

Bay Area Air Quality Management District
939 Ellis Street
San Francisco, CA 94109

Staff Report

Proposed New

**Regulation 6: Particulate Matter,
Rule 3: Wood-burning Devices**

Amendments to

**Regulation 1: General Provisions and Definitions, and
Regulation 5: Open Burning**

June 4, 2008

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I. EXECUTIVE SUMMARY

The Bay Area Air Quality Management District (Air District) is proposing a new rule, Regulation 6: Particulate Matter, Rule 3: Wood-burning Devices. The purpose of the rule is to limit emissions of particulate matter (PM) and visible emissions from wood-burning devices as part of an overall wood smoke reduction program within the jurisdiction of the Air District. In addition, the Air District is proposing minor changes in current Regulation 1: General Provisions and Definitions and Regulation 5: Open burning, which are discussed later in this report.

It is the responsibility of the BAAQMD to ensure that state and federal ambient air quality standards are achieved and maintained in its geographical jurisdiction. Health-based air quality standards have been established by California and the federal government for the following criteria air pollutants: ozone, carbon monoxide (CO), nitrogen dioxide (NO₂), particulate matter less than 10 microns in diameter (PM₁₀), particulate matter less than 2.5 microns in diameter (PM_{2.5}), sulfur dioxide (SO₂) and lead. The National Ambient Air Quality Standards (NAAQS) were established to protect sensitive receptors with a margin of safety from adverse health impacts due to exposure to air pollution. The California standards are more stringent than the federal standards, and in the cases of PM₁₀ and SO₂, far more stringent. California has also established standards for sulfate, visibility, hydrogen sulfide, and vinyl chloride.

During recent winters, the Bay Area Air Basin exceeded the 24-hour PM_{2.5} NAAQS an average of 17 days. Air District staff anticipates a non-attainment designation for this newly lowered standard. The emission limitations in this proposed rule are intended to address this expected non-attainment status and reduce the adverse public health impacts of PM in the Bay Area. PM is of concern because it can enter nasal passages and the lungs and cause serious health effects such as aggravated asthma, nose and throat irritation, bronchitis, lung damage, and premature death. People with respiratory illnesses, children and the elderly are more sensitive to the effects of PM, but it can affect everyone.

The Bay Area experiences its highest PM concentrations in the winter, especially during the evening and night time hours. Wood-burning is the single greatest source contributing to the PM concentrations, based on an analysis of chemical composition of sampled airborne PM combined with emission inventory data. Emission calculations indicate wood smoke contributes only about 10 percent of total PM emissions on an annual basis, but approximately 33 percent of total wintertime PM_{2.5}. Reductions in wood smoke emissions will be necessary to achieve clean air on a district-wide basis. Staff estimated the expected emission reduction of PM_{2.5} due to implementation of this rule will be 983 tons per year or 716 tons in the wintertime (November through February).

A draft Environmental Impact Report (EIR) was prepared to investigate and discuss elements of the proposed regulation that could result in any potential environmental impacts. The EIR concludes that the proposed regulation would have no adverse environmental impact. A socioeconomic analysis mandated by Section 40728.5 of the California Health and Safety Code was prepared by Applied Economic Development, Berkeley, California. The analysis concludes that there are no significant impacts resulting from changes in household spending habits, meaning small businesses, particularly retail and services, are not disproportionately impacted by the rule.

The proposed rule would reduce wintertime PM_{2.5} levels by curtailing wintertime wood-burning emissions from all wood-burning devices, which includes fireplaces, EPA certified devices, pellet stoves and masonry heaters, and achieve additional reductions by requiring cleaner burning technologies in new construction. In addition, burning will be improved by limiting the moisture content of wood used throughout the year in wood-burning devices.

Currently, there is no Air District rule that directly limits emissions from wood-burning devices. Air District Regulation 1: General Provisions and Definitions has historically excluded regulation of any fires associated with residential heating and will be amended to remove this exclusion. An amendment to existing Regulation 5, Open Burning, will remove an exemption for outdoor wood fires set for recreational purposes and create a requirement to curtail burning outdoors during the winter.

II. BACKGROUND

A. Introduction

Wood-burning devices contribute substantial amounts of fine airborne particulate matter into the atmosphere. It is during the winter months, with certain meteorological conditions, that these devices contribute up to one third of total fine airborne particulate matter in air and threaten the public health.

Wood-burning devices are defined as any wood-burning stove or heater, pellet-fueled device, fireplace, or any indoor permanently installed device burning any solid fuel for space-heating or aesthetic purposes. In the process of burning wood or a solid-fuel product, such as manufactured logs, pressed logs or wood pellets, these devices must vent gases and combustion by-products through a flue or chimney. These emissions contribute to air pollution including PM.

Emissions from wood-burning devices can vary depending on a variety of factors, including the design and age of the wood-burning device, the type and amount of fuel used, and the ability of the user to operate the device in accordance with manufacturer's specifications. This variation may be seen in Figure 1, "Relative Emissions of Fine

Particles”. The graph shows the average fine particle emissions in pounds per million Btu (British thermal unit, a heat value unit) for a variety of wood-burning devices. The figure also compares wood-burning devices to oil and gas-fueled furnaces.

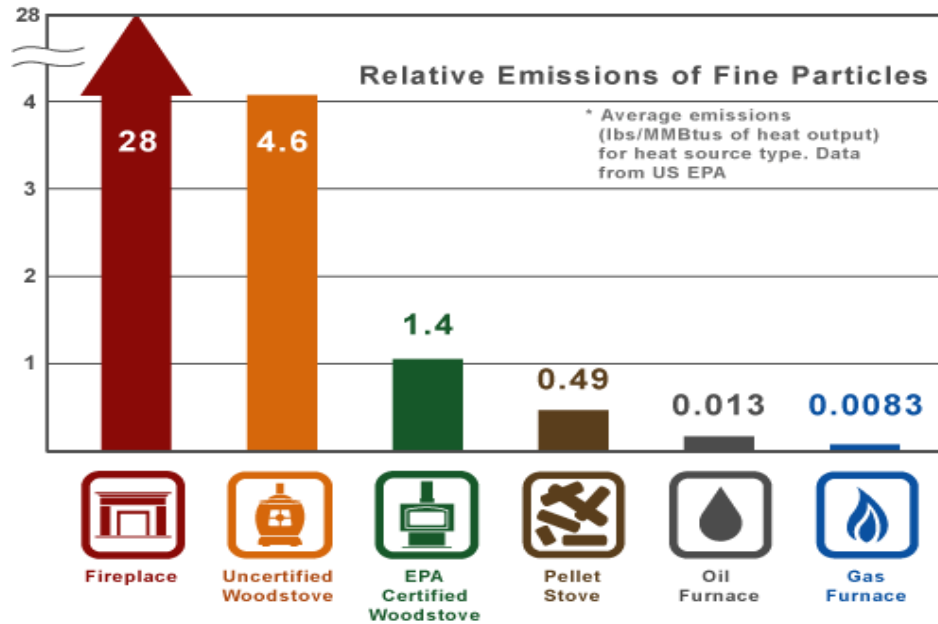


Figure 1 Relative Emissions of Fine Particles, by device type.
 (<http://www.epa.gov/airprogram/oar/woodstoves/refptext.html>)

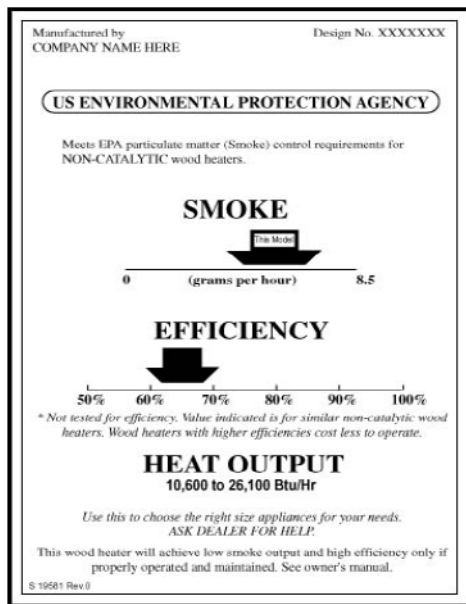
The United States Environmental Protection Agency (EPA) has established new source performance standards for residential wood-burning devices since 1988, including certification procedures.¹ The emission limits and effective dates for wood stoves are shown in Table 1.

¹ Most wood-burning stoves to be sold in the United States must be certified by the U.S. EPA in accordance with Title 40 of the Code of Federal Regulations (CFR), Part 60, Subpart AAA -- Standards of Performance for New Residential Wood Heaters. A list of certified devices, including those that are exempt from certification but meet the emission standards, is maintained by EPA at <http://www.epa.gov/woodstoves/index.html>

	Wood Stove Type	
	Catalytic	Non-Catalytic
Phase I		
Emission Limit (gr/hr)	5.5	8.5
Effective date for mfg	7/1/88	7/1/88
Effective date for sales	7/1/90	7/1/90
Phase II		
Emission Limit (gr/hr)	4.1	7.5
Effective date for mfg	7/1/90	7/1/90
Effective date for sales	7/1/91	7/1/91

Table 1. Summary of New Source Performance Standards for Residential Wood Stoves. (AP42 for Woodstoves, July 29, 1996)

An EPA certified wood stove can be identified by a temporary paper label attached to front of the wood stove and a permanent metal label affixed to the back or side of the wood stove (Figure 2.) One purpose of certification is to verify and document, in accordance with standardized testing by an independent body, the wood-burning device is designed such that the PM emissions to the atmosphere are less than the applicable emission limits for the specific device type.



Temporary Wood Stove Label



Permanent Wood Stove Label

Figure 2. Example of an EPA certification on a wood-burning stove.

Not all wood-burning qualify for EPA certification; however many manufacturers recognize the advantage of certification, which is generally considered proof of cleaner

burning technology. EPA has recognized this demand and is developing test protocols for devices which are not required to get EPA certification, such as masonry heaters. The Air District supports this approach since it leads to cleaner burning devices and provides a national standard for clean burning devices under EPA guidance. These devices could be allowed for new construction, either in a new structure or as part of a remodel in the District, should certain models be able to demonstrate that they can meet future, voluntary EPA approved emission targets according to EPA approved test methods for low-mass fireplaces and masonry heaters.

B. Emissions Inventory

Burning wood dates back to early human history and, since it is a natural process, is sometimes thought to have a benign impact upon human health (Naeher, et al 2007). However, combustion processes, including the combustion of wood in wood-burning devices, are a major source of anthropogenic air pollution, including hydrocarbons, PM, toxic compounds, carbon monoxide, nitrogen oxides, and sulfur dioxides.

PM is a mixture of very small liquid droplets and solid particles suspended in the air. Negative health effects are linked to both droplets and particles. Numerous studies have shown that mortality and hospital admission related to pulmonary and cardiovascular disease increase on days with high particulate air pollution levels (Dominici et. al, 2006; Sällsten et. al, 2006). In addition to premature death in people with heart or lung disease, the EPA has conducted literature surveys on health studies that have linked exposure to PM, especially fine particles. Their synopsis discusses these studies and additional findings that link fine particulate to several other 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.

The EPA lowered the NAAQS after reviewing numerous health studies examining the deleterious impact of fine airborne particulate matter on public health. Air District staff conducted a peer-reviewed literature search to update staff's understanding of the most recent findings on the public health impacts of fine particulate. These studies find links to lung function decrements, inflammation and permeability, susceptibility to infection, cardiac affects, increased asthma attacks, more use of medicines, more doctor and hospital visits, increased absenteeism, and increased premature mortality within sensitive receptors. Several of these studies are listed in the Appendix of this report.

Residential wood combustion is an important contributor to ambient fine particle levels

in the United States (Fine 2004). Through the use of ambient PM monitoring, chemical mass balance, Carbon-14 dating combined with Bay Area winter 2005 emission data, staff has estimated wood smoke as the single greatest contributor (~33%) to PM_{2.5} on peak days in the Bay Area. A breakdown of sources contributing to PM is shown in Figure 2 (Fairly 2008).

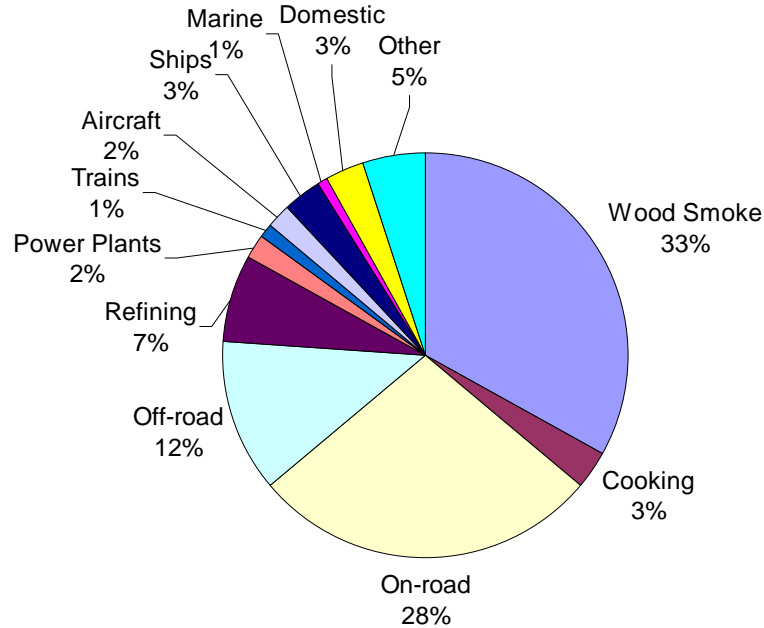


Figure 2. PM_{2.5} Concentration on Peak Days by Constituent in the Bay Area

To estimate the amount of PM coming from wood-burning, Air District staff used data from telephone survey results from Bay Area residents from multiple years. These results were then correlated with projected demographic trends from the Association of Bay Area Governments (ABAG), which were based on U.S. Census data, and used to arrive at the estimated number of devices. These data, along with an annual through-put (fuel load), also derived from survey results, and an emission factor based on EPA documentation in AP-42, were then used to generate a PM estimate for each county in the Bay Area. These data are summarized in Table 2 in tons per day (tpd) and tons per year (tpy), for both PM₁₀ and PM_{2.5}.

County	Wood Stove, Inserts and Pellet Stoves PM ₁₀	Fireplace PM ₁₀	Wood Stove PM _{2.5}	Fireplace PM _{2.5}
Alameda	0.03 tpd	2.28 tpd	0.03 tpd	2.19 tpd
Contra Costa	0.76 tpd	4.32 tpd	0.73 tpd	4.15 tpd
Marin	1.03 tpd	0.37 tpd	0.99 tpd	0.36 tpd
Napa	0.33 tpd	0.41 tpd	0.32 tpd	0.39 tpd
San Francisco	0.03 tpd	0.28 tpd	0.03 tpd	0.27 tpd
San Mateo	0.38 tpd	0.70 tpd	0.36 tpd	0.67 tpd
Santa Clara	0.65 tpd	3.11 tpd	0.62 tpd	2.99 tpd
Solano (Part within Air District)	0.05 tpd	0.89 tpd	0.05 tpd	0.85 tpd
Sonoma (Part within Air District)	1.27 tpd	1.43 tpd	1.22 tpd	1.37 tpd
Total Emissions Bay Area	4.54 tpd	13.80 tpd	4.36 tpd	13.25 tpd
Total Emissions Bay Area	1657 tpy	5037 tpy	1591 tpy	4836 tpy

Table 2. Summary of PM emissions from wood-burning devices by county (based on 2005 data).

Because the category of PM₁₀ also includes PM_{2.5}, a large portion of PM₁₀ particles are also PM_{2.5} particles (Houck 1998). Therefore, the majority of PM from wood smoke is fine particles. It is these fine particles that are of greatest concern to public health according to recent studies (Woodruff 2006).

C. Available Control Technology

Increased PM emissions from wood-burning result from inefficient combustion of the wood. Increasing combustion efficiency reduces emissions and reductions in PM emissions can be achieved through use of cleaner burning wood devices and proper burning techniques.

Wood stoves are wood-burning devices that are enclosed to control combustion. EPA-certified stoves employ either a catalytic or non-catalytic system to increase combustion of the exhaust stream. These units are either stand alone or installed into a building's walls. A wood-burning insert can be placed in either a new or an existing fireplace.

Some EPA-certified stoves utilize a catalyst to reduce the ignition temperature so that additional combustion continues to occur in the gases exhausted from wood stoves. A catalyst in a stove is a ceramic honey-combed combustor that is coated with a noble metal, such as platinum or palladium. These types of stoves require maintenance and eventually catalyst replacement during the lifetime of the stove in order to operate properly. The EPA certification emission limit for catalytic stoves is 4.1 grams of particulate matter per hour.

EPA-certified non-catalytic stoves, on the other hand, achieve low-emission, cleaner burning by decreasing the firebox size, increasing turbulence (mixing) within the firebox, and adding baffles as well as secondary burn tubes to combust exhaust gases. These stoves still require maintenance to operate effectively, but do not have a catalyst to

replace. The EPA certification emission limit for non-catalytic stoves is 7.5 grams per hour.

Pellet stoves were developed during the 1970's to provide additional alternatives to fossil fuel. These devices burn pellets very cleanly and do not require EPA certification, although many manufacturers have the devices certified by the EPA. Pellet stoves burn wood that has been compressed into pellet form for combustion and easy storage. Some pellet stoves burn products other than wood, such as wheat or corn. In addition to the need to be vented to the outside of the structure, pellet stoves require electricity to utilize active air and fuel management systems to control combustion efficiency.

A pellet stove is a factory-built, highly engineered, wood-burning device that utilizes solid-fuel pellets usually made from wood waste products. Some newer pellet stoves can now burn agricultural products such as corn or other biomass renewable energy pellets. Some pellet stoves are not required to be EPA-certified due to either the high air-to-fuel ratios (a high volume of air moving through the device relative to the amount of fuel) or high burn rates (high rate of fuel combustion) they utilize. Pellet stoves control both fueling rates and combustion rates with engineered machinery such as screw conveyors and air blowers. Modern pellet stoves by design are cleaner burning. In fact, some pellet stoves have been EPA certified under the exact same testing methods used by regular wood-burning stoves and inserts, thereby demonstrating equivalent low PM emission levels to EPA-certified devices. For most modern pellet stoves, their emissions have been demonstrated to be in the lower range, lower PM emission levels, of the EPA certification requirements.

A masonry heater is a site-built, or site-assembled, solid-fueled heating device consisting of a firebox, a large masonry mass, and a maze of heat exchange channels. While a masonry heater may look like a fireplace, it operates differently. It stores heat from a rapidly burning fire within its masonry structure, and slowly releases the heat over time. The suggested fueling method is to burn short, hot fires with many hours in between fires. Masonry heaters are not required to be EPA certified due to the high air-to-fuel ratios they utilize and the weight of these devices. While these devices cannot be emission tested using the same testing methods as used for EPA certified devices and many pellet stoves, a conversion is available. This conversion method, however, is not widely accepted.

The EPA does not have any formal or required certification process, mandatory or voluntary, for these devices yet. Until such time as EPA has such a process, staff is proposing that masonry heaters not be considered approved devices in the proposed regulation. However, the proposed rule has a provision to allow masonry heater to be allowed in new construction, either in a new structure or as part of a remodel, should EPA develop a certification process in the future for these devices.

Proper burning techniques focus on proper fuel selection and fire-building. Dry or “seasoned” wood has a moisture content of 20 percent or less. This wood burns more efficiently since less heat is required to vaporize water in the wood. Proper wood placement for a fire also improves the combustion efficiency. Requiring proper labeling of seasoned wood for sale will provide the consumer with the necessary information on how to comply with mandatory wood-burning curtailment. Overall, an efficient fire leads to more complete combustion, lower emissions and lower fuel costs. Table 3 shows the range of efficiencies of various wood heater types.

Wood Heater Type	Efficiency %	
	Range	Average
Conventional	41.7 – 63.1	53.6
Non-catalytic	66.2 – 72.6	68.3
Pellet - certified	57.6 – 75.2	67.5
Pellet - exempt	33.4 – 70.5	55.5
Catalytic	63.0 - 78.4	67.9
Masonry	54.0 – 65.0	58.4

Table 3. Summary of Wood Heater Net Efficiencies (AP42 for Woodstoves, July 1996)

D. Regulatory Framework

Wood smoke has been a concern for the Air District as scientific research began establishing a stronger link between emissions from wood combustion and public health. Since 1991, the Air District has promoted various voluntary programs to reduce wood smoke emissions. These programs include a voluntary curtailment program, an annual random public survey to assess wood-burning practices in the Bay Area and a model ordinance for local governments to adopt to reduce PM from wood smoke. The Air District has also directed a financial incentives program on a limited basis promoting cleaner burning technologies.

The voluntary curtailment program is called Spare the Air Tonight (STAT). The program advises Bay Area residents to not burn wood on evenings with meteorological conditions leading to increased PM levels that already impact public health. The Air District has also conducted an annual wintertime survey following STAT advisories in order to ascertain and document the public’s attitudes and behavior with respect to burning wood.

The Air District developed and promoted a model ordinance that cities and counties may adopt to further reduce wood smoke impacts in their community. The model ordinance includes the following suggested elements:

- curtails burning during STAT advisories;
- specifies criteria for cleaner wood-burning devices; and

- limits fuel type to materials appropriate for wood-burning devices (no garbage, etc).

Local ordinances, based on the Air District’s model ordinance to reduce PM from wood smoke, have been adopted by 40 of the 107 Bay Area cities and eight of nine counties. The local ordinances that have been adopted vary in the degree to which they incorporate elements of the model ordinance. Those jurisdictions that have adopted an ordinance with a mandatory, as opposed to voluntary, curtailment provision are shown in Table 4, along with other provisions of their ordinances.

CITY	Adopted	Curtailment Action upon STAT Advisory	Certified Device in New Construction	Certified Device in Remodels	Prohibits Conversion from Gas to Wood
Fremont	Jul 02	Mandatory	✓	✓	✓
Gilroy	Mar 05	Mandatory	✓	✓	
Los Gatos	Dec-92	Mandatory	✓	✓	
Martinez	Sep 05	Mandatory	✓	✓	✓
Mill Valley	Sep 05	Mandatory	✓	✓	✓
Oakland	May 05	Mandatory	✓		✓
Rohnert Park	Sep 04	Mandatory	✓	✓	✓
San Pablo	Dec 01	Mandatory	✓	✓	✓
Union City	Apr-99	Mandatory	✓	✓	✓

Table 4. Cities that have adopted a mandatory requirement in local ordinances.

The Air District will continue to support adoption of ordinances in individual jurisdictions. No provision in the proposed new Regulation 6, Rule 3 prohibits a local jurisdiction from adopting a more stringent requirement in a local ordinance.

The Air District co-sponsored and managed a financial incentive, or “wood stove change-out,” program in Santa Clara County as part of an air quality mitigation program required by the California Energy Commission. Rebates were offered to residents to remove non-EPA-certified wood-burning devices, install only EPA-certified devices, or to retrofit wood-burning fireplaces with natural gas fireplaces. More recently the Air District offered financial incentives for upgrades throughout the entire Air District. The District distributed \$500,000 in two phases; a pilot phase in January 2008 and an enhanced program in April 2008. The District’s Cleaner Burning Technology Incentives Program will provide similar incentives in the future.

In developing the proposed regulation, the Air District reviewed similar regulation in other Air Districts. Table 3 is a summary of the requirements at other air districts. The table heading identifies six elements. These six elements are common in regulations to reduce wood smoke and are described in detail later in this report. The following is a brief description of each standard:

- **Mandatory Solid Fuel Burning Curtailment:** Prohibits burning wood or other solid fuel during periods when air quality is unhealthy.

- Prohibition of Exceeding Visible Emission Limit: Places limits on the density of emissions resulting from wood or other solid fuel combustion.
- Sale, Transfer or Installation Criteria for Devices: Establishes specifications for wood-burning devices which are to be sold, resold or installed within the air district.
- Criteria for Devices in New Building Construction: Requires new building construction to install wood-burning devices with cleaner burning emissions criteria or gas-fueled devices.
- Prohibition against Burning Garbage or Certain Fuel: Prohibits the burning of garbage and/or other materials not suitable as a fuel in a wood-burning device.
- Requirements for Sale of Seasoned Wood: Establishes criteria for the sale of firewood, such as having a moisture content of less than 20 percent to reduce emissions when combusted.

AIR DISTRICT	RULE	CONTROL ELEMENT					
		Mandatory Solid Fuel Burning Curtailment	Prohibition of Exceeding Visible Emission Limit	Sale, Transfer or Installation Criteria for Devices	Criteria for Devices in New Building Construction	Prohibition Against Burning Garbage or Certain Fuel	Requirements for Sale of Seasoned Wood
San Joaquin Valley	4901	✓	✓	✓	✓	✓	✓
Great Basin	431	✓	✓	✓	✓	✓	
Sacramento	417			✓		✓	✓
	421	✓	N/A	N/A	N/A	N/A	N/A
Yolo-Solano	2.40			✓	✓	✓	✓
Northern Sonoma	R4-1			✓		✓	✓
Monterey Bay	400					✓	
Shasta	3.23			✓	✓	✓	
Butte	207			✓	✓	✓	
Feather River	3.17			✓	✓		
South Coast	445			✓	✓	✓	

Table 5. Other Air Districts' Wood Smoke Reduction Programs.

The control elements shown in the column headings of Table 5 reflect the breadth of current rules regulating wood smoke. The proposed Regulation 6, Rule 3, draws from those control elements which have proven effective in maximizing the reduction of PM from wood smoke and at the same time minimizing economic or lifestyle adjustments required of impacted stakeholders. Stakeholders include individual residents and organizations such as manufacturer and vendor-based industries and hearth-related organizations.

III. REGULATORY PROPOSAL

The proposed new Regulation 6, Rule 3, would:

- Restrict operation of any indoor or outdoor fireplace, fire pit, wood or pellet stove or fireplace insert on specific days during the winter when air quality is forecast to exceed the National Ambient Air Quality Standard for PM_{2.5}.
- Limit excessive visible emissions from wood-burning devices.
- Require cleaner burning technology (EPA Phase II certified wood-burning device, pellet stove, approved low-mass fireplace or masonry heater) when wood-burning devices are sold, resold or installed.
- Require cleaner burning technology (EPA Phase II certified wood-burning device, pellet stove, approved low-mass fireplace or masonry heater) if wood-burning devices are permitted for installation in new building construction.
- Prohibit the burning of garbage, plastics and other inappropriate types of materials.
- Require labeling and disclosure of the moisture content on wood sold for use within District, including instructions on how to dry the wood if it has a moisture content greater than 20 percent by weight.
- Require a warning label on packages of wood and other solid fuels (such as pressed logs and pellets) stating the use of the product can be harmful to public health and a message to check Air Quality status before burning these products.

The proposed new Regulation 6, Rule 3, provides limited exemptions from the curtailment standard.

The proposed rule requires public awareness information to be included with sale of each wood-burning device addressing proper use of the device and information on the health effects of wood smoke. Wood-burning device manufacturers and sellers are required to provide documentation that the device meets the emission limits of this proposed rule. Sellers of firewood must label firewood or solid fuel with a health warning regarding the harmful effects of wood smoke on public health. Sellers of seasoned firewood must properly label firewood as seasoned. Sellers of non-seasoned wood must properly label the wood as not appropriate for burning and provide information on how to properly dry the wood before burning.

The proposed rule includes standard test methods for the determination of visible emissions, the moisture content of wood, the amount of particulate emissions from the use of a wood-burning device, and a reference to the EPA certification and equivalency process.

Mandatory Solid Fuel Burning Curtailment

This standard would prohibit the operation of a wood-burning device whenever the Air District forecasts an excess of the NAAQS for PM_{2.5} levels. Forecasts for mandatory curtailments will be posted on the Air District's website or provided by news releases, phone-line or email list-serve as well as other means deemed appropriate by the Air District.

The proposed rule has a limited exemption from this standard for a person:

- whose wood-burning device is the only source of space heat; or
- located where natural gas is unavailable; or
- located where electrical service is unavailable (which includes power outages).

Visible Emission Limitation

The Ringelmann No. 1 limit is a visible emission standard equivalent to 20% opacity. This standard will limit excessive visible emissions from chimneys, stovepipes or flues based on visual observation of emissions which exceed at least six minutes in any one-hour period. The proposed rule has a limited exemption for emissions from the startup of a new fire for a period that is not to exceed twenty minutes in any four-hour period.

The Air District will conduct outreach to the public on determining excessive smoke opacity, using clean burning techniques and other methods to minimize wood smoke.

Criteria for Sale, Resale or Installation of Wood-burning Devices

This standard applies to both used and new devices. A wood-burning device shall not be sold, resold, transferred or installed within the Bay Area unless it is one of the following:

- A U.S. EPA Phase II certified wood-burning device;
- A pellet-fueled device;
- A low mass fireplace, masonry heater, or other wood-burning device of a make and model that meets EPA emission targets and is approved by the Air District.

Low mass fireplaces, or zero clearance fireplaces which are commonly installed in new housing construction, and masonry heaters or other wood-burning devices would be approved devices if they can demonstrate, under EPA approved test methods under development for low mass fireplaces, that they meet future, voluntary emission reductions. The emission testing methods for this class of wood-burning devices are only comparable methods to EPA certification test methods and the emission test results must be converted. It is the test results conversion, for comparison with EPA certification emission levels that is not widely accepted.

Northern Sonoma County Air Pollution Control District staff submitted comments to Air

District staff raising concerns over the emission testing methods for masonry heaters. While masonry heaters can achieve lower emissions than conventional fireplaces, masonry heaters cannot be certified under the same test methods as EPA-certified stoves. The EPA does not have any formal certification process, mandatory or voluntary, for these devices yet. Until such time as EPA has such a process, staff is proposing that masonry heaters not be considered cleaner burning technology in the proposed regulation. However, the proposed rule has a provision to allow masonry heater to be allowed in new construction, either in a new structure or as part of a remodel, should EPA develop a certification process in the future for these devices.

The voluntary “EPA Low-mass Fireplace Program” is being developed by the EPA utilizing a stakeholder process which considers the mutual needs of EPA, state regulators and device manufacturers. In the first phase of this program, an emission limit of 5.1 g/kg is being proposed with appropriate emission testing methods that can be approved by EPA. While masonry heaters are not currently included in this program, there are proposals to include them and masonry heaters could be allowed for new construction, either in a new structure or as part of a remodel in the District, should certain models be able to demonstrate that they can meet future, voluntary EPA approved emission targets according to EPA approved test methods for low-mass fireplaces and masonry heaters.

Criteria of Wood-burning Devices in New Building Construction

This proposed standard specifies that a wood-burning device installed in new construction must be one of the following:

- A U.S. EPA Phase II certified wood-burning device;
- A pellet-fueled device;
- A low mass fireplace, masonry heater, or other wood-burning device of a make and model that meets EPA emission targets and is approved by the Air District.

This standard applies to new construction where installed in a new building or structure or as part of a remodel. The standard only affects devices that burn wood or other solid fuel. Any device that operates on natural gas or electricity is allowed under this standard.

Prohibition Against Burning Garbage or Inappropriate Materials

This standard requires that the following materials cannot be burned under any circumstance: garbage, chemically treated wood, non-seasoned wood, used or contaminated wood pallets, plastic products, rubber products, waste petroleum products, paints and paint solvents, coal, animal carcasses, glossy and/or colored paper, salt water driftwood, particle board, and any material not intended by a manufacturer for use as a fuel in a wood-burning device.

Retail Sale of Wood

This standard requires that seasoned wood supplied or offered for sale must contain a moisture content of 20 percent or less by weight for cleaner burning. This requirement will be the responsibility of any manufacturer, supplier or retailer of seasoned firewood to ensure moisture content is below 20 percent by weight and appropriate for burning.

Wood that does not have a moisture content of 20 percent or less by weight must be labeled as unseasoned wood and include instructions on how to properly dry the wood before burning. This standard focuses on a manufacturer, supplier or retailer of firewood and not individual residents. The Air District will conduct outreach, however, to individuals to assist them on learning how to season wood.

Administrative Requirements

The Air District has sole authority over enforcing the proposed regulation and will independently verify any violation before issuing a Notice of Violation or taking other enforcement action.

Any person or builder that sells a device or a new building with a wood-burning device must provide public awareness information regarding the proper use and maintenance of the wood-burning devices as well as information on the adverse public health impacts. The following statement must be included in the information provide, “Wood smoke contains harmful particulate matter (PM) which is associated with numerous negative health effects.”

The manufacturer or seller of any wood-burning device must provide documentation to any purchaser that the device is U.S. EPA Phase II certified or that the device meets the equivalent U.S. Phase II emission limits or meets the emission limits specified in the proposed Regulation 6, Rule 3. EPA specifies the requirements for documentation in 40CFR60, Subpart AAA.

Six months following rule adoption, the following requirements become effective:

- Any seasoned wood packaged for sale must include a package label identifying the wood as having a moisture content of 20 percent or less by weight. Seasoned wood, with the exception of those intended for cooking (such as charcoal) must also be labeled stating that wood smoke contains harmful PM which is associated with numerous negative health effects. Seasoned wood must be sold with a label attached that has the following statement: “This wood meets air quality regulations for moisture content to be less then 20 % (percent) by weight for cleaner burning.”
- Unseasoned wood must be identified as having a moisture content of greater than

20 percent as well as indicate this wood is not appropriate for burning. Informational material will be required to be distributed with unseasoned wood. This material will educate the consumer on the methods required to properly dry the wood. Unseasoned wood must be sold with a label attached that has the following statement: “This wood does NOT meet air quality regulations for moisture content and must be properly dried before burning.”

- All solid fuel must be labeled with the following message: “HEALTH WARNING: This product and similar solid-fuel products produce particulate matter when burned which can be harmful to public health. Your city, county or air pollution control district may prohibit the use of this product and wood burning on days when air pollution levels may be high. Please check before using.”

Documentation

Any person claiming an exemption from the Mandatory Solid-fuel Curtailment requirement must be able to provide documentation or records explaining why the wood-burning device is the only source of space heat for the structure and whether the situation is temporary or permanent to the Air District upon request.

Test Methods

Visible emissions shall be determined in accordance with the Air District’s Manual of Procedures-Volume 1 – Enforcement Procedures, Evaluation of Visible Emissions.

Moisture content of wood shall be determined by ASTM Test Method D 4442-92 or a hand-held moisture meter operated in accordance with ASTM Test Method D 4444-92, Standard Test Methods for Use and Calibration of Hand-Held Moisture Meters.

The methods used to determine particulate emissions and EPA certification or determination of equivalency shall be performed in accordance with EPA Method 28, 5G, 5H, EPA Guidance Document for Residential Wood-Burning Devices or other EPA approved methodology.

Amendments to Existing Regulations

Regulation 1 establishes general provisions and definitions which apply to all Air District rules and regulations. Regulation 1 currently excludes any fire for residential heating from any Air District requirements. An amendment is being proposed to eliminate this exclusion in order to allow regulation of indoor fires.

Currently, Regulation 5 regulates open burning, or fires conducted outside of buildings. However, recreational fires are exempt provided only clean and dry wood is used. In

order for a mandatory curtailment to be consistent, the curtailment must be applicable also to outdoor recreational fires. Therefore, an amendment to Regulation 5 is being proposed to remove the exemption for recreational fires. Fires used outdoor for residential cooking will not be affected.

IV. EMISSION REDUCTIONS

Emission reduction calculations for the proposed regulation are based upon baseline emission inventory data for wood-burning devices in the Bay Area. Survey data and household population estimates from the ABAG for 2005 were used. Staff estimates 983 tons per year reduction of PM_{2.5} from implementation of the proposed rule. A discussion of the annual average emission reduction associated with each requirement of the proposed regulation follows:

Mandatory Solid Fuel Burning Curtailment

The mandatory curtailment requirement will reduce emissions from solid fuel burning devices during periods when the National Ambient Air Quality Standard is forecast to be exceeded. The requirement will decrease fine PM concentrations during critical winter months when PM air pollution reaches unhealthy levels. Typically, emission reductions are estimated and reported in tons of pollutant per year. Therefore staff calculated the reductions based on the seasonal impact of the proposed standard for the winter burn season of November through February. Staff used the total annual emissions from Table 1 combined with survey results on burning patterns that 78% of the total solid fuel burned occurs in the wintertime.

Over a period of 17 curtailment days (average number of days in excess of NAAQS for PM_{2.5} in past five winter season in Bay Area) during a 120 day long wintertime burn season, the PM_{2.5} reductions are calculated to be 716 tons per wintertime burn season as well as for the annual average since the curtailment only applies from November through February. This is at a 100% compliance rate.

Visible Emission Limitation

Air District staff has not calculated an emission reduction value for this standard due to the lack of sufficient data. There are not consistent quantitative correlations between opacity and PM mass. This lack of correlation is largely due to the various flow rates from chimneys and stove pipes, combined with changing or variable particulate size and composition. A Ringelmann No. 1 standard (20% opacity), however, is consistent with visible emission standards applied to industrial sources and indicates efficient solid fuel combustion. Staff anticipates the cumulative effect of this standard will contribute to lower local and overall ambient PM concentrations.

Criteria for Sale, Transfer or Installation of Wood-burning Devices

To calculate the emission reduction on a per wood-burning device basis, calculations were based on assumptions of 50 grams per hour of PM_{2.5} for high-emitting or non-certified devices and 5 grams per hour of PM_{2.5} for low-emitting or certified devices. Therefore, the reduction is calculated as the difference between the two rates, or 45 grams per hour.

According to Air District survey results, data indicates likely annual burn times in residences range from 30 to 150 hours per year. Therefore, in pounds per year based on a per unit basis for upgraded units, estimated reductions will be 3 to 15 pounds per year of PM_{2.5} per wood-burning device.

The Air District conducted a ‘change out’ program to assist individuals upgrade to cleaner burning technology. This program occurred in two phases and is ongoing. In the first phase 185 units were converted to cleaner burning technology; 76% were natural gas fueled devices. In the second phase, to date, 139 out of 666 units have been converted to natural gas fueled devices. A gas fueled device is the cleanest burning device in terms of particulate matter, and therefore provides the greatest emission reduction.

This requirement prevents the sale of non-EPA certified wood burning devices or high emitting devices. Some wood stoves are engineered to purposely have an air-to-fuel ratio which exceeds 35 to 1. Since these devices are ‘exempted’ from EPA certification, the EPA does not prohibit their sale or use. This requirement prevents these high emitting devices from being sold within the Air District.

Criteria of Wood-burning Devices in New Construction

Air District staff anticipates that requiring installation of wood-burning devices which are EPA certified or designated low emitting into any new construction will reduce annual PM_{2.5} by approximately 58 tpy in new buildings, structures and new wood-burning devices in remodels. This emission reduction is based on survey results indicating the type of fuel Bay Area households are burning and the frequency at which the households are burning. These trends were applied to ABAG household projections forward looking to 2015 from 2005.

To calculate the emissions reduction projected for the requirement for cleaner burning devices in new construction, staff started with two assumptions:

- (1) Current emission levels carried forward to 2015 without the New Construction Standard will increase by 2.8 tpd of PM_{2.5} over ten years,
- And,
- (2) Lower emission levels projected forward to 2015 with the New Construction Standard will increase by 1.2 tpd of PM_{2.5} over ten years.

The difference between (1) and (2) is 1.6 tpd of PM_{2.5}. The annual results are achieved by multiplying 1.6 by 365, and then dividing by 10 to achieve per year averages which are summarized in Table 6.

Process description	PM _{2.5} (tpy)
(1) Projected emissions WITHOUT new construction requirement	102
(2) Projected emissions WITH new construction requirement	44
Bay Area Reduction [Difference between (1) and (2)]	58

Table 6. PM reduction annualized amounts based upon new household population growth.

Prohibition Against Burning Garbage, Non-Seasoned Wood or Certain Materials

The prohibition against burning garbage or other materials not intended for wood-burning device use has no emission reduction calculated. This standard, however, is anticipated to reduce toxic air contaminants from residential burning.

Requirements for Seasoned Wood

Air District staff anticipates that burning seasoned wood increases combustion efficiency and decreases emissions. Seasoned wood has a moisture content of less than 20% by weight.

According to Air District survey results, staff estimates that 6.5% of all Bay Area residents burned fresh cut, non-seasoned firewood. Of those that were unsure of their firewood source, Air District staff approximated that half burned unseasoned wood. The total annual emissions (see Table 2) from both wood stoves (including inserts and pellet stoves) (1591 tpy) and fireplaces (4836 tpy) is 6427 tpy of PM_{2.5}. Therefore, approximately 6.5% of total annual emissions from wood burning is from non-seasoned wood and equals 417 tpy of PM_{2.5}.

In “A comparison of Masonry Fireplace Emissions Testing Methods”, seasoned wood was demonstrated to emit approximately 50 percent less PM_{2.5} than non-seasoned wood (Senf, 1995) so staff estimated that 50 percent emissions from non-seasoned wood or 209 tpy of PM_{2.5} can be reduced with this requirement.

Reductions Summary

Table 7 below summaries the estimated reductions based on quantifiable reductions on the proposed regulation. Other requirements, while not quantified, are anticipated to better protect public health through emissions reductions. Staff will continue to work toward quantifying total reductions.

Proposed Regulation Requirement	Estimated TPY Reduction of PM_{2.5}
Mandatory Curtailment	716
New Construction	58
Requirements for Seasoned Wood	209
Total	983

Table 7. Summary of reductions based on proposed rule requirements.

V. ECONOMIC IMPACTS

This section discusses the estimated costs associated with the proposed rule.

A. Labeling Requirement

The proposed regulation requires a label be placed on solid fuel, which includes manufactured logs. The manufactured log industry estimates it will cost \$1.25 million to comply with the labeling requirement given the full range of different packaging types (95 types of packaging).

Staff estimated a cost for industry compliance (further analysis is provided in socioeconomic analysis in the Appendix of this report) requiring just the Individual logs to be labeled. Since just the individual logs need to be labeled, and not the carton, staff subtracted the cost for adding a label to the carton. This distinction drops the industry estimate for cost of compliance by \$875,000 for the first year to \$347,500.

Industry estimated an additional 10%, or \$34,750, to account for smaller purchase amounts of labels due to geographical limitations of the labels. Staff estimated an additional cost of 15%, or \$52,125 for each year to account for this cost. This factor increased the first year cost to \$399,625 and \$660,250 for five years to comply with the labeling requirement.

Industry provided total annual sales data (but only for grocery store sales, which approximates only 45% of total sales): \$21,000,000; or \$105,000,000 for five years.

Table 8 below summaries the costs on a 1-year and 5-year time horizon based on total sales and total volume:

Description	1 year	5 year
Percent of cost to comply, total sales	1.9%	0.63%
Cost on a per unit (6 log box) basis	\$0.30	\$0.11
Cost per individually wrapped log	\$0.05	\$0.02

Table 8. Summary of estimated costs for industry compliance with labeling requirement.

B. Curtailment

The curtailment standard of the proposed regulation will prohibit the operation of a wood-burning device when air quality reaches unhealthy levels. Therefore, during these times, individuals will be required to operate another form of space heating. Because unavailability of natural gas is an exemption from this standard, the price of natural gas is used for a cost analysis.

The average PG&E customer winter natural gas usage is 60 therms per month, while the average PG&E customer summer natural gas usage is 24 therms per month. Therefore, the difference or 36 therms per month is used for winter usage for heating.

In summary, at 36 therms per month, the average daily usage (in a 30 day month) is 1.2 therms per day for heat. Therefore, at \$1.21 to \$1.44 per therm per day for 1.2 therms per day the cost to heat will be \$1.45 to \$1.72 per day of curtailment, minus the cost of solid fuel.

C. New Installations of Cleaner Burning Devices

The proposed rule will require homebuilders that install a wood-burning device chose an approved wood-burning device (EPA-Phase II certified or a pellet fueled device.) While these devices produce less emissions than a typical fireplace (a “zero clearance” or “low-mass” fireplace), they have a higher cost. However, homebuilders can install gas fueled devices, which are not affected by the proposed rule, and the installation cost of these devices will not be affected by the proposed rule. A builder choosing to install an approved device rather than a gas fueled device will have an increased cost. However, eight of the nine bay area counties have adopted the Air District’s model ordinance for wood-burning devices, which requires cleaner burning technology in new construction, subject to county building permits. Therefore, industry costs will not be impacted in these counties.

D. District Staff Impacts

Currently, the District does not regulate emissions from residential wood-burning but does respond to air pollution complaints, which are handled by air quality inspectors. In

2007 there were 78 wood smoke complaints received by the Air District; no notices of violations were issued. It is difficult to predict the number of complaints that will be received due to implementation of the rule; however, staff expects an increase in the number of complaints received after rule adoption. In addition, shift or overtime work is anticipated as the majority of wood-burning complaints occur in the evening.

Since the proposed new rule adds new standards for wood-burning devices it is anticipated that additional resources will be needed to handle the increase in inspections and investigations, process non-compliance letters and settle notices of violation, purchase moisture meters, track curtailment days and update the emission inventory, and to enhance current outreach efforts. These costs have been considered in the District's budget.

E. Incremental Costs

Under California Health and Safety Code Section 40920.6, the District is required to perform an incremental cost analysis for a proposed rule under certain circumstances. To perform this analysis, the District must (1) identify one or more control options achieving the emission reduction objectives for the proposed rule, (2) determine the cost effectiveness for each option, and (3) calculate the incremental cost effectiveness for each option. To determine incremental costs, the District must "calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option."

For the proposed regulation, staff has not identified any incremental costs since the regulation does not impose any one specific control technology. EPA-certified devices are the industry standard for any new wood-burning devices.

F. Socioeconomic Impacts

A socioeconomic analysis mandated by Section 40728.5 of the Health and Safety Code was prepared by Applied Economic Development, Berkeley, California. The analysis concludes there are no secondary impacts resulting from changes in household spending habits, meaning small businesses, particularly retail and services, are not disproportionately impacted by the rule.

VI. ENVIRONMENTAL IMPACTS

Pursuant to the California Environmental Quality Act, the District's environmental consultant, Environmental Audit, Inc., has prepared a draft Environmental Impact Report (EIR) for the proposed rule to determine whether it would result in any significant environmental impacts. The draft EIR concludes that the proposed rule would not have any adverse impacts and an increase in greenhouse gas emissions is not significant. The EIR is available on the Air District's website at www.baaqmd.gov and open for public

comment until June 18, 2008.

VIII. REGULATORY IMPACTS

Section 40727.2 of the Health and Safety Code requires an air district, in adopting, amending, or repealing an air district regulation, to identify existing federal and district air pollution control requirements for the equipment or source type affected by the proposed change in district rules. The district must then note any differences between these existing requirements and the requirements imposed by the proposed change. Adoption of this rule would not conflict with any existing federal or Air District requirement.

IX. RULE DEVELOPMENT PROCESS

District staff has undertaken a rule development process with extensive public outreach to involve all stakeholders in developing this proposal, including solid fuel manufacturers, hearth product trade organizations and industry representatives, national and local health organizations, county health departments, wood suppliers and members of the public with an interest in wood burning. This included a series of seven workshops, nine informational meetings and ongoing outreach to interested parties and the general public.

The purpose of the rule workshops was to solicit comments from the public on the proposed Regulation 6, Rule 3. In November 2007, the Air District conducted seven rule development workshops in the following cities: Oakland, Santa Rosa, San Jose, Concord, Vallejo, Redwood City, and Livermore.

These workshops were well received and generated several common questions and comments. These may be summarized as follows:

- EPA-certified devices and pellet fueled devices should be allowed to operate during a curtailment.
- Sub-divide the Air District into smaller zones for curtailment, rather than implementing a curtailment throughout the entire District.
- The effectiveness and methodology of enforceability of the proposed regulation should be explained.
- Clarification is needed in the language for the exemption when the only source of heat is a wood-burning device.
- The notification methods for informing the public of a curtailment period should be expanded and made better known.

As a result of these comments, staff revised the rule where deemed appropriate. These changes include:

- An exemption from the curtailment standard to permit those individuals relying on wood burning as an only source of heat to burn solid fuel during a curtailment, and a provision to provide documentation explaining why the device is the only source of heat for a residence and if the situation is temporary or permanent.
- Clarification to the Administrative Requirements specifying the Air District has sole authority regarding enforcement and will independently verify any violation.
- Notification of curtailment periods will be made broadly available to the public through 1-800-HELP-AIR, www.baaqmd.gov, email updates and various media outlets.

In April 2008, the Air District conducted nine informational meetings in the following cities: Redwood City, Napa, Santa Rosa, Vallejo, Concord, Livermore, Novato, San Jose and Oakland. The purpose of these meetings was to explain recent changes and obtain public input.

Throughout the rule development process staff presented to the following Air District committees:

- Staff is scheduled to present to Advisory Council Public Health Committee on June 9, 2008
- Stationary Source Committee meeting on May 19, 2008
- Advisory Council Public Health Committee on March 12, 2008
- Stationary Source Committee meeting on March 3, 2008
- Stationary Source Committee meeting on December 3, 2007
- Budget and Finance Committee meeting on December 12, 2007
- Stationary Source Committee meeting on September 17, 2007
- Stationary Source Committee meeting on March 8, 2007.

Staff has met with concerned and interested stakeholders including Realtor Associations, the American Lung Association and members of the Hearth, Patio & Barbecue Association, which includes retail stores and manufacturers. Air District staff has also spoken with the Home Builders Association of Northern California and the Marin County Community Development Sustainability Team.

X. CONCLUSION

Pursuant to Section 40727 of the California Health and Safety Code, the proposed rule must meet findings of necessity, authority, clarity, consistency, non-duplication, and reference. The proposed regulation is:

- Necessary to protect public health by reducing particulate matter emissions to meet the requirements of Senate Bill 656 Particulate Matter Implementation Schedule;
- Authorized by California Health and Safety Code Sections 40000, 40001, 40702, and 40725 through 40728;
- Clear, in that the new regulation specifically delineates the affected industry, compliance options, and administrative requirements for industry subject to this rule, so that its meaning can be easily understood by the persons directly affected by it;
- Consistent with other District rules, and not in conflict with state or federal law;
- Non-duplicative of other statutes, rules, or regulations; and
- Implementing, interpreting and making specific the provisions of the California Health and Safety Code sections 40000 and 40702.

An Environmental Impact Report prepared by Environmental Audit, Inc., concludes that there will be no adverse environmental impacts from adoption of the proposed rule. A socioeconomic analysis prepared by Applied Development Economics concludes that the affected industries will be able to absorb the costs of compliance with the proposed rule without economic dislocation or loss of jobs.

District staff recommends adoption of proposed Regulation 6, Rule 3: Wood-burning Devices, adoption of proposed amendments to Regulation 1 and Regulation 5, and certification of the draft Environmental Impact Report.

XI. REFERENCES

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