

Bay Area Air Quality Management District
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Staff Report

Proposed Particulate Matter Implementation Schedule

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I. BACKGROUND

A. What is Particulate Matter (PM)?

Particulate matter (referred to as PM) consists of very small liquid and solid particles suspended in the air, and includes particles smaller than 10 microns in size (PM₁₀) as well as finer particles smaller than 2.5 microns in size (PM_{2.5}). Particles with a size between 2.5 and 10 microns are sometimes referred to as "coarse particles".

Ambient PM is made up of particles that are emitted directly, such as soot and fugitive dust, as well as secondary particles that are formed in the atmosphere from reactions involving precursor pollutants such as oxides of nitrogen, sulfur oxides, volatile organic compounds, (NO_x, SO_x, and VOC), and ammonia. Secondary PM and combustion soot tend to be fine particles (PM_{2.5}) while fugitive dust is mostly coarse particles.

Some particles are directly emitted into the air. They come from a variety of sources such as cars, trucks, buses, industrial facilities, cooking, power plants, construction sites, tilled fields, unpaved roads, stone crushing, and burning of wood.

Other particles may be formed indirectly when gases from burning fuels react with sunlight and water vapor. These can result from fuel combustion in motor vehicles, at power plants, and in other industrial processes. Many combustion sources, such as motor vehicles and power plants, emit PM directly and also emit pollutants that form secondary PM.

B. What Kinds Of Problems Does PM Cause?

1. Human Health

Exposure to particulate pollution is linked to increased frequency and severity of asthma attacks and even premature death in people with pre-existing cardiac or respiratory disease. Those most sensitive to particulate pollution include infants and children, the elderly, and persons with heart and lung disease.

When we inhale, we breathe in air along with any particles that are in the air. The air and the particles travel into our respiratory system (the lungs and airway). Along the way the particles can stick to the sides of the airway or travel deeper into the lungs. The farther particles go, the worse the effect. Smaller particles can pass through the smaller airways.

Many scientific studies have linked breathing PM to a series of significant health problems, including:

- aggravated asthma
- increases in respiratory symptoms like coughing and difficult or painful breathing
- chronic bronchitis
- decreased lung function
- premature death

2. Visibility impairment

PM is the major cause of reduced visibility (haze) in the United States, including both urban and rural areas. PM reduction programs are underway in cities as well as places like the Grand

Canyon and the Great Smokey Mountains National Parks where millions of tourists come every year to take in the views.

3. Atmospheric deposition

The smaller particles are lighter and stay in the air longer and travel farther. PM₁₀ particles can stay in the air for minutes or hours while PM_{2.5} particles can stay in the air for days or weeks before settling as deposition on surfaces. PM₁₀ particles can travel as little as a hundred yards or as much as 30 miles. PM_{2.5} particles can go even farther; many hundreds of miles before settling out. The effects of this settling include:

- making lakes and streams acidic
- changing the nutrient balance in coastal waters and large river basins
- depleting the nutrients in soil
- damaging sensitive forests and farm crops

4. Aesthetic damage

Certain types of PM, such as soot, can stain and damage stone and other materials, including culturally important objects such as historic buildings, monuments, and statues. Cleaning up these landmarks is expensive and time consuming.

5. Public Nuisance

PM can become a public nuisance when it is concentrated at the local level. The nuisance effects can include soiling of personal property, increased respiratory ailments, reduced visibility, odor, or other problems. These effects can have the most impact on sensitive populations, such as children, the elderly and those with existing respiratory illness or compromised immune systems.

II. WHAT ARE PM CONDITIONS IN THE BAY AREA?

The U.S. Environmental Protection Agency (U.S. EPA) and the California Air Resources Board (ARB) have adopted ambient air quality standards for PM₁₀ and PM_{2.5} (Table 1). California's standards are the most health-protective standards in the nation and are designed to provide additional protection for the most sensitive groups of people. According to ARB, attainment of California's standards is expected to result in the prevention of premature deaths, incidences of asthma among children, and over millions of lost work days per year.

TABLE 1

	California Standard (µg/m³)	Bay Area Status	National Standard (µg/m³)	Bay Area Status
PM₁₀ - Annual	20	Nonattainment	50	Attainment
PM₁₀ - 24-hour	50	Nonattainment	150	Unclassified
PM_{2.5} - Annual	12	Nonattainment	15	Attainment
PM_{2.5} - 24-hour	--	--	65	Attainment

State and National particulate matter ambient air quality standards. The levels of the standards are expressed in micrograms per cubic meter (µg/m³). Status of Bay Area based on data available as of 11/23/2004.

Today, virtually all of California is considered to be in "nonattainment" for the State PM₁₀ standard, with most urban areas, the Central Valley, and several other areas in nonattainment for the State PM_{2.5} standard. The Bay Area is currently in attainment of the Federal PM₁₀ and PM_{2.5} standards.

III. WHAT IS BEING DONE TO REDUCE PM POLLUTION IN THE BAY AREA?

The Bay Area Air Quality Management District (Air District) implements a number of regulations and programs to reduce PM emissions. These include rules limiting direct PM emissions from open burning of agricultural and non-agricultural waste, controlling dust from earthmoving and construction/demolition operations, limiting emissions from various combustion sources such as cement kilns and furnaces, and reducing PM from composting and chipping activities. In addition, the Air District also enforces rules that limit indirect PM precursor emissions such as NO_x from power plants, industrial facilities, and other combustion sources, and VOCs from petroleum refineries, coatings and solvents, product manufacturing, fuel storage, transfer and dispensing activities, and many other industrial and commercial facilities.

The Air District also administers programs that deal specifically with emissions from wood-burning appliances such as fireplaces, wood stoves and heaters. These programs include the Spare the Air Tonight campaign that advises Bay Area residents not to burn wood on evenings that are forecast to have conditions favorable for increased PM levels. The Air District has also developed a model wood burning ordinance for cities and counties, and administers incentive programs to replace older and dirtier wood-burning equipment with EPA-certified devices.

To reduce PM emissions from mobile sources, the Air District implements a variety of incentive programs to encourage fleet operators and the public to voluntarily replace or retrofit older higher polluting vehicles/equipment with newer lower polluting vehicles/equipment. The types of projects funded include purchasing low-emission vehicles, re-powering old polluting heavy duty diesel engines, and installing after market emissions control devices that reduce particulates and NO_x emissions. These incentives are available for a wide variety of on-road and off-road equipment. In addition, one program focuses specifically on school buses while another deals specifically with refuse trucks. The Air District also operates a vehicle buy-back program to provide financial incentives to remove the oldest most polluting vehicles from Bay Area roadways.

IV. SB 656 PM IMPLEMENTATION SCHEDULE

A. What is the SB 656 PM Schedule?

In 2003 the California Legislature enacted Senate Bill 656 (SB 656) to reduce public exposure to PM₁₀ and PM_{2.5}. SB 656 requires ARB, in consultation with local air districts, to develop and adopt, by January 1, 2005, a list of the most readily available, feasible, and cost-effective control measures that could be used by ARB and the air districts to reduce PM₁₀ and PM_{2.5}. The goal of SB 656 is to make progress in the near-term toward attainment of State and national PM₁₀ and PM_{2.5} standards.

The potential PM control measures on ARB's list are based on rules, regulations, and programs

existing in California as of January 1, 2004 to reduce emissions from new, modified, and existing stationary, area, and mobile sources.

For more information about SB 656 and to view related documents, please go to www.arb.ca.gov/pm/pmmeasures/pmmeasures.htm.

B. The SB 656 Process

As required by SB 656, ARB compiled a list of existing PM rules, regulations, and programs in California as of January 1, 2004. This list included 103 different measures that are being implemented by any air district to address both direct and indirect PM emissions. Local districts must review the ARB list and identify the measures most appropriate for their respective regions. Air Districts must adopt an implementation schedule that prioritizes the appropriate measures based on cost effectiveness and their effects on public health, air quality, and emissions reductions. The SB 656 legislation and ARB guidance directs each air district to base their evaluation of potential PM reduction measures on the nature and severity of the PM problem in their area.

SB 656 requires that local air districts not include measures on the implementation schedule if they are substantially similar to measures already adopted by the air district or are scheduled to be adopted within two years of the implementation schedule, or if the air district has determined that there are readily available, feasible, and cost-effective alternative control measures that will achieve equivalent or greater reductions. In addition, measures to reduce PM precursors already being addressed in the air district's attainment plan for state ozone standards are also exempt from the implementation schedule.

C. Sources of PM in the Bay Area

Air District staff has analyzed both direct and indirect sources of PM throughout the Bay Area. Based on 2000-2003 ambient air monitoring data, the Air District and the ARB estimated that the PM_{2.5} fraction of total PM accounted for approximately 60% of PM₁₀ during the winter and approximately 45% during the rest of the year. On days when the PM standards are exceeded, PM_{2.5} can account for as much as 90% of PM₁₀. On an annual basis, the ARB estimated that PM_{2.5} comprised approximately 50% of the PM₁₀ levels. Therefore, PM_{2.5} is seen a significant component of the region's total PM problem.

Air District staff and ARB staff have been working on ways to determine the sources of PM in the region. One method was to evaluate the Air District's source inventory for specific stationary and area sources. Another method was to analyze the nature of the PM collected as part of the region's participation in the state's PM_{2.5} speciation network of ambient air monitors.

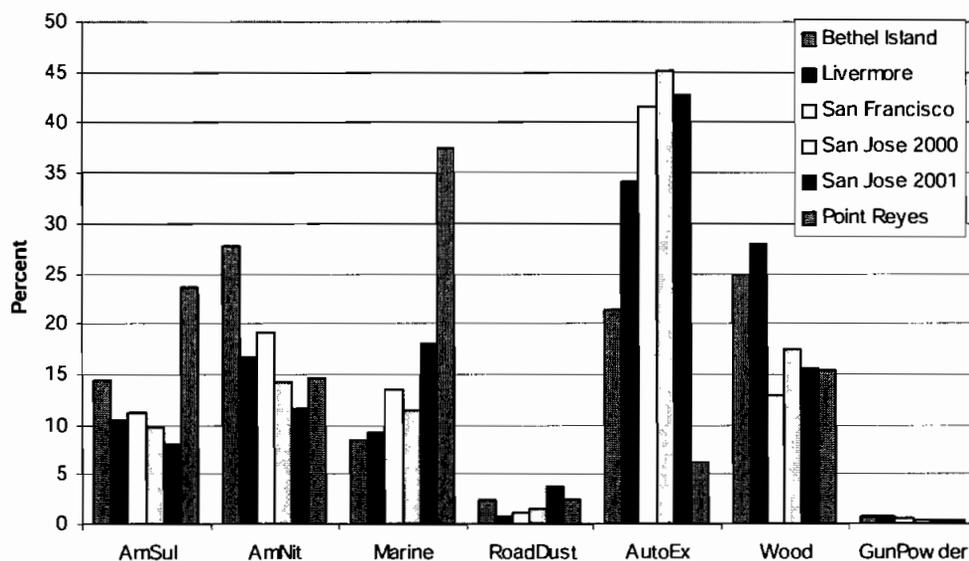
The emissions inventory data collected by the Air District reflects PM₁₀. Based on the inventory data, combustion activities such as residential wood burning, construction/demolition activities, road dust, and emissions from on and off-road engines have been identified as significant sources of PM₁₀ emissions. While the inventory is helpful in determining potential PM₁₀ sources in the region, it does not provide the full picture of the makeup of the region's PM. The nature of particulates is that larger, coarser particles tend to settle out of the air closer to their emission source while smaller particles, such as the size of PM_{2.5}, tend to remain suspended in the air

longer and travel further. In addition, direct and indirect sources of PM needed to be distinguished. Therefore, further evaluation of the sources of PM was needed.

The data collected from ambient air monitoring in the region, reflects both PM₁₀ and PM_{2.5}. Recent scientific studies have found specific chemical components of PM to be associated with likely emission source categories. To help determine the sources of PM collected from ambient air monitors Air District staff applied an approach called the chemical mass balance (CMB) analysis using a computer model to apportion ambient PM collected on filters to a set of source categories, such as fossil fuel combustion, wood smoke, and geological dust. The CMB model found the mix of sources that best matches the ambient PM samples collected at monitoring sites, chemical species by chemical species. The results were then compared to the Air District's emissions inventory to further refine the source categories.

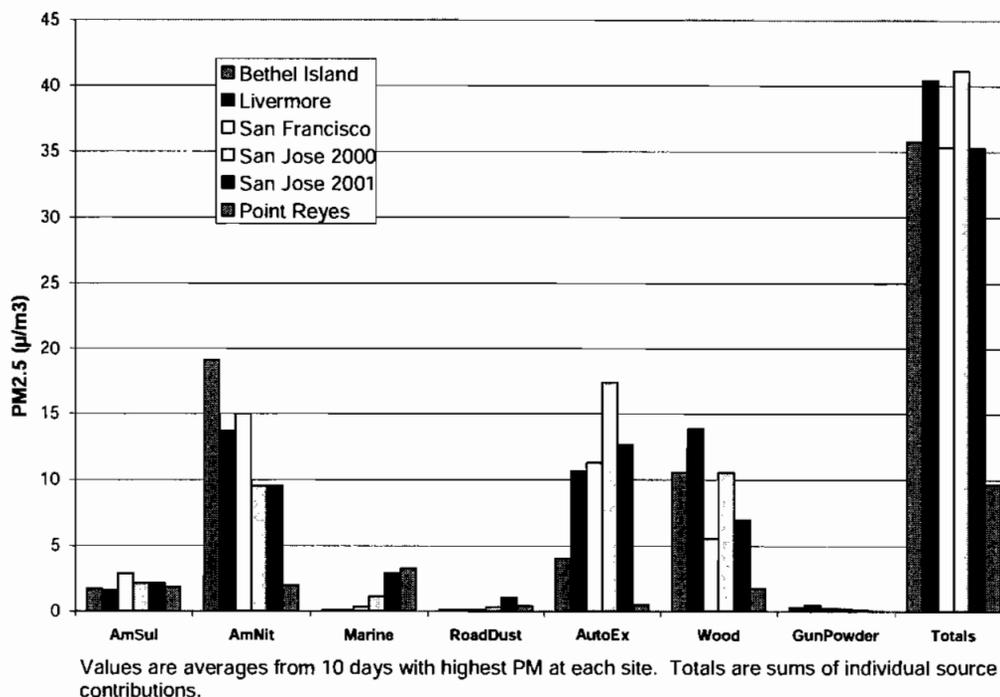
The combined analysis showed that for annual average PM_{2.5} the largest source categories are on and off road motor vehicle exhaust and carbon from cooking and wood-burning activities. These categories include both directly emitted PM and secondary PM, such as ammonium nitrate formed by atmospheric reactions of ammonia with nitrogen oxides from motor vehicles and other combustion sources. Geological dust was found to be a minor component of ambient PM. During the winter, residential wood smoke and cooking are major contributors to ambient PM. Combustion PM_{2.5}, which includes vehicle exhaust, is the second major component of PM_{2.5} and a significant component of PM₁₀. Ammonium nitrate is also a principal component of ambient PM. Winter conditions – cool temperatures, low-wind speeds, low inversion layers, and high humidity – favor the formation of ammonium nitrate and the buildup of PM in the region. Road dust and other dust producing activities also contribute to ambient PM₁₀, but not PM_{2.5}, and have a more local impact. The Figures 1 and 2 below summarize the results of the CMB analysis to determine source categories for both annual PM_{2.5} and peak PM_{2.5}.

FIGURE 1
Annual Percentage PM_{2.5} Contributions from Various Source Categories



The values shown are the mass from individual source categories as a percentage of the total estimated mass. Thus, the percentages sum to 100% for each site.

FIGURE 2
Source Contributions to Peak Bay Area Ambient PM_{2.5}



V. SB 656 MEASURES EVALUATION PROCESS

To address the requirement of SB 656, the ARB compiled a list of existing PM rules, regulations, and programs in California as of January 1, 2004. This list included 103 different measures that are being used by various air districts to address both direct and indirect PM emissions. Each air pollution control air district in the state has characteristics and emissions sources specific to the region. For this reason, not every item on the ARB's list of 103 measures would be applicable to every region. The SB 656 legislation directed each air district to base their further reduction measures on the nature and severity of the PM problem in their area. For example, the San Joaquin Valley has a significant PM problem and is considered to be in non-attainment of the federal PM₁₀ and PM_{2.5} standards. The San Joaquin Valley Air Pollution Control District (SJVAPCD) has had to create PM Plans to address how they will achieve attainment and the severity of their region's problem necessitated very aggressive regulations. The Bay Area, however, is in attainment of the federal PM standards and the PM problem here is not as extreme. Therefore, some measures that may be necessary to address the PM problem in San Joaquin Valley may not be as necessary or cost effective in the Bay Area.

Additional guidance in the SB 656 legislation states that the Air District should not include measures if they are substantially similar to those scheduled to be adopted within two years of the Implementation Schedule or if the Air District has determined that there is a readily available, feasible, and cost-effective alternative control measure that will achieve equivalent or

greater reductions. In addition, measures to reduce PM precursors already being addressed in the Air District's ozone attainment plan are also exempt from the Implementation Schedule. Air District staff compared each of the 103 measures on ARB's list with existing Air District rules, regulations and programs to determine if equivalent measures are already being used or are being addressed in other ways. For a full description of each ARB measure, please visit http://www.arb.ca.gov/pm/pmmeasures/board_approved_list.pdf. The results of this evaluation are represented in the table below.

Measure Evaluations Results	ARB Control Measure Number
Equivalent measures that are already being used by the Air District	1, 3, 13 - 18, 20 - 33, 36, 38 - 41, 49, 51, 54, 57 - 60, 63, 65, 71, 73 - 78, 81, 85 -89, 90 - 98, 101 - 103 (61 total)
Air District lacks authority to regulate	99 and 100 (2 total)
No Bay Area Sources	19, 35, 48, 61, 66 (5 total)
Insignificant potential emissions reductions	34, 37, 42, 43, 69, 72 (6 total)
Already being proposed in Ozone Strategy Control Measures	45, 46, 64, 70, 79, 80, 82 (7 total)
Identified as further study measure in Ozone Strategy	55, 56, 62, 67, 68, 83, 84 (7 total)
Identified for further study and evaluation - wood burning.	2, 4 - 12 (10 total)
Identified for enhancement/amendment - wood burning. Added to Implementation Schedule.	1 and 3 (2 total)
Identified for new rulemaking - combustion emissions from stationary and portable IC engines and charbroiling operations. Added to Implementation Schedule.	47 and 53 (2 total)

VI. PROPOSED PM IMPLEMENTATION SCHEDULE

The next step in the process was to evaluate the potential air quality and health benefits, cost effectiveness, and feasibility of the measures that are not currently being used by the Air District and propose additional measures for the Air District to adopt. The proposed new or amended measures are listed below.

PROPOSED PM IMPLEMENTATION SCHEDULE

Measure	ARB Control Measure Number	Adopt/Amend	Full Implementation
Further limit NOx and VOC emissions from stationary and portable internal combustion engines.	47	2006	TBD
Limit PM and VOC emissions from commercial charbroiling operations that use chain-driven charbroilers.	53	2006	TBD
Amend existing program aimed at voluntary curtailment of wood burning during periods of predicted high PM by adjusting the threshold for "Spare the Air Tonight" alerts.	3	2005	2005
Amend existing public awareness program to provide additional outreach and educational resources. Enhance existing wood-burning ordinance program.	1	2005	2005

VII. ADDITIONAL PM REDUCTION EFFORTS

The SB 656 guidance on the Implementation Schedule focuses on the measures list compiled by the ARB. However, in addition to the measures referenced in the Implementation Schedule, the Air District plans to address PM emissions through other programs.

A. Community Air Risk Evaluation (CARE) Program

The Air District has initiated a Community Air Risk Evaluation (CARE) program to determine health risk associated with toxic air pollutants in the Bay Area. When completed, the study will be a tool the Air District can use to reduce toxic air pollution in areas with the highest health risk. The program will look at all toxic air pollutants with an emphasis on diesel exhaust, which is thought to be the major source of airborne health risk in California.

The program includes enhanced air monitoring that will better determine the relative contribution of air pollution sources, including vehicles, industrial emissions and/or wood burning to ambient particulate levels. As a result of the study, a "gridded" emission inventory (2 km x 2 km grid) for air toxics will be developed for the Bay Area. Based on the technical analyses, the Air District can focus on reducing toxic pollutants in areas with the highest health risk by using incentives, grant program funding and regulatory controls. A CARE Task Force of diverse stakeholders will assist the Air District in its efforts.

B. Vehicle Incentive Programs

The Air District currently operates a variety of vehicle incentive programs aimed at reducing mobile sources of emissions. These programs address light-duty fleet and heavy-duty vehicles as well as school buses and off-road engines.

The Carl Moyer program, for example, provides funds on an incentive basis for the incremental cost of cleaner than required engines and equipment. Eligible projects include cleaner on-road, off-road, marine, locomotive and stationary agricultural pump engines, as well as forklifts, airport ground support equipment, and auxiliary power units. The program achieves near-term reductions in emissions of oxides of nitrogen (NO_x) and reduces PM. The types of projects and the available funding under this program have recently been expanded.

The incentive programs are all contingent on funding available to the Air District. In some cases the funding comes to us from the Air Resources Board and in other cases the funding comes through federal or other state sources. The Air District looks for opportunities to garner additional funds that can be used for emission reduction projects in the Bay Area. Air District staff will continue to pursue legislation additional resources for the region which can then be disbursed to applicable PM reduction programs.

C. Wood Burning

The Air District has been working to address woodsmoke. The Air District issues "Spare the Air Tonight" advisories on nights when Air Quality Index readings for PM_{2.5} are expected to exceed 150. On these nights, we ask residents not to drive and not to use their fireplaces and woodstoves. The Air District is proposing to adjust this threshold so that Spare the Air Tonight advisories will be more protective of public health. In addition, the Air District plans to pursue further public outreach and information programs that will highlight the significant air quality impacts of wood burning and encourage home and business owners to avoid wood burning and purchase the cleanest wood burning equipment available.

In 1998 the Air District, with stakeholder input, developed a model woodsmoke ordinance for fireplaces and woodstoves as a guidance document for cities and counties that wish to regulate sources of particulate matter in their communities. The ordinance does not ban woodburning in fireplaces but seeks to take advantage of new, cleaner technologies that have been developed to effectively reduce woodsmoke pollution. Air District staff work with health agencies and interested residents in the Bay Area to advocate for the adoption of the ordinance, and now 37 cities and seven of the 9 Bay Area counties have woodsmoke ordinances. The Air District will continue to enhance and improve its model woodsmoke ordinance with the goal of getting more municipalities and counties to adopt it. It is important to note that many of the measures addressing wood burning on the ARB's list of control measures are already included in the Air District's model ordinance program (such as measures 4, 5, and 6) while other measures were created to deal with very severe and specific regional PM problems, such as mandatory no burn days in San Joaquin Valley which is in non-attainment of the federal and state PM standards. In addition to expanding efforts on its public outreach campaigns and model wood burning ordinance, the Air District will continue to analyze the source of PM in the region to determine if there are areas where certain activities such as wood burning create localized public health concerns because of geographical, meteorological or other conditions unique to that location.

The Air District will further characterize the nature of wood burning's contribution to the region's PM_{2.5} burden and will work with local stakeholders to determine appropriate measures to address the issue.

D. Ozone Strategy Further Study Measures

The Air District, in cooperation with the Metropolitan Transportation Commission and the Association of Bay Area Governments, is preparing the Bay Area Ozone Strategy. The Ozone Strategy will address California air quality planning requirements. A critical component of the Ozone Strategy document is the set of control measures to further reduce ozone precursor emissions in order to reduce ozone levels in the Bay Area and to reduce transport of pollution to downwind regions. The control strategy includes stationary source measures, mobile source measures and transportation control measures. In addition, the Air District has also identified a number of further study measures. Some of the further study measures identified in the Ozone Strategy are also on the ARB's list of 103 control measures for indirect PM emissions. Like many of the further study measures in the Ozone Strategy, these measures need to be researched in greater depth to determine their potential impact on air quality and public health, cost effectiveness, and feasibility. The Air District will continue to evaluate the further study measures to determine whether they are viable PM control measures as well as ozone control measures.

Many of the following measures are addressed in existing BAAQMD regulations and the Air District is will be studying them to determine whether to make them more stringent. These measures are included in both the Air District's Draft Ozone Strategy as further study measures and the ARB's list of PM measures:

- Chipping and grinding operations – ammonia and VOC
- Composting – ammonia and VOC
- Solvents in food product manufacturing and processing
- Coatings – adhesives and sealants (VOC)
- Coatings – architectural coatings (VOC)
- Solvent cleaning operations (VOC)
- Degreasing operations (VOC)

STATE OF CALIFORNIA

Energy Resources Conservation
and Development Commission

Application for Certification for the)
LOS ESTEROS CRITICAL ENERGY FACILITY) Docket No. 03-AFC-2
PHASE 2)
(LOS ESTEROS 2))
_____)

PROOF OF SERVICE

I, Travis Merlo, declare that on November 3, 2005, I deposited copies of the attached *BAAQMD Staff Report: Proposed Particulate Matter Implementation Schedule dated September 12, 2005* in the United States mail in Sacramento, California, with first-class postage thereon fully prepaid and addressed to all parties on the attached service list.

I declare under the penalty of perjury that the foregoing is true and correct.



Travis Merlo

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03-AFC-2

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