

**PARTICULATE MATTER  
MONITORING NETWORK DESCRIPTION  
FOR THE  
MONTEREY BAY  
MONITORING PLANNING AREA**

PREPARED BY

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## **1.0 INTRODUCTION**

This plan provides a description of the PM<sub>2.5</sub> ambient monitoring network designed for the Monterey Bay Monitoring Planning Area. The deployment of this network is a critical component in the national implementation of the new PM<sub>2.5</sub> National Ambient Air Quality Standards (NAAQS). The ambient data from this network will be used for designating areas as attainment or nonattainment, developing cost-effective control programs, and to tracking the progress of such programs.

During the early process of the PM<sub>2.5</sub> network design the Air Resources Board (ARB) and the local air quality districts established Monitoring Planning Areas (MPAs) for the State. The entire State is covered by 18 MPAs. These MPAs will be used for planning monitoring locations for PM<sub>2.5</sub>. They are not intended for designating areas as attainment or nonattainment or planning control measures. The U.S. EPA has not yet established the boundaries to be used for these purposes.

The proposed PM<sub>2.5</sub> monitoring network for the Monterey Bay MPA includes two core SLAMS sites and one IMPROVE site in a Class I area. One of the PM<sub>2.5</sub> sites is located at an existing PM<sub>10</sub> site. The second PM<sub>2.5</sub> SLAMS site will be located at a new monitoring site. The SLAMS sites will operate a Federal Reference Monitor (FRM) and one of these sites will also include a collocated sampler for QA/QC requirements and a speciation monitor to further define the chemical composition of the PM<sub>2.5</sub>. In addition to the two SLAMS sites operated by the District, the U.S. EPA is proposing one additional PM<sub>2.5</sub> site in a Class I areas within the Monterey Bay MPA. This one site will be located in the Ventana Wilderness.

### **1.1. Physical Setting**

The Monterey Bay MPA is the same as the North Central Coast Air Basin. The MPA contains 3 counties -- all of Monterey, Santa Cruz , and San Benito Counties.

### **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<sub>2.5</sub> regulations.

The MSAs included in the Monterey Bay MPA are listed along with population figures in Table 1.5.1. The cities and counties included in the MPA are listed along with population figures in Table 1.2.1.

**Table 1.2.1 Population in the Monterey Bay Monitoring Planning Area by City and County**

<b>Monterey County</b>	<b>Population (based on 1995 figures)</b>
Carmel	4,350
Del Rey Oaks	1,553
Gonzales	6,000
Greenfield	9,301
King City	9,450
Marina	16,595
Monterey	31,378
Pacific Grove	15,987
Salinas	124,702
Sand City	227
Seaside	26,942
Soledad	18,290
Unincorporated	96,673
<b>Total County Population</b>	<b>361,448</b>
<b>Santa Cruz County</b>	<b>Population (based on 1995 figures)</b>
Capitola	10,187
Santa Cruz	54,004
Scotts Valley	10,031
Watsonville	34,170
Unincorporated	135,386
<b>Total County Population</b>	<b>243,778</b>
<b>San Benito County</b>	<b>Population (based on 1995 figures)</b>
Hollister	23,927
San Juan Bautista	1,914
Unincorporated	18,592
<b>Total County Population</b>	<b>44,433</b>
<b>Total Population Monterey Bay MPA</b>	<b>649,659</b>

### **1.3 Climate and Weather**

The Monterey Bay MPA is in the Monterey Bay Area and has a mild climate due to its proximity to the ocean. Winter temperatures average 45-50 °F and summer temperatures average in the low 70's. Greater temperature extremes occur in the inland portions of the air basin.

Temperature inversions are characteristic of the area's coastal marine climate. During the late summer and fall, the relatively cool air can become trapped under a warm air layer preventing the dispersion of air pollutants.

The prevailing sea breeze in the Monterey Bay area is created by heating of the interior portions of the State by the sun, which forms an updraft and tends to draw the relatively cooler air over the ocean inland. This tends to make the prevailing wind direction from the west. At night as the land cools in comparison to the temperature of the ocean, the action is reversed. Topographic troughs between the principal mountain ranges act as "funnels" through which the prevailing winds are directed.

### **1.4 Dominant Economic Activities and Emission Sources**

In the Monterey Bay MPA, the dominant land use in the region is agriculture with approximately 1,626,000 agricultural acres or 338,500 farmed acres (pasture land excluded). About 82 percent of farmed agricultural land is in the Salinas Valley with 12 percent in San Benito and 6 percent in Santa Cruz County. The gross agricultural crop value for 1996 was \$1.9 billion in Monterey County, \$160 million in San Benito County, and \$240 Million in Santa Cruz County for a total of over \$2.3 billion.

Institutional land uses occupy significant portions of the land area within the region. Military land uses in Monterey County include Fort Hunter-Liggett, Camp Roberts, and the Naval Postgraduate School, and the Presidio of Monterey. Other major institutional uses are the University of California at Santa Cruz (UCSC) and the Soledad Correctional Facility. Fort Ord, comprising almost 28,000 acres, was closed in 1993. The state University at Monterey Bay and UCSC have received over 2000 acres of Fort Ord land for education and research uses.

The region has a significant amount of land in open space and recreation uses including several large State Parks, the Ventana Wilderness (164,503 acres), the Los Padres National Forest (304,035 acres), and the Pinnacles National Monument. Over 17,000 acres of Fort Ord have been dedicated to open space and recreational uses. The California Department of Parks and Recreation operates over 25 visitor facilities in the region.

Industrial activity includes oil production (San Ardo oil field), power generation (Moss Landing), commercial fishing (Moss Landing), cement manufacturing (Davenport), quarrying activities (all three counties), agricultural processing in the Salinas and Watsonville areas, sand mining (Hollister, Marina, Scotts Valley, and the North Coast of Santa Cruz County), asbestos mining and milling (San Benito County and Monterey County, respectively) food processors (Salinas, Watsonville and Santa Cruz) and electronic manufacturing firms (Scotts Valley,

Santa Cruz, Watsonville and Salinas.

The PM<sub>2.5</sub> 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.

The predominant sources of directly emitted PM<sub>2.5</sub> vary regionally in California. In Southern California, inventory estimates show that approximately 25% of PM<sub>2.5</sub> is from mobile sources. In the San Joaquin Valley, the mobile contribution is only 9% but geologic dust sources are more substantial PM<sub>2.5</sub> contributors. In the San Francisco region, fireplaces are a major source of PM<sub>2.5</sub>. In the Southeast Desert region, dust sources are dominant. Each region in the state has its own unique mix of PM<sub>2.5</sub> source contributors.

Precursors to secondary PM<sub>2.5</sub> formation in California include oxides of nitrogen (NO<sub>x</sub>) 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 PM<sub>2.5</sub> 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 PM<sub>2.5</sub>.

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

Based upon the U.S. EPA PM<sub>2.5</sub> regulations, all Metropolitan Statistical Areas (MSAs) with population greater than 200,000 are required to have core PM<sub>2.5</sub> SLAMS (This is a site in a populated area representing PM<sub>2.5</sub> 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.

In the Monterey Bay MPA, there is one MSA and one Primary MSA (PMSA). Both MSAs within the Monterey Bay MPA require PM<sub>2.5</sub> Monitoring. The Salinas MSA is required to have one PM<sub>2.5</sub> monitoring site sampling on a 1 in 3 day schedule. The Santa Cruz / Watsonville MSA is required to have one PM<sub>2.5</sub> monitoring site sampling on 1 in 3 day schedule. Both sampling sites, one for each MSA within the planning area, will be considered core PM<sub>2.5</sub> sites.

Table 1.5.1 identifies the number of core PM<sub>2.5</sub> monitoring sites to be operated within the Monterey Bay Monitoring Planning Area.

**Table 1.5.1 Required and Proposed Core PM2.5 Monitoring Sites**

MSA/PMSA/County	Population in 1995	Required Core PM2.5 Monitoring Sites		Planned PM2.5 Sites
		Everyday Sampling	1 in 3 day Sampling	
Salinas, MSA	355,660	0	1	1
Santa Cruz/Watsonville, MSA	229,734	0	1	1
<b>Total</b>		<b>0</b>	<b>2</b>	<b>2</b>

## **2.0 PM2.5 MONITORING NETWORK ELEMENTS**

Several types of PM2.5 monitors will be part of the PM2.5 monitoring network. This section summarizes the two types of PM2.5 monitors under discussion:

- 1) monitors planned for deployment in 1998 and 1999.
- 2) currently operating particulate matter monitors at PM2.5 sites.

For a summary of particulate matter monitoring outside of the PM2.5 monitoring network, please refer to Appendix 1 in the statewide summary.

### **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 National Ambient Air Quality Standards to determine attainment/nonattainment status.
- (2) developing and tracking of 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 North Central Coast Air Basin and to develop control strategies, multiple monitor types will be needed. The 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, speciation samplers are required for deployment as part of the PM2.5 network. Speciation samplers provide a full chemical characterization of ambient aerosols for developing emission mitigation strategies and for tracking the success of implemented control programs.

The Monterey Bay MPA PM2.5 SLAMS monitoring network will consist of two monitoring sites. Both of these sites will be deployed in 1998. Each site will operate FRM samplers purchased through the national contract established by the U.S. EPA. One site in the MPA will operate collocated samplers for QA/QC evaluation.

A PM2.5 speciation sampler is proposed for one site in 1999. Table 2.1.1 lists the monitoring site and the type of instruments planned at this site. 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
Salinas (new Site)	060531003	XX	Y		
Santa Cruz-Soquel Ave.	060870007	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 network in the Monterey Bay MPA consists of eight monitoring sites. The monitoring instruments operating at these sites include:

- 8 High Volume Size Selective Inlet samplers (SSIs) collecting 24-hour average PM10 samples.

One of the proposed PM2.5 sites will be located at an existing PM10 sites and one will be located at a new monitoring site. Table 2.2.1 summarizes the particulate matter monitoring resources available at the proposed PM2.5 monitoring sites. The complete summary of particulate matter monitoring resources in the North Central Coast Air Basin can be found in Attachment I in the statewide summary.

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

- Compare measured concentrations to the State and federal 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 activities.

**Figure 2.1.1**

**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
Salinas (new site)	060531003		X		
Santa Cruz-Soquel Ave.	060870007		X		

**Codes:**

- X Existing monitor
- SSI High volume Size Selective Inlet sampler collecting 24-hour average PM10 samples
- Dichot Dichotomous sampler collecting 24-hour average fine fraction and coarse fraction samples
- TEOM Tapered Element Oscillating Microbalance collecting PM10 measurements hourly
- BAM Beta Attenuation Monitor collecting PM10 measurements hourly

**2.3 PM2.5 Quality Assurance**

The agencies operating PM2.5 monitors in the Monterey Bay 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 PM2.5 over 24-hour periods on Teflon-membrane filters from air drawn at a controlled flow rate through a tested PM2.5 inlet. Within 96 hours after the sample collection period, the filter contained in the filter cassette is 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 are to be transported to the ARB Monitoring and Laboratory Division in Sacramento or other assigned laboratory. The filters containing PM2.5 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 Monterey Bay 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 Monterey Bay MPA has fairly uniform topography and climate. The existing particulate matter network in the North Central Coast MPA consists of eight 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 one existing PM10 site would be well suited as a location for monitoring PM2.5. The second PM2.5 site will be at a new monitoring location. Both sites selected to operate PM2.5 samplers are located in populated areas where high PM2.5 concentrations are expected. These sites should provide useful information about PM2.5 transport, emission sources, and population exposure.

#### **3.2 Site Description**

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

- Uses 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 average standard.

Based on these criteria, the following sites listed in Table 3.2.1 are identified for use for PM2.5 monitoring within the Monterey Bay 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
Salinas (new site)	060531003	MBU	Neighborhood	M	C	FRM/SQ
Santa Cruz-Soquel Ave.	060870007	MBU	Neighborhood	R	C	FRM/SQ

The following codes are used in this table:

**Operating Agency:**

MBU Monterey Bay Unified APCD

**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.
- HS To support special health studies.
- P Monitoring at PAMS areas

**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 monitoring objectives at each of the monitoring sites in the Monterey Bay MPA will be further evaluated during the next year’s annual network plan when PM2.5 data will be available from these sites.

#### **4.0 PM2.5 MONITORING SITES TO BE DEPLOYED IN 1999**

There are plans to deploy one PM2.5 chemical speciation monitor within the Monterey Bay MPA in 1999 at the new Salinas site.

#### **4.1 Monitoring Sites Operating PM2.5 FRM Monitors**

There are no plans to deploy any additional PM2.5 FRM within the Monterey Bay MPA in 1999.

#### **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 districts will evaluate existing chemical speciation samplers and select the best-suited instruments for the monitoring conditions in the Monterey Bay MPA. The selected instrument will collect samples for the currently targeted chemical analytes, and include the following:

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

The monitoring site in Salinas was selected for collecting chemically speciated data because it best meets the following list of criteria in 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 an monitored area.

**Table 4.2.1 PM2.5 Chemical Speciation Sampling**

<b>PM2.5 Chemical Speciation Site</b>	<b>AIRS Site ID</b>	<b>Operating Agency</b>	<b>Monitoring Method</b>
Salinas (new Site)	060531003	MBU	to be determined

MBU

Monterey Bay Unified APCD

### **4.3 Continuous PM2.5 Monitoring**

There are no plans to deploy any continuous monitors within the Monterey Bay MPA in 1998 or 1999.

## 5.0 SAMPLING FREQUENCY

The U.S. EPA requirements call for everyday sampling of PM<sub>2.5</sub> at certain core SLAMS sites and one in three day sampling at all other PM<sub>2.5</sub> and all PM<sub>10</sub> sites. In order to collect sufficient data and at the same time conserve monitoring resources, the ARB and the local air quality districts are proposing alternative sampling frequencies for PM<sub>2.5</sub> and PM<sub>10</sub>.

### 5.1 PM<sub>2.5</sub> FRM Sampling Frequency

Sampling will be performed on a 1 in 3 day sampling schedule at both sites in the Monterey Bay MPA as specified in the regulations.

**Table 5.1.1 PM<sub>2.5</sub> FRM Sampling Frequency**

Site Location	AIRS Site ID	Operating Agency	Sampling Frequency	
			Required	Proposed
Salinas (new site)	060531003	MBU	1 in 3 day	1 in 3 day
Santa Cruz-Soquel Ave.	060870007	MBU	1 in 3 day	1 in 3 day

MBU

Monterey Bay Unified APCD

### 5.2 PM<sub>2.5</sub> Chemical Speciation Sampling Frequency

The federally required sampling frequency for PM<sub>2.5</sub> chemical speciation is once in 12 days. This sampling frequency may not be sufficient in some cases to adequately support plans to control PM<sub>2.5</sub> source emissions. The appropriate sampling frequency will be determined at a later date and will depend largely on data needs and available resources.

### 5.3 PM<sub>10</sub> Sampling Frequency

The new U.S. EPA minimum requirement for PM<sub>10</sub> 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 days, with certain exceptions to be determined on a case by case basis.