SACRAMENTO METROPOLITAN
AIR QUALITY MANAGEMENT DISTRICT

For Agenda of **September 24, 2009**

To: Board of Directors
Sacramento Metropolitan Air Quality Management District

From: Larry Greene,
Executive Director/Air Pollution Control Officer

Subject: Adopt a Resolution Approving Amendments to Rule 421 – Mandatory Episodic Curtailment of Wood and Other Solid Fuel Burning

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Recommendations

1. Determine that the amendment of Rule 421 is exempt from the California Environmental Quality Act (CEQA);
2. Decide whether to include one or more of the options in the proposed amendment; and
3. Approve the attached resolution amending Rule 421.

Executive Summary

Staff recommends amending the wintertime fireplace and wood stove burning restrictions to help achieve federal health standards and minimize further regulatory burdens on other industries. The staff recommendation maintains the exemption for EPA certified devices and pellet stoves on some days. The Board may consider several alternatives that provide greater health protections than staff's recommendation, including one alternative that eliminates that exemption. Staff considered extensive public comments obtained at five workshops held in July as well as meetings with stakeholders, and recommends a modest increase in the number of No Burn days in light of economic concerns expressed by residents that burn wood for heat.

Rule 421, Mandatory Episodic Curtailment of Wood and Other Solid Fuel Burning currently contains the following key provisions.

- Prohibits burning wood, pellets, and other solid fuels (e.g. corn) when fine particle pollution (PM2.5) concentrations are forecast to exceed the federal health standard during the months of November through February.
- Prohibits burning when PM2.5 concentrations are predicted to exceed 35 $\mu g/m^3$, except burning in EPA certified wood stoves or pellet stoves (called a Stage 1 day.)
- Prohibits all burning when PM2.5 concentrations are forecast to exceed 40 $\mu g/m^3$ (called a Stage 2 day.)
- The rule does not apply to natural gas or propane fireplaces and stoves.
- The rule exempts burning that is the sole source of heat, or in situations when not burning would be a financial hardship to a resident.

Staff's recommendation would change the thresholds noted above for calling Stage 1 and Stage 2 days to 31 and 35 $\mu g/m^3$, respectively. This change would add 5 No Burn days on average and each additional Stage 1 No Burn day there would be an estimated 10% improvement in air

quality, and a 23% improvement on additional Stage 2 days. Staff's recommendation would have resulted in historically a reduction of 3 days over the health standards on average.

These rule changes are important because:

1. Sacramento does not meet state or federal health standards for fine particle air pollution (PM2.5).
2. Fine particulate pollution is linked to serious adverse health effects, including aggravated asthma, heart attacks, and premature death in people with heart or lung disease. New health studies have increased the concern about wood smoke health impacts, particularly impacts on children.
3. The largest single source of Sacramento's wintertime PM2.5 emissions is wood, pellet and other solid fuel burning in fireplaces, inserts, wood and pellet stoves.

Studies showed that Rule 421 has been very successful in improving air quality. The Sonoma Technology, Inc. (STI) study found up to a 23% improvement in PM2.5 air quality from Rule 421. Aurora Research Group found that 92% of the respondents were aware of burning restrictions. Although the public response to the rule and air quality improvements were significant, they are not sufficient to meet the health standards. There were 20 unhealthful days during the winter 2008/2009 season.

Other options for modifying the rule that are included for Board consideration are:

<table>
<tr><th colspan="8">Optional threshold changes (µg/m³)</th></tr>
<tr><td></td><td colspan="2">Current rule</td><td colspan="2">Recommended Change</td><td>Option A</td><td colspan="2">Option B</td></tr>
<tr><td>Voluntary threshold</td><td colspan="2">25</td><td colspan="2">25</td><td>20 or 25</td><td colspan="2">20</td></tr>
<tr><td>Stage 1 threshold</td><td colspan="2">35</td><td colspan="2">31</td><td>Eliminated</td><td colspan="2">25</td></tr>
<tr><td>Stage 2 threshold</td><td colspan="2">40</td><td colspan="2">35</td><td>30</td><td colspan="2">30</td></tr>
<tr><th colspan="8">Changes in Number of No Burn Days</th></tr>
<tr><td></td><td>Stage 1</td><td>Stage 2</td><td>Stage 1</td><td>Stage 2</td><td>Single Stage</td><td>Stage 1</td><td>Stage 2</td></tr>
<tr><td>Average # of No Burn days</td><td>7</td><td>16</td><td>5</td><td>23</td><td>31</td><td>13</td><td>31</td></tr>
<tr><td>Average additional # of No Burn days</td><td colspan="2">–</td><td colspan="2">5</td><td>8</td><td colspan="2">21</td></tr>
<tr><td>Average # of voluntary No Burn days</td><td colspan="2">22</td><td colspan="2">17[1]</td><td>33 @ 20 µg/m³
13 @ 25 µg/m³</td><td colspan="2">20</td></tr>
<tr><td colspan="8">Contingency Option – Automatically reduce threshold to 20 µg/m³ if Sacramento does not meet federal health standards by 2014 or 2019 deadlines – Average of 64 No Burn days (41 additional No Burn days)</td></tr>
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Staff is not recommending Option A, Option B or the Contingency Option.

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[1] The number of days is lower than the current rule, even though the threshold has not changed, because some of the previous voluntary days would become mandatory No Burn days.

Attachments

The table below identifies the attachments to this memo.

Item	Attachment
Board Resolution	A
Proposed Rule 421 and Options	B
May 2009 Board Letter Attachment A – Aurora Survey Report Attachment B – STI Phase I Report	C
Staff Report Appendix A – 40727.2 Matrix Appendix B – List of Changes to Rule Appendix C – Aurora Survey Report Appendix D – STI Phase I Report Appendix E – Emissions Calculations Appendix F – Workshop Notice Comments and Responses Appendix G – ERG Socioeconomic Evaluation	D
Comments and Responses from Public Hearing Notice	E
STI Transport Analysis	F
Evidence of Public Notice	G

Background and Health Effects

Particulate matter (PM) is a mixture of very small liquid droplets and solid particles. Adverse health effects are linked to particles that are less than 10 microns in diameter (PM10), and fine particles that are less than 2.5 microns in diameter (PM2.5). The District is currently designated as a nonattainment area for the state and federal[2] health standards for PM10 and for the state health standard for PM2.5. In addition, the District will be nonattainment for the federal 2006 24-hour PM2.5 National Ambient Air Quality Standard (NAAQS) when formal designations are published later this year.

Wood smoke also contains other air contaminants including volatile organic compounds (VOCs) and nitrogen oxides (NOx), which are precursors to aerosol forms of PM2.5, and toxic and/or cancer-causing substances, such as benzene, formaldehyde and benzo-a-pyrene, a polycyclic aromatic hydrocarbon (PAH). In addition, black carbon is a component of wood smoke.

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

According to the U.S. Environmental Protection Agency (EPA), health studies have linked exposure to particulate matter, especially fine particles, to several significant health problems, including:

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

Exposure to particulate matter pollution can cause coughing, wheezing, and decreased lung function even in otherwise healthy children and adults. Postmenopausal women, because they are more susceptible to heart and vascular disease, are more susceptible to cardiovascular health impacts from fine particulates. EPA estimates that thousands of elderly people die prematurely each year from exposure to fine particles. In addition, a recent study (Dominici et al., 2006) of the correlation between PM2.5 concentrations and hospital admission rates concluded that short-term exposure to PM2.5 increases the risk of hospitalization for cardiovascular and respiratory diseases.

The California Air Resources Board (CARB) heard the results of several studies[3] that showed smoke from wood fires aggravates lung and heart disease and increases the number of hospital admissions. The research results indicate exposure to wood smoke may reduce lung function and reduce the blood's ability to clot properly. In addition, wood smoke exposure may also increase substances in the body that lead to cardiovascular and pulmonary inflammation. The studies also found that up to 70 percent of smoke from chimneys can re-enter a home or neighboring residences.

The research further found that children are more likely to be harmed by PM2.5 and wood smoke than adults because their respiratory systems are still developing, they breather more air per pound of body weight, and they are more active outdoors. Recent studies have concluded that children breathing PM2.5 and wood smoke are likely to experience:

- more coughing and wheezing,
- reduced lung function if they have asthma[4],
- permanent reduction in lung air capacity[5],
- ten percent increased hospital admissions from respiratory problems[6], and
- decreases in memory function and scores on intelligence tests[7].

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[3] California Air Resources Board, The potential health impacts of residential wood burning, Jan. 2009, http://www.arb.ca.gov/research/health/healthup/Jan09.pdf

[4] Allen R et al 2008, Changes in lung function and airway inflammation among asthmatic children residing in wood smoke-impacted urban area. *Inhal Toxicol.* 20(4):423-433

[5] Gauderman WJ et al, The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age. *N Engl J Med* 351;11:1057-1063, Sept 2004

[6] Anderson ZJ et al, Ambient particle source apportionment and daily hospital admissions among children and elderly in Copenhagen. *J Expos Sci Environ Epidemiol.* 17(7):625-636.

[7] Suglia F et al, Association of Black Carbon with Cognition among Children in a Prospective Birth Cohort Study. *American Journal of Epidemiology*. 2008:167:280-286

In 2008, CARB updated their studies of mortality effects from elevated PM2.5 concentrations. They now estimate that in the Sacramento Metropolitan Area, up to 600 premature deaths would be avoided at an economic benefit of over $3 billion per year if the region met the state and federal annual PM2.5 standards.

In addition, studies have shown that with less air pollution, people will walk and bicycle more for recreation and transportation[8]. People who live in an area more conducive to walking have been shown to walk more, weigh less, and have lower blood pressure[9,10]. Rule 421 has the potential to increase walking of residents by decreasing wood burning emissions. Furthermore, the analysis of Rule 421 effectiveness has shown the largest air quality improvement occurred in the early evening, when people are more likely to be active or commuting home from work or school. Staff has received feedback from some members of the public that the reduction in wood smoke has made it nicer to walk and has reduced health concerns from breathing wood smoke.

State and Federal Requirements

The District is currently designated as a nonattainment area for the state PM10 and PM2.5 standards and the District does not meet federal health standards for fine particle air pollution (PM2.5). On December 22, 2008, the EPA Administrator signed rules designating the Sacramento area as nonattainment for the federal 24-hour PM2.5 health standard of 35 $\mu g/m^3$. The designations are under review by the new administration and are expected to be published in the coming months. Attainment plans are expected to be due in late 2012 and the attainment deadline will be 2014, but may be extended to 2019 if properly justified to EPA.

The plan must include transportation conformity budgets and control measures. Transportation conformity budgets will require that future transportation projects stay within the specified emission levels to meet attainment and progress goals. Failure to submit a plan can result in withholding of federal transportation project approvals and funding.

The District's strategy to improve particulate matter air quality includes a three-pronged approach to reducing emissions from wood burning: providing financial incentives, regulating new wood burning installations, and reducing burning from existing fireplaces and wood stoves. The District provides financial incentives to remove or replace existing fireplaces and dirty wood stoves. Rule 417 prohibits installing new fireplaces and dirty wood burning devices. The last prong was the adoption of Rule 421, Mandatory Episodic Curtailment of Wood and Other Solid Fuel Burning, in 2007. Residents and businesses that take advantage of the financial incentives to install gaseous fuel burning devices are exempt from wood burning regulations[11].

Based on 2006-2008 PM2.5 data, PM2.5 concentrations have increased, likely due to weather influences. It is likely that the current Rule 421 alone will not be enough to attain the federal health standard before the plan is due. Strengthening Rule 421 by lowering the thresholds will

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[8] Pikora T et al, Developing a framework for assessment of the environmental determinants of walking and cycling. *Social Science & Medicine*. 56 (2003): 1693-1703

[9] Frank LD et al, Many Pathways from Land Use to Health. *Journal of the American Planning Association.* 72 (2006): 75-87

[10] Fuzhong L et al, Built environment and changes in blood pressure in middle aged and older adults. *Preventive medicine*. 48(2009)237-241.

[11] The District has given away $766,600 to incentivize the changeout of 2128 devices. Over 1900 of the devices were fireplaces and 75% of the replacement devices are gaseous fueled.

help to reduce PM2.5 concentrations during winter months. These changes combined with state and local measures may be sufficient to meet federal health standards.

The federal Clean Air Act requires attainment plans to include Best Available Control Measures (BACM). If we cannot show we have reached attainment with the current version of Rule 421, then other measures will need to be considered such as controls on agriculture, fugitive dust, and more stringent controls on PM control devices.

Because Sacramento County is designated as a nonattainment area for the PM standards, the District was required by state law, Senate Bill (SB) 656, to adopt a plan for implementing feasible, cost effective measures to attain the state and federal PM standards. Rule 421 implemented measures in the SB656 plan. Other wood smoke and other plan measures were postponed pending evaluation of the effectiveness of Rule 421 in reducing particulate matter concentrations. Without strengthening Rule 421, the postponed measures, rejected measures, and measures contained in other district's control plans are more likely to be needed to meet state health standards.

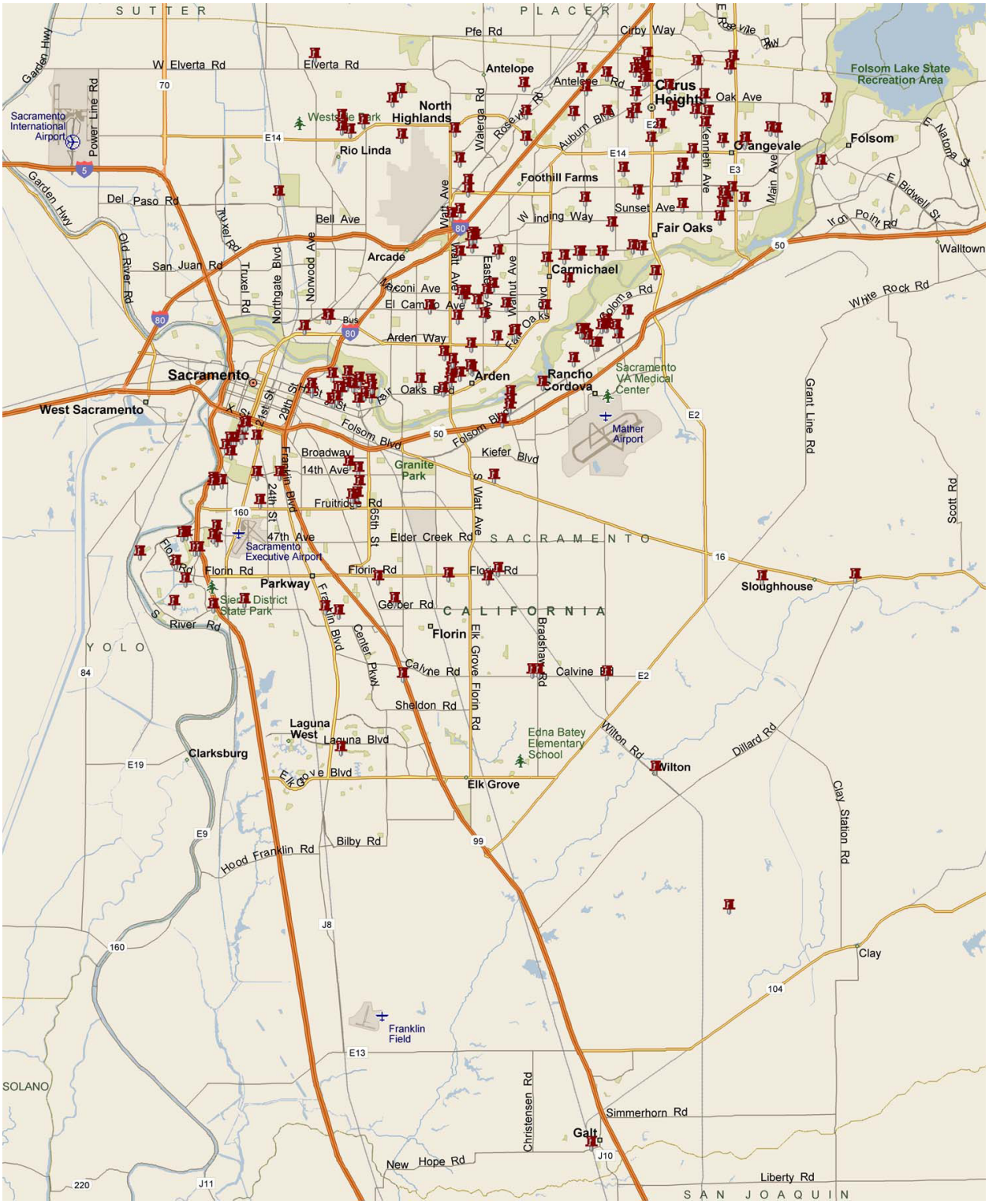
May Board Letter Discussion

On May 28, 2009, Staff presented an informational item to the Board. Staff presented the results of two studies that showed that Rule 421 has been very successful in improving air quality. The Sonoma Technology, Inc. (STI) study found a 10% improvement on a Stage 1 No Burn day and a 23% improvement on a Stage 2 No Burn day in PM2.5 air quality from Rule 421. Aurora Research Group found that 92% of the respondents were aware of burning restrictions. Staff used the Aurora Survey to determine compliance rates for Stage 1 and Stage 2 No Burn days.

Some Board members expressed concern that having too many No Burn days will reduce compliance especially if the change is too drastic. Others expressed a desire to increase public education, emphasize the benefits of changing out old devices, and requested staff make a recommendation on the rule options. Finally, at least one Board member requested a map of the violations issued last year. This map can be found on the following page.

The May Board Letter is included in Attachment C.

Rule 421 Violation Map



New Information

This section presents results from two new studies were completed after the May Board hearing, both studies suggest that Rule 421 provides important air quality benefits in Sacramento County. The studies and their results are discussed briefly here. They confirm that Rule 421 restrictions in rural areas provide important health benefits. In addition, this section discusses new emissions inventory information which is an important consideration regarding whether to maintain the Stage 1 exemption for EPA certified and pellet stoves.

Phase II Transport Analysis and Results

During the 2007 adoption of Rule 421, Board members requested a study of the impacts of transported air pollutants, particularly from rural Sacramento County, on peak PM2.5 concentrations and whether it is necessary to include those areas in the Rule 421 program. The language of Rule 421 permits partial County forecasts, but to-date the no burn forecasts include all Sacramento County residents.

Sonoma Technologies Inc. (STI) recently completed a new study that quantified the relative contributions of wood smoke from rural Sacramento County and other counties. This study showed that the area responsible for the most significant portion of wood smoke emissions impacting our worst air quality site, near Del Paso Manor Elementary School, is from urban Sacramento County. However, rural Sacramento County emissions contribute significantly (26 percent) to pollution levels in Elk Grove, which exceed health standards.

STI's analysis quantified the contribution of residential wood smoke emissions in surrounding areas to primary PM2.5 concentrations at the air monitoring stations at Del Paso Manor Elementary School, Elk Grove at Bruceville Road, and Folsom City Hall. Of these three sites, only the Del Paso Manor monitoring station has a Federal Reference Monitor (FRM) used to determine attainment with federal air quality standards. The Del Paso Manor monitoring station exceeds the federal health standards. The Bruceville and Folsom monitoring stations measure PM2.5 concentrations using Beta Attenuation Monitors (BAM). Both sites record air quality concentrations that do no meet the federal health standards. STI also evaluated Sacramento County impacts at two locations in neighboring counties, Roseville, and Davis.

STI conducted two different analyses, called: Comprehensive Air Quality Model (MM5/CAMx) and Transported Emissions Assessment Kit (TEAK). Both models use spatially and temporally resolved meteorological data and wood smoke emissions data to estimate daily contributions of primary wood smoke emissions from urban and rural Sacramento County and surrounding counties to PM2.5 concentrations at several receptor sites. Neither model accounted for the nitrogen oxide or volatile organic compound emissions from wood smoke that also contribute to PM2.5 pollution problems.

- Comprehensive Air Quality Model (MM5/CAMx)
  MM5/CAMx modeling used information gathered by the $20 million Central California Air Quality Studies (CCAQS) during December 15, 2000 through January 9, 2001. This model is a state-of-the-art tool developed by UC Davis and other academic researchers that was used by CARB and the San Joaquin Valley air district in their 2008 PM2.5 State Implementation Plan. This air quality model allowed STI to analyze sub county region impacts and account for wet and dry particle deposition and turbulent diffusion.

- Transported Emissions Assessment Kit (TEAK) model
  TEAK modeling traces monitored air quality backwards in time and space to identify the source and relative contribution from other counties. The model was run for 2000/2001 to allow corroboration and comparison with the MM5/CAMx model, and for the 2007/2008 and 2008/2009 CBYB seasons to allow evaluation of additional, more recent, weather conditions. The key limitation of this model is that it does not account for particle deposition or diffusion which both can reduce PM2.5 concentrations. Therefore, the results from the TEAK model are expected to be slightly higher than MM5/CAMx.

The results indicate that primary PM2.5 concentrations from wood smoke at monitors within Sacramento County are mostly attributable to wood smoke sources in Sacramento County. STI found that at all three Sacramento County locations, wood smoke from urban Sacramento County is the largest contributor, and No Burn days are an effective way to reduce PM2.5. Urban Sacramento contributes 79% at Del Paso Manor, 26% at Bruceville and 53% at Folsom. In addition, at the Bruceville monitor, the rural parts of Sacramento County are the second largest contributor (26%) of wood smoke primary PM2.5 and No Burn days in rural Sacramento County has a substantial effect on reducing PM2.5 at Bruceville. The study also showed that Sacramento County impacts air quality in adjacent counties, 9 to 35% at Davis, and 17 to 54% in Roseville. The study showed that there was almost no impact from adjacent districts at the Sacramento site monitoring the worst air quality, Del Paso Manor, but a modest to significant impact on the sites closer to county boundaries, Folsom and Bruceville. Because neither of these sites are used for federal attainment purposes, the studies suggest that wood smoke from adjacent counties is unlikely to prevent the Del Paso Manor station from attaining the standards. However, wood smoke from other counties does impact public health of citizens that reside near county borders.

The Phase II STI report[12] is included in Attachment F.

New Emission Inventory

New CARB emission inventory information shows the contribution for fireplaces has significantly decreased based on a revised fireplace emission factor, percent of fireplaces used, amount of wood used and accounting for supplemental heating or aesthetic fireplace use.

A common misperception is that EPA certified and pellet stoves are better for air quality than fireplaces. However, recent CARB emissions inventory updates show that emissions from EPA certified devices are generally higher than fireplaces because they are used more frequently and for a longer duration to provide heat. Therefore, to the extent that maintaining the Stage 1 program encourages replacement of fireplaces with EPA certified and pellet stoves, that would not result in an air quality benefit. The District does not provide financial incentives for replacements or retrofits of fireplaces with EPA certified and pellet stoves or inserts.

[12] STI conducted analyses for several different emissions inventory because of proposed changes discussed in the emissions impacts section below. The results presented in this Board letter are based on analysis results that used the updated CARB emissions inventory presented in Appendix B of the Phase II STI report.

Device Type	PM2.5 per device per year (lbs/year)
Fireplace –	
Aesthetic	3
Heating	24
Uncertified wood stove	71
Catalytic wood stove	47
Non-Catalytic wood stove	34
Uncertified wood insert	57
Catalytic wood insert	38
Non-Catalytic wood insert	27
Pellet stove	6

Summary of Proposed Amendments

Although the public response to the rule and air quality improvements were significant, they are not sufficient to meet the health standards. There were 20 unhealthful air quality days during the winter 2008/2009 season. Therefore, staff is recommending modest changes to increase the number of no burn days to provide additional health protection. The proposed change in no burn thresholds are based on two new pieces of information, estimated forecast under-prediction, and the actual air quality benefits of the Stage 1 no burn days.

Recommended Change - Reduce the Stage 1 threshold from 35µg/m^3 to 31 µg/m^3 to account for the potential underprediction in air quality forecasts. Reduce the Stage 2 threshold from 40 µg/m^3 to 35 µg/m^3 to account for the actual benefits that occur on Stage 1 No Burn days. The recommended change is expected to result in 5 more No Burn days. On each additional Stage 1 No Burn day there would be an estimated 10% improvement in air quality, and a 23% improvement on additional Stage 2 days. The recommended change would have resulted in historically a reduction of 3 days over the health standards on average.

Of the options considered, the Recommended Change provides the smallest increase in the number of No Burn days. The Board may want to consider increasing the number of No Burn days even more. Staff evaluated the following options.

Option A – Change to a single-stage program, thereby eliminating the Stage 1 exemption for EPA certified wood stoves and pellet stoves. Set the No Burn threshold to 30 µg/m^3 and either maintain the voluntary threshold at 25 µg/m^3 or reduce it to 20 µg/m^3. These thresholds are consistent with the San Joaquin Valley APCD program, and are more likely to meet Clean Air Act requirements for reasonably available control measures. Option A is expected to result in 8 more No Burn days.

This was the staff recommendation presented at the public workshops. However, many comments at the workshops expressed concern that eliminating a two-stage program, with its exemption for EPA certified devices and pellet stoves on Stage 1 days, would reduce the incentive for people to switch to cleaner devices and also be unfair to those who have already invested in cleaner devices. Note that although, recent information shows that EPA certified and pellet stoves are not beneficial because owners of those devices burn more

wood, the public perception is that they are cleaner than fireplaces. This is an area where public education regarding this new information may be needed.

Option B - Maintain the Stage 1 exemption but lower the threshold more; set the Stage 1 threshold to 25 $\mu g/m^3$ and the Stage 2 threshold to 30 $\mu g/m^3$ to be consistent with the San Joaquin Valley No Burn threshold. Reduce the voluntary threshold to 20 $\mu g/m^3$. Option B is expected to result in 21 additional No Burn days.

Contingency Option - Include a provision to automatically change to a single-stage program eliminating the Stage 1 exemption for EPA certified and pellet devices with a reduced threshold of 20 $\mu g/m^3$ if Sacramento does not meet the federal health standards by the required deadlines, either 2014 or 2019. Using the past 5 years of data, this would result in up to approximately 41 additional No Burn days. However, due to uncertainty in the effectiveness of future control measures to improve air quality the actual number of days would likely be lower.

In addition, Staff recommends adopting language that clarifies that the intent of the Rule is that first-time violators may complete and pass the smoke awareness course.

Under the staff-recommended option, on each additional Stage 1 No Burn day there would be an estimated 10% improvement in air quality, and a 23% improvement on additional Stage 2 days. Based on analysis of the actual forecast and observed PM2.5 concentrations for 2007-2009 periods, if the proposed thresholds had been in place, Sacramento County would have had the following additional avoided exceedances per year:

- Staff Recommendation – 3 fewer exceedances than the current rule
- Option A – 4 fewer exceedances than the current rule
- Option B – 5 fewer exceedances than the current rule

The number of avoided exceedance days will likely be higher in the future because, historically, on our very worst days, a 23% air quality improvement hasn't been enough to attain the standards. But as air quality improves, due to emission reductions from other sources, 23% may be enough and the actual number of days avoided will be higher.

Impact on Businesses and Public

Rule 421 applies to anyone who burns wood, pellets or any other solid fuel in open fires or solid fuel burning devices (fireplaces, wood or pellet stoves or inserts), and commercial fireplace installations in locations such as hotels and restaurants.

Impacts analyzed included: 1) reduced wood and pellet sales by retailers, 2) increased fuel costs to consumers/businesses if wood retailers raise prices to maintain revenue, and 3) changes in heating costs from reduced supplemental heat from wood or pellets. Businesses with solid fuel burning devices other than those used for cooking would have a cost savings from reduced wood use, because they generally burn wood for aesthetic purposes. An increase in the number of No Burn days will increase the cost savings. Staff does not have information to quantify the impact, if any, to these businesses due to the loss of ambience.

The impact on wood retailers is due to reduced wood burning by the public, and therefore, the amount of wood sold by retailers. The estimated value of the wood products not purchased over the entire winter season due to reduced burning is $577,781; $1,137,064; $1,620,987; and

$4,211,867 for the Recommended Change, Option A, Option B and the Contingency Option, respectively.

In the socioeconomic analysis for these amendments, Appendix G of the Staff Report (Attachment D), worst case impacts to businesses were estimated using two different assumptions. The first impact assessment used an assumption that all of the lost revenue from wood sales due to the additional No Burn days falls upon independent wood dealers and that dealers could not increase prices. In other words, no wood is sold in grocery stores or other retail outlets. This would result in the following potential maximum impacts to revenues and jobs for independent wood dealers:

- Recommended Change: 4.6% loss in revenue, 2.8 jobs lost
- Option A: 8.7% loss in revenue, 5.3 jobs lost
- Option B: 14% loss in revenue, 8.5 jobs lost
- Contingency Option: 34.1% loss in revenue, 20.6 jobs lost

In the second analysis wood retailers raise prices to maintain income while selling less fuel. The following potential maximum price increase and impacts to consumers may occur:

- Recommended Change: 4.6% price increase, $11-$18 increased cost per household per season
- Option A: 8.7% price increase, $22-$35 increased cost per household per season
- Option B: 14% price increase, $35-$56 increased cost per household per season
- Contingency Option: 34.1% price increase, $84-$136 increased cost per household per season

The costs noted above represent 0.02% to 0.24% of the Sacramento County 2007 median income.

The third impact assessment used an assumption that all of the lost revenue falls upon large retail stores. Under this assumption, intended to estimate the maximum impact on retail stores, the percentage loss in revenue is negligible under all of the options and no job losses are expected. Since wood is sold by both independent wood dealers and retailers, the actual job losses would likely be lower than estimated.

Many of the residents affected by the rule burn wood for ambiance and would experience cost savings from reduced wood use. For those who use wood as their primary or supplemental heat source, burning wood only provides a clear cost savings if wood is obtained without any costs associated with cutting and transporting the wood. For those who purchase their wood, there will be a shift in costs from wood to an alternate source for heat. The data in the table below show that it costs less per unit of heat delivered to use natural gas than to use wood, and that electric heating is only slightly more expensive than burning wood. The average cost of heating a typical home with a certified wood stove for 30 days is $139 and $172 of a pellet stove, while the cost is $153 for electricity and $88 for natural gas. Anecdotal information from comments during public workshops suggests that some consumers may have reduced heating costs from using wood or pellets as a supplemental heat source. Reported cost savings may result from personal comfort choices and/or because wood burning may heat main living areas while other rooms remain cooler than if the home's alternative heat source were used, resulting in a net reduction in heat delivered.

Heating Device	Thermal Efficiency	Fuel Cost per mmBtu of Heat Delivered
Fireplace	7%	$206.23
Certified Wood Stove	63%	$22.91
Pellet Stove	76%	$28.29
Propane Fireplace	75%	$34.24
Natural Gas Fireplace	75%	$14.54
Electric Fireplace	>99%	$25.23
Gas Central Heat & Air	80%	$13.63
Electric Central Heat & Air	100%	$25.23
Propane Central Heat & Air	80%	$32.10

Note:
1. Used as primary source of heat
2. PG&E rates for natural gas (Winter 2009)
3. SMUD rates for electricity (Winter 2009)
4. Average cost of cord of wood[13] = $269, average cost of pellets[13] = $344/ton, and Cost of propane = $2.31/gallon

District Impacts

Compliance and enforcement will remain the same as the current rule. Approximately 1.2 FTE was required to administer the 10 Stage 1 days and 28 Stage 2 days experienced in the 2008/2009 season. Using a ratio of the options to last season, and keeping in mind that last season was an above average year for the number of No Burn days, the estimated Staff resources for the additional No Burn days for the enforcement/compliance effort are 0.16 FTE, 0.25 FTE, 0.66 FTE, or 0.82 FTE for the Recommended Change, Option A, Option B, or Contingency respectively, specifically for the following:

1) Surveillance by inspection Staff on the additional No Burn days for at least 1 hour per day per inspection Staff member (or a total of 8 hours on weekends/holidays).
2) Responding to the increase in reported burning or smoke complaints from the public due to the additional No Burn days.
3) Handling of the increase in Notice of Violations (NOVs) from the additional No Burn days.

Emission Impacts

The California Air Resources Board is responsible for preparing the wood burning emission inventory for Sacramento County. Wood smoke is the single largest source of directly emitted PM2.5, 49% as reported by CARB's 2005 California Emission Forecast System (CEFS) wintertime PM2.5 emissions inventory for Sacramento County. The 2005 emissions inventory is 8.30 tons on an average winter day from wood burning in Sacramento County.

The residential wood smoke combustion emissions inventory is being re-evaluated by CARB in preparation for upcoming federal PM2.5 plans. Several relevant surveys have been conducted since CARB last modified the methodology.

[13] Socioeconomic Impact Analysis for SMAQMD Rule 421 Amendments, ERG, 2009

For detailed emission inventory calculations see Appendix E, Emissions Calculations, of the Staff Report (Attachment D).

The emissions reductions were calculated using results from the 2009 Aurora Survey of burning behavior during the Rule 421 No Burn program. The table below summarizes the revised CARB methodology estimates the daily average PM2.5 emissions from wood burning in Sacramento County during November – February and the estimated emission reductions from Stage 1 and Stage 2 days. Detailed calculations and data sources are presented in Appendix E of the Staff report (Attachment D).

Pollutant	Nov. – Feb. Daily Average Emissions (tons/day)	Reductions (tons/day)	
		Stage 1 Day	Stage 2 Day
PM10	11.95	5.17	8.37
PM2.5	11.47	4.97	8.03
NOx	1.39	0.59	0.76
CO	78.5	22.3	54.8
VOC	35.2	18.9	24.6

Note: Each option has the same reduction per No Burn day but the number of No Burn days differs in each option.

Environmental Review and Compliance

Rule 421 was created as part of the response to the requirements of Senate Bill 656 that the District implement cost-effective control measures for particulate matter emissions. Staff finds that the proposed rule is exempt from the California Environmental Quality Act as an action by a regulatory agency for protection of the environment (Class 8 Categorical Exemption, Section 15308 State CEQA Guidelines) and because it can be seen with certainty that there is no possibility that the activity in question may have a significant adverse effect on the environment (Section 15061(b) (3), State CEQA Guidelines).

California Public Resources Code (Section 21159) requires an environmental analysis of the reasonably foreseeable methods of compliance. Staff anticipates that users of solid fuel burning devices will comply with No Burn day restrictions by not burning for ambience and, where wood burning provides supplemental heat, by using alternative sources such as natural gas or electricity. The use of these alternative fuels will result in a decrease in the emissions of particulate matter and other air pollutants, including greenhouse gasses, with a corresponding improvement in air quality and public health.

There has been some debate as to whether the burning of wood should be considered “carbon neutral,” because even though carbon dioxide is released from the burning of wood, carbon dioxide was absorbed by the living trees. Burning simply returns that carbon dioxide to the atmosphere, thus the term “neutral.” However, the term “carbon neutral” is something of a misnomer, because other greenhouse gasses, including methane and nitrous oxide (much more potent greenhouse gasses than carbon dioxide) and black carbon particles (another global warming pollutant), are released when wood is burned, while only the carbon dioxide is absorbed by living trees. Carbon neutrality, at least with respect to carbon dioxide emissions, depends on a number of factors, including whether the wood has been harvested from a

sustainable resource. Both BAAQMD[14] and SJVAPCD[15] have found that a large percentage of the firewood being burned comes from nonsustainable activities. In particular, there has been a loss in the acreage of oak woodlands in Northern California, including the foothills on the eastern side of the Central Valley, attributable to urban growth, firewood harvesting, and land clearing for vineyards and developments. Similar activities have been conducted in Sacramento County and the surrounding areas. It may take as long as 200 years for young trees to approach the carbon storage capacity of old growth forests.

Based on the foregoing, staff believes wood burning in Sacramento County is not carbon neutral. Nevertheless, Staff has examined the net effect on greenhouse gas emissions under two scenarios: 1) the burning of wood is not carbon neutral, and 2) the burning of wood is carbon neutral with respect to carbon dioxide. The analysis also considered greenhouse gas emissions associated with electricity due to fuel burned at electrical power plants. The following table shows the results of this analysis, based on equal heat outputs using natural gas or electricity rather than wood combustion on No Burn days.

Heat Source	GHG Emissions (metric tons/yr CO_2 Equiv.)			
	Recommended Change	Option A	Option B	Contingency Option
Wood	6,249	11,891	19,070	46,557
Wood – Carbon (CO_2) neutral	552	1,051	1,686	4,116
Natural Gas	1,270	2,418	3,877	9,466
Electricity – Only CO_2	1,418	2,698	4,326	10,561

As shown in the table, if wood burning is not carbon neutral, there is a net decrease in greenhouse gas emissions from using natural gas or electricity instead of wood on No Burn days. Even assuming, wood burning is carbon (CO_2) neutral, the increase in greenhouse gas emissions from using the replacement fuels on No Burn days is marginal. Under the Recommended Option, assuming that wood burning is carbon (CO_2) neutral, and wood is replaced by electricity on No Burn days, there is a worst case net increase in greenhouse gas emissions of 866 metric tons per year of CO_2 equivalents, which represents only 0.005% of the greenhouse gas emission inventory for Sacramento County and 0.0002% of the California inventory.

Even in the worst case (Contingency Option, using electricity instead of wood), the increase in greenhouse gas emissions represents only 0.04% of the greenhouse gas emission inventory for Sacramento County and 0.001% of the California inventory.

Staff has concluded that no significant environmental impacts will be caused by compliance with the proposed rule.

Cost Effectiveness

The cost effectiveness of the amendments can be calculated by using the cost (lost sales for wood suppliers) and the emissions reductions discussed earlier. The Recommended Change

[14] BAAQMD, *Draft Environmental Impact Report for the Bay Area Air Quality Management District's Proposed Regulation 6, Rule 3 Wood-Burning Devices*, May 2008
[15] SJVAPCD, *Final Staff Report Proposed Amendments to Rule 4901*, October 2008

cost effectiveness is estimated to be $3.14 per pound of PM2.5 for a Stage 1 No Burn day and $5.32 per pound of PM2.5 for a Stage 2 No Burn day. To put these costs into perspective, it is useful to compare the cost effectiveness for other District rules. District Rule 417, Wood Burning Appliances, cost $4.19/lb of PM2.5 in today's dollar. It should be noted that most of the District's existing rules are for controlling ozone precursors, usually VOC or NOx. Rule 421 also achieves NOx reductions. The cost effectiveness of this rule is $2.80 - $4.86 per pound of NOx + PM2.5. The 2005 amendments to District Rule 411, NOx from Boilers, Process Heaters and Steam Generators cost $13.90/lb of NOx. The cost effectiveness of the gasoline dispensing regulations (Rule 449, Transfer of Gasoline into Vehicle Fuel Tanks; 12/17/1991 rule amendments) is at the higher end of the cost effectiveness range, costing $17/lb of VOC in today's dollars. Rule 452, Can Coating (8/21/1990 rule amendments), is at the low end of the range at a cost of $1/lb of VOC in today's dollars.

Public Outreach

Staff conducted five public workshops throughout Sacramento County between July 13th and July 22nd. Each workshop started with a structured presentation of the four options with time available for questions and comments. The workshops were held in downtown Sacramento, Carmichael, Folsom, Galt and at the District office. The noticing for these public meetings included:

- Letters to all elected officials in Sacramento County
- Ad in the Our Region section of the Sacramento Bee
- Notices to newspapers across Sacramento County
- Notices to radio stations across the region
- Letters to homeowner associations
- Notice on the District's Web site
- Notices by mail and e-mail to the District's list of parties interested in rule development.

Staff received comments and questions at the workshops, through the mail, e-mail and at stakeholder meetings. Comments and responses are listed in Appendix F of the Staff report (Attachment D). In addition, Staff conducted stakeholder meetings with HBPA and various retailers, Sacramento Area Realtors, and Breathe California.

A notice for the September 24, 2009 public hearing was published in the Sacramento Bee, Our Region Section on August 24, 2009. The notice was also mailed to attendees of the public workshop, affected sources, and persons who have requested rulemaking notices.

Public Comments

Staff received over 200 comments on the proposal presented at the July workshops. Staff's responses to these comments are included in the Staff report. A large number of comments received at the workshops and via email were on the initial staff recommendation, which was to eliminate the Stage 1 exemption for certified devices. Many comments were from owners or

local wood stove retailers of certified or pellet devices, and the Hearth Patio and Barbeque Association who opposed eliminating the current two-stage program, with its limited exemption for certified and pellet devices on Stage 1 No Burn days. After consideration of these comments, Staff changed the recommendation to maintain the limited exemption on Stage 1 days for EPA certified and pellet stoves/inserts.

Other comments supported Staff's workshop Recommended Change and supported the more stringent Option B. A few comments, predominantly from hearth product manufacturers or their association, offered an option of having the District adopt a no visible smoke rule, where visible smoke emissions are prohibited during the entire winter season. Additionally, some comments suggested that we work to eliminate burning in all fireplaces.

An option to prohibit visible smoke for the entire winter season would affect all 155,649 fireplaces, 14,310 uncertified wood stoves and 44,184 uncertified wood inserts as well as tens of thousands of certified devices which are not capable (either by design or user operation) of burning without visible smoke on every day, not just on the bad air quality days. One manufacturer claims to have a catalytic retrofit device that reduces visible smoke from fireplaces. The cost of replacing or retrofitting all fireplaces and uncertified wood stoves/inserts is estimated to be up to $400 million or more. In addition, this approach would burden our limited staff resources by requiring enforcement on every day of the wood burning season instead of just No Burn days. Additionally, a total ban on wood burning would increase the likelihood of decreasing compliance rates. Therefore staff does not recommend establishing a comprehensive winter time smoke ban at this time.

A comment from Duraflame received after this public hearing notice was issued suggested 1) eliminating the voluntary curtailment, 2) making the rule a single stage No Burn program eliminating the limited exemption for EPA certified devices and pellet devices, and 3) setting the No Burn threshold at 35 $\mu g/m^3$. The voluntary curtailment program provides a mechanism to inform the public that PM2.5 concentrations are elevated, but not to the extent that a mandatory curtailment is warranted. Many members of the public will choose not to burn as a result of this message resulting in an improvement in air quality. Messaging for the District's Check Before You Burn program clearly differentiates between voluntary requests and mandatory requirements

A significant number of comments/questions were about how the District and the CBYB program function. The remaining comments were about emissions inventory, transport of fine particle pollution from surrounding areas, economic impacts, number of No Burn days, meteorology and other rules and regulations of the District.

Comments received since release of the Staff report are presented in Attachment E and all other comments are presented in Appendix F of the Staff Report (Attachment D).

Conclusion

Studies reported that public response and air quality improvements from Rule 421 are significant, but are not sufficient to meet federal health standards at this time. More recent health studies show significant adverse health effects, including effects on children, can be specifically attributed to wood smoke. Other health studies indicate that Sacramento has a higher number of premature deaths from high PM2.5 concentrations than previously believed. Wood smoke is the single highest source of PM2.5 emissions. Controls on other sources may be avoided if additional benefits from Rule 421 can be achieved. Staff evaluated potential benefits from reducing the thresholds using the results from STI and Aurora Research Group's evaluation of Rule 421 effects and recommends threshold changes that will result in a modest increase in the number of no burn days.

Staff requests approval of the staff recommendation. Staff requests that the Board determine that the amendment of Rule 421 is exempt from CEQA and approve the attached resolution adopting Rule 421 as proposed. As an alternative to the staff recommendation the Board could also choose greater health protections provided by the options. The options may increase costs on affected businesses and residents; and, higher increases in the number of No Burn days, may decrease compliance rates.

Respectfully Submitted

_____
Larry Greene
Executive Director/Air Pollution Control Officer

Approved as to form:

_____
Kathrine Pittard
District Counsel

Attachments

Attachment A
Board Resolution

Attachment B
Proposed Rule 421
& Rule 421 Options

Attachment C
May 2009 Board Letter

(Includes the STI and Aurora studies)

Attachment D
Staff Report and Appendices

Attachment E
Comments and Responses from Public Hearing Notice
(Received After August 24, 2009)

E-mail comment received from Duraflame, Inc on August 21st

Comment #1: **We recommend the District abandon its voluntary no burn program, as the levels of proposed restriction are far below what is necessary to be protective of air quality. The San Joaquin Valley Air District has demonstrated that a simplified program with one threshold for no burn days is easy to communicate and an effective method to reduce emissions from wood burning on bad air days. Eliminating the voluntary program also improves the simplicity of communicating the program to the public.**

Response: This recommendation is consistent with staff's original proposal and would be easier to communicate. However, the voluntary curtailment program informs the public when PM2.5 concentrations are elevated, but not to the extent that a mandatory curtailment is warranted. Many members of the public will choose not to burn as a result of this message resulting in an improvement in air quality. Messaging for the District's Check Before You Burn program clearly differentiates between voluntary requests and mandatory requirements.

Comment #2: **We do have concerns about the emissions threshold level the District has proposed for the one-stage mandatory curtailment and recommend the level be set at the Federal 24-hour standard for PM2.5 emissions violations.**

Response: The threshold for Option A, that is the one stage option, is 30 $\mu g/m^3$, which is the same as San Joaquin Air Pollution Control Districts adopted rule. This is threshold is recommended to be slightly below the federal health standard, to account for forecasting uncertainties.

Comment #3: **We do not support the District's proposal to implement a contingency measure that would automatically reduce the emissions threshold for no burn days in 2015.**

Response: The contingency measure is an option for the Board to consider, but is not recommended at this time. The San Joaquin Air Pollution Control District adopted a contingency measure in Rule 4901 in October 2008.

E-mail comment received from Sharon Lynes on August 22nd

Comment #4: **The new proposal is just more government regulation.**

Response: See response to Comment #28 in Appendix F.
The District is charged with protecting public health, in this case reducing the health risks from high levels of particulates in the air. There are many incentive strategies and regulations already in place to reduce particulate pollution problems, including reducing pollution from cars, trucks, buses, construction equipment, industrial and commercial boilers and power plants. Because fireplaces and wood stoves contribute 54% of directly emitted particulates, the Board adopted Rule 421 in 2007 to reduce wood smoke only on those days when air quality was forecast to be poor. However, the PM2.5 levels in the county are still above the federal health standards. Staff recommends adjusting this rule as the most effective way to achieve additional reductions in ambient PM2.5 levels with the least impact.

Comment #5: **Many jobs and family incomes are reliant on the firewood industry.**

Response: See response to Comment #197 in Appendix F.
If all of the reduced sales were borne entirely by independent wood dealers that did not increase their wood prices, there would be 3 jobs lost; from the staff recommendation. Obviously, , some wood is sold in grocery stores and other larger retail outlets, therefore the actual number of jobs lost, if any, would be less. For more details see the "Socioeconomic Impact" section of the Staff report and ERG's Socioeconomic Report in Appendix G of the Staff Report (Attachment C).

Comment #6: **Diesel exhaust from trucks, buses, and autos with diesel engines has no regulations such as Smog II on gasoline engines in autos in the Sacramento Area.**

Response: See response to Comment #71 of Appendix F.
Heavy duty trucks and buses have been subject to inspection for excessive smoke conducted by the California Highway Patrol weigh stations and other roadside locations since 1998. CARB has several other programs that subject heavy-duty diesel vehicles to periodic self inspection and idling regulations.

Other diesel vehicles are under state law to be incorporated into the Smog Check Program beginning January 2010.

Comment #7: **Consider the fact that in the late fall and winter when the dew point is reached in the evening, any particulate matter in the atmosphere acts as nucleii for the dew, thus helping to clean the air nightly.**

Response: See response to Comment #110 of Appendix F.
Fog does remove fine particles from the air through the effects of scavenging and deposition processes. A recent study[16] suggested that fog may be relatively better at removing some organic carbon emissions from wood smoke, and less effective at removing polycyclic aromatic hydrocarbons, which are toxic compounds emitted from burning wood. Fog also may increase some types of secondary organic aerosol fine particles when soluble volatile organic compounds are converted to nonvolatile products that are released when fog evaporates. In addition, fog interactions with inorganic aerosol species have been more widely researched. Nighttime aqueous phase reactions occur during which the liquid water in fog combines with nitrogen oxide compounds to form nitric acid. The nitric acid then reacts with available ammonia in the air to form ammonium nitrate particulate aerosols. Ammonium nitrate is the largest source of secondary PM2.5. The science regarding the competing processes of PM2.5 production and removal continues to evolve[17].

Comment #8: **I would encourage the SMAQMD to divert their energy to attacking the air pollution sources that are with us the entire year, not just for 4 months in**

[16] "Examination of the Influence of California Regional Particulate Air Quality Study Fog Episodes on Aerosol Formation and Removal" by Collett, Herckes, Chang, and Lee of Colorado State University and Pandis and Fahey of Carnegie Mellon University, January 13, 2005.

[17] "The ammonium nitrate particle equivalent of NOx emissions for wintertime conditions in Central California's San Joaquin Valley" by Stockwell, Watson, Robinson, Steiner, and Sylte, Atmospheric Environment 34 (2000) 4711-4717.

the late fall and winter. What is SMAQMD doing about NOx pollution and -smog in the summer in areas around Folsom and Roseville?

Response: The District has many rules which regulate sources that emit NOx and VOC. In addition, the District has committed to adopting several other control measures in the 2008 Attainment Plan for the 8-hour Ozone standard that also provide wintertime PM2.5 air quality benefits. However, as this source represents over 50% of wintertime PM2.5 emissions, this rule provides critical air quality benefits.

E-mail comment received from Larry Pinney on August 24th

Comment #9: **Anyone with an older wood burning insert is not being offered an alternative to our investment. If you want to limit us in any way then you need to offer us something like a catalytic converter so that we don't have to start all over again.**

Response: EPA has required the new wood stoves and inserts meet the emission standards since 1992. Devices that don't meet these standards are at least 17 years old. Wood smoke is the single largest directly emitted PM2.5 emissions source and noncertified wood burning devices (pre-1992 units) are the largest contributor to residential wood combustion emissions. For this reason, Rule 421 already prohibits wood burning in an uncertified device on both Stage 1 and Stage 2 No Burn days.

Written comment received from June Chan on August 26th

Comment #10: **I'm in support of tougher air pollution regulations and less burning of any type and an increase in the number of no burn days in Sacramento County. There is a need for tougher air quality restrictions.**

Response: See response to Comment #16 of Appendix F.
Thank you for your support for air quality goals.

E-mail comment received from Zina Powning on August 30th

Comment: **We heat our small house with wood. We live on a fixed income and cannot afford high PG&E heating costs. Please do not make it even harder for us to stay warm by increasing the number of days when we can't burn.**

Response: See response to Comment #111 of Appendix F. Burning wood only provides a clear cost savings if wood is obtained without any costs associated with cutting and transporting the wood. However, some residents, like yourself, report lower fuel bills from using wood, particularly as a supplemental heat source. See the "Impact on Businesses and Public" section of this memorandum for more details. Consequently, staff recommends the smallest increase in the number of no burn days of the options considered to provide greater health protections, and to potentially avoid other costs on businesses and farmers.

Attachment F
STI Transport Analysis

Attachment G
Evidence of Public Notice