</sub> emissions in Oakland, a monitor should be located in the Oakland area.

Two PM<sub>10</sub> monitors are required for the San Jose-Sunnyvale-Santa Clara MSA. One monitor is being operated by the Monterey Bay Unified APCD in San Benito County. The second monitor is at the San Jose station. It will also be used to derive PM course measurements, which can be calculated by subtracting PM<sub>2.5</sub> concentrations from PM<sub>10</sub> concentrations. Consequently, the San Jose PM<sub>10</sub> monitor is rated high.

Table 10. PM<sub>10</sub> Correlations Between Stations in 2008.

County	Station 1	Station 2	Avg Relative Diff (0 to 1)	Distance (km)	correlation R-squared
Contra Costa	Bethel Island	Concord	0.36	35	0.61
	Bethel Island	Napa	0.34	66	0.44
	Bethel Island	San Jose	0.33	76	0.38
	Bethel Island	San Rafael	0.39	77	0.34
	Bethel Island	San Pablo	0.37	63	0.30
	Bethel Island	San Francisco	0.38	72	0.27
	Concord	Napa	0.25	48	0.74
	Concord	San Rafael	0.22	43	0.66
	Concord	San Jose	0.33	66	0.64
	Concord	Bethel Island	0.36	35	0.61
	Concord	San Pablo	0.30	29	0.53
	Concord	San Francisco	0.33	38	0.46
	San Pablo	San Francisco	0.12	22	0.88
	San Pablo	San Rafael	0.20	14	0.74
	San Pablo	San Jose	0.21	79	0.58
	San Pablo	Concord	0.30	29	0.53
	San Pablo	Napa	0.24	39	0.53
	San Pablo	Bethel Island	0.37	63	0.30
Napa	Napa	Concord	0.25	48	0.74
	Napa	San Rafael	0.22	42	0.69
	Napa	San Jose	0.22	112	0.60
	Napa	San Pablo	0.24	39	0.53
	Napa	Bethel Island	0.34	66	0.44
San Francisco	San Francisco	San Pablo	0.12	22	0.88
	San Francisco	San Rafael	0.23	25	0.67
	San Francisco	San Jose	0.24	64	0.50
	San Francisco	Concord	0.33	38	0.46
	San Francisco	Napa	0.27	61	0.44
	San Francisco	Bethel Island	0.38	72	0.27
Santa Clara	San Jose	Concord	0.33	66	0.64
	San Jose	Napa	0.22	112	0.60
	San Jose	San Pablo	0.21	79	0.58
	San Jose	San Rafael	0.25	88	0.56
	San Jose	San Francisco	0.24	64	0.50
	San Jose	Bethel Island	0.33	76	0.38
Marin	San Rafael	San Pablo	0.20	14	0.74
	San Rafael	Napa	0.22	42	0.69
	San Rafael	San Francisco	0.23	25	0.67
	San Rafael	Concord	0.22	43	0.66
	San Rafael	San Jose	0.25	88	0.56
	San Rafael	Bethel Island	0.39	77	0.34

Table 11. List of Permanent PM<sub>10</sub> Monitor Locations in 2009.

Station	County	Monitoring Objective	Max 24 hour Value (µg/m <sup>3</sup> ) 2007-09	Assigned Value from Assessment
Bethel Island	Contra Costa	Background & Transport	78.2	Medium
Concord	Contra Costa	Population Oriented	50.5	Medium
San Pablo	Contra Costa	Population Oriented	54.4	Low
San Rafael	Marin	Population Oriented	52.6	Medium
Napa	Napa	Population Oriented	51.7	Medium
San Francisco	San Francisco	Population Oriented	65.7	High
San Jose	Santa Clara	NCore	64.7	High

<sup>1</sup> 24-hour values at or below the national PM<sub>10</sub> standard of 150 µg/m<sup>3</sup> meet the standard.

## **PM<sub>2.5</sub> Monitoring**

The Air District currently operates PM<sub>2.5</sub> monitors at 13 sites in the Bay Area, and the California Air Resources Board operates a monitoring site in Point Reyes. Nine of the PM<sub>2.5</sub> sites have continuous monitors, four sites have both continuous and filter-based monitors, and one site has two filter-based monitors. The Air District is in the process of replacing its non-regulatory continuous samplers with federal equivalent method (FEM) continuous samplers. To date, seven of the sites with continuous samplers use FEM-type samplers. By the fall of 2010, three more non-FEM samplers will be replaced with FEM samplers. Exceedances of the national 24-hour PM<sub>2.5</sub> standard have been recorded at most sites in the Bay Area over the last 3 years. Most exceedances occur during winter months, but can also occur during large forest fires.

Figure 7 shows the current Bay Area PM<sub>2.5</sub> monitoring stations. The stations are superimposed on a gridded PM<sub>2.5</sub> emission map. It shows that the stations are generally located in areas of high PM<sub>2.5</sub> emissions. Point Reyes, a background concentration site, is located in an area of low PM<sub>2.5</sub> emissions.

The number of required PM<sub>2.5</sub> monitors for each MSA in the Bay Area is determined by its population and design value, as specified in Table D-5 of Appendix D to 40 CFR Part 58 – PM<sub>2.5</sub> Minimum Monitoring Requirements. PM<sub>2.5</sub> design values are calculated concentrations (see footnotes no.1 & 2 in Table 12) used to determine the PM<sub>2.5</sub> attainment status of an area. Table 12 shows that the Air District monitoring network meets or exceeds the PM<sub>2.5</sub> minimum monitoring requirements. No additional monitors are required for the SIP because the Bay Area has only recently been designed non-attainment and the SIP planning is in progress.

Table 13 lists the stations where PM<sub>2.5</sub> concentrations are measured in the Bay Area along with the monitoring objective and the PM<sub>2.5</sub> design value for each site. The last column rates the importance of the data measured at the site in meeting both the Air District's and EPA's monitoring objectives.

The Air District desires to operate at least one PM<sub>2.5</sub> monitor in each of the nine Bay Area counties. There are six counties with only one monitor: Contra Costa, Napa, San Francisco, San Mateo, Solano, and Sonoma. All monitors in those counties, except Santa Rosa, are rated high because they are the only monitors in those counties and they all have recorded exceedances of the 24-hour national PM<sub>2.5</sub> standard. The Vallejo and Santa Rosa monitors are also rated high because one monitor is required within each MSA.

Alameda County has four monitoring sites. Livermore is rated high because the design value is very close to the standard. Oakland is rated high because it has recorded exceedances, and it is in one of the three major cities in the Bay Area. Oakland West is rated high because it is a source oriented site. Fremont is rated medium because exceedances of the PM<sub>2.5</sub> standard have been measured at the site though the design value is well below the standard.

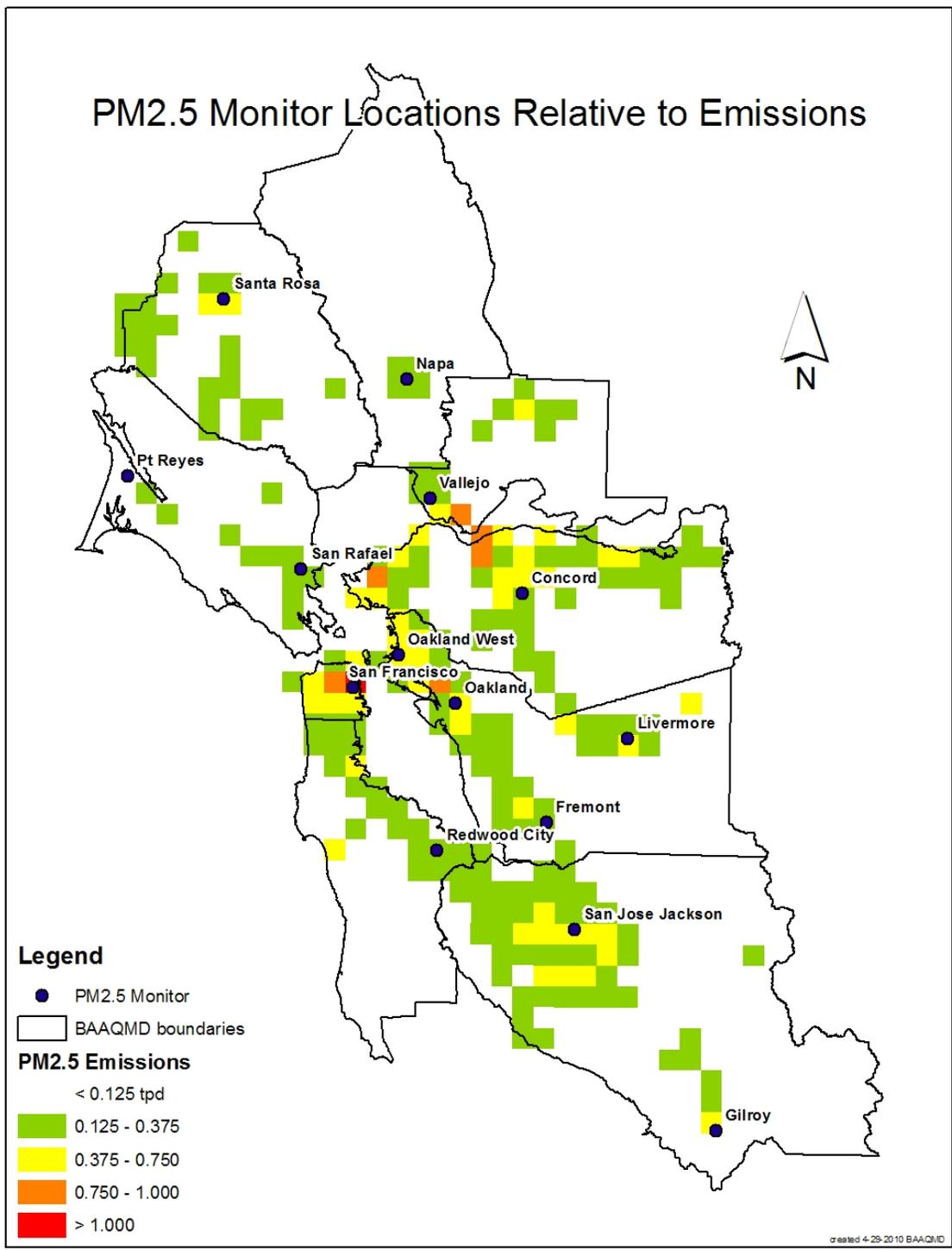


Figure 7. Map of Air District PM<sub>2.5</sub> Monitoring Stations and PM<sub>2.5</sub> emissions.

Table 12. Minimum Monitoring Requirements for PM<sub>2.5</sub> SLAMS Sites.

MSA	County	Population in millions 2009	Annual Design Value <sup>1</sup> (µg/m <sup>3</sup> ) 2009	24-hour Design Value <sup>2</sup> (µg/m <sup>3</sup> ) 2009	Monitors Required	Active Monitors <sup>5</sup>
San Francisco-Oakland-Fremont	SF, San Mateo, Alameda, Marin, Contra Costa	4.32	9.4	34	3	7
San Jose-Sunnyvale-Santa Clara	Santa Clara, San Benito	1.84	10.8	34	3	3 <sup>3</sup>
Santa Rosa-Petaluma	Sonoma	0.47	8.2	28	1	1
Vallejo-Fairfield	Solano	0.41	9.8	36	1	1
Napa	Napa	0.13	None <sup>4</sup>	None <sup>4</sup>	0	0

<sup>1</sup> Annual design values are calculated at each monitoring site by taking the 3-year mean (2007-2009) of the annual averages for each site. The design values shown for each MSA in this table are the highest design value of monitors in the MSA that are within the boundaries of the BAAQMD. Design values at or below the national PM<sub>2.5</sub> annual standard of 15 µg/m<sup>3</sup> indicate the area meets the standard.

<sup>2</sup> Daily design values are calculated by taking the 3-year mean (2007-2009) of the 98<sup>th</sup> percentiles for each site. The design values shown for each MSA in this table are the highest design value of monitors in the MSA that are within the boundaries of the BAAQMD. Monitors outside of the BAAQMD may have a higher design value. Design values at or below the national PM<sub>2.5</sub> 24-hour standard of 35 µg/m<sup>3</sup> indicate the area meets the standard.

<sup>3</sup> One of the monitors is located in Hollister in San Benito County and is operated by the Monterey Bay Unified Air Pollution Control District.

<sup>4</sup> There are no EPA FRM or FEM PM<sub>2.5</sub> monitors in Napa County.

<sup>5</sup> Does not include the non-FEM continuous monitors at Napa and Pt Reyes.

Marin County has two PM<sub>2.5</sub> monitors. The monitor at San Rafael is rated high because exceedances of the 24-hour standard have been recorded, and it is the largest city in the county. Point Reyes is rated high because it is the only background measurement site within the Air District.

The San Jose-Sunnyvale-San Benito MSA requires 3 monitors. One monitor is operated in San Benito County by the Monterey Bay Unified APCD. The Air District operates two PM<sub>2.5</sub> monitors in Santa Clara County, one at San Jose and the other at Gilroy, both are rated high.

Table 13. List of Permanent PM<sub>2.5</sub> Monitor Locations in 2009.

Station	County	Monitoring Objective	24-hour Design Value <sup>1</sup> (µg/m <sup>3</sup> )	Annual Design Value <sup>2</sup> (µg/m <sup>3</sup> )	Assigned Value from Assessment
Fremont	Alameda	Population Oriented	27	9.4	Medium
Livermore	Alameda	Population Oriented	34	9.4	High
Oakland	Alameda	Population Oriented	25	9.4	High
Oakland West	Alameda	Source Oriented	25	11.4	High
Concord	Contra Costa	Population Oriented	33	8.7	High
Point Reyes	Marin	Background	15	5.8	High
San Rafael	Marin	Population Oriented	34	NA <sup>3</sup>	High
Napa	Napa	Population Oriented	32	12.4	High
San Francisco	San Francisco	Population Oriented	27	9.4	High
Redwood City	San Mateo	Population Oriented	28	8.7	High
Gilroy	Santa Clara	Population Oriented	24	8.8	High
San Jose	Santa Clara	NCore	34	10.8	High
Vallejo	Solano	Population Oriented	36	9.8	High
Santa Rosa	Sonoma	Population Oriented	28	8.2	High

<sup>1</sup> Design values at or below the national PM<sub>2.5</sub> 24-hour standard of 35 µg/m<sup>3</sup> meet the standard.

<sup>2</sup> Design values at or below the national PM<sub>2.5</sub> annual standard of 15 µg/m<sup>3</sup> indicate the area meets the standard.

<sup>3</sup> The PM<sub>2.5</sub> monitor at San Rafael was installed in October 2009. There is less than one year of data to date, which is inadequate to calculate an annual design value.

## Summary

The purpose of this assessment is to rate the effectiveness of each monitor in the Bay Area Air Quality Management District's air monitoring network in meeting the monitoring objectives defined in 40 CFR, Part 58 Appendix D, and the local objectives of the Bay Area Air Quality Management District. This assessment also determines whether new monitors or sites are needed and if monitors or sites may be discontinued to free up resources for alternative monitoring efforts.

Table 14 shows that most stations have a mix of high and medium ratings. San Francisco, Oakland, and San Jose are highly rated for most pollutants. San Francisco and Oakland monitors are rated high because they are in major cities in the Bay Area. San Jose is rated high because it is one of the major cities in the Bay Area and the monitors at the site are needed to meet NCore requirements.

Table 14. List of Assessment Ratings of Permanent Monitors in 2009.

Station	CO	Ozone	NO <sub>2</sub>	SO <sub>2</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>
Fremont	Low	Low	Low			Medium
Hayward		Medium				
Livermore		High	High			High
Oakland	High	High	High			High
Oakland West	High		High	High		High
Bethel Island	High	High	High	Medium	Medium	
Concord	Medium	High	Medium	High	Medium	High
Crockett				High		
Martinez				High		
Richmond 7th				High/Low		
San Pablo	Low	Low	Low	High/Low	Low	
Pt Reyes						High
San Rafael	Medium	High	Medium		Medium	High
Napa	Medium	High	Medium		Medium	High
San Francisco	Medium	High	High		High	High
Redwood City	Medium	High	Medium			High
Gilroy		High				High
Los Gatos		High				
San Jose	High	High	High	High	High	High
San Martin		High				
Fairfield		High				
Vallejo	Medium	Medium	Medium	Medium		High
Santa Rosa	Medium	High	Medium			High

Most of the stations that measure one or two pollutants are also rated high. Crockett and Martinez are rated high because they are located near refineries. Fairfield, Los Gatos, San Martin, and Gilroy are rated high because they are located in areas of high levels of ozone.

Pt Reyes and Bethel Island are rated high because they are located in background or transport areas. Bethel Island is also located in a high ozone area. Oakland West is rated high because it is a source oriented site and the monitors were specifically chosen for this site to measure the impacts from the Port of Oakland and nearby highways.

Fremont, San Pablo, and Richmond 7<sup>th</sup> stations have the lowest pollutant importance ratings. Fremont has low ratings for CO, ozone, and NO<sub>2</sub>, and a medium rating for PM<sub>2.5</sub>. The Air District is investigating whether this station should be closed.

The San Pablo station has low ratings for CO, ozone, NO<sub>2</sub>, and PM<sub>10</sub>, and a high rating for SO<sub>2</sub> if the Richmond 7<sup>th</sup> station is closed. This station is likely to remain because it is the only multi-pollutant air monitoring station near the Chevron Refinery and the local community has an interest in seeing air quality measurements.

If the San Pablo station continues to operate, then the SO<sub>2</sub> data collected at the nearby Richmond 7<sup>th</sup> station would then be rated low.

As for new monitors, the Air District is investigating the possibility of locating an ozone monitor in Brentwood and a PM<sub>10</sub> monitor in Oakland. Photochemical modeling suggests an area of high ozone area near Brentwood, south of Bethel Island. The PM<sub>10</sub> emissions map indicates high PM<sub>10</sub> levels near downtown and West Oakland.