

**SACRAMENTO METROPOLITAN
AIR QUALITY MANAGEMENT DISTRICT**

For Agenda of **May 24, 2007**

To: Board of Directors
Sacramento Metropolitan Air Quality Management District

From: Larry Greene, Air Pollution Control Officer
Sacramento Metropolitan Air Quality Management District

Subject: Further Study of Wood Burning Measures - Mandatory No-Burn Restrictions

Recommendations

This is an information item.

Executive Summary

The largest single source of Sacramento's wintertime fine particulate matter (PM2.5) air quality problems is residential wood burning. Fine particulate matter is linked to serious adverse health effects, including aggravated asthma, heart attacks, and premature death in people with heart or lung disease.

California Health and Safety Code, Section 39614 (SB656) required air districts to establish an implementation schedule for the most cost effective control measures to reduce particulate matter emissions. In July 2005, your Board approved a SB656 implementation schedule that included consideration of a rule to prohibit non-essential residential wood burning on days with poor particulate matter air quality.

Current data suggests the Sacramento area will likely be designated nonattainment for the new Federal 24-hour PM2.5 National Ambient Air Quality Standard. A designation of nonattainment will require an attainment plan, including transportation conformity budgets and all measures necessary for the area to achieve attainment. If a mandatory no-burn measure is successfully implemented prior to the federal designations in 2010, it may help avoid the nonattainment designation.

Staff completed further analysis of residential wood burning restrictions and is beginning the public part of the process to establish a prohibition of non-essential residential wood burning during poor air quality events, called a "mandatory curtailment" rule. The analysis so far has produced the following key findings:

- Similar rules have been successfully implemented in other areas, and have shown improvements in particulate matter air quality.
- The most effective local control measure for wood burning emissions is a mandatory curtailment program. The targeted reductions from this measure are greater than the combined reductions from all other wood burning measures that are under consideration.

- A public opinion survey of Sacramento County residents (including a sub-sample of low-income residents) revealed that:
 - 71% of all respondents would support the adoption of mandatory curtailment restrictions.
 - 78% of respondents who burn wood indicated that they would be likely to comply with a mandatory curtailment request.
 - 91% of respondents who burn wood indicated that they would be likely to comply with a voluntary curtailment request. However, of those wood-burning respondents who heard this past winter's Spare the Air message, only 46% actually curtailed their wood burning.
 - 59% of all respondents heard the wintertime Spare the Air requests not to burn this past winter.

Based on these findings, staff will solicit input on a proposed rule and staff analysis at public workshops scheduled for the week of July 23, 2007, and will plan to return for Board consideration of a proposed rule this fall.

Health Effects and Air Quality

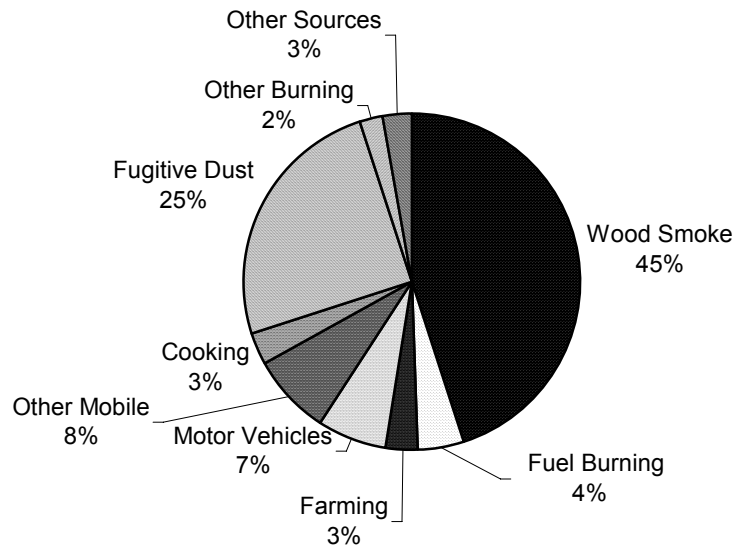
Particulate matter (PM) is a mixture of very small liquid droplets and solid particles. Adverse health effects are linked to particles that are less than 10 microns in diameter (PM₁₀), and fine particles that are less than 2.5 microns in diameter (PM_{2.5}). According to the U.S. Environmental Protection Agency (EPA), health studies have linked exposure to particulate matter, especially fine particles, to several significant health problems, including:

- increased respiratory symptoms, such as irritation of the airways, coughing, or difficulty breathing;
- decreased lung function;
- aggravated asthma;
- development of chronic bronchitis;
- irregular heartbeat;
- nonfatal heart attacks; and
- premature death in people with heart or lung disease.

Exposure to particulate matter pollution can cause coughing, wheezing, and decreased lung function even in otherwise healthy children and adults. EPA estimates that thousands of elderly people die prematurely each year from exposure to fine particles. In addition, a recent study (Dominici et al., 2006) of the correlation between PM_{2.5} concentrations and hospital admission rates concluded that short-term exposure to PM_{2.5} increases the risk of hospitalization for cardiovascular and respiratory diseases.

The District is currently designated as a nonattainment area for the state and federal¹ PM₁₀ standards and for the state PM_{2.5} standard. The 2005 emission inventory for Sacramento County shows that residential wood smoke is the single largest source of fine particles, accounting for 45% of wintertime PM_{2.5} emissions.

¹ Based on 1998-2000 monitoring data, EPA made a finding (February 15, 2002 Federal Register, Volume 67, Number 32, Page 7082 et seq.) that Sacramento County attained the federal ambient PM₁₀ standard by the applicable December 31, 2000 attainment deadline. Note that this EPA finding did not redesignate the Sacramento district to attainment.



Previous Commitments and Actions

Senate Bill 656 (SB656, Sher, Health and Safety Code Section 39614) required the California Air Resources Board (CARB) to develop a list of the most readily available, feasible, and cost-effective control measures that could be employed to reduce particulate matter emissions, and each air district to adopt an implementation schedule for the most cost-effective measures. In November of 2004, CARB adopted a list of particulate matter control measures to be considered by districts, and on July 28, 2005, the District adopted an implementation schedule for SB656. The following wood burning measures are on the SB656 implementation schedule:

- Require use of USEPA-Certified Phase II or equivalent devices
- Public Awareness Program with either a voluntary curtailment or mandatory curtailment
- Require replacement of non-certified units upon sale of property
- Restrict number of wood burning fireplaces allowed in new residential developments
- Control of wood moisture content. Prohibit burning materials that are not intended for use in fireplace/heater

In October 2006, Rule 417 was adopted to implement several of the SB656 measures. Rule 417 requires cleaner wood burning equipment in new installations, regulates wood moisture content, and prohibits the burning of inappropriate materials. In addition, a public awareness program was expanded last fall, including regional forecasting of particulate matter air quality and voluntary no-burn requests. The District also provides financial incentives for modification of existing fireplaces and replacement of dirty wood stoves with cleaner equipment. Today, the Board will consider providing higher incentives for low income residents.

In addition to the mandatory no-burn restrictions, the District committed to complete further study of the replacement of non-certified devices upon sale of property and restricting the number of wood burning devices allowed in new residential developments, and if found to be

feasible, adopt the measures. The following table shows the estimated emission reductions and cost effectiveness for these wood burning control measures that have not yet been adopted.

Wood Burning Control Measure	Estimated Annual PM2.5 Emission Reduction (tons/yr)	Estimated Cost Effectiveness (\$/lb)
Mandatory Curtailment	113 - 785	\$4.17 – 4.77
Replacement of Non-Certified Devices Upon Sale of Property	92 – 194	\$0.89 – \$17.97
Restricting the Number of Wood Burning Devices Allowed in New Residential Developments	75	Cost Savings

As shown in the table, the potential emission reductions from a mandatory curtailment program are greater than the combined reductions from the other two wood burning measures under consideration. Additionally, the emission reductions from a mandatory curtailment program are specifically targeted for days with the poorest air quality.

Federal Nonattainment Impacts

The District meets the 1997 federal PM2.5 standards. The Sacramento area will likely be designated nonattainment for the new federal PM2.5 standards. The new federal PM2.5 standards were effective December 2006, with nonattainment designation expected to be effective in 2010 and attainment plans due by 2013.

Attainment will be determined using the three year average high PM2.5 concentrations, beginning in 2006 or 2007. To illustrate our current situation, PM2.5 measurements from Sacramento County monitoring stations were analyzed for the years 2004-2006, as shown in the following table. All three Sacramento County monitoring stations recorded daily values above the federal standard of 35 µg/m³. If air quality improves and the area is not designated nonattainment, many additional controls and requirements may be avoided.

98th Percentile PM2.5 Concentration² Years 2004-2006	
Monitoring Station	µg/m³
13 th and T Street	41.3
UCD Med. Center - Stockton Blvd.	38.7
Del Paso Manor	48.7
Standard	35

If designated nonattainment, an attainment plan must be submitted in 2013. The plan must include transportation conformity budgets and control measures. Transportation conformity budgets will require that future transportation projects stay within specified emission levels that

² This data was acquired at the three stations located in Sacramento County that have federal reference method monitors. The data is from 2004, 2005, and 2006. The average value is calculated according to procedures specified in Appendix N of Title 40, Code of Federal Regulations Part 50. The procedures require selection of the 98th percentile monitored concentration. For example, in 2006 the top seven readings were excluded from the calculation.

meet attainment and progress goals.

The federal Clean Air Act requires attainment plans to include best available control measures. Residential burning restrictions would likely be required as part of that federal plan. In addition, the following control measures that were excluded from our original SB656 list would need to be reconsidered:

- Controls for non-agricultural open burning, including residential burning of vegetative waste
- Controls for fugitive dust from bulk materials storage and handling
- Design restrictions to reduce fugitive dust from new and modified paved roads
- Control of fugitive dust from agricultural sources such as tilling, off-field operations, paved and unpaved roads, and livestock operations
- Control of chipping and grinding operations, and co-composting with biosolids and/or manure

Other measures would need to be considered from reviews of the most recent control plans from other nonattainment areas such as the San Joaquin Valley APCD and South Coast AQMD. These measures include:

- Emission reductions from school bus fleets
- More stringent control efficiency requirements for PM control devices such as baghouses, wet scrubbers, and electrostatic precipitators
- Controls of agricultural and prescribed burning
- Control of emissions from green waste composting
- Residential furnaces

Voluntary Curtailment

Curtailment means a reduction in residential wood burning on forecasted poor air quality days. Wood burning curtailment programs do not apply to wood burning that is the sole source of heat to a residence. The objective is to reduce the amount of wood burned for ambience, aesthetic reasons, or supplemental heating. This curtailment does not apply to gas logs, gas fireplace inserts, or any other gas burning devices.

Air quality forecasts use the established air quality index (AQI). This AQI chart has been used in the Spare the Air program for many years. Voluntary curtailment requests the public curtail or reduce burning wood on days when the AQI is forecast to exceed a preset threshold. Voluntary curtailment requests have been made over the years, typically around winter holidays.

Sacramento area air quality forecasts are made by Sonoma Technologies, Inc. (STI). STI has been forecasting for the region since 1996 and has developed methods for particulate matter forecasting for the Environmental Protection Agency's AIRNOW program. This past fall 2006, the regional Spare the Air program for ozone was expanded to include fine particulate matter. As part of that program, eight voluntary curtailment requests were made when the AQI was forecast to exceed 127. A recent survey indicated that of those people who heard the no-burn request, 46% complied and reduced their number of fires.

Studies of the effectiveness of voluntary curtailment program have been conducted by the Bay Area AQMD, which has had a voluntary curtailment program (Spare the Air) for several years.

Their studies shows 1.5 – 6.5% of people who burn alter their burning behavior in response to voluntary curtailment days.

Mandatory Curtailment

A number of areas have adopted mandatory curtailment measures, which have been in effect for several years (see table below). Many of these locations have shown reductions of particulate matter concentrations. Additionally, several other areas are currently developing mandatory curtailment measures, including the Bay Area AQMD, which is shortly expected to provide details of their proposed program. Details will be provided as available.

District or Location	In Effect Since
San Joaquin Valley APCD	2003
Denver, Colorado	1987
Puget Sound, Washington	1995
Bernalillo County (Albuquerque), New Mexico	1995
Mammoth Lakes, California	1990

In the city of Fresno, which is within the SJVAPCD, wintertime PM_{2.5} concentrations showed a 33% reduction from 2001 to 2005³. In Puget Sound, Washington, only one mandatory burn day has been called in the last ten years. The town of Mammoth Lakes has shown a reduction of approximately 40% in PM₁₀ over the life of its program⁴. If a 30% reduction occurs at Del Paso Manor, our peak site, that site's average concentration would be 34 µg/m³, attaining the federal standard.

Survey Results

In an effort to gauge public awareness of fine particulate matter air quality problems and health impacts, and to gauge support and likely compliance with a curtailment program, a random telephone survey of Sacramento County residents was conducted in April 2007. The survey received responses from 499 county residents, including a subset of 139 who would be classified as low-income residents based on federal guidelines. Among the key findings are:

- 71% of all respondents would support the adoption of mandatory curtailment restrictions. Among low-income residents, the percentage was nearly identical (73%).
- 78% of respondents who burn wood indicated that they would be likely to comply with a mandatory curtailment.
- 91% of respondents who burn wood indicated that they would be likely to comply with a voluntary curtailment request. However, of those wood-burning respondents who heard this past winter's Spare the Air message, only 46% actually curtailed their wood burning.
- 59% of all respondents heard the wintertime Spare the Air requests not to burn this past winter. Among low-income residents, the percentage was 57%.
- Only 20% rated the area's air quality as poor, and only 13% rate wood smoke as a very serious cause of winter time air pollution.

³ Data presented at the CRPAQS Update, November 3, 2006 PC Meeting

⁴ Data presented at the U.S. EPA Residential Wood Smoke Training/Workshop, March 14-15, 2007

- No respondents indicated wood burning as their sole source of heat.
- Ownership of at least one wood burning appliance was lower among low-income residents (34%) than among the overall population (54%).
- Among those who reduced their burning of wood last winter, 46% did so because of air quality or health concerns, or because they heard a request not to burn. Among low-income residents, the percentage who reduced their wood burning for these reasons was much lower (26.7%).
- The strongest response to suggested methods of communicating a mandatory curtailment episode was disseminating the information through news outlets, such as television and radio

The final report for the survey is included in Attachment A.

Mandatory Curtailment Options

A key factor in a mandatory curtailment program is setting the PM_{2.5} threshold at which a mandatory curtailment is declared. A lower threshold will result in more curtailment days and a greater benefit in improving air quality and reducing adverse health effects, but will have a greater impact on residents. This may increase opposition to the rule, and possible reluctance on the part of individuals to comply with the increased number of curtailment days. Fewer curtailment days may increase public acceptance, but will reduce the effectiveness of the rule. The threshold could start at a higher level, and reduce the threshold to the federal health standard levels after two years. However, this approach will not achieve benefits in time to affect or prevent the initial federal nonattainment designation.

In determining what threshold to set for the mandatory curtailment, the historical PM_{2.5} data for the last few years were examined to determine possible effects. The following table shows the number of days each winter that exceeded certain 24-hour thresholds.

Days Above PM 2.5 Thresholds				
Season	65 µg/m ³	53 µg/m ³	40.5 µg/m ³	35 µg/m ³
2003/2004	2	5	12	28
2004/2005	0	3	12	27
2005/2006	6	9	19	28
2006/2007	3	11	31	38
Average	3	7	19	30

The thresholds used are chosen for the following significance:

- 65 µg/m³ – 1997 federal 24-hour standard
- 53 µg/m³ – 127 AQI, 2006 level at which voluntary curtailment called
- 40.5 µg/m³ – Equivalent to 100 on the current AQI scale
- 35 µg/m³ – New 2006 federal 24-hour standard, 89 AQI

Another key aspect of a mandatory curtailment program is enforcement of the rule. The most widely used enforcement method is visual inspection of chimneys for emissions. These inspections can be triggered by complaints from the public, or by random inspections of neighborhoods. Any residence found to be in violation will be issued a citation, and be subject

to monetary fines. Several districts have alternate methods to avoid the fine for first time offenders, such as attending a wood smoke education class.

Wood Burning Statistics and Emissions

Residential wood burning emissions are calculated using the following statistics. The ranges are based on estimates available from previous surveys, as well as the most recent phone survey. In Sacramento County:

- 155,600 - 195,800 residences have fireplaces
- 25,100 - 90,400 residences have wood stoves
- 30,100 – 80,300 residences have wood burning inserts
- 2,000 – 15,000 residences have pellet stoves

Of the homes with wood burning equipment:

- 101,100 - 139,000 residences with fireplaces burn wood
- 16,300 - 76,800 residences with wood stoves burn wood
- 25,600 – 52,200 residences with wood burning inserts burn wood
- 2,000 – 9,800 residences with pellet stoves burn pellets

Among those respondents to the survey who use wood burning fireplaces or fireplace inserts, 57% use them more for aesthetics, while 43% use them more for supplemental heating. Among the low-income residents, 38% use them more for aesthetics, while 62% use them more for supplemental heating.

The emissions reductions are based on the number days of Mandatory Curtailment per year and existing usage patterns. Emissions are based on the following assumptions:

- The average wood usage per residence is based on survey responses.
 - 29% of residences will not comply with the rule.
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Cost Effectiveness

To determine the cost effectiveness of this measure, the costs associated with the rule were calculated, and the total cost was divided by the reduction in PM2.5 emissions.

The first set of costs is the production and distribution of the mandatory curtailment notices. Surveys have indicated the preferred method to be notified is by news media. The costs for notification include the production of any advertisements, and buying advertising time.

The second set of costs is the reduction in fuel consumed during curtailment days. Since the majority of wood and wood products are purchased, this will be a cost borne by wood dealers.

Staff estimates the cost effectiveness of a mandatory curtailment program to be \$4.17 - \$4.77 per pound of PM2.5 reduced.

Public Outreach

In an effort to ensure that the District has maximum input from the public on this issue, a series of public workshops will be held prior to bringing a rule to the Board.

City	Workshop Location	Tentative Date/Time
Sacramento	SMUD Energy & Technology Center	July 23, 6:30 PM
Citrus Heights	City Council Chambers	July 24, 6:30 PM
Folsom	City Council Chambers	July 25, 1:00 PM
Rancho Cordova	City Hall	July 25, 6:30 PM
Sacramento	SMAQMD District Office	July 26, 1:30 PM
Elk Grove	Laguna Creek High School	July 26, 6:30 PM

Staff will send notices to – and if requested, meet with – interested associations, such as the Building Industry Association, Breathe California, Hearth Patio and Barbecue Association, and the Sacramento Association of Realtors. Staff will inform the public of the proposed rule and invite them to participate in the workshops. The means for notifying the public may include, but are not limited to:

- Ad in the Metro Section of the Sacramento Bee
- Ads in community newspapers
- Ads in ethnic and foreign language newspapers
- Homeowners associations/newsletters
- Notice on the District's web site
- Notices by mail to the District's list of parties interested in rule development
- Flyers at senior centers, adult education centers, community centers, and grocery stores.

Additionally, the District will meet individually with interested parties who request it.

Conclusion – Next Steps

The staff analysis shows that mandatory curtailment is the most effective wood burning control available in achieving compliance with the new federal 24-hour standard for PM_{2.5}. Staff will begin public review of a proposed rule to implement a mandatory curtailment program.

Staff will solicit input on the following proposed components of the rule:

- Exemption for wood burning as the sole source of heat in a residence,
- Natural gas, propane and other gaseous fireplaces, furnaces, stoves, and inserts will not be subject to restrictions.
- Curtailment threshold beginning the winter of 2007 (threshold may be phased in over several years)
- Outreach to inform the public of air quality forecasts and curtailment.

Staff's goal is to seek Board approval of the proposed rule this fall.

Staff will inform interested associations and the public of the proposed rule and invite them to participate in the workshops. The means for notifying the public will include ads in local and community newspapers and newsletters, notification by mail, posting on the District's website, and flyers at local community centers.

Respectfully Submitted

Larry Greene; Air Pollution Control Officer
Sacramento Metropolitan
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Approved as to form:

Kathrine Pittard, District Counsel
Sacramento Metropolitan
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Attachment

Attachment A
Final Survey Report