

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
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Final Draft Staff Report

Proposed Rule 445 - Wood Burning Devices

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EXECUTIVE SUMMARY

Residents of the South Coast Air Basin (Basin) are exposed to some of the highest ambient concentrations in the nation of PM10 and PM2.5, collectively referred to as particulate matter or PM. A study by the California Air Resources Board (CARB) estimated that the elevated PM2.5 levels in the Basin result in 5,400 premature deaths per year based on 1999/2000 air quality data. The District is required under Health and Safety Code §39614 to develop and adopt the most readily available, feasible and cost-effective control measures to reduce PM10 and PM2.5 based on rules, regulations and programs existing in California. Many California air districts and other states have already developed wood smoke control programs.

In response to air quality conditions, PM-related health effects, and State law mentioned above, the 2007 Air Quality Management Plan (AQMP) included a control measure to reduce PM emissions from wood burning fireplaces and wood stoves.¹ This control measure represents a State Implementation Plan (SIP) commitment to reduce PM emissions from wood burning devices by one ton per day by the year 2014. Proposed Rule 445 has been developed to assist in the attainment of State and federal PM standards for the Basin and to implement the 2007 AQMP control measure. An incentive program is also planned in conjunction with the Proposed Rule 445 to encourage the public to switch to cleaner hearth products.

Proposed Rule 445, beginning six months after adoption, would require all fireplaces installed in new developments to be gaseous-fueled. For existing residential and commercial developments, Proposed Rule 445 would require wood burning devices sold or installed in the Basin six months after adoption to be U.S. EPA Phase II-certified or equivalent. Proposed Rule 445 would prohibit the burning of any product not intended for use as a fuel (e.g., trash) in a wood burning device and would require commercial firewood facilities to only sell seasoned firewood (20% or less moisture content) from July through February.

An extensive public outreach and education program will be initiated after rule adoption to provide the public information on the rule requirements and health effects information. As part of the education and outreach program the public will be informed when it is not advisable to use wood burning devices based on poor air quality conditions in specific areas during the wood burning season (November through February).

Contingent on future air quality conditions, a mandatory wood burning curtailment program is also proposed. Specifically, if the Basin continues to exceed federal PM2.5 standards, a mandatory wood burning curtailment program would be implemented beginning in November of 2013. During a wood burning curtailment period, the public will be required to refrain from both indoor and outdoor solid fuel burning in specific areas based on air quality forecasts.

Cookstoves are proposed to be exempt from Proposed Rule 445. Other exemptions are proposed for new developments that are not serviced by natural gas and those 3,000 or more feet above mean sea level (MSL). During wood burning curtailments, exemptions are provided for: properties where a wood burning device is the sole heat source, low income households, properties without natural gas service, properties above 3,000 MSL, and ceremonial fires.

¹ Control Measure #2007BCM-03, http://www.aqmd.gov/aqmp/07aqmp/aqmp/Appendix_IV-A.pdf - page IV-A-59

Emissions from wood burning stoves and fireplaces are estimated at approximately six tons of PM_{2.5} per annual average day in 2006, and over 11 tons per winter day.² Emission reductions for the Proposed Rule 445 requirements are approximately one ton per day by 2014. This is an important strategy to help the Basin achieve the PM standards.

SUMMARY OF PUBLIC PROCESS

A Working Group comprised of representatives of industry, agencies, environmental organizations and interested persons, was convened in July of 2006 to discuss key aspects of a potential wood smoke control program. Subsequent meetings were held in 2006 and 2007. During the Working Group meetings, AQMD staff presented information and solicited suggestions on a proposed wood smoke reduction program. A Proposed Rule 445 Public Workshop and Public Consultation meeting were also conducted in early 2007 and a draft rule and staff report was released. In response to comments from the CARB, a revised control measure was included in the 2007 AQMP. The 2007 AQMP, including the revised wood smoke control measure, was adopted by the AQMD Board in June 2007. The 2007 AQMP was subsequently approved by CARB in September of 2007 and submitted to the U.S. EPA.

On August 15, 2007, the South Coast Air Quality Management District (AQMD) staff convened a one-day Technical Forum and Roundtable to discuss issues associated with wood burning in southern California. The goals of the Forum were to:

- 1) Discuss the magnitude of wood smoke emissions to ambient PM_{2.5} levels in southern California;
- 2) Evaluate control technologies for wood-burning devices; and
- 3) Learn from the experiences of several air pollution control agencies that have implemented wood smoke reduction programs.

Forum participants included AQMD staff, a panel of industry experts, agency regulators (representatives from San Luis Obispo County, Washoe County and the San Joaquin Valley) and the general public. In addition to the panel presentations there were discussions on firewood moisture content, wood burning curtailment programs, public outreach efforts, incentive programs, outdoor wood burning, and lessons learned from other agencies that have implemented wood smoke reduction programs.

An Ad-Hoc Committee, including two AQMD Governing Board members, met on November 30, 2007. Working Group meetings and an additional public consultation meeting were held in mid-January, 2008.

AIR QUALITY STANDARDS

The District monitors ambient air quality for criteria pollutants (ozone, carbon monoxide, particulate matter, lead and sulfate) at 32 locations within the Basin. The Basin is not in attainment with the 24-hour or annual average National Ambient Air Quality Standard (NAAQS) for PM_{2.5}. The Basin is also not in attainment with State annual average air quality standards for PM_{2.5}. The 2007 AQMP, approved by the CARB on September 27,

² www.arb.ca.gov/app/emsinv/ccos/fcemssumcat_cc212.php

2007 included a control measure to reduce fine particulate emissions from wood burning devices. As part of the adoption resolution, the CARB Board directed that the relevant portions of the 2007 AQMP be submitted to U.S. EPA as a SIP revision to meet federal Clean Air Act requirements. The following table presents a summary of the federal NAAQS and State of California air quality standards for particulate matter.

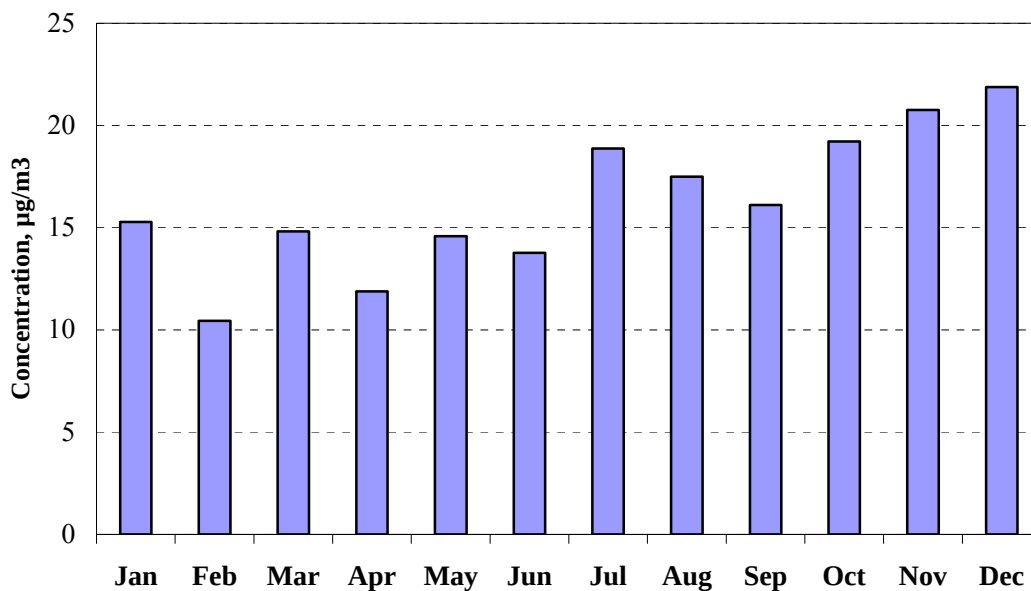
Table 1
Summary of Particulate Standards ($\mu\text{g}/\text{m}^3$)

Jurisdiction	PM10		PM2.5	
	Annual	24-Hour	Annual	24-Hour
Federal	--	150	15	35
California	20	50	12	--

PM2.5 AIR QUALITY IN THE SOUTH COAST AIR BASIN

PM2.5 is monitored at various sites throughout the District. Unlike ozone that has a predictable summertime increase; ambient PM2.5 measurements tend to be higher in the third and fourth quarters of the year. Figure 1 shows the 2005 Basin average PM2.5 concentration for each month of the year. All information presented in Figure 1 is expressed in terms of micrograms per cubic meter ($\mu\text{g}/\text{m}^3$).

Figure 1
PM2.5 Seasonal Variation, 2005
Monthly Average Concentration in the Basin ($\mu\text{g}/\text{m}^3$)



HEALTH EFFECTS FROM FINE PARTICULATE MATTER

The following is an excerpt from Chapter 2, Air Quality and Health Effects, from the 2007 Air Quality Management Plan.

A consistent correlation between elevated ambient fine particulate matter (PM₁₀ and PM_{2.5}) levels and an increase in mortality rates, respiratory infections, number and severity of asthma attacks and the number of hospital admissions has been observed in different parts of the United States and various areas around the world. In recent years, studies have reported an association between long-term exposure to air pollution dominated by fine particles (PM_{2.5}) and increased mortality, reduction in life-span, and an increased mortality from lung cancer.

Daily fluctuations in fine particulate matter concentration levels have also been related to hospital admissions for acute respiratory conditions, to school and kindergarten absences, to a decrease in respiratory function in normal children and to increased medication use in children and adults with asthma. Recent studies show lung function growth in children is reduced with long-term exposure to particulate matter. The elderly, people with pre-existing respiratory and/or cardiovascular disease, and children appear to be more susceptible to the effects of PM₁₀ and PM_{2.5}.

A recent study by the CARB estimated that the elevated PM_{2.5} levels in the South Coast Air Basin result in 5,400 premature deaths, 140,000 asthma/lower respiratory symptoms and 980,000 lost work days per year based on 1999/2000 air quality data. Another study showed that 82 percent of California's exposure and 52 percent of population-weighted national exposure to PM_{2.5} concentrations above federal air quality standards occurs in southern California.

Health Effects from Wood Smoke

Wood smoke is generally in the fine fraction of PM with most particles having an aerodynamic diameter of 2.5 microns or less. Wood smoke is comprised of nitrates, microscopic pieces of fly ash, dust, smoke, and soot as well as polycyclic organic hydrocarbons. Wood smoke is usually released near ground level in populated areas and is especially apt to be breathed by many residents. The health effects of household and neighborhood wood smoke have been studied extensively. The greatest health effect from wood smoke originates from fine particles that can cause health problems ranging from minor irritations such as burning eyes and runny noses to chronic illnesses such as bronchitis. Fine particles also can aggravate chronic heart and lung diseases and are linked to premature deaths in people with these conditions. Persons that may be more susceptible to health effects from wood smoke include those with existing heart or lung disease (congestive heart failure, angina, chronic obstructive pulmonary disease, emphysema or asthma), the elderly, and the young.³ A literature search of available studies (Boman, et al, 2003) also recently concluded that there is no reason to assume that the effects of particulate matter in areas polluted with wood smoke are weaker than elsewhere [e.g., areas with similar ambient PM concentrations not affected by wood smoke]. Conclusions in a more recent health effects study included a statement that there is no persuasive evidence that wood smoke particles are significantly less dangerous for respiratory disease than other major categories of combustion-derived particles in the same size range (Naeher, et al, 2007). The same study did acknowledge, however, that there is too little evidence available to make a judgment

³ US EPA Fact Sheet, Health Effects of Wood Smoke, <http://www.epa.gov/woodstoves/healtheffects.html>

concerning the relative toxicity of wood smoke particles with respect to cardiovascular or cancer outcomes.

Fireplace Wood Smoke Toxic Emissions

The following is an excerpt from U.S. EPA AP-42 regarding toxicity of wood smoke emissions from fireplaces (U.S. EPA, 1996).

Hazardous air pollutants (HAPs) are a minor, but potentially important, component of wood smoke. A group of HAPs known as polycyclic organic matter (POM) includes potential carcinogens such as benzo(a)pyrene (BaP). POM results from the combination of free radical species formed in the flame zone, primarily as a consequence of incomplete combustion. Under reducing conditions, radical chain propagation is enhanced, allowing the buildup of complex organic material such as POM. The POM is generally found in or on smoke particles, although some sublimation into the vapor phase is probable.

These findings are further supported in a 2007 publication in *Inhalation Toxicology* entitled “Wood Smoke Health Effects: A Review” (*Inhalation Toxicology*, 19:67-106, 2007)

OTHER AGENCY EFFORTS TO REDUCE WOOD SMOKE EMISSIONS

California Air District Efforts to Reduce Wood Smoke Emissions

Many California air districts have developed programs/regulations to reduce emissions from wood burning devices including the Yolo-Solano Air Quality Management District, the San Joaquin Valley Unified Air Pollution Control District and the Sacramento Metropolitan Air Quality Management District and the Bay Area Air Quality Management District. These programs vary in stringency based on climate and local concerns. Table 2 presents a summary of some of the key elements of wood smoke reduction programs in other regions.

Table 2
Summary of Wood Smoke Control Programs in Other Regions

Agency	Standards for New Construction ⁴	Firewood Sales ⁵	Wood Burning Curtailment	Opacity Standards for Operation	Property Transfers ⁶
San Joaquin Valley UAPCD	√ ⁷	√	Mandatory		√
Sacramento Metropolitan AQMD	√	√	Mandatory		
Bay Area AQMD (Proposed)	√	√	Mandatory	√	
Yolo-Solano AQMD	√	√			
San Luis Obispo County	√	√	Voluntary		
Town of Mammoth Lakes	√		Mandatory	√	√
Northern Sonoma County	√	√			

In addition to the programs summarized in Table 2, wood smoke reduction programs have also been adopted in the following California county air districts: Mendocino, Butte, Glenn, Kern, Placer, Shasta, and Tehama.

Staff has considered all the elements of wood smoke reduction programs in other areas and public input and has designed the proposed rule for the Basin.

California Air Resources Board Efforts to Reduce Wood Smoke Emissions

In 1989, CARB approved a suggested control measure (SCM) to reduce emissions from wood burning devices. This SCM was forwarded to appropriate local air pollution control districts for use in developing regulations to reduce emissions from residential wood combustion. A summary of the most effective potential control actions from CARB's SCM include:

Voluntary Curtailment Program: This program encourages the public to refrain from use of wood heaters and fireplaces when air quality is expected to be poor.

⁴ Primarily U.S. EPA Phase II-certified or equivalent for new construction unless noted otherwise

⁵ Firewood sold or advertised as seasoned must have a moisture content of 20% or less

⁶ Non-U.S. EPA Phase II-certified stoves or fireplace inserts (not open-hearth fireplaces) must be removed or replaced during property transfers

⁷ Open hearth wood burning fireplaces prohibited in new developments with a density of more than two units per acre

Public Awareness Programs: The goal is to inform the public about the proper operation and maintenance of wood heaters and health effects of wood smoke.

Replacement of Existing Wood Heaters: Upon the sale of real property that contains a wood heater, the heater must be clean burning as reflected by an U.S. EPA-certified, Oregon-certified, or pellet-fueled wood heater.

Moisture Content of Seasoned Wood: Dry wood burns more efficiently; therefore firewood that is offered for sale as "seasoned wood" must have a moisture content of 20 percent by weight or less.

Prohibited Fuel Types: Garbage, treated wood, plastic, rubber, waste petroleum products, paints and paint solvents, and coal having a sulfur content exceeding more than one percent by weight are prohibited from being burned in a wood-burning device.

CARB also compiled a list of PM control measures pursuant to SB 656.⁸ In June 2005, AQMD staff conducted a review of the control measures. For the majority of the stationary and area source categories, AQMD has been identified as having the most stringent rules in California. For one source category (i.e., wood-burning fireplaces/heaters) no equivalent AQMD rule existed. A wood burning control measure was not included in the AQMD SB 656 implementation schedule, however, as the 2003 AQMP included a control measure for wood burning devices (MSC-06).

National Efforts to Reduce Wood Smoke Emissions

The U.S. EPA has previously adopted New Source Performance Standards for new wood heaters (wood stoves and fireplace inserts) sold since 1992.⁹ Currently, there are no federal certification requirements for traditional fireplaces that have an air-to-fuel ratio in excess of 35:1, as a suitable test method has not been developed. An ASTM Fireplace Task Group has developed and approved an emissions and measurement protocol which may be used by U.S. EPA and/or individual states to set emission thresholds for low emission fireplaces, however, work continues in developing a fueling protocol to conduct the evaluations.

In addition to the New Source Performance Standards for wood burning stoves and fireplace inserts developed by the U.S. EPA, a variety of programs have been initiated to assist in the removal of older wood burning technologies and replacement with cleaner technologies. Specifically, the U.S. EPA has initiated the Great American Woodstove Change-Out program to assist local agencies in developing and implementing programs intended to reduce emissions from wood stoves. Under the program, agencies and hearth product retailers have provided financial incentives for the replacement of non-certified wood stoves with U.S. EPA Phase II-certified devices. The Energy Policy Act, approved on August 8 of 2005, also establishes a rebate program for the purchase of renewable/biomass energy-fueled devices with an efficiency of at least 75 percent (Title II, subtitle A, Section 106), however, funding and implementation mechanisms must be resolved.

⁸ ARB, Proposed List of Measures to Reduce Particulate Matter – PM10 and PM2.5, (Implementation of Senate Bill 656, Sher), Approved November 18, 2004

⁹ 4.1 grams PM per hour for catalytic heaters and 7.5 grams per hour for non-catalytic heaters

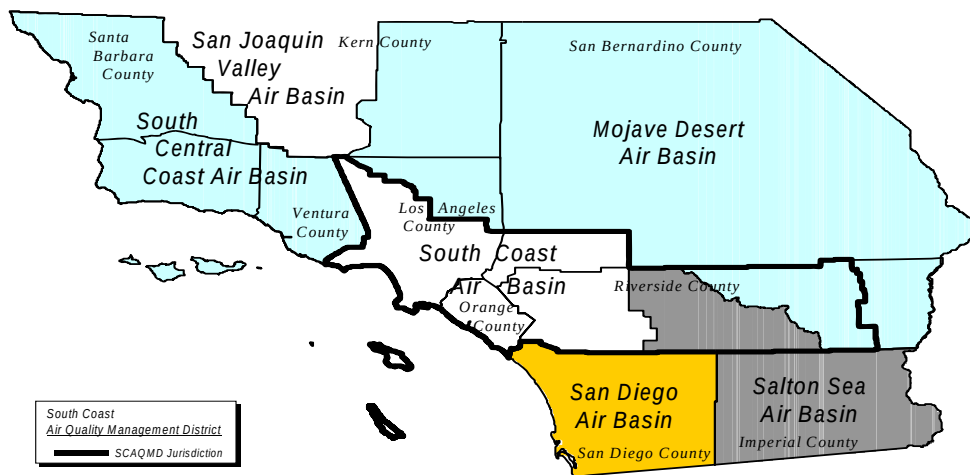
In addition to the national efforts listed above, jurisdictions in several other western states have adopted wood smoke reduction programs including, but not limited to, Albuquerque, Denver, Phoenix, Reno, Las Vegas, Puget Sound and Oregon.

PURPOSE AND APPLICABILITY

The purpose of this rule is to reduce the amount of particulate matter entrained in the ambient air from wood burning devices. Proposed Rule 445 is applicable to specified persons and businesses within the South Coast Air Basin portion of the South Coast Air Quality Management District's jurisdictional boundaries. Figure 2 shows the Basin boundaries in relation to other jurisdictions in southern California.

Proposed Rule 445 is applicable to any person that manufactures, sells, or offers to sale, or installs a wood burning device. The Proposed Rule would affect large and small businesses and the general public. Examples of large businesses covered by the proposed rule include the building industry and manufacturers of wood burning devices. Smaller businesses affected would be hearth product retailers and wood suppliers. The general public that burns wood would also be affected if mandatory curtailments are necessary.

Figure 2
South Coast Air Basin Boundaries



LEGAL AUTHORITY

The AQMD obtains authority to adopt, amend, or repeal rules and regulations from Health and Safety Code Sections 39002, 40000, and 40001.

AFFECTED INDUSTRY

The following background information was obtained from CARB¹⁰ and U.S. EPA¹¹ documents.

The types of devices that burn wood in a typical residence are: 1) fireplaces, 2) fireplace inserts, and 3) wood burning stoves (includes subcategories). The most common wood burning device in a home is the traditional, open-hearth (uncontrolled) fireplace. A fireplace is generally masonry or, more recently, a prefabricated (metal), enclosure with the combustion area facing the interior of the house and a chimney to exhaust the flue gas. Combustion air can be supplied from outside air or from inside air. A fireplace is an inefficient method of heating a house and in some cases can have a negative heating efficiency, if the inside air is used as combustion air. Specifically, when inside air is used for combustion air the colder outside air will be drawn into the house to balance the inside air loss due to combustion.

Fireplace inserts are devices that fit into a fireplace. Fireplace inserts that burn wood, pellets, or gaseous fuels are commercially available and can provide similar efficiencies as wood burning stoves. U.S. EPA Phase II-certified wood and pellet burning inserts are also available. These devices can be used to heat a house, or a portion of the house, by radiating heat into the interior house space or, with the aid of a fan, circulating air around the insert and venting heated air into the house. The result is better fireplace heating performance and a safer system.

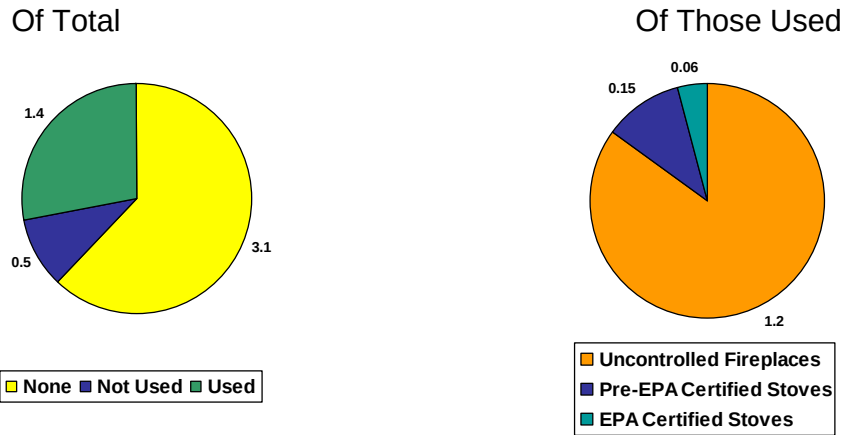
Wood stoves are stand alone devices that vent flue gas through an existing chimney or flue. They are enclosed wood heaters that control burning or burn time by restricting the amount of air that can be used for combustion. Wood stoves are used both as the primary source of residential heat and to supplement conventional heating systems. Based on known variations in construction, combustion, and emission characteristics, there are five different wood stove subcategories: (1) the conventional [non-EPA Phase II-certified] wood stove; (2) the non-catalytic U.S. EPA Phase II-certified wood stove; (3) the catalytic U.S. EPA Phase II-certified wood stove; (4) the pellet stove; and (5) the masonry heater. The newer, certified models, as well as the pellet and masonry units have significantly improved safety and efficiency characteristics. Electric fireplaces (primarily decorative but some have heating elements) have also been developed by industry as fireplace inserts or wall mounted devices but the extent of their use in the southern California market is unknown. Wood stoves are more common in the higher elevations.

As shown in Figure 3, out of approximately 5 million households in the South Coast Air Basin, 1.9 million have a wood burning device based on data from the American Housing Survey. Of those devices only 1.4 million are actually used. The majority of the 1.4 million are uncontrolled fireplaces.

¹⁰ ARB (California Air Resources Board), Area Source Methodology, Section 7.1, Residential Wood Combustion, July 1997

¹¹ EPA, AP-42, Section 1.9, Residential Fireplaces, October 1996

Figure 3
Wood Burning Stoves and Fireplaces

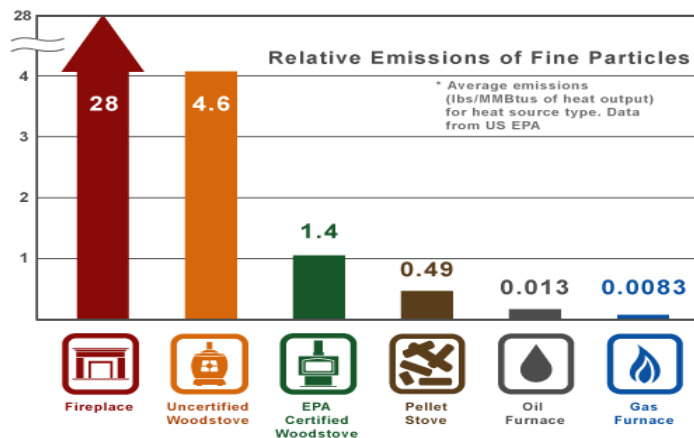


Source: OMNI Environmental Resources, October 2006 from American Housing Survey, conducted by US Census Department.

An AQMD staff survey of five to six new housing developments in each of the Basin's four counties for a total of 22 inspections was conducted in 2007 to determine the types of fireplaces that were being constructed in new developments (primarily single family and condominium projects). The survey indicated that the majority of the developments had at least one fireplace in each unit. Of the total units inspected, approximately 14 percent were constructed or planned to be constructed with dedicated natural gas systems, approximately 44 percent with dual-use (natural gas or wood) fireplaces, and approximately one percent being electric fireplaces. The balance had no wood burning devices at all.

Figure 4 presents a relative comparison of fine particulate emissions from various heating sources.

Figure 4
Relative Emissions from Various Heating Sources¹²



¹² <http://www.epa.gov/airprogm/oar/woodstoves/refp.html>

SUMMARY OF PROPOSED RULE

Proposed Rule 445 is summarized below.

Subdivisions (a) – Purpose; (b) – Applicability; (c) Definitions

These sections describe the purpose of the rule, what parties are subject to rule, and key definitions used throughout the rule.

Subdivision (d) – Requirements

New Development

Paragraph (d)(1) of Proposed Rule 445 would prohibit the installation of a wood burning device into any new development, which is defined as any residential or commercial development that begins construction on or after six months after rule adoption. The date at which construction begins is further defined as the date at which the building permit has been approved or when the foundation for the structure has been started, whichever occurs first. The lead time is intended to allow projects that were recently approved or are currently under construction to be completed as approved.

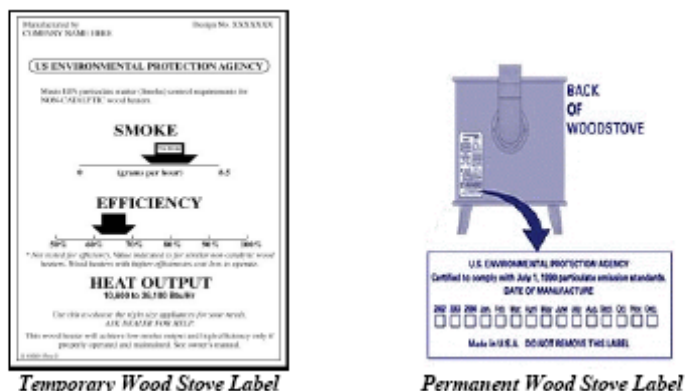
Existing Developments (Remodels, Household Additions, or Replacements)

Under the provisions of paragraph (d)(2), no person shall sell, offer for sale, supply or install a new or used permanently installed indoor or outdoor wood burning device or gaseous-fueled device unless it is one of the cleanest technologies available. This is essentially a prohibition of sale on hearth products that only clean products are available for sale or installation in the Basin. This is the primary means to affect existing houses or new construction exempt under the proposed rule. Examples of devices that would be allowed to be installed into existing developments include: a U.S. EPA Phase II-certified wood burning heater (i.e., wood stove or fireplace insert), a pellet-fueled wood stove, a masonry heater (not open hearth fireplace), a fireplace determined to meet U.S. EPA Phase II certification standards, or a dedicated gaseous-fueled fireplace. Generally, U.S. EPA Phase II certification standards are 4.1 grams PM per hour for catalytic heaters and 7.5 grams per hour for non-catalytic heaters. This provision will allow new wood-burning devices to be evaluated for equivalency as they are developed. New U.S. EPA Phase II-certified wood heaters have a certification placard on the back (Figure 5) of the device and the U.S. EPA maintains a list of certified wood heaters on a web site.¹³ Paragraph (d)(2) does not prohibit the installation of new pellet stoves and masonry heaters as these devices are designed to burn very efficiently and do not require U.S. EPA certification.¹⁴ At the present time there are no open hearth fireplaces that meet the U.S. EPA Phase II certification standards but one may become available in the future. These requirements are also proposed to become effective six months following rule adoption.

¹³ <http://www.epa.gov/Compliance/resources/publications/monitoring/caa/woodstoves/certifiedwood.pdf>

¹⁴ <http://www.epa.gov/woodstoves/basic.html>

Figure 5
U.S. EPA Phase II-Certification Label



Prohibition of Burning Non-Wood Items

Paragraph (d)(3) of Proposed Rule 445 prohibits the burning of items not intended by a manufacturer for use as fuel in a wood burning device. Examples of such items include garbage, treated wood, particle board, plastic products, rubber products, waste petroleum products, paints, coatings or solvents, or coal.

Firewood Sales

Firewood with too high a moisture content will not burn efficiently and will smolder, resulting in increased emissions and creosote build-up. Seasoned wood (aged for at least four to six months) will burn hotter, cut fuel consumption and reduce smoke inside and outside the home. Accordingly, Proposed Rule 445 includes provisions regarding firewood sales. Specifically, under paragraph (d)(4), commercial firewood facilities would be prohibited from selling non-seasoned firewood (greater than 20% moisture content) during the consecutive months of July through February. During the remainder of the year there would be no restrictions on firewood sales. This provision does not apply to manufactured logs. Commercial firewood facilities are defined as any operation that has a business license that sells, or offers for sale, bulk firewood. These provisions would not apply to grocery stores and other retailers that sell packaged firewood.

Wood Burning Curtailment Program

If air quality has not improved and PM_{2.5} exceedances still occur, a wood burning curtailment program is also proposed. It would be effective during the wood burning season (consecutive months of November through February each year) for specific areas that are projected to have PM_{2.5} levels above the standard. The District would begin with an outreach and education program to inform the public about health effects when it is not advisable to burn wood in any indoor or outdoor wood burning device due to poor air quality conditions. The mandatory curtailment requirement would be triggered by forecasts of PM_{2.5} levels above 35 $\mu\text{g}/\text{m}^3$. This level coincides with the federal 24-hour PM_{2.5} ambient air quality standard and is generally consistent with an Air Quality Index (AQI) rating as unhealthy for sensitive persons. Based on a review of 2003-2006 air quality data, on average, 25 days would be above 35 $\mu\text{g}/\text{m}^3$, however, due to anticipated improvements in air

quality, it is expected that there would be fewer days above the federal 24-hour standard in the future, possibly none.

Recognizing that the Basin consists of a relatively large geographic area with varying climatic and air quality conditions, it is intended that the curtailment forecast would be issued for smaller sub-regions. Specifically, the Basin is divided into 13 general forecast areas (i.e., Coastal, Metropolitan, San Fernando Valley, etc.) and is further divided into 34 Source Receptor Areas (SRAs) which are currently used for other air quality forecasting messages. Either of these sub-regional boundaries could be used as a starting point for the wood burning curtailment program, however, every effort will be made to utilize information that is readily available to the public (i.e., zip codes, municipal boundaries) to convey the message when a wood burning curtailment is forecast.

If PM_{2.5} air quality conditions do not improve sufficiently to meet the federal air quality standards by 2013, the education and outreach program would become a mandatory wood burning curtailment program starting with the 2013-2014 wood burning season. Prior to implementation of the mandatory (if necessary) wood burning curtailment program, an extensive public education and outreach program would be implemented to ensure that the public was informed of program elements. Additional discussion of the public education and outreach program as well as efforts to ensure compliance with the mandatory curtailment program (if needed) is included later in this report.

Subdivision (f) – Exemptions

Paragraph (f)(1) exempts cookstoves from Proposed Rule 445. Generally, cookstoves are defined under Title 40 of the Code of Federal Regulations (CFR) Section 60.531 as a wood-fired device that is primarily designed for cooking and has the following characteristics: 1) an oven with an oven rack with a volume of one cubic foot or greater, 2) a device for measuring oven temperature, 3) a flame path that is routed around the oven, 4) a shaker grate, 5) an ash pan, 6) an ash clean-out door beneath the oven, and 7) the absence of a fan or heat channels to dissipate heat from the device.

In instances where there is no existing natural gas infrastructure within 150 feet of a property or when a property is 3,000 or more feet above mean sea level, paragraph (f)(2) would exempt new developments from the prohibition of installing a wood burning device, but are expected to comply with paragraph (d)(2) due to sales restrictions.

Paragraph (f)(3) exempts indoor and outdoor wood burning devices included in the sale or transfer of properties from the existing development requirements included in paragraph (d)(2).

Paragraph (f)(4) exempts historic sites or contributing structures from the existing development requirements included in paragraph (d)(2).

Paragraph (f)(5) exempts manufactured logs from the prohibition of burning non-wood items.

Paragraph (f)(6) establishes specific exemptions from the mandatory wood burning curtailment program that, if necessary, could be implemented in 2013. As detailed in paragraphs (f)(6)(A) through (E), these limited exemptions include:

- Households where a wood burning device is the sole source of heat;

- Low income households;
- Residential or commercial properties without natural gas service or 3,000 above mean sea level; and
- Ceremonial (including religious) fires exempted under District Rule 444 – Open Burning.

Further discussion of these exemptions and how compliance with the mandatory curtailment program provisions would be ensured is included under the heading Compliance Activities.

Subdivision (g) – Administrative Requirements

As part of the comprehensive public education and outreach program, the District will develop an extensive effort to ensure that the public is knowledgeable about how to obtain information on when a curtailment day is forecast. Subdivision (g) of Proposed Rule 445 specifies the minimum requirements to inform the public when a curtailment day is forecast but every effort will be undertaken to make sure people are informed. A summary of the procedures that will be used to notify the public when a curtailment day is forecast includes one or more of the following:

- A recorded telephone message;
- Messages posted on the District’s web site;
- Electronic mail messages to persons or entities that have requested such information;
- Notifying broadcast and print media; and
- Any additional method that the Executive Officer determines is appropriate.

Subdivision (h) – Penalties

Subdivision (h) establishes the penalty provisions for any person that violates the mandatory wood burning curtailment provisions that could be implemented beginning in 2013. As noted in paragraphs (h)(1) through (h)(3), the penalties are minor for a first infraction (i.e., wood smoke awareness course or nominal fine) and increase proportionately for subsequent violations. It should be noted that the penalty structure proposed in subdivision (h) is applicable for each wood burning season and prior notices of violation for previous years are not additive. A summary of the penalties specified in subdivision (h) of Proposed Rule 445 include:

- 1st offense: online class or \$50 penalty;
- 2nd offense: install dedicated gaseous-fueled fireplace or \$150 penalty; and
- 3rd offense: \$500 penalty or environmental project through mutual settlement agreement program.

PUBLIC OUTREACH

An extensive outreach program is planned for Proposed Rule 445 as this is a new source category for the District and because the proposal affects the general public and construction trades instead of industrial sources. Outreach efforts are planned as a two-pronged approach with a public education program and an information program for affected industries.

The public education program will include a web site with a summary of the rule requirements, answers to frequently asked questions, links to other web sites (CARB and U.S. EPA), and the health effects of wood smoke. Additional efforts to increase public awareness of the District wood smoke reduction program may include, but are not limited to, outreach to local governments, interested organizations, and homeowner associations.

The information program for affected industries is intended to help ensure compliance with the Proposed Rule 445 provisions related to new developments or remodels. Specifically, District staff will notify those affected by the subdivision (d) requirements for new construction, remodels/additions and commercial firewood facilities of the Proposed Rule requirements and effective dates. Anticipated groups targeted for the information program include home builders, local governments, architects, retail outlets, and land developers. The District will also work with commercial firewood facilities to ensure that they are aware of the Proposed Rule 445 provisions related to selling only seasoned firewood from July through February as well as tools available for ensuring compliance.

INCENTIVE PROGRAM

As part of the Proposed Rule 445 outreach and education program, the AQMD staff is proposing to develop an incentive program to encourage existing houses with open-hearth wood burning fireplaces to switch to dedicated gaseous-fueled fireplaces. Similar programs are currently in effect in numerous other areas of the State including the San Joaquin Valley, Sacramento County, and the San Francisco Bay Area.

Staff will bring a Request for Proposals (RFP) for the Board's consideration as a separate Governing Board item. The intent is to hire a third party to implement a gas log buy-down program where the public would receive financial assistance to install a gas log set into an existing wood burning fireplace. As part of the program, the AQMD funding is intended to pay partial funding for installation as well as for the gas log set. Providing funding for professional installation is considered a valuable component of the program both to ensure that participating households are located in targeted areas as well as to reduce the potential for safety concerns from improper installations. Households that presently burn wood in an open hearth fireplace would be targeted for the program to help ensure emission reductions. The incentive amount will be determined at a later date, but is expected to be funded by mitigation fees generated by AQMD Rule 1309.1 (Priority Reserve). A \$500,000 gas log buy-down pilot project is anticipated first and additional AQMD Rule 1309.1 funding may be allocated in the future.

COMPLIANCE ACTIVITIES

Wood smoke reduction programs have been implemented in other regions for years. Staff has consulted with other agencies as to the most effective ways to ensure public participation. The following paragraphs describe how compliance with these Proposed Rule 445 provisions is envisioned.

Paragraph (d)(1) – Standards for New Development

Subsequent to rule adoption, an outreach program will be initiated to notify affected industries of the requirements for new developments. Following outreach activities, District staff could conduct spot checks on development projects to ensure that homes constructed after the effective date have dedicated gaseous-fueled fireplaces. A dedicated gaseous-fueled fireplace has a gas log set or other design features that preclude wood burning that can be clearly identified. Compliance related activities would be conducted prior to occupancy and AQMD compliance staff will monitor development projects to ensure that only dedicated gaseous-fueled fireplaces are installed in new developments. AQMD staff could also follow up on tips or complaints from homeowners on their own individual residences.

Paragraph (d)(2) - Standards for Existing Developments (i.e., Remodels)

Compliance with the standards for existing development would be accomplished by an education and outreach program to homeowners, persons involved in the remodeling industry (e.g., architects), fireplace installers and local government staff. Informational brochures would be developed to inform interested parties of the Proposed Rule 445 requirements for existing developments (i.e., EPA Phase II-certified, pellet-fueled, a masonry heater or a dedicated gaseous-fueled device). This information would be distributed to the interested groups identified previously and would be placed on the AQMD web site. As mentioned, U.S. EPA Phase II-certified wood heaters have an identification tag, and model numbers are listed on a U.S. EPA web site.¹⁵ Interested groups could also contact AQMD compliance staff for a consultation in the event that there are questions about whether a wood burning device is acceptable. No follow-up compliance activities are anticipated after the installation of a wood burning device into an existing residential or commercial property.

Paragraph (d)(4) – Requirements for Commercial Firewood Facilities

Paragraph (d)(4) provisions regarding the moisture content of firewood sold from July through February would be implemented at the commercial firewood facility level and would not involve individual residences. District staff would conduct random inspections at commercial firewood facilities to ensure that the moisture content is 20 percent or less. Proposed Rule 445 states that moisture content would be determined by ASTM Method D 4442-92, a handheld moisture meter operated in accordance with ASTM Test Method D 4444-92 or any other method approved by the CARB, U.S. EPA and the Executive Officer. ASTM Method D 4442-92 is the oven drying method and involves collecting and weighing samples, drying the sample under controlled conditions, reweighing the sample and calculating the difference between the raw and dried sample to determine moisture content.

Proposed Rule 445 allows for use of hand-held moisture meters to determine moisture content. Product designs vary, but most use a set of pins to probe the electric resistance of the wood, are easily calibrated and correction factors are then applied based on wood species. Costs for the devices vary based on features; however, models are commercially available for less than \$100, but up to \$400. During compliance inspections, efforts would be undertaken to ensure that wood is taken from various portions of a pile to lessen the impact of surface moisture from precipitation.

¹⁵ <http://www.epa.gov/Compliance/resources/publications/monitoring/caa/woodstoves/certifiedwood.pdf>

Subdivision (e) – Wood Burning Curtailment Program

As mentioned, wood burning curtailment programs have been implemented in several California air districts including San Joaquin Valley, Sacramento Metropolitan AQMD, Bay Area AQMD, and others).

Subsequent to adoption of Proposed Rule 445, the public would be informed when it is not advisable to use wood burning devices due to poor air quality conditions. Anyone wishing to access information for the education and outreach program will be able to obtain the forecast via the District's web site or through a toll free number (800) CUT-SMOG [288-7664]. Efforts to expand this notification process through a list-serve e-mail, media weather forecasts and Public Service Announcements will be considered in the future.

If the wood burning program becomes mandatory during the 2013 wood burning season, AQMD compliance staff could do periodic surveillance or would respond to public complaints. If visible wood smoke was observed from a wood burning device, the address of the property would be noted and the property owner would be issued a notice of violation (NOV) by mail. No attempt would be made by staff to interact with individuals during a wood smoke compliance inspection. If the property was not owner-occupied, the NOV would still be sent to the owner and arrangements would need to be made between the owner and the tenant. As part of the NOV process, the recipient would be informed of the exemptions included in Proposed Rule 445 (i.e., sole source of heat, low income household, etc.). The NOV material would also describe the process for complying with an NOV (i.e., participating in a wood smoke education class or paying the nominal penalty) or what information is necessary to submit to the AQMD to show that the property is eligible for an exemption from the wood burning curtailment program. Subdivision (g) describes the proposed penalty structure for Proposed Rule 445.

EMISSIONS INVENTORY

Emissions from residential wood burning devices result primarily from incomplete combustion and include PM, CO, NO_x, SO_x, and ROG, although particulate emissions have been the focus of air district wood smoke reduction programs. Studies have shown that the particulate emissions are generally in the accumulation (≤ 2.5 microns) size range (Jacob, et.al., 2000). Additionally, incomplete combustion of wood produces polycyclic organic matter, a group of compounds classified as hazardous air pollutants under Title III of the federal Clean Air Act.

Emissions Inventory

Table 3 shows 2007 AQMP annual average day wood burning emissions inventory for the base year (2002) and future years.

Table 3
Annual Average Emissions from Residential Wood Combustion (tons/day)

Emissions (Tons/Day)	2002	2014	2023
Annual Average: PM2.5 Inventory	5.8	6.5	7.0

EMISSION REDUCTIONS

The 2007 AQMP estimated emissions from wood burning fireplaces and stoves at 5.8 and 6.5 tons of PM2.5 per annual average day in 2002 and 2014, respectively. Through interpolation, the 2008 PM2.5 emissions inventory (the year of rule implementation) was estimated at 6.15 tons per annual average day. The 2007 AQMP further estimated emissions reductions for the wood burning control measure at one ton of PM2.5 per annual average day by 2014. Implementation of Proposed Rule 445 is intended to achieve the emissions reductions outlined in the 2007 AQMP and 2014 is identified as the target demonstration year as the attainment date for the federal PM2.5 standard is 2015.

The paragraph (d)(1) prohibition of wood burning fireplaces in new developments is a source of Proposed Rule 445 emission reductions. Staff has estimated that requiring the installation of dedicated gaseous-fueled fireplaces in new developments would reduce PM2.5 emissions by 115 tons per year (0.32 tons per day) by 2014. This estimate is based on the growth factors applied to Southern California Association of Governments (SCAG) household projections forward looking to 2014 from 2008. Specifically, the reduction achieved from requiring only dedicated gaseous-fueled fireplaces in new construction was based on the projected increase in emissions carried forward to 2014 without the Proposed Rule 445 requirements and the reduction in emissions associated with the Proposed Rule 445 requirements.¹⁶ Calculations for these estimates are presented in Appendix A.

It should be noted that data used for the AQMP control measure indicates that, based on a survey of 1,601 households conducted in the late 1980's, 24 percent of the Basin-wide total households actually burn wood. Based on the recent AQMD Compliance staff survey of 22 new housing developments in the four county jurisdiction (17 single family, 4 condominium, & 1 apartment complex), out of a total 2,692 housing units surveyed, 59 percent had some type of fireplace (44% dual fuel/natural gas ready, 14% dedicated gas, 1% electric). This is comparable to figures of the Census Bureau's American Housing Survey (AHS) which states that 63 percent of existing housing in Riverside-San Bernardino and 75 percent of existing housing in Anaheim-Santa Ana have a usable fireplace.

Assuming this trend continues into the future, the figure of 24 percent of households that burn wood as derived under the AQMP is 55 percent of the total dual fuel/natural gas ready units ($24\% \div 44\%$) found by AQMD inspectors. It could then be concluded that the balance of the remaining dual fuel/natural gas ready fireplaces (45%) have chosen to use natural gas

¹⁶ Applying the SCAG growth factors for housing to the 1997 baseline wood burning households results in an estimate of approximately 14,000 traditional, open-hearth wood burning devices precluded from being installed each year under the provisions of Proposed Rule 445.

instead of wood. Putting this into the perspective of emissions growth from 2008 to 2014, can be shown as follows:

PM2.5 Growth (2008–2014) = 0.35 tons per annual average day (tpd)

Therefore, the reductions from Proposed Rule 445 paragraph (d)(1) would be 0.35 tpd by 2014.

Based on the proposed rule exemptions, it was assumed that 10 percent of the emissions growth would still occur. The resulting rule benefit is then estimated at 0.32 tpd PM2.5 by 2014.

Using the data from the AQMD staff survey and from the AQMP (above):

0.18 tpd of emission reductions would occur from rule implementation (55% of 0.32 tpd) by 2014

and,

0.14 tpd of emission reductions would occur in absence of the proposed rule due to consumer choice for gaseous-fueled devices (45% of 0.32 tpd) by 2014

This trend towards gaseous-fueled fireplaces in new developments is expected to continue and sales data from hearth product retailers supports this assumption. Therefore, it may be concluded that some of the emission reductions calculated from Proposed Rule 445 paragraph (d)(1) requirements may occur in the absence of the rule.

Additional emission reductions could be achieved through the paragraph (d)(2) provisions that require U.S. EPA Phase II-certified (or equivalent) devices in existing house (i.e., remodels) but no attempt has been made to quantify these reductions because the number of traditional, open-hearth fireplaces added or remodeled in existing households is unknown.

Additional emission reductions are associated with Proposed Rule 445 subdivision (e) wood burning curtailment program that could be implemented during the 2013-2014 wood burning season, if necessary, to meet the federal PM2.5 NAAQS. Based on the 2014 winter, PM2.5 emissions inventory of approximately 12.4 tons per winter day and an average of 25¹⁷ wood burning curtailment days forecasted during the November through February time period and a seventy five percent compliance rate, the emission reductions from wood burning prohibitions are estimated at 243 tons of PM2.5 per year (0.67 tons per day) by 2014. Appendix A presents the calculations for these estimates.

Taken together, the emission reductions from the Proposed Rule 445 paragraph (d)(1) and subdivision (e) requirements would equal approximately one ton of PM2.5 reduction per day by 2014. This matches the 2007 AQMP emissions reduction commitment of one ton per annual average day by 2014.

Additional emission reductions are expected through implementation of the gas log buy-down program. These emission reductions would be a function of the amount of wood precluded from being burned in an existing wood burning fireplace. In order to provide a range of potential emission reductions from the gas log buy down program, a range of wood burning rates has been presumed. Specifically, based on a Basinwide average wood burning rate of 110 pounds per year and 20,000 participating households, the emission reductions would be 18 tons of PM2.5 per year. Based on a wood burning rate of 274 pounds per

¹⁷ 25 estimated wood burning curtailment days based on 2003-2006 air quality data

household (San Bernardino County average), the emission reductions would be 33 tons of PM_{2.5} per year. A mid-range value for these two estimates is approximately 26 tons per year or 0.1 tons of PM_{2.5} per annual average day.

Green House Gas Emissions

Particulates have been the primary focus of wood smoke reduction programs over the years. Recently, however, additional attention has been focused on greenhouse gas emissions and the potential for changes in these emissions. All forms of combustion result in the release of carbon dioxide (CO₂) which has been identified as the primary source of climate change emissions. Based on U.S. EPA AP-42 emission factors, direct CO₂ emissions for wood burning devices are approximately twice that of gaseous-fueled fireplaces. A comparison of CO₂ emissions from these two fuel sources is complicated by the fact that wood may be considered a renewable resource (referred to as carbon neutral) while fossil fuels such as natural gas are not. Under international greenhouse gas accounting methods developed by the International Panel on Climate Change for inventory development, biogenic carbon is part of the natural carbon balance and it will not add to atmospheric concentration of carbon dioxide.¹⁸ However, there are a number of parameters to be considered as to the carbon neutrality of wood. Specifically, there are uncertainties relative to the contribution to global warming by the burning of wood (an instantaneous release of CO₂) versus natural degradation and release of CO₂ over time. Also, there is an unknown as to the reforestation and replacement of trees on an equivalent basis, which goes towards the neutrality. Other uncertainties include process and transportation of woody material that ends up as firewood for use by consumers. There is also another issue as to the effects of black carbon from incomplete combustion and its short term effects on global warming, which is separate from the emissions of CO₂. An analysis of the impact of Proposed Rule 445 in terms of climate change (global warming) emissions will be included in the California Environmental Quality Act (CEQA) documentation for the proposed project.

COST-EFFECTIVENESS

Cost-effectiveness is calculated by dividing the estimated compliance costs of a proposed regulation by the estimated emission reductions. Proposed Rule 445 compliance costs were based on assumptions regarding incremental increase in costs for new residential construction provided by product vendors. Maintenance costs were presumed to be zero as the traditional, open-hearth (uncontrolled) fireplaces that would have been installed in absence of the regulation would be subject to equivalent maintenance as the devices installed to comply with Proposed Rule 445. These costs were divided by the estimated emission reductions for 20 years (estimated equipment lifetime) in order to obtain a cost-effectiveness estimate using the Discounted Cash Flow (DCF) methodology. The DCF methodology is based on the following formula:

$$\frac{K + \text{OEM (PVF)}}{\text{Emission Reductions} \times 20 \text{ years}}^{19}$$

¹⁸ Energy Information Administration, Voluntary Reporting of Greenhouse Gases Program, <http://www.eia.doe/oiaf/1605/coefficients.html>

¹⁹ Estimated equipment lifetime

Where:

K – capital costs

O&M – recurring (maintenance) costs

PVF – present value factor (12.5)

Emissions from wood burning devices are highly variable based on the amount and type of fuel (wood) used annually. Cost effectiveness of an air pollution control program is directly dependant on the emissions reductions from program implementation. An estimation of typical wood usage based on a typical household was used to calculate the cost-effectiveness of the program recognizing that it is not possible to accurately determine the amount of wood precluded from being burned in new developments as a result of the Proposed Rule 445 requirement to only install dedicated gaseous-fueled fireplaces. Based on an incremental increase of \$500 to install a dedicated gaseous-fueled fireplace, the cost-effectiveness of the Proposed Rule 445 requirements would range from approximately \$5.5 to \$13.7 per pound (\$11,000 to \$27,400 per ton) of PM_{2.5} reduced. Appendix B includes the cost-effectiveness estimated based on varying wood usage factors. It should be noted that the incremental cost estimate of \$500 for installing a dedicated gaseous-fueled fireplace was obtained from a northern California air district regulation and AQMD staff believes that there would a reduction in the incremental cost for large-scale land development projects in southern California due to economies of scale.

Because emissions reductions have not been estimated for the proposed requirements for paragraph (d)(2) existing developments (e.g., EPA Phase II-certified or equivalent), it is not possible to calculate cost-effectiveness for these provisions. However, replacement of an existing uncertified freestanding wood stove with an U.S. EPA Phase II-certified wood stove have been estimated to range from approximately \$3,400 to \$4,150 and costs for replacement of an existing uncertified freestanding cordwood stove with a freestanding gas stove has been estimated at approximately at approximately \$3,400 (Houck, 2006). Cost estimates for replacing non-U.S. EPA Phase II certified fireplace inserts are similar.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

Pursuant to the California Environmental Quality Act (CEQA) and AQMD Rule 110, an Environmental Assessment (EA) for PR 445 has been prepared (SCAQMD No. 090207JK, February 2007). The purpose of the EA is to describe the proposed project and to identify, analyze, and evaluate any potentially significant adverse environmental impacts that may result from adopting and implementing the proposed Rule 445.

No significant adverse impacts were identified for any environmental topic in the Draft EA. The Draft EA has been circulated to the public for a 30-day review and comment period from February 9, 2007 to March 13, 2007. One comment letter was received during the public review and comment period and will be addressed and included in the Final EA.

SOCIOECONOMIC ASSESSMENT

A socioeconomic assessment has been prepared and is available as part of the Set Hearing package.

DRAFT FINDINGS

Health and Safety Code Section 40727 requires the AQMD to adopt written findings of necessity, authority, clarity, consistency, non-duplication and reference.

Necessity

A need exists to adopt Rule 445 to implement the 2007 AQMP control measure BCM-03 and in order to assist in the attainment of State and federal PM standards for the South Coast Air Basin.

Authority

The AQMD Governing Board obtains its authority to adopt, amend, or repeal rules and regulations from California Health & Safety Code Sections 39002, 40000, 40001, 40702, and 40725 through 40728, inclusive.

Clarity

The proposed amended rule has been written or displayed so that its meaning can be easily understood by persons directly affected by it.

Consistency

The proposed amended rule is in harmony with and not in conflict with or contrary to, existing statutes, court decisions or state or federal regulations.

Non-Duplication

The proposed amended rule does not impose the same requirements as any state or federal regulations. The amendment is necessary and proper to execute the powers and duties granted to, and imposed upon, AQMD.

Reference

By adopting the Proposed Rule, the AQMD Governing Board will be implementing, interpreting, and making specific the provisions of the California Health & Safety Code Section 40001 (rules to achieve ambient air quality standards).

Alternative Control Measures - Health and Safety Code Section 40440.5, subsection (c)(3) requires an analysis of alternative control measures. One alternative is to not adopt the proposed rule. The emission reductions, however, are necessary as part of the AQMD's plans to meet State and federal air quality standards. Several other possible alternative control measures are discussed below.

One alternative would be to establish density restrictions that would allow the installation of a limited number of traditional, uncontrolled fireplaces in rural areas. The traditional, uncontrolled fireplaces produce more emissions than dedicated gaseous-fueled fireplaces allowed under Proposed Rule 445. This would reduce the emission reduction benefits of the proposed rule.

Another more stringent option would be to initiate the mandatory wood burning curtailment program prior to 2013. Staff believes that public education is an important component of any wood smoke reduction program and, to that end, will be initiating a comprehensive education and outreach program subsequent to rule adoption. This education and outreach program will inform the public of health effects from wood smoke and identify cleaner alternatives.

The public will also be informed when it is not advisable to use wood burning devices due to poor air quality as part of the education and outreach program.

A further more stringent option would be to include a property transfer requirement that would require households with non-U.S. EPA Phase II-certified heaters (not open hearth fireplaces) to remove or replace these devices at the time of sale. Staff believes that the benefits of such a program would be limited because the number of these devices used in warm climates, such as southern California, is unknown. Furthermore, based on an average turn-over rate of ten years per property it could be estimated that a very limited number of these devices would be subject to property transfer provisions prior to the 2015 PM_{2.5} attainment date. For these reasons, staff believes that the current proposal, in conjunction with an incentive program that encourages the public to switch from wood burning to gaseous-fueled devices, will achieve emission reductions in a more timely manner.

Incremental Cost-Effectiveness – Health and Safety Code Section 40920.6 (a)(3) requires the District to perform an incremental cost effectiveness analysis prior to adopting rules to meet the requirements for a Best Available Retrofit Control Technology (BARCT) rule, or to implement feasible measures pursuant to use of an alternative emission reduction strategy under Health and Safety Code Section 40914. Proposed Rule 445 is not being adopted to meet a BARCT requirement nor is it being adopted as a feasible measure pursuant to an alternative reduction strategy under Health and Safety Code Section 40914. Therefore, an incremental cost-effectiveness analysis is not needed.

Draft Comparative Analysis - Health and Safety Code §§40727.2 requires a written analysis comparing the proposed rule with existing federal, State and District regulations. Health and Safety Code §§40727.2, subsection (c) and (d) further require the analysis to review averaging provisions, operating parameters, work practice requirements, and monitoring, reporting and recordkeeping requirements associated with existing applicable rules and proposed regulations. .

As mentioned, the U.S. EPA has previously adopted performance standards for new wood heaters (wood stoves and fireplace inserts) sold since 1992.²⁰ Proposed Rule 445 is consistent with these requirements as wood burning units that meet the U.S. EPA performance standards would be allowed to be installed and operated in remodels. Proposed Rule 445 is also complementary to the federal program as it also prohibits the sale of used wood burning heaters that do not meet U.S. EPA performance standards. Table 4 below identifies other State and AQMD rules that apply to the sources subject to Proposed Rule 445. Footnotes explain the differences between Proposed Rule 445 and the other State and AQMD rules where relevant.

²⁰ 4.1 grams PM per hour for catalytic heaters and 7.5 grams per hour for non-catalytic heaters

Table 4
Comparison of Proposed Rule 445 and Other AQMD Rules

Rule	Source	Emission Reductions / Limits (footnotes provide comparison with Proposed Rule 445 requirements)	Averaging Procedures, Work Practices, Operating Provisions	Monitoring, Recordkeeping, Reporting, Test Methods
State H&S Code 41701	Applicable to any source.	Prohibits discharge of excessive visible emissions. ²¹	40 percent opacity can not be exceeded three minutes in any hour, cumulatively.	Test methods - based on opacity as determined by Ringlemann chart or U.S. EPA Method 9.
AQMD 401 (Visible Emissions)	Any single source of emissions; would include exhaust stack emissions.	Prohibits excess visible emissions. ²²	20 percent opacity can not be exceeded three minutes in any hour, cumulatively.	Test methods -based on opacity as determined by Ringlemann chart or U.S. EPA Method 9.
AQMD 402 (Nuisance)	Applicable to any source.	Prohibits public nuisance caused by emissions of air contaminants. ²³	None.	None specified.
AQMD 404 (Particulate Matter – Concentration)	Applicable to any source.	Prohibits discharge of particulate matter in excess of certain rates. ²⁴	Based on grains per cubic foot of air stream.	None specified.
AQMD 405 (Solid Particulate Matter – Weight)	Applicable to any source.	Prohibits discharge of particulate matter weight in excess of specified rates. ²⁵	Establishes maximum discharge rate (lbs/hr) based on process weight per hour.	None specified.

All Feasible Measures Analysis

The District is required under State law to adopt all feasible measures relative to other State programs to reduce particulate matter emissions from wood burning devices (refer to Health and Safety Code Section 39614). This measure is included in the 2007 AQMP, and for that reason as well, it must be implemented. Table 5 provides a summary of the wood smoke reduction programs in other air districts throughout the State. In accordance with Health & Safety Code section 39614 and as described in the Alternative Control Measure discussion (page 22 of the draft staff report), these measures were evaluated as part of this rule development process. Staff believes that the Proposed Rule 445 elements represent a reasonable proposal for the South Coast Air Basin given that residential wood burning has

²¹ Health and Safety Code § 41701 provisions are implemented primarily in response to public complaints. Proposed Rule 445 requirements are applicable regardless of whether public complaints are filed.

²² Rule 401 requirements are based in response to public complaints and visual observations. Proposed Rule 445 requirements are applicable regardless of whether public complaints are filed.

²³ Rule 402 provisions are implemented primarily in response to public complaints. Proposed Rule 445 requirements are applicable regardless of whether public complaints are filed.

²⁴ This Rule is used in conjunction with the AQMD's permitting system for point sources of air pollution. Wood burning sources are not subject to AQMD permits.

²⁵ Under Rule 405, point source emissions are addressed through the permit evaluation process. Proposed Rule 445 sources are not subject to the AQMD's permitting system.

been estimated to represent less than ten percent of PM_{2.5} emissions in this region. This can be compared with residential wood smoke emissions that are estimated to contribute 30 percent or more of PM_{2.5} emissions in the other air districts identified in Table 5. Together, the Proposed Rule 445 standards for new developments, the education and outreach program, and the incentive program to encourage the public to switch from wood burning to gaseous-fueled devices represent a feasible and cost-effective control program that the District can employ to reduce the emissions of particulate matter from wood burning devices.

Table 5
Comparison of Proposed Rule 445 to Other California Air District Wood Smoke Reduction Programs

Agency	New Construction	New units EPA certified or equivalent	Firewood sales	Curtailment 24-hour forecast	Penalty structure	Property transfer	Exemptions
SCAQMD PR 445	Dedicated gas only		prohibit sale of unseasoned wood [>20% moisture content] from July to February	Mandatory PM2.5 35 µg/m ³ (~100 AQI) ≥November, 2013	Beginning 2013: 1 st occurrence - online class or \$50 fine 2 nd occurrence - \$150 fine or install dedicated NG fireplace 3 rd occurrence - mutual settlement Per Season Basis		1) Cook stoves 2) limited curtailment exemptions: A) sole heat source, B) low income, C) no NG service, D) above 3,000 MSL, E) religious or ceremonial fires
Sacramento		√	√ ²⁶ Labeling Requirement	Mandatory (implemented in 2007) Stage 1 35 µg/m ³ mandatory/ EPA Phase II OK Stage 2 40 µg/m ³ No burning Voluntary PM2.5 >25 <35µg/m ³	1 st year – warning letter. Subsequent years, \$50 for 1 st infraction or attend class 2 nd mutual settlement agreement		1) Cook stoves 2) Limited curtailment exemptions: A) sole heat source, B) economic hardship, C) religious ceremonies, D) EPA Phase II devices during a Stage 2 advisory
San Joaquin Valley	Natural gas units in urban areas due to density restrictions	√	√ ²⁶	Mandatory (implemented in 2003) PM10 >~250µg/m ³ Voluntary >~150µg/m ³	\$50 for 1 st infraction or attend class 2 nd up to \$1,000	√	1) Cook stoves 2) limited curtailment exemptions: A) sole heat source, B) no NG service, C) homes above 3,000 MSL
Yolo-Solano		√	√ ²⁶	Voluntary			Cook stoves

²⁶ Prohibit sale of wood sold or advertised as seasoned unless moisture content is 20% or less

Table 5
Comparison of Proposed Rule 445 to Other California Air District Wood Smoke Reduction Programs

Agency	New Construction	New units EPA certified or equivalent	Firewood sales	Curtailment 24-hour forecast	Penalty structure	Property transfer	Exemptions
Bay Area ²⁷ (Proposed)		√	√ ²⁶	Proposed mandatory curtailment program based on conditions when a negative impact upon public health resulting from levels of particulate matter 2.5 microns in size or less (PM2.5) is forecast. Proposed for implementation in 2008.			1) Cook stoves 2) Start up emissions from opacity standards 3) limited curtailment exemptions: A) sole heat source, B) no NG service

²⁷ Previously implemented as a model ordinance developed by Bay Area AQMD and adopted, with modifications, by local governments. Bay Area AQMD proposed adoption of Regulation 6, Rule 3 in November 2007 which would compliment local government programs.

CONCLUSION

Proposed Rule 445 will implement 2007 AQMP control measure BCM-03 (PM Emissions from Wood Burning Fireplaces and Stoves) and will reduce emissions growth by requiring dedicated gaseous-fueled devices in new developments. The comprehensive outreach and education program to be implemented in conjunction with Proposed Rule 445 will also inform the public of health effects from wood smoke, cleaner alternatives to wood burning and when air quality or meteorological conditions are not favorable for wood burning. PM_{2.5} emission reductions for the Proposed Rule 445 requirements are approximately one ton per day by 2014. Proposed Rule 445 will facilitate, in part, attainment of State and federal particulate air quality standards. There will also be a concomitant reduction in toxic emissions as the public switches to cleaner hearth devices.

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Appendix A

Emission Reductions Calculations

The following paragraphs describe the estimated PM_{2.5} emissions reductions associated with implementation of Proposed Rule 445 (Wood Burning Devices).

Paragraph (d)(1) and (d)(2) – Standards for New and Existing Developments

The following table summarizes the 2008-2014 increase in PM_{2.5} emissions from wood burning devices based on Southern California Association of Governments (SCAG) growth factors for housing projections.

2008 Baseline Emissions (tons/annual average day)	2014 Baseline Emissions (tons/annual average day)	2008–2014 Growth (tons/annual average day)
6.15	6.5	0.35

The Proposed Rule 445 requirement to install only dedicated gaseous-fueled fireplaces in new developments would essentially eliminate all future growth from this source category. Therefore, these Proposed Rule 445 requirements would result in 0.35 tons of PM_{2.5} emissions reductions per day by 2014. These reductions are, however, adjusted downward by ten percent to account for the Proposed Rule 445 exemptions (i.e., new developments above 3,000 MSL and areas without natural gas service). As a result, the Proposed Rule 445 emissions reductions for paragraph (d)(1) requirements have been estimated at 0.32 tons per annual average day by 2014 ($0.35 \text{ tons} \times .9 = 0.32 \text{ tons}$). The controlled (with Proposed Rule 445 adopted) PM_{2.5} emissions inventory for wood burning is, therefore, 6.18 per annual average day in 2014 ($6.5 \text{ tons} - 0.32 \text{ ton} = 6.18 \text{ tons}$) and will serve as a basis for estimating the emissions reductions for the wood burning curtailment program discussed under the heading, Mandatory Wood Burning Curtailments.

It should be noted that the growth in emissions from wood burning devices listed above is based on the presumption that the percentage of households that had wood burning devices in the past will remain the same in future developments. However, based on limited information from CARB and informal discussions with industry representatives, the trend in new home construction is to install dedicated gaseous-fueled fireplaces due, in part, to some local building code requirements and home owner preference. Approximately 40 percent of new construction statewide (CARB, 1997) includes wood burning fireplaces and, based on local residential building trends, 40 percent of those would be built with wood burning capabilities (the remaining being gaseous fueled). That equates to 16 percent of all new construction being built with wood burning fireplaces. Some of the emission reductions calculated from the paragraph (d)(1) requirements may occur in the absence of the rule.

Additional emission reductions could be achieved through the paragraph (d)(2) provisions that require U.S. EPA Phase II-certified (or equivalent) devices in existing house (i.e., remodels) but no attempt has been made to quantify these reductions because the number of traditional, open-hearth fireplaces added to existing households is unknown.

Subdivision (e) – Mandatory Wood Burning Curtailments

Additional emissions reductions are associated with Proposed Rule 445 subdivision (e) mandatory wood burning curtailment program that could be implemented during the 2013-2014 wood burning season, if necessary, to meet the federal PM_{2.5} NAAQS. The 2014 controlled emissions inventory mentioned above is a starting point for estimating these emissions reductions. Because wood burning emissions are higher in winter months, it is first necessary to convert the annual average day emissions inventory to a winter day emission inventory. The first step to convert annual average day emissions to winter day emissions is to multiply annual average day emissions by 365 days per year to obtain annual emissions from wood burning devices. Based on Statewide temporal profiles developed by ARB, approximately 69% of emissions from wood burning devices occur during the wood burning season (November through December). Winter day emissions can then be estimated by multiplying the annual emissions by 69% to represent the total emissions during the wood burning season. The total emissions for the wood burning season are then divided by 120 days (days in months of November through February) to obtain an estimate of the average winter days emissions. The following table presents an estimate of the 2014 winter day emissions for wood burning devices.

Table A-1
Estimate of 2014 Winter Day Emissions for Wood Burning Devices

2014 Annual Average Day Emissions Inventory (tons)	Days per year	Annual Emissions (tons)	Percent of Emissions Occurring in Winter Months ²⁸	Winter Emissions (tons)	Winter Days (Nov. – Feb.)	Winter Day Emissions (tons per winter day)
6.19 x	365	= 2,259	x 0.69	= 1,559	÷ 120	= 12.99

Based on the 2014 PM_{2.5} emissions inventory of approximately 12.99 tons per winter day and an average of 25²⁹ wood burning curtailment days forecasted during the November through February time period and a seventy five percent compliance rate, the emissions reductions from wood burning prohibitions are estimated at 244 tons of PM_{2.5} per year by 2014. These calculations are presented below.

Winter Day Emissions (tons)	Curtailment Days per Season	Compliance Rate	Annual PM _{2.5} Reductions from Curtailment Program (2014)
12.99	x 25	x 0.75	= 244 tons

The annual reductions from the curtailment program presented above can then be converted back to annual average day emissions reductions by dividing the annual emissions by 365 days. Accordingly, the 2014 emissions reductions from the wood burning curtailment

²⁸ ARB Statewide Temporal Profile, Area Source Emissions, Section 7.1, Residential Wood Combustion, July 1997.

²⁹ 25 estimated wood burning curtailment days based on 2003-2006 air quality data for days > 35 µg/m³

program have been estimated at approximately 0.67 ton of PM_{2.5} per annual average day (244 tons ÷ 365 days = 0.67 ton).

Taken together, the emissions reductions from the Proposed Rule 445 paragraph (d)(1) and subdivision (e) requirements would equal 0.99 ton per annual average day by 2014 (0.32 ton + 0.67 ton = 0.99 ton). This can be compared with the 2007 AQMP emissions reduction commitment of one ton per annual average day by 2014.

Gas Log Buy Down Program

Additional emissions reductions are expected through implementation of the gas log buy down program. These emissions reductions would be a function of the amount of wood precluded from being burned in an existing wood burning fireplace. In order to provide a range of potential emissions reductions from the gas log buy down program a range of wood burning rates has been presumed. Specifically, based on a Basinwide average wood burning rate of 110 pounds of wood per year and 20,000 participating households, the emissions reductions from the gas log buy down program would be 18 tons of PM_{2.5} per year. For reference, 110 pounds of wood equals approximately four fires per household per year (based on a burn rate of 7.7 pounds per hour and three hours per fire). Based on a wood burning rate of 274 pounds per household (San Bernardino County average) the emissions reductions would be 33 tons of PM_{2.5} per year. A mid-range value for these two estimates is approximately 26 tons per year or 0.07 ton of PM_{2.5} per annual average day. Using the previously described methodology, the annual average day emissions reductions for the gas log buy down program can be estimated as 0.15 ton per average winter day (0.07 tons per annual average day x 365 days per year x 0.69 wood burning season temporal factor ÷ 120 days per wood burning season = 0.15 ton per average winter day). If the pilot program is successful, it may be expanded in the future, which would result in additional emission reductions.

Appendix B - Proposed Rule 445 Cost-Effectiveness Calculations

South Coast Air Quality Management District
Proposed Rule 445 (Wood Burning Devices)

Assumptions:

Cord Wood Weight:	1,400	kgs (OMNI, 2006)		
Wood Burning rate (1):	0.065	Cords of wood burned per household in Riverside County (AQMP, 2003)	91	kgs of wood/avg./yr
Wood Burning rate (2):	0.089	Cords of wood burned per household in SB County (AQMP, 2003)	124.6	kgs of wood/avg./yr
Wood Burning rate (3):	0.0356	Cords of wood burned per household, Basin composite (AQMD, 2003)	49.8	kgs of wood/avg./yr
Kgs per hour:	3.5	Kgs per hour (OMNI, 2006) burn rate		
Hours for NG equiv:	26	Hours of fuel consumed for Riverside County WB rate (1)		
Hours for NG equiv:	35.6	Hours of fuel consumed for San Bernardino County WB rate (2)		
Hours for NG equiv:	14.24	Hours of fuel consumed for AQMP composite wood burning rate (3)		
Gas log costs \$:	500	Costs for dedicated gaseous-fueled gas log set (SMAQMD, 2006)		
	0	O&M costs presumed to be zero as existing units would have comparable costs		
Present Value Factor:	N/A	Not applicable as O&M is zero		

PM2.5 Emission Factors:

16.61	(g/kg)	Traditional open hearth fireplace (AP-42, 1995) PM10 converted to PM2.5 by multiplying by 0.96
0.127	(g/hr)	Natural gas log set (based on 40,000 btu gas log set and 0.007 lbs/MMBTU (AP-42, Section 1.4)

Emissions Reductions:

Uncontrolled (lbs/yr)			Controlled (lbs/yr)			Emissions Reductions (lbs/yr)		
Open Hearth Fireplace (1)	Open Hearth Fireplace (2)	Open Hearth Fireplace (3)	Natural Gas Fireplace (1)	Natural Gas Fireplace (2)	Natural Gas Fireplace (3)	Emissions Reductions (1)	Emissions Reductions (2)	Emissions Reductions (3)
3.33	4.56	1.82	0.0073	0.0100	0.0040	3.32	4.55	1.82

1a) Cost-Effectiveness (wood burning rate 1)

Costs	ER (lbs) *
500	66

Cost Effectiveness	
7.5	\$ / lb (1)

1b) Cost-Effectiveness (wood burning rate 2)

Costs	ER (lbs) *
500	91

Cost Effectiveness	
5.5	\$ / lb (2)

1c) Cost-Effectiveness (wood burning rate 3)

Costs	ER (lbs) *
500	36

Cost Effectiveness	
13.7	\$ / lb (3)

Appendix C Public Comments and Responses

AGENCY COMMENTS AND RESPONSES

The following comments were received from the U.S. EPA, Region IX, and the California Air Resources Board (CARB), and are followed by staff responses.

Comment 1: SCAQMD's efforts to strengthen this rule as additional emission reductions from wood burning appliances are critical to attain the health-based PM 2.5 standard in the South Coast Air Basin. With one exception noted below, we believe District staff's extensive rule development efforts have resulted in an effective and reasonable set of requirements (U.S. EPA, Region IX).

Paragraph 445(e) establishes implementation of the mandatory wood burning curtailment program six years after rule adoption. We recommend significantly earlier implementation, and we note that other state and local agencies, including San Joaquin and Sacramento APCDs, have adopted similar requirements that are already in effect.

Staff Response: Staff appreciates the support in this rule development effort. Regarding implementation of the mandatory wood burning curtailment program, the contribution of wood smoke from residential and commercial combustion to PM2.5 levels in the Basin is less than the contribution/burden of other jurisdictions referenced in the comment. However, the emissions are not insignificant and at various times during the winter months can result in poor air quality at various locations throughout the Basin. The District will begin an education and outreach program immediately after rule adoption to alert the public about wood smoke health effects and cleaner alternatives to wood burning. As part of the program, the public would be informed when it is not advisable to use wood burning devices due to poor air quality conditions. In addition to the rule development efforts, an incentive program is also proposed to encourage the public to switch from wood burning to gaseous-fueled hearth products. Emission reductions are anticipated as a result of the public education and outreach program and the incentive program that will be implemented in the early years of program implementation.

Comment 2: The Air Resources Board staff has reviewed Proposed Rule 445, and, based on the information available to us at this time, we have no comments. (CARB, November 27, 2007)

Staff Response: Comment noted.

PUBLIC COMMENTS AND RESPONSES

A Proposed Rule 445 public consultation meeting was conducted on January 17, 2008. Additionally, a Governing Board Ad-Hoc Committee meeting on Proposed Rule 445 was

held on November 30, 2007. In addition to the oral comments at the meetings, staff received written comment letters specific to Proposed Rule 445 during a comment period that ended on January 30, 2008. Many of the comments on the Proposed Rule or the staff report concerned issues brought up by more than one commentor. The following are general responses to these comments. Following these general responses is a summary of individual oral and written comments, followed by staff responses.

Staff also received comments on rule language that was released prior to adoption of the 2007 AQMP and release of the current version of Proposed Rule 445. Comments that were received on the prior rule language that have been superseded by the current rule language have not been included; however, general comments that are still applicable to a wood smoke reduction program have been retained where appropriate.

General Comments and Responses

GR-1 Is a regulation for wood burning needed? What are the implications if the District does not adopt a wood burning regulation?

Staff Response: Residents of the Basin are exposed to some of the highest ambient concentrations of PM_{2.5} in the nation. The Basin and the San Joaquin Valley are the only two air basins in the State classified as non-attainment by U.S. EPA for the federal PM_{2.5} standards. As mentioned in the draft staff report, the District is required under Health and Safety Code §39614 to develop and adopt the most readily available, feasible and cost-effective control measures to reduce PM₁₀ and PM_{2.5} based on rules, regulations and programs existing in California. Wood smoke control programs have been implemented in many other regions of the State and other areas and serve as a guide for the District. Wood smoke control programs were also included in the list of air district measures that reduce particulate matter complied by the California Air Resources Board in response to SB 656. If a wood smoke control program was not adopted, the Basin could be subject to similar or more stringent rulemaking activities by the California Air Resources Board. Proposed Rule 445 is also part of a comprehensive strategy outlined in the 2007 AQMP to achieve federal PM_{2.5} air quality standards. Failure to achieve federal PM_{2.5} standards by the mandated attainment date could result in federal sanctions, including the possible loss of federal transportation funding.

GR-2 There is a limited variety of truly dedicated gaseous-fueled fireplace models available for new construction. Allow devices in new developments to include larger wood burning fireplaces that have been outfitted with gas log sets that preclude wood burning.

Staff Response: Staff agrees. Based on comments received, the definition of a gaseous-fueled fireplace includes any fireplace where the burner pan and associated equipment are affixed to the masonry or metal base of the fireplace. This would allow installation of a masonry or prefabricated wood burning fireplace in new developments provided that ceramic logs or other features are included that preclude wood burning. To improve clarity, a dedicated gaseous-fueled fireplace has also been added to the acceptable options for installations in existing developments (i.e., remodels, additions, replacements).

GR-3: How is a regulation that affects individual households in an area as large as the South Coast Air Basin enforceable?

Staff Response: AQMD staff believes that an extensive public education and outreach program is a key component to ensure compliance with Proposed Rule 445. This understanding was shared by other air districts that have recently developed wood smoke reduction programs and participated in the August 2007 Wood Smoke Technical Forum held at the District. The draft staff report includes a discussion of how compliance activities would be accomplished for individual elements of Proposed Rule 445 based on lessons learned from the Technical Forum and the experiences of other air districts. Every effort will be made to work with industries that supply firewood and hearth products to consumers. An extensive public education and outreach program will be initiated prior to taking any formal compliance activities.

GR-4: Paragraph (d)(1) of Proposed Rule 445 should be amended to allow the cleanest wood burning devices in new developments. At a minimum, the cleanest wood burning devices should be allowed in rural or low density areas (i.e., lot size of 0.5 acre or greater).

Staff Response: There have not been studies to substantiate the appropriate density level restrictions for wood burning devices that would be health protective. In fact, PM_{2.5}, due to its small particle size, can stay in the air for long periods of time. Proposed Rule 445 has, therefore, been written to preclude installation of wood burning devices in new developments in order to achieve more emissions reduction potential and safe-guard public health. Staff also believes that a single standard for new developments will improve clarity to the homebuilding industry, thereby resulting in increased compliance rates. As noted in the draft staff report, the trend in new developments is to install gaseous-fueled fireplaces and some of the emission reductions associated with the proposed rule will occur even in absence of the program, based on construction standards and consumer demand.

GR-5: Staff should focus on implementation of the proposed wood burning curtailment program and allow this program three years to operate before implementing any of the additional best technology controls proposed in the rule. If wood burning curtailment emission reductions are not enough relative to achieving the State and federal particulate standards, the new development standards could be contemplated.

Staff Response: While the public education and outreach program and the potential mandatory wood burning curtailment program are important elements of the rule and its implementation, the requirement to install only dedicated gaseous-fueled devices in new developments is also very important. The technology is available and on the market. The Basin is in non-attainment for both the State and federal annual average and 24-hour PM_{2.5} standards and staff is recommending that the best preventive measures be employed. In addition, PM_{2.5} is a criteria pollutant with the most adverse health effects and the South Coast Air Basin has a disproportionate exposure to air pollution, in particular fine particulate matter < 2.5 microns. If unrestricted in the future, wood smoke emissions from new developments would add to the already significant PM_{2.5} levels.

GR-6: Proposed Rule 445 paragraph (d)(2) should be modified to allow installation of next generation wood burning fireplaces in existing developments.

Staff Response: Staff is aware that the U.S. EPA has conducted several stakeholder meetings to develop a potential voluntary partnership with hearth product manufacturers to develop a cleaner wood burning fireplace. However, the emission standard and fuel loading protocols are not currently available for evaluation. Staff therefore cannot recommend the inclusion of a low emission wood burning fireplace in Proposed Rule 445 at this time. When the proposed voluntary emission standard for a low emission fireplace is finalized, staff will evaluate whether an amendment to the rule is warranted. This concept has been added to the Proposed Rule 445 resolution. Paragraph (d)(2) does, however, allow installation of an open hearth wood burning fireplace provided that the device can meet the same emission standards as U.S. EPA Phase II-certified wood burning heaters.

GR-7: The rule states that wood sold between July and February must be less than twenty percent moisture content. Individual home owners are not going to have moisture meters. Is there a better way to distinguish dry wood that would be more useful to home owners (such as length of time since wood was cut)?

Staff Response: Yes. As described in the draft staff report, a general rule for consumers is that split wood may be considered seasoned after 6 to 12-months of drying, however site-specific conditions may vary. Dry seasoned wood is relatively easy for buyers to distinguish from green, unseasoned wood, in that it has a hollow sound when hit together. Tips on identifying seasoned firewood will be provided to the public as part of the outreach materials to be developed in conjunction with the proposed rule. Only commercial firewood facilities are subject to the provisions regarding firewood sales.

GR-8: A two-phased wood burning curtailment program should be developed where U.S. EPA Phase II-certified devices are allowed to be used during periods of moderate pollution levels and all wood burning is prohibited when air quality conditions are more serious. This would encourage persons with older non-EPA Phase II-certified devices to upgrade equipment so that they could burn more often.

Staff Response: While it is acknowledged that U.S. EPA Phase II-certified devices and pellet stoves are designed to pollute less than open hearth wood burning fireplaces, the emissions from these devices are still at least ten times higher than gaseous-fueled devices. Additionally, U.S. EPA Phase II wood burning devices and pellet stoves can generate excessive smoke if not installed or operated properly. Staff recommends establishing a single wood burning curtailment threshold for all solid fuel burning as the most appropriate approach for improving air quality.

GR-9: A six-month phase in period for the standards for new construction is relatively quick. Additional time may be necessary to inform home builders, architects and local governments of the Proposed Rule 445 requirements for new and existing developments.

Staff Response: Through the rule development process, extensive contacts have been made with those industries that may be affected by Proposed Rule 445. AQMD staff will develop fact sheets and web-based information for immediate distribution to all interested parties. Staff recommends keeping the implementation of these provisions at the six month time period as identified in the proposed rule.

Individual Comments and Responses

A. Title 24

Comment 1: The State of California Title 24 building energy efficiency standards may be an avenue to assist with implementation of the paragraph (d)(1) standards for new construction.

Staff Response: Based on a review of the 2005 residential compliance manual for the State of California Title 24 program there are presently mandatory requirements intended to limit infiltration of air associated with fireplaces, decorative gas appliances, and gas logs. According to the manual, fireplace efficiency can also be greatly improved through proper air control and reduced infiltration is also a benefit when the fireplace is not in use. Staff believes that the Proposed Rule 445 requirements are consistent with the Title 24 requirements as efforts to improve household heating efficiency will result in reduced air pollutant emissions. As part of the implementation program, staff will explore working with the California Energy Commission to ensure that Proposed Rule 445 standards for new development are implemented in the Basin.

B. New Construction, Paragraph (d)(1) Requirements

Comment 2: The staff report does not demonstrate the nexus between restrictions on new construction throughout the entire District, and the need to focus on particulate levels in the areas of greatest concern. The majority of the occupied portion of the District is already built out and any restrictions on new homes will have virtually no impact on those existing communities, and will instead only impact the fringe of the Basin.

Staff Response: The reader is referred to the response to comment GR-4, 5 and 6. A large amount of residential construction is ongoing in various areas throughout the Basin. Residential expansions are occurring in northern and eastern Los Angeles County, western San Bernardino and Riverside Counties, and foothill areas of Orange County. Areas of urban redevelopment are also occurring throughout the Basin.

Comment 3: The District should partner with members of the hearth products industry to implement effective public information programs to educate homeowners about cleaner burning options that reduce emissions from residential combustion. Public education about cleaner burning practices with episodic controls that discourage or prohibit residential wood burning on days with poor air quality have proven to be very effective.

Staff Response: Staff agrees. In conjunction with the public awareness provisions of the rule, including other public outreach efforts, staff will work with any willing member of the hearth products association to inform the public about the rule, its requirements, and to educate the public about cleaner burning alternatives.

C. Outdoor Wood Burning Devices and Cookstoves

Comment 4: Will backyard (patio) wood burning units be addressed by the wood burning curtailment program included in the proposed rule?

Staff Response: Yes. The mandatory wood burning curtailment program that may be implemented in 2013 would be applicable to any indoor and outdoor wood burning device or portable outdoor wood burning device on property zoned for residential uses.

Comment 5: How are campfires and beach (bon fire) fires affected by the proposed rule?

Staff Response: They are not. Proposed Rule 445 is focused on residential wood burning devices alone. Camp and beach fires would not fall under the purview of this rule.

Comment 6: Are wood-fired pizza ovens and other wood-fired cooking devices included in the definition of cookstoves?

Staff Response: Paragraph (c)(2) of Proposed Rule 445 defines cookstoves and subparagraph (f)(1) exempts cookstoves. The paragraph (c)(2) definition states that cookstoves are defined under Title 40 of the Code of Federal Regulations (CFR) Section 60.531. The CFR generally defines cookstoves as a wood-fired appliance that is primarily designed for cooking and has the following characteristics: 1) an oven with an oven rack with a volume of one cubic foot or greater, 2) a device for measuring oven temperature, 3) a flame path that is routed around the oven, 4) a shaker grate, 5) an ash pan, 6) an ash clean-out door beneath the oven, and 7) the absence of a fan or heat channels to dissipate heat from the appliance. A wood-fired pizza oven that meets this definition would be exempt from Proposed Rule 445.

D. Episodic Curtailments

Comment 7: The mandatory episodic curtailment program should be based a separate forecast and be based on PM2.5 values. Any future forecasting system should be made by 3:00 pm to be applicable for the upcoming evening and should be made at the sub regional level (i.e., coastal, inland, etc.).

Staff Response: As discussed in the draft staff report, the District would initiate an outreach program after rule adoption to advise the public to refrain from operating a wood burning device when PM2.5 levels are forecast to exceed the federal 24-hour PM2.5 standard of 35 $\mu\text{g}/\text{m}^3$. This level generally conforms with the Air Quality Index (AQI) of 100. Efforts would be made to tailor these forecasts to specific regions and to time the forecasts to ensure adequate notification to the public. This program would be refined in the years subsequent to rule adoption and in advance of the mandatory wood burning curtailment program that would be implemented in 2013, if necessary.

Comment 8: Improve cooperation with the proposed episodic curtailment periods and the outreach program by revising the proposal to include advice to use clean burning technologies, such as manufactured firelogs in wood burning fireplaces.

Staff Response: Staff has evaluated test data provided by one manufactured log manufacturer which compare cord firewood and manufactured logs for fires in a fireplace setting. The comparison of emissions is based on fires lasting three hours in duration and does not include a comparison of burning manufactured logs with shorter duration wood fires that may be a realistic situation in many cases. Fires of a shorter duration may emit less

VOC, toxics, and particulates when compared with manufactured firelogs. The manufacturer-supplied test data is also based on proper use of the product under laboratory conditions and does not account for operator variability (including improper product use) that may occur under real-world conditions. Additionally, there are a variety of manufactured firelogs in the market place (including petroleum based products) that further complicate a comparison of these products to firewood. Toxicity remains a concern from these products. Furthermore, it is difficult for an air district to conclude that manufactured logs are clean alternatives and recommended for public use when particulate emissions from gaseous-fueled devices are more than ten times lower. Based on the information above, the AQMD will remain neutral on the use of manufactured firelogs in outreach materials.

Comment 9: The episodic control program is the single most effective tool to address wood smoke on a 24 hour basis. These programs are the most effective at addressing the majority of wood burning households, the fireplaces users. As the District's inventory indicates, the majority of PM_{2.5} from residential wood combustion in the air basin is generated by the burning of wood in open fireplaces. A carefully introduced program can have profound impacts, much greater than any other element of the rule. An episodic control program should include several key attributes: 1) no-burn forecasts must be accurate; 2) they must be simple to explain and timely; and 3) they must include incentives to accelerate the change out of the old device. For these reasons, it is recommended that a curtailment program be implemented prior to 2013.

Staff Response: Staff agrees that a curtailment program can be a useful component of a wood smoke reduction effort. Time is needed after Rule adoption, however, to improve PM_{2.5} forecasting procedures as this is a key component of the wood burning education and outreach program. Due to the importance of PM_{2.5} forecasting to the success of the program, staff believes that the additional time is necessary to develop a program that achieves each of the attributes suggested by the comment. In the interim time period, an incentive program is proposed to encourage the public to switch to cleaner hearth products (i.e., gaseous-fueled). An expanded discussion of the proposed outreach and education program as well as the incentive program is included in the draft staff report.

Comment 10: The episodic control program should be implemented throughout the year and not just during the months of November through February.

Staff Response: Emissions from residential wood combustion is a new source category for the District and the proposal affects the general public and construction trades instead of more traditional, industrial sources of air pollution. As a result, the District's wood smoke reduction program includes an extensive education and outreach program element that would be in place year-round. During the rule development process there were discussions about having a year-round forecast to inform the public when it was not advisable to burn wood however it was believed that it was better to focus on the time period when the emissions and the associated health impacts from wood burning are greatest (November through February). It was believed that targeting these months would focus the public's attention when wood burning emissions are highest instead of providing too much information throughout the year. This approach is consistent with wood smoke reduction programs established in many other California air districts.

Comment 11: Section (g) procedures for the mandatory curtailment program should list procedures (including internet-based) for the public to file a complaint. Also, the Proposed Rule should specify that no person shall cause or allow the emissions and odors from wood burning devices such that the smoke can clearly be seen or smelled beyond the property line of the emission source so as to cause determinant, nuisance, annoyance or endanger the comfort, repose, health or safety of any neighbor. A companion provision could be added to the proposed rule that stated that a frequent fireplace user subject to multiple complaints would be subject to the penalty provisions of subdivision (h) unless they could demonstrate that the wood burning device is EPA Phase II-certified or equivalent.

Staff Response: Staff agrees with the suggestions to inform the public of complaint procedures. AQMD staff believes, however, that this information can be disseminated as part of the education and outreach program and does not need to be specified in the rule. Staff believes that the suggestions regarding a compliance mechanism for persons subject to multiple complaints is not consistent with the general intent of the rule to limit emissions growth. This would be outside the scope of the proposed regulation.

Comment 12: Religious or ceremonial fires should be exempted from the mandatory wood burning curtailments that could be implemented in 2013 under Proposed Rule 445.

Staff Response: AQMD staff believes that every effort should be used to reduce emissions from wood burning through proper techniques and improved technologies but agrees that open fires are an important part of some ceremonies. As a result, subparagraph (f)(5)(E) exempts ceremonial fires from the mandatory wood burning curtailments that may be implemented in 2013, including those fires used for religious purposes.

E. Emissions Tradeoffs

Comment 13: The proposed rule could result in an increase of green house gas emissions by providing incentives for the increased use of non-renewable fossil fuels (e.g., natural gas).

Staff response: An analysis of the impact of Proposed Rule 445 in terms of climate change (global warming) emissions is included in the California Environmental Quality Act (CEQA) documentation for the proposed project. Based on U.S. EPA AP-42 emission factors, wood burning in an open hearth fireplace generates more than twice the directly emitted CO₂ emissions when compared with gaseous-fueled fireplaces. Section 1.10 of AP-42 does, however, note that CO₂ emissions from wood burning heaters may not increase total atmospheric CO₂ because the emissions may be offset by the uptake of CO₂ by regrowing biomass. As noted in the draft staff report, there a number of parameters to be considered as to the carbon neutrality of wood. Specifically, there are uncertainties relative to the contribution to global warming by the burning of wood (an instantaneous release of CO₂) versus natural degradation and release of CO₂ over time. The California Global Warming Solutions Act of 2006 (AB 32) acknowledges the importance of timing of emissions reductions and notes the following:

“If applicable, the greenhouse gas emission reduction occurs over the same time period and is equivalent in amount to any direct emission reduction required pursuant to this division” [Health and Safety Code Section 38562(d)(3)]

Also, there is an unknown as to the reforestation and replacement of trees on an equivalent basis, which factors into the neutrality determination. Other uncertainties include process and transportation of wood material that ends up as firewood for use by consumers. There is also another issue as to the effects of black carbon from incomplete combustion and its short term effects on global warming, which is separate from the emissions of CO₂.

From a public policy perspective it is important to note that the AB 32 acknowledges that greenhouse gas regulations should not interfere with efforts to achieve health-based air quality standards. Specifically, Section 38562 (b)(4) of the Health and Safety Code states that the state board shall:

“Ensure that activities undertaken pursuant to the regulations compliment, and do not interfere with, efforts to achieve and maintain federal and state ambient air quality standards and to reduce toxic air contaminant emissions”

Comment 14: The program seems to encourage the use of natural gas. Is there any cost analysis that compares the costs of heating a house with wood as opposed to natural gas? Also, burning firewood represents use of a renewable resource while natural gas is a non-renewable resource.

Staff response: As noted in the draft staff report, an open hearth fireplace is not an efficient source of heat, regardless of fuel type (i.e., natural gas or wood). Specifically, heating efficiencies for masonry and prefabricated wood burning fireplaces have been reported to range from -10 to 10 percent.³⁰ U.S. EPA Phase II-certified stoves and inserts have higher heating efficiencies (up to 68%), however, electric and natural gas furnaces have heating efficiencies of 95 and 78 percent, respectively.³¹

F. Moisture Content of Firewood Sold or Advertised as Seasoned

Comment 15: There is a distinction between the different sources of firewood. Firewood sold in bundles at grocery stores is bought primarily by persons seeking wood for immediate use and it is burned primarily for aesthetic purposes. Persons buying firewood for heating are more likely to buy larger amounts of wood sold by cordwood vendors. Efforts should be made to require cordwood vendors to ensure that firewood moisture content levels are 20 percent or less, recognizing that firewood with too high of a moisture content results in greater smoke and higher fine particulate emissions.

Staff Response: Paragraph (d)(4) of the proposed rule requires licensed commercial firewood facilities to only sell seasoned firewood from July through February. Acknowledging that persons using wood for heating purposes will burn more wood than those using wood for aesthetic purposes, special attention will be given to commercial firewood facilities as part of the comprehensive outreach program.

Comment 16: Attention should be directed to tree trimming services that sell freshly cut wood from tree trimming jobs.

³⁰ California Air Resource Board, Wood Burning Handbook, 2005
http://www.arb.ca.gov/cap/handbooks/wood_burning_handbook.pdf

³¹ Energy Information Agency, Fuel Cost Calculator, 2007 <http://www.eia.doe.gov/neic/experts/heatcalc.xls>

Staff Response: If the sale of wood is a part of a business that is licensed, the provisions of Proposed Rule 445 related to commercial firewood facilities would apply.

G. Impact of Accidental Fires on Ambient PM concentrations

Comment 17: The staff report for Proposed Rule 445 estimates PM emissions from residential wood burning but does not appear to take into account the large number of accidental fires that accrue in large numbers on a daily basis throughout the South Coast Air Basin. Based on a review of county fire marshal data, it appears that there are approximately 85 to 114 accidental fires occurring on a daily basis in the region. It appears that the effect of accidental fires on PM emissions may be much greater than residential wood burning. If this is the case, is there a need for adoption of Proposed Rule 445?

Staff Response: You are correct that accidental fires are a large portion of the inventory of biomass burning in the Basin. The data provided in the comment letter includes information on various types of accidental fires including structure fires and brush/vegetation fires. PM_{2.5} emissions include emissions from wildfires, structural/automotive fires, agricultural burning, forest management and weed abatement. In total these were estimated at approximately 15 tons per annual average day in 2005 by the California Air Resource Board.

Presuming that the data included in the comment letter identifies accidental fires that occur throughout the year (not specific to winter months) and that emissions from accidental fires are the dominant source of PM from solid fuel combustion, it would be expected that PM emissions from solid fuel combustion would be the same throughout the year. The following information indicates a notable increase in solid fuel combustion PM emissions during winter months based on source apportionment studies. Specifically, Figures A and B present the estimated contribution of wood smoke to ambient PM₁₀ levels using the chemical mass balance model (Phase II of the Children's Health Study, ARB, 2001). Figure A presents 1995 data for November and December while Figure B presents data during the May through November time period. It should be noted that the information presented in Figures A and B do not include emissions from paved road dust (largest source category) or secondary PM₁₀ emissions (e.g., ammonium nitrate and sulfate).

Figure A

Contribution to Atmospheric PM₁₀ Mass, 1995 (November - December)

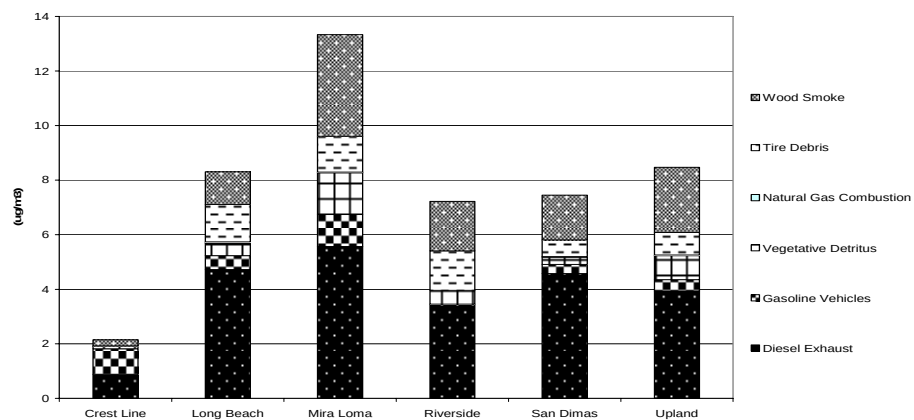
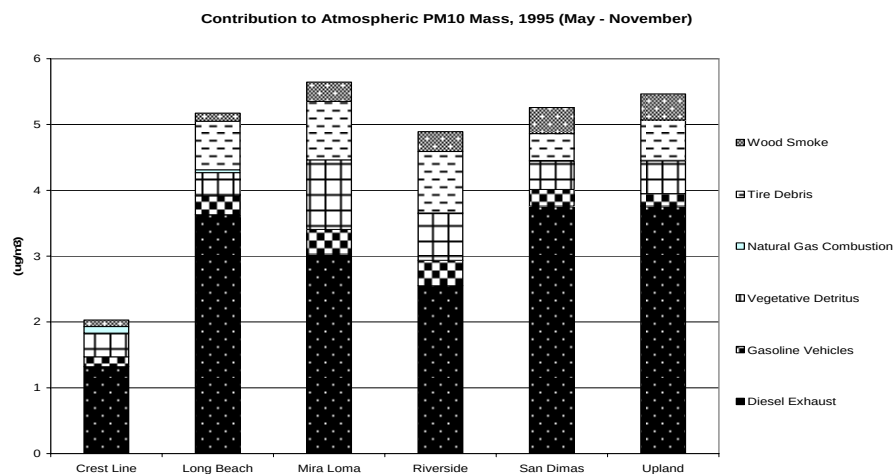


Figure B

As illustrated in the Figure A (winter months), the estimated contribution of wood smoke to ambient PM₁₀ levels ranges from less than one microgram per cubic meter ($\mu\text{g}/\text{m}^3$) in the mountain community of Crestline to nearly four $\mu\text{g}/\text{m}^3$ in the community of Mira Loma. As would be expected, the data in Figure B (Spring-Summer months) shows a smaller contribution of wood smoke to ambient PM₁₀ mass (generally less than $0.4 \mu\text{g}/\text{m}^3$).

Recognizing that residential wood burning will increase in cooler temperatures (winter months), it seems reasonable to conclude that the measured winter increase in PM emissions from solid fuel combustion is attributable to residential wood burning.

The information presented in the emissions inventory is emissions quantification that focuses on residential wood combustion based on the best available information for this area. The emissions inventory information is independent of accidental fires and does not factor into ambient monitored data relative to the inventory calculations. Based on the information above, District staff continues to believe that emissions from residential wood burning are a significant source of PM emissions, especially during winter months. Additionally, the emissions from accidental fires, by definition, can not be reduced while it is possible to reduce emissions from residential wood combustion through use of improved technology. Additionally, Proposed Rule 445 is also necessary as part of the all feasible measures requirement for this region.

H. Grants or Incentive Programs

Comment 18: In conjunction with Proposed Rule 445, the AQMD should establish a grant or incentive program to encourage the public to switch to cleaner alternatives to uncontrolled fireplaces.

Staff Response: The AQMD staff intends to develop an incentive program to encourage existing houses with wood burning fireplaces that are currently plumbed for natural gas to switch to dedicated gaseous-fueled hearth products and there is a Request for Proposals going to the AQMD Governing Board concurrently with this proposed rule. Similar programs are currently in effect in numerous other areas of the State including the San Joaquin Valley, Sacramento County, and the San Francisco Bay Area. Additionally, the

Clean Stove Act of 2007, H.R. 4244 was introduced in Congress in November of 2007. This legislation would authorize a \$500 tax credit to encourage consumers to remove their old, polluting wood stoves and replace them with a new U.S. EPA Phase II-certified wood stove or a pellet stove technologies. AQMD staff continues to track this legislation and will include any final information on the program in Proposed Rule 445 outreach information.

I. Neighborhood Smoke

Comment 19: A neighbor burns a lot of wood and the smoke is affecting my household. Sometimes the smoke smells like garbage.

Staff Response: Staff acknowledges that residential wood burning can result in smoke emissions that can affect surrounding properties. As part of the proposed rule education and outreach program, residents will be informed of the health effects from wood smoke and cleaner technologies. The proposed program to provide financial incentives for households that burn wood to switch to gaseous-fueled devices may be a solution in instances where neighbors have been the subject of frequent complaints. Individual cases of neighbors complaining about smoke from other neighbor's wood burning must be addressed outside of Proposed Rule 445. Regarding smoke from garbage burning, Proposed Rule 445 prohibits the burning of items not intended for use in a wood burning device (i.e., trash, garbage, plastic, etc.).

J. Use of Portable Outdoor Burning Devices

Comment 20: The Proposed Rule does not appear to address one of the top (if not the top) contributors to nighttime air degradation and particulate pollution in most of our residential neighborhoods. Specifically, the rule does not address the use of portable fire pits that are offered for sale by many retailers. Eliminating or restricting this type of "recreational burning" would provide significant improvement of neighborhood air quality.

Staff Response: The mandatory wood burning curtailment program that could be implemented in 2013 does include the use of portable outdoor wood burning devices (i.e., fire pits and chimineas) on property zoned for residential uses. Information on use of these devices will also be part of the education and outreach program implemented after rule adoption. Specifically, the public would be informed when it is not advisable to conduct any solid fuel burning due to poor air quality. Although the availability of these products appears large, the actual use and contribution of emissions from these devices to exceedance of PM air quality standards in this region is unknown. The District has based Proposed Rule 445 on wood smoke regulations included in other jurisdictions throughout the State. Staff is not aware of any other air district regulations in the State that prohibit the sale or use of portable outdoor burning devices.

K. Wood Smoke Health Effects and Recreational Burning

Comment 21: Proposed Rule 445 does not address the problem of wood smoke. Wood smoke, a big source of air pollution, is as deadly as vehicle exhaust and has many the same toxicants as cigarettes. Wood smoke is chemically active in the body forty times longer than tobacco smoke. Many states are enacting legislation against secondhand tobacco smoke but

they continue to overlook recreational wood burning. Allowing the installation of U.S. EPA Phase II-certified heaters encourages more wood burning.

Staff Response: As noted in the draft staff report, the health effects of public exposure to fine particulate matter are well documented. The draft staff report also includes specific health effect information from public exposure to wood smoke. Staff appreciates receiving the additional wood smoke health effect information included in the comment letters. This information will be reviewed and included as appropriate in materials developed as part of the Proposed Rule 445 public education and outreach program. Under the staff recommendation, wood burning devices would not be allowed to be installed in new developments. An incentive program is also proposed in conjunction with the proposed rule to encourage the public to switch from wood burning to gaseous-fueled devices.

L. Restriction of firewood sales

Comment 21: Proposed Rule 445 will not allow commercial firewood facilities to sell wood year round. This will cause these small businesses to reduce employees which will reduce revenues and will in turn reduce the money that is generated through taxes to local governments and the State. The Proposed Rule will also likely require the submission of additional forms and fees. The wood that would be banned from being used in fireplaces would end up going to landfills. The use of a fireplace is a low cost, efficient way to heat your home.

Staff Response: Proposed Rule 445 requires that firewood sold by commercial firewood facilities from July through February have a moisture content of at least 20 percent or less. There are no restrictions on firewood sold at other times of the year. The commercial firewood facilities could incur a loss of sales from July through February due to their inability to sell non-seasoned firewood. However, their lost sales may be compensated with the sales of seasoned firewood. Moreover, Proposed Rule 445 does not require commercial firewood facilities to submit forms or fees. Adoption of the proposed rule may increase the storage time for green or freshly cut wood but a significant increase in landfill disposal of firewood is not anticipated due to the value of the commodity. As mentioned in the draft staff report, an open hearth fireplace is not an efficient source of heat. Please also see response to comment number 15.