

**PARTICULATE MATTER
MONITORING NETWORK DESCRIPTION
FOR A
SANTA BARBARA COUNTY
MONITORING PLANNING AREA**

PREPARED BY

Air Quality Data Review Section
California Air Resources Board

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1.0 INTRODUCTION

This plan provides a description of the PM_{2.5} and PM₁₀ ambient monitoring network designed for the Santa Barbara County Monitoring Planning Area (MPA). Airborne particles with aerodynamic diameter less than 10 microns (PM₁₀) are small enough to be inhaled. The PM₁₀ includes fine particles with aerodynamic diameter less than 2.5 microns (PM_{2.5}) as a component. The deployment of the PM_{2.5} network is critical to the national implementation of the new PM_{2.5} National Ambient Air Quality Standards (NAAQS). The ambient data from this network will be used for designating areas as attainment or nonattainment, developing particulate matter control programs, and tracking the progress of such programs.

During the early stages of the PM_{2.5} network design process, the Air Resources Board (ARB) and the local air quality management districts established MPAs for the State. The entire State is covered by 18 MPAs. These MPAs will be used for planning monitoring locations for PM_{2.5}. They are not intended for designating areas as attainment or nonattainment or planning control measures. The boundaries to be used for these purposes will not be established until adequate PM_{2.5} data are available. The ARB and the local air quality management districts will recommend appropriate nonattainment boundaries to the U.S. EPA.

The proposed PM_{2.5} monitoring network for the Santa Barbara MPA includes two monitoring sites. Both of these sites are located at existing PM₁₀ sites. These sites will be operated by the California Air Resources Board and will use PM_{2.5} Federal Reference Method (FRM) monitors.

1.1 Physical Setting

The Santa Barbara County MPA includes all of Santa Barbara County on the California central coast. A large portion of the county includes the Santa Ynez Mountains. These mountains rise rather swiftly from the coastal plain that makes up the Santa Barbara Coast.

1.2 Population Characteristics

The population of an Metropolitan Statistical Area (MSA) is one of the key parameters in determining the minimum number of required monitoring sites per the U.S. EPA PM_{2.5} regulations. The Santa Barbara MPA, the Santa Barbara-Santa Maria-Lompoc MSA, and Santa Barbara county have the same boundaries. The 1990 population figures are listed in Table 1.2.1 and Table 1.5.1.

Table 1.2.1 Population in the Santa Barbara County MPA by County

<u>County</u>	<u>Population (in 1990)</u>
Santa Barbara	354,072
Total Population	354,072

1.3 Climate and Weather

In Santa Barbara County, the summers are generally warm and sunny, although cooler and cloudier than farther inland. There is a definite maritime influence with some summer fog. The average mid-summer temperature is 65 to 71 degrees F.

1.4 Dominant Economic Activities and Emission Sources

The economic bases of Santa Barbara vary somewhat from those of other California cities of comparable size: tourism, investment income, pensions, county government, higher education, local trade, offshore oil drilling, and limited manufacturing.

The PM2.5 in California’s air is the result of primary and secondary particulates. Primary particulate emissions are directly emitted from sources such as residential fireplaces, diesel trucks, forest burning, dust sources, and industrial processes. Secondary particulates form when gaseous or non-particulate substances react in the atmosphere with other substances to produce particulate matter. wind erosion as the major contributor to directly emitted particulate matter in Imperial County

The predominant sources of directly emitted PM2.5 vary regionally in California. In the Santa Barbara County MPA, inventory estimates show that approximately 40 percent of PM2.5 is from fires and about 35 percent from geologic dust sources. The remaining 25 percent comes from the mix of other source contributors, including mobile sources and residential fuel consumption.

Precursors to secondary PM2.5 formation in California include oxides of nitrogen (NOx) from motor vehicles and other combustion sources, ammonia emissions, certain organic substances which form particulate matter, and additional emission sources. Secondary particulate levels are highly variable and are dependent on atmospheric conditions and precursor levels for formation. For example, in some regions at certain times of the year the secondary particles can comprise 50% or more of the total ambient measured PM2.5 concentrations. At other times, the secondary particulates are nearly negligible. Because secondary particles form through complex and variable atmospheric processes, it is not currently possible to produce accurate secondary particulate emission estimates as can now be done for the primary, directly emitted PM2.5.

1.5 PM2.5 Monitoring Requirements

Based upon the U.S. EPA PM2.5 regulations, all Metropolitan Statistical Areas with population greater than 200,000 are required to have a core PM2.5 SLAMS (this is a site in a populated area representing PM2.5 concentrations on a neighborhood or urban scale). The required number of core SLAMS and the sampling frequency are determined by the 1990 census population statistics for each MSA. In general, the greater the population in an MSA, the more monitoring sites required for that area. One additional core monitor that samples everyday is required in every Photochemical Assessment Monitoring Station (PAMS) area.

The Santa Barbara County Monitoring Planning Area (MPA) corresponds to the Santa Barbara-Santa Maria-Lompoc MSA. The Santa Barbara County MPA was recently classified as a PAMS area. Based on this classification the MPA may be required to have a PM2.5 monitor sampling everyday at a PAMS site. This potential requirement was not considered for the purpose of developing this plan.

The regulations also require a PM2.5 monitor for every 200,000 people living either outside of an MSA or in MSAs with fewer than 200,000 people. These additional sites are supposed to sample for PM2.5 once every three days. The Santa Barbara County MPA corresponds to the MSA. Consequently, in the Santa Barbara County MPA, there were no people living outside of MSAs or in an MSA with fewer than 200,000 people.

Table 1.5.1 identifies the number of core PM2.5 monitoring sites to be operated within the Santa Barbara County MPA.

Table 1.5.1 Required Core PM2.5 Monitors

MSA/PMSA/County	Population in 1990	Required Core PM2.5 Monitors		Allocated Monitors
		Sampling everyday	Sampling 1 in 3 day	
Santa Barbara-Santa Maria-Lompoc MSA	354,072	0	2	2
Total	354,072	0	2	2

2.0 PM2.5 MONITORING NETWORK ELEMENTS

This section summarizes PM2.5 monitoring sites planned for deployment in 1998 and 1999. In most cases, the existing particulate matter monitoring sites will be used for the additional PM2.5 monitoring. The existing particulate matter data have assisted in the design of the PM2.5 network by providing information on the trends and the magnitude of concentrations. These data will be valuable in the future in understanding the particulate size distributions of emission sources and developing control strategies. The particulate matter monitors currently operating at the sites selected for PM2.5 monitoring are also summarized in this section.

Refer to Section 2.0 in the California Particulate Matter Monitoring Network Description for a summary of particulate matter monitoring outside of the PM2.5 monitoring network.

2.1 PM2.5 Monitors Planned for Deployment

The planned PM2.5 monitoring network will collect data for multiple objectives, including:

- (1) Comparing sampling results with the PM2.5 NAAQS to determine attainment/nonattainment status.
- (2) Developing and tracking implementation plans for the area.
- (3) Assisting health studies and other ambient aerosol research activities.

In order to understand the nature of the PM2.5 problem in the Santa Barbara County and to develop control strategies, multiple monitor types will be needed. The PM2.5 Federal Reference Method (FRM) sampler is a gravimetric filter-based sampler that produces a concentration measurement of PM2.5 over a 24-hour period. The FRM alone cannot support multiple information needs of the PM2.5 network. The sampler design includes a Teflon filter that can experience a loss of volatile constituents, which can be captured and retained better by other sampling techniques. In addition, it does not provide temporally resolved data or full chemical characterization of ambient aerosols.

In addition to FRM monitors, two other types of instruments are required for deployment as part of the PM2.5 network: speciation samplers and continuous mass monitors. Speciation samplers provide a chemical characterization of ambient aerosols for developing emission mitigation strategies and for tracking the success of implemented control programs. Continuous PM2.5 mass monitors will collect data for public reporting of short-term concentrations, for understanding diurnal and episodic behavior of fine particles, and for use by health scientists investigating exposure patterns. However, currently available instruments for continuous measurements of suspended particulate mass have many shortcomings. The Tapered Element Oscillating Microbalance (TEOM) sampler uses a heated inlet causing evaporation of the volatile components of the air sample. The Beta Attenuation Monitor (BAM) which samples at ambient temperatures and relative humidities may overestimate particle concentrations by allowing liquid

water to be collected along with particles. Currently there are no plans to deploy continuous PM2.5 monitors in the Santa Barbara County MPA.

The Santa Barbara County MPA PM2.5 monitoring network will consist of two monitoring sites. Each site will have a PM2.5 FRM sampler deployed in 1998. The samplers will be purchased through the National PM2.5 Sampler Procurement Contract established by the U.S. EPA.

A PM2.5 speciation sampler is proposed at one monitoring site in 1999. Table 2.1.1 lists the proposed PM2.5 monitoring sites and the type of instruments planned at these sites. Figure 2.1.1 shows the locations of the proposed sites.

Table 2.1.1 PM2.5 Monitoring Network

Site Location	AIRS Site ID	PM2.5 FRM	PM2.5 Speciation	PM2.5 TEOM/BAM	Other PM2.5 Monitor
Santa Barbara-W Carillo Street	060830010	X	Y		
Santa Maria-Library	060834001	X			

Codes:

- X Monitor to be deployed in 1998
- Y Monitor to be deployed in 1999
- XX Collocated particulate monitors used for precision data to be deployed in 1998

2.2 Existing Particulate Matter Monitors

The existing particulate matter State and Local Air Monitoring Stations (SLAMS) network in the Santa Barbara County MPA consists of four State and Local Air Monitoring Stations (SLAMS), 3 sites established for the Prevention of Significant Deterioration (PSD) program, and one special purpose health study site. The monitoring instruments operating at these sites include:

- ▶ 7 High Volume Size Selective Inlet (SSI) samplers collecting 24-hour PM10 samples.
- ▶ 1 dichotomous sampler collecting 24-hour fine fraction (≤ 2.5 microns in diameter) and coarse fraction (> 2.5 and ≤ 10 microns in diameter) samples.
- ▶ 1 continuous mass sampler collecting PM10 measurements hourly, using either a Tapered Element Oscillating Microbalance (TEOM) sampler or Beta Attenuation Monitor (BAM) sampler.
- ▶ 1 coefficient of haze instrument.

Figure 2.1.1

The proposed PM2.5 sites will be located at existing PM10 sites. Table 2.2.1 summarizes the existing particulate matter monitoring resources available at the proposed PM2.5 monitoring sites. The complete summary of particulate matter monitoring resources in the Santa Barbara County can be found in Attachment 1 in the statewide summary.

The particulate matter data obtained from the existing sites are used to meet the following objectives:

- ▶ Compare measured concentrations to the State and national PM10 standards.
- ▶ Track changes in the particulate matter concentrations over time.
- ▶ Evaluate the population exposure.
- ▶ Assess the impact from transported particulate matter.
- ▶ Assist in health studies and other research.

Table 2.2.1 Existing Particulate Matter Monitors at Proposed PM2.5 Sites

Site Location	AIRS Site ID	Dichot	PM10 SSI	PM10 TEOM/BAM	Other PM Monitors
Santa Barbara-W Carillo Street	060830010		X		COH
Santa Maria-Library	060834001		X		

Codes:

- X Existing monitor
- Dichot Dichotomous sampler collecting 24-hour average fine fraction and coarse fraction samples
- SSI High volume Size Selective Inlet sampler collecting 24-hour average PM10 samples
- TEOM Tapered Element Oscillating Microbalance collecting PM10 measurements hourly
- BAM Beta Attenuation Monitor collecting PM10 measurements hourly
- COH AISI tape sampler for soiling index (coefficient of haze)

2.3 PM2.5 Quality Assurance

The agencies operating PM2.5 monitors in the Santa Barbara County MPA will adopt a schedule for implementing quality assurance procedures developed by the ARB. Please refer to Section 3.7 in the statewide summary for more information about the schedule.

2.4 Laboratory Analyses

The FRM instruments collect PM_{2.5} over 24-hour periods on Teflon-membrane filters from air drawn at a controlled flow rate through a tested PM_{2.5} inlet. Within 96 hours after the sample collection period, the filter contained in the filter cassette will be removed from the sampler and placed in a protective container. During the period between filter retrieval from the sampler and the start of conditioning, the filter will be maintained at a temperature below 25 degrees centigrade. The filters will be transported to the mass analysis facility. It is currently proposed that the Ventura County APCD laboratory will weigh the PM_{2.5} filters from Santa Barbara County, but the final decision has not yet been made. The filters containing PM_{2.5} samples will be “conditioned” and weighed at the laboratory.

Samples collected from the speciation monitors will be analyzed by a nationwide network of 1 to 3 laboratories. These laboratories will be working under contract performing the necessary laboratory analyses. The establishment of this network of laboratories is still under development, with the specific laboratories yet to be determined.

3.0 PM2.5 MONITORING SITES TO BE DEPLOYED IN 1998

During 1998, two PM2.5 monitoring sites are planned for deployment in the Santa Barbara County MPA. This section discusses the criteria used in the selection of the two PM2.5 monitoring sites along with the important parameters that characterize each site.

3.1 Monitor Siting

The existing particulate matter network in the Santa Barbara County MPA is comprised of seven sites. During the PM2.5 site selection process, the following factors were evaluated:

- ▶ Population statistics and distribution.
- ▶ Land use characteristics.
- ▶ Local climate.
- ▶ Suspected area emission sources (wood smoke, agricultural burning, etc.).
- ▶ Existing particulate matter monitoring network.
- ▶ Existing particulate matter data, including data collected by the dichotomous network, PM10 network, and special studies.
- ▶ Potential transport corridors.
- ▶ Ongoing special health studies.

After the review process, it was determined that existing PM10 sites would be well suited as locations for monitoring PM2.5. All sites selected to operate PM2.5 samplers are located in populated areas where high PM2.5 concentrations are expected. Some of these sites will provide useful information about PM2.5 transport, emission sources, and population exposure.

3.2 Site Description

The network for the Santa Barbara County MPA, as proposed, includes two sites that will be deployed in 1998. The following characteristics apply to both sites:

- ▶ Use a Federal Reference Monitor (FRM) type sampler purchased through the national contract established by the U.S. EPA.
- ▶ Sited in a population-oriented location.
- ▶ “Site Type” is Core SLAMS.
- ▶ Represent neighborhood spatial scale.
- ▶ Provide data that will be compared to both the annual standard and the 24-hour standard.

Based on these criteria, the following sites listed in Table 3.2.1 are identified for use for PM2.5 monitoring within the Santa Barbara County MPA.

Table 3.2.1 PM2.5 Monitoring Sites to be Deployed in 1998

Site Location	AIRS Site ID	Operating Agency	Spatial Scale	Monitoring Objective	Site Type	Measurement Method
Santa Barbara-W Carillo Street	060830010	ARB	Neighborhood	M,P	C	FRM/SCH
Santa Maria-Library	060834001	ARB	Neighborhood	R	C	FRM/SCH

The following codes are used in this table:

Operating Agency :

ARB California Air Resources Board

Monitoring Objectives:

- R Represent high concentrations in a populated area.
- M Determine the highest concentration expected to occur in the area covered by the network (more than one site per area may be needed).
- T Determine the extent of regional pollutant transport.

Site Type:

- C Core SLAMS
- S Non-core SLAMS
- P Special Purpose Monitors

Measurement Method :

- FRM/SCH Federal Reference Method Single Channel Sampler
- FRM/SQ Federal Reference Method Sequential Sampler

The PM_{2.5} monitoring sites in the Santa Barbara County MPA will serve multiple purposes. The monitoring site at Santa Barbara-W Carillo Street will be used to represent areas of maximum PM_{2.5} concentrations with high population density. The other site, Santa Maria Library, is intended to be representative of air quality in an area of high population density and may not necessarily be in an area of expected maximum concentrations.

The monitoring objectives at each of the monitoring sites in the Santa Barbara County MPA will be further evaluated during the next year’s annual network review when PM_{2.5} data will be available from these sites.

4.0 PM2.5 MONITORING SITES TO BE DEPLOYED IN 1999

There are no plans to establish any additional PM2.5 monitoring sites in 1999. One of the PM2.5 sites deployed in 1998 will have a chemical speciation monitor added in 1999.

4.1 Monitoring Sites Operating PM2.5 FRM Monitors

At this time, there are no plans to establish an additional PM2.5 monitoring site in 1999 operating an FRM monitor.

4.2 PM2.5 Chemical Speciation Sampling

The basic objective of the PM2.5 chemical speciation sampling and analysis program is to develop seasonal and annual chemical characterizations and distributions, across the country, of the ambient aerosols present in PM2.5 samples. These chemically resolved data will be used to perform source attribution analyses, evaluate emission inventories and air quality models, and support health related research studies.

The EPA recognizes that sampling for chemical speciation is a developing science, and encourages creative approaches to chemical speciation sampling. The ARB and the local air quality management districts will evaluate existing chemical speciation samplers and select the best-suited instrument for the monitoring conditions in the Santa Barbara County. The selected instrument will collect samples for the currently targeted chemical analytes, that include the following:

- ▶ Cations: particulate ammonium, ionic sodium, calcium, and magnesium.
- ▶ Anions: particulate sulfate, nitrate, and chloride.
- ▶ Carbon: total, organic, and elemental.
- ▶ Trace elements: sodium, magnesium, etc., through lead.
- ▶ Semi-volatile organic particles.

The site listed in Table 4.2.1 below was selected for collecting chemically speciated data because it best meets the following list of criteria in the order of importance:

- ▶ High PM2.5 concentrations, or expected significant contribution of PM2.5 to high PM10 concentrations.
- ▶ Located in a area of significant population density.
- ▶ Located in PAMS areas where there is a maximum precursor site for PM2.5 (this may also be a high concentration site).
- ▶ Significant for atmospheric transport determinations.
- ▶ Geographical representation of a monitored area.

Table 4.2.1 PM2.5 Chemical Speciation Monitoring

Site Location	AIRS Site ID	Operating Agency	Monitoring Method
Santa Barbara-W Carillo Street	060830010	ARB	to be determined

ARB California Air Resources Board

4.3 Continuous PM2.5 Monitoring

The Federal regulation 40 CFR 58, Appendix D, 2.8.2.3, requires that continuous PM2.5 samplers be placed in metropolitan areas where there is a population greater than 1 million people. Continuous PM2.5 data are useful for public reporting of short-term concentrations, for understanding diurnal and episodic behavior of fine particles, and for use by health scientists investigating exposure patterns. The Santa Barbara County MPA, with a population of 369,608 based on the 1990 census, is not required to have a continuous PM2.5 monitor. There are no plans to deploy a continuous PM2.5 monitor in this MPA.

5.0 PM2.5 SAMPLING FREQUENCY

The U.S. EPA requirements call for everyday sampling of PM2.5 at certain core SLAMS sites and one in three day sampling at all other PM2.5 and all PM10 sites. In order to collect sufficient data and at the same time conserve monitoring resources, the ARB and the local air quality management districts are proposing alternative sampling frequencies for PM2.5 and PM10.

5.1 PM2.5 FRM Sampling Frequency

The Santa Barbara County MPA is required to have two PM2.5 sites sampling once every three days.

Initially, both sites will sample once every six days. Monitoring sites with PM2.5 concentrations above the 24-hour standard will be considered for more frequent sampling.

Table 5.1.1 PM2.5 FRM Sampling Frequency

Site Location	AIRS Site ID	Operating Agency	Sampling Frequency	
			Required	Proposed
Santa Barbara-W Carillo Street	060830010	ARB	1 in 3 day	1 in 6 day
Santa Maria-Library	060834001	ARB	1 in 3 day	1 in 6 day

ARB California Air Resources Board

5.2 PM2.5 Chemical Speciation Sampling Frequency

The federally required sampling frequency for PM2.5 chemical speciation is once in 12 days. This sampling frequency may not be sufficient in some cases to adequately support plans to control PM2.5 source emissions. The appropriate sampling frequency will be determined at a later date and will depend largely on PM2.5 data needs and available resources.

5.3 PM10 Sampling Frequency

The new U.S. EPA minimum requirement for PM10 sampling frequency is once every three days. The Air Resources Board and the local air pollution control districts in California are requesting that the U.S. EPA Region 9 grant a statewide waiver allowing sampling at the current schedule of 1-in-6-day, with certain exceptions to be determined on a case-by-case basis. To demonstrate changes in the attainment status for the national 24-hour PM10 standard, more frequent sampling may be needed. Monitoring sites with maximum 24-hour concentrations close to the 24-hour standard may be required to sample everyday or at least on a 1-in-3-day schedule.