SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Draft Staff Report
Proposed Amended Rule 445 – Wood-Burning Devices

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EXECUTIVE SUMMARY

Rule 445 – Wood Burning Devices was adopted in March 2008 to implement the PM2.5[1] Control Measure BCM-03 of the 2007 Air Quality Management Plan (AQMP) to reduce PM2.5 emissions from wood-burning devices in the South Coast Air Basin (SoCAB).[2] The rule was amended in May 2013 to implement Control Measure BCM-01 in the 2012 AQMP to address the U.S. EPA's lowering of the PM2.5 annual standard from 15 to 12 μg/m^3. The No-Burn Day curtailment threshold was also lowered from 35 to 30 μg/m^3, and additional provisions including an advisory labeling requirement for commercially sold firewood were adopted. As a consequence of *Bahr v. EPA*, 836 F.3d 1218 (9th Cir. 2016), the rule was amended in June 2020 to establish PM2.5 contingency measures that would be automatically implemented in the event that the U.S. EPA determines that the SoCAB had failed to meet a Reasonable Further Progress (RFP) milestone or to attain a PM2.5 National Primary Ambient Air Quality Standard (NAAQS) by the attainment date, pursuant to CAA Section 172(c)(9). Most recently, in October 2020, the rule was amended to add ozone contingency measures that would be implemented in the event that the U.S. EPA determines that the SoCAB had failed to meet an RFP milestone or attain the applicable NAAQS, by the applicable deadline. [3]

Rule provisions apply to manufacturers, vendors, commercial firewood sellers, and persons owning or operating a wood-burning device. The majority of wood-burning devices are fireplaces and wood-stoves, but also include any similar permanently installed, indoor or outdoor wood-burning devices. Wood-burning devices in new construction are prohibited, and replacement of existing devices must be with approved alternatives. The rule also prohibits burning of products not intended for use as fuel (i.e., residential waste) and restricts the sale of unseasoned wood. A wood-burning curtailment (No-Burn Day) program prohibits wood-burning during the wood-burning season (currently from November through February) when the ambient PM2.5 concentration in the SoCAB is forecast to exceed 29 μg/m^3.[4] Finally, the rule includes exemptions for low income households, where the device is the sole source of heating, geographic elevations 3,000 feet or higher above mean sea level, and ceremonial fires.

1 Airborne fine particulate matter ≤ 2.5 micrometers in aerodynamic diameter (μm).

2 The South Coast Air Basin (SoCAB or Basin) is a geographic region that encompasses Orange county and the non-desert portions of Los Angeles, Riverside and San Bernardino counties as defined in CCR, Title 17, Section 60104.

3 October 27, 2020 Governing Board Agenda - Special Meeting of the South Coast AQMD Governing Board,; http://www.aqmd.gov/home/news-events/meeting-agendas-minutes/agenda?title=special-meeting-of-the-governing-board-october-27-2020

4 Micrograms per cubic meter. On 9/16/2020 US EPA published the finding of a failure to attain the 24-hour PM2.5 standard triggering the Rule 445(f)(2)(A) contingency provision lowering the PM2.5 forecast threshold from 30 μg/m3 to 29 μg/m3, effective November 1, 2020.

The proposed amendment would establish a No-Burn Day contingency measure for the Salton Sea Air Basin (SSAB), which also includes the Coachella Valley area, similar to, the ozone contingency measure adopted for the SoCAB in October 2020. The contingency measure for the SSAB would only be triggered upon a final determination by the U.S. EPA that the SSAB had failed to meet an applicable 8-hour ozone RFP milestone or attain a NAAQS for the SSAB by the applicable deadline. When triggered, an ozone No-Burn Day would be declared for the SSAB during a September through April wood-burning season on days when the maximum 8-hour ozone air quality is forecast to exceed 80 ppb in the SSAB.[5] The SSAB threshold would be automatically reduced to 75 ppb and 70 ppb for a second and third U.S. EPA finding of a failure to comply with a milestone/attainment requirement for the SSAB, by the applicable due date, respectively. If triggered, No-Burn Days would reduce ambient ozone in the SSAB, during the wood-burning season.[6] Staff estimates that No-Burn Day contingency thresholds at 80, 75 and 70 ppb, if triggered, would result in an estimated Volatile Organic Compound (VOC) ozone precursor emissions reduction of 0.07, 0.24, and 0.89 tons per year (TPY), respectively.

South Coast Air Quality Management District (South Coast AQMD) staff conduct extensive outreach to ensure that the public and other stakeholders are aware of the wood-burning curtailment requirements. In addition to the South Coast AQMD Check Before You Burn web page with program information including links and videos and the Check Before You Burn map, information regarding No-Burn days is disseminated through e-mail notifications and a toll-free number. The South Coast AQMD Media Office also updates the South Coast AQMD website, provides additional notifications through website updates, press releases, sends email blasts to media contacts, news pitches to local news desks, coordinates press interviews, notifies the public on social media (Facebook, Twitter and Instagram), posts Facebook Ads on No Burn Days, and runs a Check Before You Burn video advertisement on Facebook during the wood- burning curtailment season. Outreach will similarly be conducted for the SSAB if it is anticipated that the No-Burn Day contingency measure will be triggered for the SSAB.

In response to comments submitted by U.S. EPA during the June 2020 rulemaking effort, proposed rule revisions also clarify and strengthen existing provisions. Clarification is provided that the rule prohibits aesthetic remodeling of fireplaces, but does allow for safety related repairs and rebuilding after a catastrophe. For the existing PM2.5 contingency measure, while staff anticipates that U.S. EPA will soon make a final determination that the SoCAB is in attainment with the 2006 24-hour PM2.5 NAAQS, contingency thresholds are lowered to expedite attainment if the contingency is triggered. Also, an analysis is provided showing that requiring change out of existing residential fireplaces in the South Coast AQMD, which are used almost exclusively for ambiance purposes,

5 See Attachment B.

6 The US EPA AP-42 VOC emission factor for wood combustion is 229 pounds of VOC per ton of fireplace wood burned. VOCs react with Oxides of Nitrogen (NOx) in the presence of sunlight to form ground level ozone.

whenever property ownership is transferred is not estimated to be cost effective. Such an approach is therefore not considered an economically feasible control option.

BACKGROUND

As shown in Appendix B, the jurisdiction of the South Coast AQMD encompasses all, or portions of the following three distinct air basins, the:

- South Coast Air Basin (SoCAB) which generally corresponds to metropolitan Los Angeles, Orange, western Riverside and south-western San Bernardino counties;

- Riverside county portion of the Salton Sea Air Basin (SSAB) which generally corresponds to the central portion of Riverside County, including the Coachella Valley Planning Area or Coachella valley area. The Coachella valley area is the most populated area of the SSAB encompassing cities such as Palm Springs, Desert Hot Springs, Cathedral City, Rancho Mirage, Palm Desert, Indian Wells, La Quinta, Indio, Coachella, Thermal, Indio, and Mecca, so that the SSAB is typically inferred when referring to the Coachella valley area; and

- Non-Palo Verde, Riverside County portion of the Mojave Desert Air Basin (MDAB) which generally corresponds to the eastern portion of Riverside county up to Palo Verde area. Located to the east of the SSAB it includes the locale of Desert Center. This air basin currently has an attainment status of undesignated for the NAAQSs and is not subject to Rule 445.

Ground level or ambient ozone (a colorless gas which is a component of smog) can cause respiratory health problems, including trouble breathing, asthma attacks, and lung damage. Research also indicates that ozone exposure can increase the risk of premature death. Numerous studies have linked inhalation of higher concentrations of ambient ozone with health effects such as respiratory and cardiovascular disease.[7] The federal Clean Air Act (CAA) requires the U.S. EPA to set NAAQS for criteria pollutants and to periodically review the latest health research to ensure that standards remain protective of public health. On July 18, 1997, the U.S. EPA revised the primary and secondary standards for ozone to a more health protective 0.08 ppm, averaged over an 8-hour period. In order to be further health protective, the 1997 8-hour ozone standard was lowered to 0.075 ppm in 2008, and to then 0.070 ppm in 2015.

Sections 172(c)(9) and 182(c)(9) of the CAA require contingency measures to be implemented if an ozone nonattainment area (such as the SoCAB or the SSAB) fails to meet reasonable further

[7] South Coast AQMD Proposed Amended Rule 445 Final Staff Report, Health Effects section, October 27, 2020.

progress (RFP) milestones or fails to attain the NAAQS by the required attainment date. The 2016 Air Quality Management Plan (AQMP) was developed to address the CAA requirements of the 2008 8-hour ozone standard. It was approved by the South Coast AQMD and the CARB and submitted to the U.S. EPA in April 2017. During the U.S EPA's evaluation of the 2016 AQMP, and as a result of the decision in *Bahr v. EPA*, 836 F.3d 1218 (9th Cir. 2016), the U.S. EPA advised South Coast AQMD that the contingency measures identified in the 2016 AQMP were not sufficient. The court held that control measures that have already been implemented (such as those for the 2008 8-hour NAAQS) to demonstrate compliance with RFP as well as contingency if the RFP milestones are not met do not comply with the requirement for "contingency measures" under CAA section 172(c)(9). U.S. EPA staff has interpreted this decision to mean that contingency measures must include a future requirement that is triggered by a finding of failure to meet an RFP milestone requirement or attain an applicable standard, by the due date. Therefore, the South Coast AQMD must adopt a local contingency measure to be triggered upon a finding of failure to meet an RFP milestone or an applicable ozone NAAQS by the applicable due date.

On October 1, 2019, effective October 31, 2019, the U.S. EPA approved the ozone portion of the 2016 AQMP for the South Coast Air Basin, and "conditionally approved" the RFP contingency measure requirement[8]. The conditional approval relied on specific commitments from (1) South Coast AQMD to modify an existing rule or rules, or adopt a new rule(s), that would provide for additional emissions reductions in the event that the South Coast Air Basin fails to meet an RFP milestone, and (2) for the CARB to submit the revised or new South Coast AQMD rule(s) to the U.S. EPA as a SIP revision within 12 months of the U.S. EPA's final action (effective October 31, 2019). In October 2020, Rule 445 was amended to include ozone contingency measures for the SoCAB within the 1-year time period for adopting such measures.

For the 1997 8-hour ozone NAAQS, the SSAB was originally classified as a Serious nonattainment area effective June 15, 2004.[9] In 2007, South Coast AQMD requested that the U.S. EPA reclassify the SSAB from Serious to Severe-15. This reclassification was granted effective June 4, 2010 and established an attainment date of June 15, 2019.[10] Figure 1 shows that Implementation of South Coast AQMD and CARB emissions control measures over the past several decades have resulted in demonstrable progress in reducing ozone levels, and that significant reductions in ozone precursor emissions namely NOx and VOCs resulted in a significant downward trend in ambient ozone, and ambient air quality in the SSAB has steadily improved. However, in 2017 and 2018, the State of California and other western states experienced a series of high ozone episodes primarily driven by unexpected changes in meteorology including warm and stagnant weather conditions. Higher ozone levels were

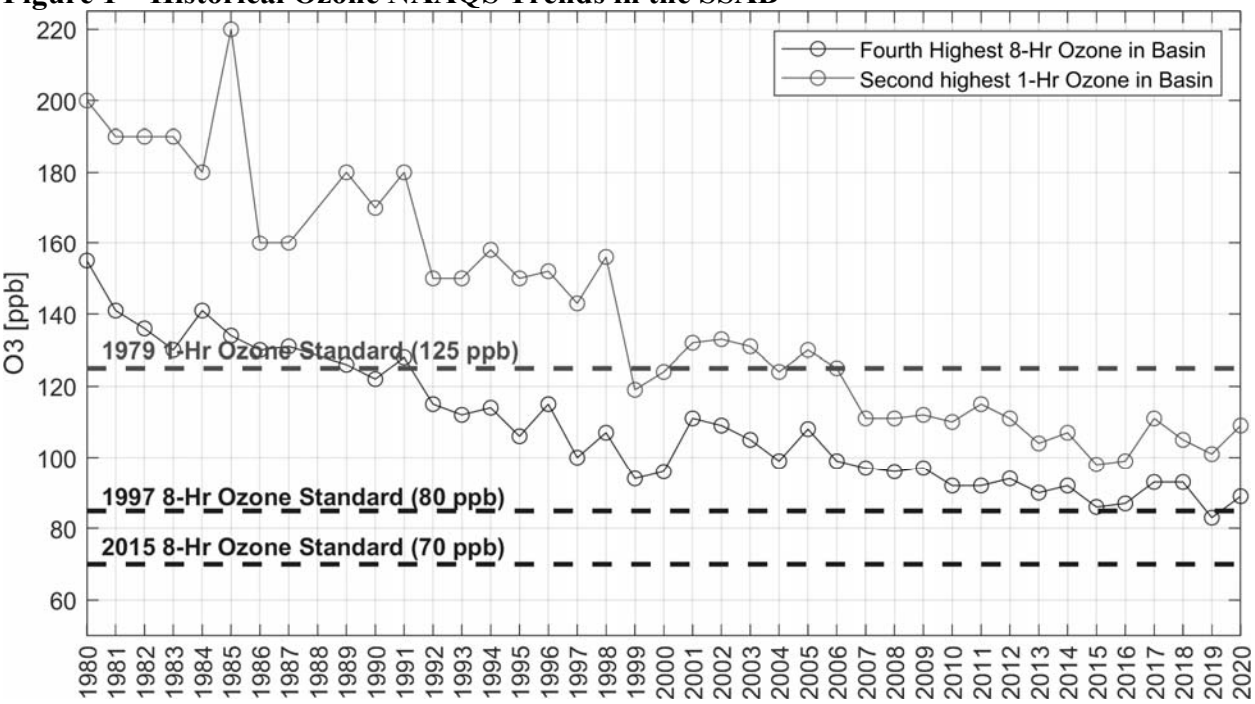
8 84 FR 52005

9 69 FR 23858 (April 30, 2004).

10 75 FR 24409 (May 5, 2010).

experienced throughout the State of California due to changes in meteorology, biogenic emissions, and/or anthropogenic emissions. Due to higher recorded ozone levels in 2017 and 2018, the Coachella Valley could not attain the 1997 8-hour ozone standard by the attainment deadline of June 15, 2019.

Figure 1 – Historical Ozone NAAQS Trends in the SSAB[11]



As a result, the South Coast AQMD requested that the U.S. EPA reclassify the SSAB from Severe-15 to Extreme ozone nonattainment.[12] On July 10, 2019, the U.S. EPA granted the reclassification request, and accordingly, under the new Extreme nonattainment classification, a revision to the State Implementation Plan (SIP) was required to be submitted to the U.S. EPA by February 14, 2021. As a result, the Coachella Valley Extreme Area Plan was developed to demonstrate attainment of the 1997 ozone standard before the required deadline of June 15, 2024 and to address the new federal CAA requirements for extreme nonattainment areas. The Coachella Valley Extreme Area Plan (excluding the contingency measures) was submitted to the U.S. EPA for inclusion into the SIP in December 2020, with contingency measures to be addressed in a separate rulemaking process. Staff is proposing the current amendment to include an ozone contingency measure for the SSAB after redesignation and pursuant to *Bahr v. EPA*, 836 F.3d 1218 (9th Cir.

[11] These measures are used as the most relevant for determining attainment status. The 4th Highest 8-Hr Ozone value in a Basin is the 98th percentile of individual station highest concentrations; with the 3-year average used to determine attainment status. Second Highest 1-Hour Ozone in Basin is plotted since the 1-hr standard is achieved when there are no more than 3 exceedances of the standard in a three year period; which is equivalent to no more than one exceedance per year on average using the 2nd highest value so obtained.

[12] 42 U.S.C. 7511(b)(3).

2016), to fulfill this requirement.

For the SSAB, Table 1 provides a summary of the requirements and current designations for the 8-hour averaged federal ozone standards:

Table 1 – Ozone NAAQS for the SSAB

Year	Average Time	Attainment Threshold	Status	Basin Designation	Attainment Date
1979	1-hour	0.12 ppm (120 ppb)	Attainment	Attained 2013	11/15/2007
1997	8-hour	0.08 ppm (80 ppb)	Nonattainment	Extreme	6/15/2024
2008	8-hour	0.075 ppm (75 ppb)	Nonattainment	Severe-15	7/20/2027
2015	8-hour	0.070 ppm (70 ppb)	Nonattainment	Severe	8/3/2033

In the South Coast AQMD ambient ozone is created as a result of a series of complex reactions involving Volatile Organic Compounds (VOC) emissions and emissions of Nitrogen Oxides in the presence of sunlight, as detailed in the Ozone Forecasting section below. Levoglucosan (a combustion product unique to wood-burning),[13] correlates closely with ambient VOC (an ozone precursor), and has been detected in the so called "shoulder" months at monitoring stations throughout the South Coast AQMD. Shoulder months are the four months of March, April, September and October which are situated on either side (or shoulders) of the current traditional November through February SoCAB PM2.5 wood-burning season. This indicates that some ambience wood-burning does take place during the shoulder months. A curtailment of wood-burning during the shoulder months is therefore anticipated to reduce VOC emissions and thus ambient ozone concentrations.[14] This is also in line with U.S. EPA AP-42 emissions factor of 229 pounds of VOC emitted per ton of fireplace wood burned.[15] Ozone contingency measures adopted for the SoCAB would implement an ozone No-Burn Day program, during an extended September through April wood-burning season, if the U.S. EPA determines that the SoCAB had failed to meet an RFP milestone or attain an area applicable ozone NAAQS by the applicable deadline. The provisions of the proposed amendment for the SSAB, mirror the ozone contingency measures adopted for the SoCAB and are based solely on RFP milestones and NAAQS thresholds and attainment due dates for the SSAB. Specific proposed language for the amendment is presented

13 http://www.aqmd.gov/docs/default-source/air-quality/air-toxic-studies/mates-iii/mates-iii-draft-report-january-2008/appendix-vii-pm2-5-source-apportionment-methodology.pdf

14 South Coast AQMD Proposed Amended Rule 445 Final Staff Report, Background section, October 27, 2020

15 https://www3.epa.gov/ttn/chief/ap42/ch01/final/c01s09.pdf

in the Proposed Rule Amendment section. The provisions of the proposed amendment of Rule 445 therefore address the mandatory rule making requirement for ozone contingency measures for the Coachella Valley area and the SSAB as a whole.

The U.S. EPA Ozone Implementation Rule also states that "contingency measures should represent one-years' worth of progress, amounting to reductions of three (3) percent of the baseline emissions inventory for the nonattainment area."[16] In addition, CAA Section 182(e)(5) allows Extreme nonattainment areas to rely on future development of new control techniques or improvement of existing control technologies as part of the control strategy for attainment of an ozone standard. Staff anticipates that the emissions reductions for the SSAB from the proposed amendment in addition to anticipated reductions from other AQMP provisions will provided the required overall three percent VOC emissions reduction for the SSAB.

Other provisions of the rule amendment will codify the current practice of allowing repairs of existing wood-burning devices (most often fireplaces) to prevent any health or safety issues and allowing limited reconstruction after a catastrophic event. Repairs would be allowed to the extent that they restore the device to a safe operating state as recommended by the manufacturer or based on adopted/published industry standards. Staff has received numerous requests to consider allowing the rebuilding of structures after the devastating series of recent wildfire events, where there has been a complete loss of structures and in some cases lives. Proposed language would allow for the reconstruction of a previously existing wood-burning device, due to a catastrophic event as defined in the rule (such as a wildfire) where the device was not the cause. In all cases any repair or reconstruction is prohibited from increasing throughput or emissions, or increasing the dimensions of the device.

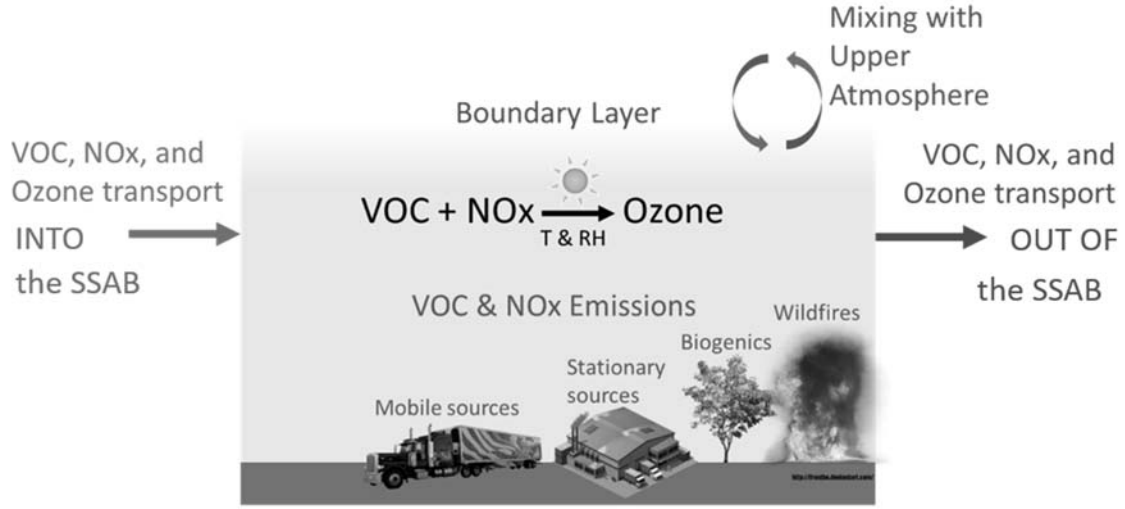
OZONE FORECASTING

NOx generated from combustion processes react with VOCs emitted from a wide variety of sources such as consumer products, mobile sources, vegetation, and combustion processes such as residential wood-burning to form ambient ozone. The chemical reactions that form ozone are highly complex and depend not only on NOx and VOC levels, but also on the ratio of VOC to NOx concentrations, temperature, the amount of sunlight, and other meteorological conditions. Figure 4 illustrates the processes influencing ambient ozone concentrations in the SSAB. The SSAB is located downwind of the South Coast Air Basin. Ozone levels in the SSAB are impacted by pollutants directly transported from the South Coast Air Basin as well as pollutants formed secondarily through photochemical reactions from precursors emitted upwind. Hence, ambient ozone in the Coachella Valley is both directly transported from the SoCAB into the SSAB and also formed photochemically from precursors emitted upwind and within the Coachella Valley. The precursors are emitted in the greatest quantity in the coastal and central Los Angeles County

16 80 FR 12264

areas of the SoCAB. The prevailing sea breeze from the SoCAB causes polluted air to be transported inland. As the air is being transported inland, ozone is formed, with peak concentrations occurring in the inland valleys of the SoCAB, extending from eastern San Fernando Valley through the San Gabriel Valley into the Riverside-San Bernardino area and the adjacent mountains. As the air is transported further inland into the SSAB through the San Gorgonio Pass, ozone concentrations typically decrease due to dilution, although ozone standards can still be exceeded – wind speed and wind direction further influence ozone concentrations throughout the SSAB.

Figure 4 – Schematic of Processes Influencing Ozone Concentrations in the SSAB



In addition to the 27 sites in the SoCAB there are also two stations, located in the cities of Palm Springs and Indio, operated by the South Coast AQMD where ambient ozone concentrations are measured.[17] Ambient ozone concentrations are also heavily dependent on meteorological conditions. Concentrations in the SSAB, and the number of days exceeding the federal ozone standards, are greatest in the late spring and summer months, with no exceedances during the winter. Ozone concentrations are a strong function of season for several reasons. The rate of reactions that produce ozone in the atmosphere proceeds faster at higher temperatures. In addition, elevated temperatures lead to increased ozone precursor concentrations by hastening the evaporation into the air of VOCs. Ozone concentrations are also dependent on sunlight intensity, which is stronger during the summer months. The stability of the atmosphere also influences ozone concentrations. Strong inversions inhibit mixing with the upper atmosphere, leading to elevated concentrations at the surface.

17 Details describing the monitoring network are presented in the annual South Coast AQMD Monitoring Network Plan available at http://www.aqmd.gov/home/air-quality/clean-air-plans/monitoring-network-plan.

South Coast AQMD staff use weather forecasts, air pollution measurements, satellite data, and mathematical models to predict ozone, particulate (PM2.5 and PM10), nitrogen dioxide, and carbon monoxide concentrations. Forecast models are tools for making predictions, which are based on and evaluated by air pollution measurements. Traditionally, South Coast AQMD staff issued a daily air quality forecast summarizing conditions expected over the entire day for each Source Receptor Area (SRA) as shown in Appendix B. With new models developed and maintained by NOAA[18] scientists, South Coast AQMD staff can also now issue hourly forecasts of PM2.5 and ozone for the next day. These models are customized using local measurements and state-of-the-science models of air pollution levels, resulting in more accurate predictions. The predicted pollutant levels are reported as an Air Quality Index (AQI). The higher the AQI, the higher the level of air pollution and potentially greater health concerns for the exposed population. Air quality forecasts are generated on the SRA level with models using monitoring data. However, not all SRAs contain an ozone monitoring station/equipment, in which case, the forecast is interpolated. Data is available in real-time and is used for air quality forecasting and public reporting of current conditions. AQI values, which are based on ozone, PM2.5, PM10, nitrogen dioxide, and carbon monoxide measurements, are reported in real-time on the South Coast AQMD and AirNow websites. Hourly forecasts provide more detailed information about pollution levels throughout the day. This can be useful, for example, in planning out what time of the day would be best for outdoor activities. For regulatory purposes however, a daily average forecast is used. The rule defines the daily ozone air quality forecast as the predicted ambient maximum 8-hour average ozone concentration expected over the 24-hour period which will be used for the SSAB No-Burn Day forecast. This is to distinguish the daily ozone forecast which is used for forecasting No-Burn days from the hourly ozone forecast, which is provided for informational purposes only. Both hourly and daily Basin forecasts can be found on the South Coast AQMD website at: http://www.aqmd.gov/forecast.

For the SSAB, if the ozone contingency measure is triggered, daily ozone air quality forecasts in the SSAB will be used to determine if ozone levels are predicted to exceed the No-Burn threshold during the resulting ozone wood-burning season (September through April). If staff determines that the daily ozone forecast for the SSAB will exceed the No-Burn Day threshold then a No-Burn Day is declared for the SSAB, regardless of the contingency measure status for the SoCAB. Conversely, a determination that the daily ozone forecast for the SoCAB will exceed the SoCAB No-Burn Day threshold (only if the SoCAB ozone contingency measure has been triggered) would result in a No-Burn Day for the SoCAB, regardless of the contingency measure status for the SSAB.

RULE 445

18 The National Oceanic and Atmospheric Administration is a federal agency providing weather forecasts. https://www.noaa.gov/

Current provisions of Rule 445 control PM2.5 wood smoke emissions from wood-burning devices through several mechanisms and would reduce VOC by established contingency measures for applicable ozone standards in SoCAB. These include:

- New developments: prohibiting the installation of wood-burning devices in developments where construction began after March 9, 2009.

- Existing developments: by limiting the sale and installation of wood-burning devices to a:
  - U.S. EPA certified wood-burning heater,
  - pellet-fueled wood-burning heater,
  - masonry heater, or
  - dedicated gaseous-fueled fireplace insert.

- A prohibition against the burning of any product not intended for use as a fuel (e.g., trash, plastics, rubber products and treated wood).

- Sale of only seasoned wood fuel (20 percent or less moisture content by weight) by commercial wood-based fuel sellers between July 1, through to the end of February of the following year.

- A labeling requirement for commercial firewood sellers to affix an indelible label to each package of firewood advising at a minimum that there are times during the year (wood-burning season) when there may be a restriction on product usage (No-Burn Days). The label or alternatively another form of written material which is provided must also list the No-Burn program toll-free number and www.8774NOBURN.org website address. This advisory is intended to let the consumer know that on days declared to be No-Burn days, wood-burning is not allowed.

- PM2.5 Wood-Burning Season Mandatory Burning Curtailment (No-Burn Day): a prohibition on operating an indoor or outdoor wood-burning device, portable outdoor wood-burning device, or wood-fired cooking device during the wood-burning season (November 1 through February of the following year) based on the specified geographic area below 3,000 feet above mean sea level and applicable daily PM2.5 air quality forecast.

- PM2.5 Contingency Measures: upon the issuance of a final determination by the U.S. EPA, that the South Coast Air Basin has failed to comply with the following requirements the applicable date to:
  (A) meet any PM2.5 Reasonable Further Progress (RFP) requirement in an attainment plan approved in accordance with § 51.1012;

(B) meet any quantitative PM2.5 milestone in an attainment plan approved in accordance with § 51.1013;
(C) submit a quantitative PM2.5 milestone report required under § 51.1013(b); or,
(D) attain the applicable PM2.5 NAAQS by the applicable attainment date,

the contingency measure(s) shall be implemented, sequentially and in the order of stringency. The triggers for No-Burn threshold are as follows:

(A) 29 μg/m^3 for first failure;
(B) 28 μg/m^3 for second failure;
(C) 27 μg/m^3 for third failure; and
(D) 26 μg/m^3 for fourth failure.

- Ozone Contingency Measures: upon the issuance of a final determination by the U.S. EPA, that the SoCAB has failed to comply with the following requirements by the applicable date to:
  (A) meet a Reasonable Further Progress (RFP) requirement in an approved attainment plan for an applicable ozone NAAQS; or
  (B) attain an applicable ozone NAAQS by the applicable attainment date, the applicable contingency measure(s) shall be implemented, sequentially and in the order of stringency,

  the contingency measure(s) shall be implemented, sequentially and in the order of stringency. The triggers for No-Burn threshold are as follows:

  (A) 80 ppb for first failure;
  (B) 75 ppb for second failure; and
  (C) 70 ppb for third failure.

- Wood-Burning Season for ozone would be effective September 1 through April 30.

Dedicated gaseous fueled fireplaces or electric powered devices are exempt from the provisions of Rule 445. Additional exemptions exist where there is no natural gas service within 150 feet of the property line, locations 3,000 feet or higher above mean sea level, when the device is the sole source of heat, when the device is in low income households, and for ceremonial fires, as defined in the Rule 444 – Open Burning.

CONTINGENCY MEASURES

In anticipation of a failure to attain the 1997 8-hour ozone standard for the SSAB by the June 2019 attainment date, South Coast AQMD requested that the U.S. EPA reclassify the area from Severe-15 to Extreme ozone nonattainment.[19] On July 10, 2019, the U.S. EPA granted the

[19] 42 U.S.C. 7511(b)(3).

reclassification request, and accordingly, under the new Extreme nonattainment classification, a revision to the State Implementation Plan (SIP) was required to be submitted to the U.S. EPA by February 14, 2021. As a result, the Coachella Valley Extreme Area Plan (for the SSAB) was developed to demonstrate attainment of the 1997 ozone standard before the required deadline of June 15, 2024 and to address the new federal CAA requirements for extreme nonattainment areas. The Coachella Valley Extreme Area Plan (excluding the contingency measure) for the SSAB was submitted to the U.S. EPA for inclusion into the SIP in December 2020, with contingency measures to be addressed in a separate rulemaking process. As a result of a court's requirements for contingency measures in *Bahr v. EPA*, 836 F.3d 1218 (9th Cir. 2016), the U.S. EPA advised South Coast AQMD that the contingency measures identified in the 2016 AQMP were not sufficient, and that South Coast AQMD must adopt a local contingency measure to be triggered upon finding of failure to meet a RFP milestone or failure to attain, by the attainment date, for the 2008 8-hour ozone NAAQS. In 2020, the U.S. EPA approved the ozone portion of the 2016 AQMP for the Coachella Valley, except for the contingency measure requirement for which the U.S. EPA deferred their actions. [20]Clean Air Act Sections 172(c)(9) and 182(c)(9) require contingency measures if an ozone nonattainment area fails to meet the RFP milestones or attain the national primary ambient air quality standard by the attainment date. The contingency measures for the 1997, 2008 and 2015 ozone standards for Coachella Valley are being addressed under amendments to Rule 445 – Wood-Burning Devices.

For the 2015 8-hour ozone standard, the Coachella Valley is classified as a Severe nonattainment area with an attainment date of August 3, 2033. The 2022 AQMP is currently being developed to address the SIP requirements including Reasonably Available Control Measures (RACM), RFP, and attainment demonstration. Consistent with CAA Act Sections 172(c)(9) and 182(c)(9), contingency measures are also required in the event of failure to meet the RFP milestones or attain the 2015 ozone NAAQS by the attainment date.

Contingency measures should provide for emission reductions approximately equivalent to either one-years' worth of air quality improvement or one year's worth of reductions needed for RFP in the years following RFP milestone and attainment years. While the proposed amendments in Rule 445 satisfy a 'triggering mechanism' requirement set by the U.S. EPA based on the *Bahr* case, the reductions from the rule alone are not adequate to satisfy the one year's worth of progress, which is defined as a 3% emission reduction requirement of either NOx or VOC (or combined) per year. [21] However, additional surplus reductions available through existing regulations and programs in place will ensure that the one-years' worth of progress is achieved.

[20] 85 FR 57714 (October 16, 2020).

21 80 FR 12264

The RFP and contingency measure requirements for the 2008 ozone standard were evaluated as part of the 2016 AQMP[22] and subsequently in the 2018 SIP update[23]. Both evaluations demonstrated that baseline emissions in the South Coast Air Basin not only provided the required RFP progress, but surplus reductions amounting to at least one-years' worth of progress (i.e. 3% emission reductions) needed for contingency measures (see Tables VI-C-1A and VI-C-1B of 2016 AQMP, and Tables IX-2 and X-4 of 2018 SIP Update). In other words, given the considerable amount of emission reductions generated from existing rules and regulations, there are surplus reductions for each of the milestone years after accounting for RFP and contingency requirements.

Contingency measures are required to result in emission reductions within one year of a final action by the U.S. EPA. It would be challenging to implement more stringent requirements, achieving additional NOx or VOC reductions, in rules involving other traditional sources within the mandated one-year time period. Retrofitting/replacement of existing equipment with newer technologies/equipment, or any permitting provisions would likely take more than one year to effectively implement. Conversely, the proposed amendment to Rule 445, does not require permitting of units, does not require units be retrofitted or replaced, and does not require reformulation or development of new products. Consequently, Rule 445 is well suited for SSAB contingency provisions since implementing a lower threshold for an ozone No-Burn curtailment program could be easily implemented in less than one year following the triggering of a contingency measure.

Based on the above analysis, the contingency measures for the SSAB will satisfy the contingency requirements for CAA section 172(c)(9) and the U.S. EPA's Ozone Implementation Rule through the proposed amendment to Rule 445. South Coast AQMD's PAR 445, Wood-Burning Devices, provides a contingency measure to be triggered if the Basin fails to meet RFP or attain the applicable ozone standards by the applicable date. The emission reductions anticipated from PAR 445, in conjunction with reductions from existing rules and regulations, are expected to achieve the reductions equivalent to or more than one-years' worth of progress. PAR 445 addresses the contingency measures for RFP and attainment for the applicable ozone standards (1997 8-hour ozone standard, 2008 8-hour ozone standard and 2015 8-hour ozone standard). Contingency measures are required four years from the effective date of designation. Accordingly, the RFP and attainment contingencies for the 2015 8-hour ozone standard are due to the U.S. EPA on August 3, 2022.

22 2016 Air Quality Management Plan. Available at http://www.aqmd.gov/home/air-quality/clean-air-plans/air-quality-mgt-plan/final-2016-aqmp

23 2018 California SIP Update. Available at https://ww2.arb.ca.gov/resources/documents/2018-updates-california-state-implementation-plan-2018-sip-update

PROPOSED AMENDMENTS TO RULE 445

Key elements of the proposed amendment include:

- Clarifying that aesthetic remodeling of an existing wood-burning device, such as for example a fireplace, is prohibited. Adding provisions for the repair of a device for health and safety purposes, or where irreparable such as due to a catastrophic event, allowing for reconstruction as long as there is no emissions increase.

- Adding an ozone contingency measure for the SSAB, mirroring the ozone contingency provision for the SoCAB. The ozone contingency measures for SSAB under the proposed rule, if triggered, achieve emissions reductions not otherwise relied upon in the current control strategy by incrementally lowering the ozone No-Burn Day forecast threshold during the ozone wood-burning season with both incremental and cumulative emissions reductions quantified (see Appendix A).

- Lowering the SoCAB PM2.5 24-hour forecast thresholds for calling a No-Burn Day in subparagraphs (f)(2)(B), (f)(2)(C) and (f)(2)(D) from 28 $\mu g/m^3$ to 27 $\mu g/m^3$, 27 $\mu g/m^3$ to 26 $\mu g/m^3$ and 26 $\mu g/m^3$ to 25 $\mu g/m^3$, respectively. The proposed lower PM2.5 contingency measure thresholds for the SoCAB achieve additional emissions reductions as quantified in Appendix C, should they be triggered.

Specific proposed amendments to the rule are as follows:

(b) Applicability	Clarifies that applicability of the rule extends to the Salton Sea Air Basin (SSAB) in the event that the ozone contingency measure for the SSAB is triggered. Rule Text: The provisions of this rule shall apply to specified persons or businesses within the South Coast Air Basin <u>(SoCAB) and, if the provisions of the ozone contingency measure in paragraph (g)(2) are triggered, the Riverside county portion of the Salton Sea Air Basin (SSAB) which includes the Coachella valley area portions</u> of the South Coast Air Quality Management District:
(c)(15) Definitions - Reconstruction	Defines reconstruction to clarify the requirement for rebuilding or reinstalling a wood-burning device, due to a catastrophic event (wildfire, flood, earthquake or other soil or geologic movements) where the wood-burning device is not the cause:

	Rule Text: RECONSTRUCTION means rebuilding or reinstalling a wood-burning device irreparably damaged due to fire, wildfire, flood, earthquake or other soil or geologic movements, where the wood-burning device was not the cause of the damage or destruction.
(c)(16) Definitions – Repair	Defines repair of a wood-burning device to clarify that it is to ensure proper operation of the unit for health and safety reasons, without increasing dimensions, throughput capacity, or emissions. Rule Text: REPAIR means restoring a wood-burning device to proper working order by replacing or servicing worn or damaged components, including cracked, damaged or worn masonry, crumbling mortar or other components. Repairs shall not increase the dimensions, throughput capacity or emissions potential of the existing wood-burning device. Repair for the purposes of this rule does not include solely aesthetic remodeling.
(c)(17) Definitions – Salton Sea Air Basin (SSAB)	Defines the area of the SSAB within South Coast AQMD jurisdiction. Also, that the Coachella Valley Planning Area or Coachella Valley is a geographic area within the SSAB. Rule Text: SALTON SEA AIR BASIN (SSAB) means for the purposes of this rule only that portion of the Salton Sea Air Basin that is contained within Riverside county, and which also includes the Coachella Valley Area as defined in Rule 103.
(c)(20) Definitions – Source Receptor Area (SRA)	Modifies source receptor area in the rule to include the SSAB. The map shown in the proposed rule as Attachment 1 is listed in this report as Appendix B. Rule Text: SOURCE RECEPTOR AREA (SRA) means any of the numbered areas in the map ~~Basin~~ as shown ~~on the map~~ in Attachment 1. SRA's 1 through 13, 15 through 29, and 32 through 38 are in the South Coast Air Basin (SoCAB). SRA 30 is in the Salton Sea Air Basin (which includes the Coachella Valley Area).

(c)(21) Definitions – South Coast Air Basin (SoCAB)	Adds the acronym for South Coast Air Basin. This will help with notation clarifying provisions of the rule applicable specifically to the SoCAB. Rule Text: SOUTH COAST AIR BASIN (SoCAB) means the non-desert portions of Los Angeles, Riverside, and San Bernardino counties and all of Orange County as defined in California Code of Regulations, Title 17, Section 60104.
(c)(24) Definitions – Wood-Based Fuel	Clarifies that charcoal may only be used as a fuel for cooking, and not for ambience or heating purposes. Rule Text: WOOD-BASED FUEL means any wood, wood-based product, or non-gaseous or non-liquid fuel, including but not limited to manufactured firelogs, wood or pellet products. For the purpose of this rule, charcoal used for cooking is not considered a wood-based fuel.
(d)(3) Requirements – Reconstruct and Repair of Wood-Burning Device	Clarifies that an existing wood-burning device (e.g., a fireplace) may be repaired for non-aesthetic or non-remodeling purposes such as safety issues as defined in the rule, or if irreparable/destroyed reconstructed, as defined (due to a catastrophic event not caused by the wood-burning device) in the rule, without an increase in dimensions, throughput capacity or emissions. Rule Text: Notwithstanding the requirements of paragraph (d)(1) or (d)(2), a wood-burning device may be repaired or, if irreparable, reconstructed as defined in this rule. There shall be no increase in the dimensions, throughput capacity or emissions potential of the reconstructed wood-burning device.
(d)(4) Requirements – Seasoned Wood	Clarifies that only seasoned wood may be used as a fuel. Rule Text: No person shall burn any product not intended for use as fuel in a wood-burning device including, but not limited to, wood unless it is seasoned wood, garbage, treated wood, particle board, plastic products, rubber products, waste petroleum products, paints, coatings or solvents, or coal.
(d)(5) Requirements	Extends by an additional two months the time period during which only seasoned fire wood may be sold (i.e., decreasing by two months the time period during which un-seasoned wood may be sold). This prevents a

– Commercial Firewood	potential conflict in rule requirements between the time period during which un-seasoned wood may be sold and the term of the ozone wood-burning season for both the SoCAB and the SSAB. In the event that ozone contingency measures for either the SoCAB or the SSAB are triggered the wood-burning season would be extended form the current November through February for the SoCAB by an additional four months (and by an eight month period in the SSAB), to September through April. This amendment prevents any potential overlap between the time period during which un-seasoned wood may be sold and the term of the ozone wood-burning season, if triggered, for both the SoCAB and the SSAB. Rule Text: A commercial firewood seller shall only sell seasoned wood from July 1 through the end of ~~February~~ April of the following year. Any commercial firewood seller may sell seasoned as well as non-seasoned wood during the remaining months.
(e) SoCAB Wood-Burning Season PM2.5 Mandatory Burning Curtailment (No-Burn Day)	Clarifies that the PM2.5 No-Burn Day provisions in subdivision (e) of the rule only apply to the SoCAB, and "day" is revised to "Day" for the No-Burn Day abbreviation for clarification purposes only. Rule Text: SoCAB Wood-Burning Season PM2.5 Mandatory Burning Curtailment (No-Burn ~~d~~Day) No person shall operate an indoor or outdoor wood-burning device, portable outdoor wood-burning device, or wood-fired cooking device on a calendar day during the wood-burning season for PM2.5 so declared to the public by the Executive Officer to be a mandatory wood-burning curtailment day (No-Burn Day) ~~day~~ based on the specified geographic area below 3,000 feet above mean sea level and applicable daily PM2.5 air quality forecast as follows: (1) Basin-wide if the daily PM2.5 air quality forecast for any source receptor area exceeds 30 μg/m3 in the SoCAB, or
(f) PM2.5 Contingency Measures	Clarifies that PM2.5 contingency measure is only applicable to the SoCAB. Rule Text: SoCAB PM2.5 Contingency Measures

(f)(1) SoCAB PM2.5 Contingency Measures	Updates South Coast Air Basin with the SoCAB acronym, without any resulting change in the scope of the rule. Rule Text: (1) Upon the issuance of a final determination by U.S. EPA, pursuant to 40 CFR § 51.1014(a), that the ~~South Coast Air Basin~~SoCAB has failed to comply with the following requirements by the applicable date to:
(f)(2) SoCAB PM2.5 Contingency Measures	Clarifies that the existing contingency measures are only with regard to PM2.5, and lowers the ambient PM2.5 24-hour forecast PM2.5 contingency thresholds for calling a No-Burn day. Currently, staff anticipates that a final determination will be made that the SoCAB is in attainment with the 2006 24-hour PM2.5 NAAQS. Staff also anticipates attainment of the 2012 annual PM2.5 standard by the December 31, 2025 attainment due date. However, this proposal will result in steeper PM2.5 emission reductions than would be achieved at the current thresholds if/when the U.S. EPA makes a final determination that the SoCAB has failed to meet an applicable PM2.5 RFP milestone or attain a PM2.5 NAAQS, by an applicable deadline. Rule Text: A Basin-wide, mandatory wood-burning curtailment during the wood-burning season if the daily PM2.5 air quality forecast for any SRA exceeds: (A) 29 µg/m^3 PM2.5, upon a final determination of a failure to comply with any of the provisions of paragraph (f)(1); (B) ~~28~~ 27 µg/m^3 PM2.5, upon a final determination of a failure to comply with any two of the provisions in paragraph (f)(1); (C) ~~27~~ 26 µg/m^3 PM2.5, upon a final determination of a failure to comply with any three of the provisions in paragraph (f)(1); and (D) ~~26~~ 25 µg/m^3 PM2.5, upon a final determination of a failure to comply with any four of the provisions in paragraph (f)(1).

(g) Ozone Contingency Measures	Subdivision (g) clarifies that the ozone contingency measure would be applicable for both the SoCAB and the SSAB. However, paragraph (g)(1) clarifies that the ozone contingency measure triggers for the SoCAB are applicable for the SoCAB only. Paragraph (g)(2) clarifies that the SSAB ozone contingency measure triggers are applicable for the SSAB only. Rule Text: (g) SoCAB and SSAB Ozone Contingency Measures (1) For the SoCAB: Upon the issuance of a final determination by U.S. EPA, that the ~~South Coast Air Basin~~SoCAB has failed to comply with the following requirements by the applicable date to: (A) meet a Reasonable Further Progress (RFP) requirement in an approved attainment plan for an applicable SoCAB ozone NAAQS; or (B) attain an applicable SoCAB ozone NAAQS by the applicable attainment date.~~,~~ For the SoCAB only, the applicable contingency measure(s) specified in paragraph (g)(~~2~~3) shall be implemented, sequentially and in the order of stringency. (2) For the SSAB: Upon the issuance of a final determination by U.S. EPA, that the SSAB has failed to comply with the following requirements by the applicable date to: (A) meet a Reasonable Further Progress (RFP) requirement in an approved attainment plan for an applicable SSAB ozone NAAQS; or (B) attain an applicable SSAB ozone NAAQS by the applicable attainment date. For the SSAB only, the applicable contingency measure(s) specified in paragraph (g)(3) shall be implemented, sequentially and in the order of stringency.

(g) (3) Ozone Contingency Measures	Clarifies that the ozone contingency measure would be in place for both the SoCAB and SSAB. Also, that while the SSAB contingency measure provisions mirror those of the SoCAB, contingency measure for each Basin are triggered independently of the other Basin, and based on a failure to comply with an RFP milestone or to attain an ozone NAAQS, by the applicable attainment date, for the specific Basin. Therefore, the ozone contingency measure could potentially, once a final determination has been made by U.S. EPA for a Basin, be in effect for one Basin and not the other and depending on the timing, due dates and number of determinations made (due to potentially missed deadlines specific to the Basin) result in different No-Burn Day thresholds even when the ozone contingency measure has been triggered for both Basins. In addition, a clarification is provided that the forecast thresholds in subparagraphs (g)(3)(A), (g)(3)(B) and (g)(3)(C) are specific to ozone. Contingency measures, triggered for each final determination of a failure to comply or missed milestone, increase in stringency by decreasing the curtailment forecast threshold in a step wise fashion at 80, 75 and 70 ppb. These forecast thresholds reflect the 1997, 2008 and 2015 8-hour ozone NAAQS, respectively. Once in effect, operation of wood-burning devices on No-Burn days based on the daily maximum 8-hour ozone forecast as defined in paragraph (c)(3), during the wood-burning season for ozone, from September 1 through April 30 as defined in paragraph (c)(27), would be prohibited in all areas of the SSAB located below 3,000 feet. Rule Text: (3) Basin-wide, in the applicable air basin only (SoCAB or SSAB) below 3,000 feet above mean sea level, no person shall operate an indoor or outdoor wood-burning device, portable outdoor wood-burning device, or wood-fired cooking device on a calendar day during the wood-burning season for ozone, so declared by Executive Officer to be a wood-burning curtailment day (No-Burn Day) ~~day~~ due to forecasted ambient ozone concentration levels, if the daily maximum 8-hour ozone air quality forecast for any SRA in the applicable Basin (SoCAB or SSAB) exceeds: (A) 80 ppb ozone, upon a final determination of a first failure to comply with any of the provisions of paragraph (g)(1) or (g)(2), as applicable;

	(B) 75 ppb ozone, upon a final determination of a second failure to comply with any of the provisions of paragraph (g)(1) or (g)(2), as applicable; and (C) 70 ppb ozone, upon a final determination of a third failure to comply with any of the provisions of paragraph (g)(1) or (g)(2), as applicable.
(h) Prohibitions on Permissive Burn Days	No Burn day is updated to No-Burn Day for clarification without impacting the scope of the rule. Rule Text: Prohibitions on Permissive Burn Days as described in Rule 444(c)(25)(C) or restrictions on Marginal Burn Days as described in Rule 444 (c)(21)(D) shall be in effect only if a No-Burn ~~d~~Day is declared during any of the consecutive months of November, December, January or February.
(j) Administrative Requirements	Clarifies wood-burning curtailment as a No-Burn Day, updates both a public noticing method and specifies that No-Burn Day declarations will be made for both the SoCAB and SSAB, as applicable. Rule Text: The Executive Officer will provide public notice of a mandatory wood-burning curtailment (No-Burn Day) through one or more of the following methods: (1) A recorded telephone message; (2) An interactive map showing the areas where burning is prohibited; (~~2~~3) Messages posted on the South Coast Air Quality Management District web site; (~~3~~4) Electronic mail messages to persons or entities that have requested such notice; (4~~5~~) Notifying broadcast and print media operating within the boundaries of the ~~South Coast Air Basin~~SoCAB and the SSAB; and (~~5~~6) Any additional method that the Executive Officer determines is appropriate.

(k) Penalties	Clarifies that penalties are applicable to violations of contingency measure provisions if triggered. Rule Text: Any person that violates the provisions of subdivision (e), (f) or (g) is subject to the following:
Attachment 1- Source Receptor Areas	Attachment 1 of the rule is updated to show the division between air Basins and also major locales in the SSAB which would be subject to the rule if the ozone contingency measure in the rule is triggered.
Other	Other clarifications include updating the numbering sequence in the rule and various references. For example, references in paragraph (i)(5) and (i)(6) of the proposed rule are updated accordingly.

EMISSION REDUCTIONS

- SSAB Ozone Contingency Measure
  Appendix A provides a detailed methodology for the estimated VOC emission reductions from the proposed rule if the SSAB contingency measure is triggered. The methodology is based on an analysis of relevant historical daily ambient ozone concentrations in the SSAB from January 2016 through December 2019. Table 2 summarizes the estimated total annual SSAB VOC emission reductions as detailed in Appendix A. Upon rule amendment, if contingency measures are triggered the resulting VOC emissions reduction will be 0.07 TPY, based on the anticipated number of annual Basin-wide curtailment days at a daily maximum 8-hour ozone air quality forecast threshold of 80 ppb. Similarly, upon triggering a second contingency measure (lowering the forecast threshold to 75 ppb) and triggering a third contingency measure (lowering the forecast threshold to 70 ppb), would result in estimated VOC emissions reductions of 0.24 and 0.89 TPY, respectively.

Table 2 - Estimated VOC Reductions (TPY) By Ozone Curtailment Thresholds

SSAB Daily Maximum 8-Hour Ozone Contingency	Upon Triggering the First Threshold	Upon Triggering a Second Threshold	Upon Triggering a Third Threshold
Forecast Threshold	80 ppb	75 ppb	70 ppb
TPY	0.07	0.24	0.89

- SoCAB PM2.5 Contingency Measure No-Burn Day Threshold Reduction
  Appendix C provides a detailed methodology for the estimated PM2.5 emission reductions from the proposed reduction of PM2.5 No-Burn Day thresholds. The methodology is based on an analysis of relevant historical daily ambient ozone concentrations in the SoCAB from January 2016 through December 2019. Table 3 summarizes the estimated total annual SoCAB PM2.5 emission reductions as detailed in Appendix C. Upon rule amendment, if the contingency measure is triggered the resulting PM2.5 emissions reduction would be 220.7, 239.8 and 257.2 TPY, respectively.

Table 3 - Estimated PM2.5 Reductions (TPY) For Reduced PM2.5 Contingency Threshold Reductions

SoCAB Daily PM2.5 Contingency	Total Reduction	Additional Reductions beyond Current Rule	Incremental Reductions
Existing Rule – Threshold at 29 $\mu g/m^3$	185.9	----------	----------
Proposed amendment – Lowering Threshold to 27 $\mu g/m^3$	220.7	34.8	34.8
Proposed amendment – Lowering Threshold to 26 $\mu g/m^3$	239.8	53.9	19.1
Proposed amendment – Lowering Threshold to 25 $\mu g/m^3$	257.2	71.3	17.4

AFFECTED SOURCES

An estimated 1.4 million wood-burning devices in the SoCAB are currently subject to the provisions of Rule 445. It is estimated that up to 0.4 million wood-burning devices would be potentially subject to the provisions of Rule 445 in the SSAB if the proposed SSAB ozone contingency measure is triggered.[24] The number of affected sources is not anticipated to change greatly since wood-burning devices have lengthy lifetimes and Rule 445 prohibits the installation of wood-burning devices in new developments or remodeling of existing fireplaces. Rather it is anticipated that the proposed amendments will decrease the number of days that the devices can be operated resulting in emissions reductions. No additional costs are expected to be incurred from the proposed amendment. Provisions of the proposed amended rule would largely impact wood-burning devices which are almost exclusively used for aesthetic purposes.

PUBLIC PROCESS

PAR 445 is being developed through a public process. A Public Workshop is scheduled for March 25, 2021, with close of comments on April 8, 2021 and the proposal is scheduled to be presented at the Stationary Source Committee on April 16, 2021.

SOCIOECONOMIC ASSESSMENT

A socioeconomic impact assessment will be conducted and released for public review and comment at least 30 days prior to the South Coast AQMD Governing Board Hearing, which is anticipated to be on June 4, 2021.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Pursuant to the California Environmental Quality Act (CEQA) and South Coast AQMD's certified regulatory program (Public Resources Code Section 21080.5, CEQA Guidelines Section 15251(l) and South Coast AQMD Rule 110), the South Coast AQMD, as lead agency, is reviewing the proposed project to determine if it will result in any potential adverse environmental impacts. Appropriate CEQA documentation will be prepared based on the analysis.

24 James E. Houck and Brian N. Eagle, "Residential Wood Combustion Emission Inventory South Coast Air Basin and Coachella Valley Portion of Salton Sea Air Basin 2002 Base Year" Based on a 2002, www.omni-test.com, October 24, 2006, http://www.omni-test.com/publications/SCAQMD-RWC4.pdf.

CONCLUSION

It is necessary to amend Rule 445 to promulgate a new contingency measure for the SSAB to satisfy U.S. EPA concerns that existing AQMP ozone measures do not satisfy requirements under CAA section 172(c)(9) subsequent to the decision in *Bahr vs. EPA*. Furthermore, the South Coast AQMD is under a deadline of June 30, 2021, to submit an ozone RFP contingency measure for the SSAB to the U.S. EPA. Amending Rule 445 satisfies this requirement by adding such a contingency measure for ozone in the rule. The proposed amendment would add a new ozone contingency measure specific to the SSAB that would be triggered upon a finding of a failure to comply with either an 8-hour ozone RFP milestone or NAAQS, by the applicable due date. If triggered in the SSAB, the contingency would, during a September through April wood-burning season for ozone, require wood-burning curtailment (No-Burn Day) when the daily maximum ozone is forecast to exceed 80 ppb in the SSAB. Subsequent determinations of a failure would automatically and incrementally lower the wood-burning curtailment threshold for ozone to 75 ppb and then 70ppb. Ozone precursor VOC emissions reductions are estimated to average 0.07, 0.24 and 0.89 TPY, respectively.

Staff anticipates a final determination by U.S. EPA that the SoCAB is currently in attainment with the PM2.5 24-hour NAAQS. Furthermore, staff anticipates that the SoCAB will also attain the PM2.5 annual NAAQS by the applicable due date. However, in order to further ensure attainment as expeditiously as practicable, staff is proposing to strengthen the contingency measure for the SoCAB. The proposed amendment would reduce current thresholds for the PM2.5 SoCAB No-Burn Day provision from 28 $\mu g/m^3$ to 27 $\mu g/m^3$, 27 $\mu g/m^3$ to 26 $\mu g/m^3$, 26 $\mu g/m^3$ to 25 $\mu g/m^3$, which if triggered, are estimated to reduce ambient PM2.5 emissions 220.7, 239.8 and 257.2 TPY, respectively.

In addition, staff is responding to comments provided by U.S. EPA during the June 2020 Rule 445 rulemaking effort. Proposed rule language would clarify that remodeling of fireplaces and other wood-burning devices is prohibited except for health and safety related repairs, or reconstruction where an existing wood-burning device is destroyed due to a catastrophe. Neither repair nor reconstruction can increase dimensions, throughput capacity, or emissions. Also, an analysis is provided demonstrating that a rule provision mandating fireplaces be converted to a less polluting device option when ownership of a property is transferred, is not cost-effective. Furthermore, the proposed amendments are anticipated to have negligible cost impacts and no negative environmental impacts.

DRAFT FINDINGS UNDER CALIFORNIA HEALTH AND SAFETY CODE SECTION 40727

Requirement to Make Findings:

California Health and Safety Code Section 40727 requires that prior to adopting, amending or repealing a rule or regulation, the South Coast AQMD Governing Board shall make findings of

necessity, authority, clarity, consistency, non-duplication, and reference based on relevant information presented at the public hearing and in the staff report.

Necessity
Proposed Amended Rule 445 is needed to promulgate additional contingency measures required under Clean Air Act Section 172(c)(9), 42 U.S.C. Section 7502(c)(9), to be put into effect and which can be automatically triggered upon an EPA finding of failure to meet reasonable further progress or attainment for an applicable ozone standard, as required by Bahr v. EPA, 836 Fd.3d 1218 (9th Cir. 2016).

Authority
The South Coast AQMD Governing Board has authority to adopt Proposed Amended Rule 445 pursuant to the California Health and Safety Code Sections 39002, 40000, 40001, 40440, 40702, 40725 through 40728, and 41508.

Clarity
Proposed Amended Rule 445 is written or displayed so that its meaning can be easily understood by the persons directly affected by it. The addition of definitions will improve the clarity.

Consistency
Proposed Amended Rule 445 is in harmony with and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations.

Non-Duplication
Proposed Amended Rule 445 will not impose the same requirements as any existing state or federal regulations. The proposed amended rule is necessary and proper to execute the powers and duties granted to, and imposed upon, the South Coast AQMD.

Reference
By adopting Proposed Amended Rule 445 the South Coast AQMD Governing Board will be implementing, interpreting or making specific the requirements in Clean Air Act Section 172(c)(9), 42 U.S.C. Section 7502(c)(9), as articulated by Bahr v. EPA, 836 F3d 1218 (9th Cir. 2016).

COMPARATIVE ANALYSIS

Under California Health and Safety Code Section 40727.2, the South Coast AQMD is required to perform a comparative written analysis when adopting, amending, or repealing a rule or regulation. The comparative analysis is relative to existing federal requirements, existing or proposed South Coast AQMD rules and air pollution control requirements and guidelines which are applicable to wood-burning devices. The proposed ozone-related amendments to Rule 445 do not conflict or

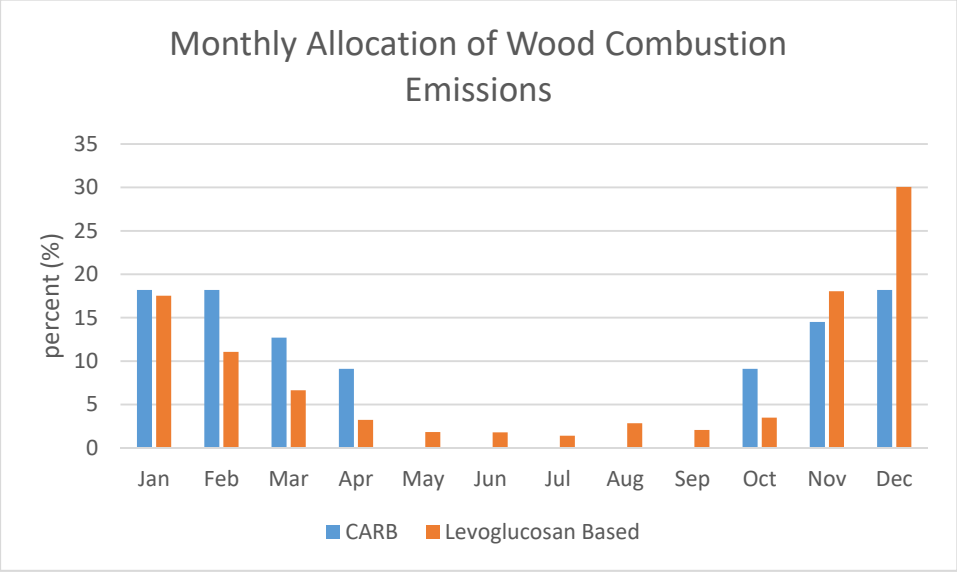
overlap with existing federal requirements for wood burning devices. Existing provisions of Rule 445 for PM2.5 do not conflict with existing federal requirements for PM2.5 for wood burning devices in U.S. EPA's New Source Performance Standards, 40 CFR pt. 60, Sub. AAA. South Coast AQMD's only other regulation pertaining to burning, Rule 444 regulates open burning and does not conflict with Rule 445.

VOC Emission Reductions Expected from the Rule Amendment

1. Baseline Emissions

Annual average VOC emissions developed for the 2016 AQMP were utilized to estimate reductions expected from the proposed amended Rule 445. The two emission categories subject to the rule are Residential Wood combustion for Wood Stoves and Fireplaces. The annual average emissions of VOC from the two categories are 0.385 tons per day (TPD) in 2017. The rule baseline emissions do not change in future years. Excluding mountainous areas with altitude higher than 3000 ft, the wide total emissions subject to the rule are 0.243 TPD in annual average emissions.

Residential wood burning has a distinctive seasonal signal with more activity during cold months and less in warm months. Wood burning emissions used to be allocated in January to April and October to December[1]. However, recent levoglucosan measurements indicate that wood burning occurs throughout the year in the South Coast Air Basin. Levoglucosan is an organic compound indicating the presence of wood burning smoke. The measurements were taken at 10 locations within the South Coast Air Basin as a part of Multiple Air Toxics Exposure Study V (MATES V) conducted during the period of May 2018 to April 2019. Figure 1 provides monthly fraction of levoglucosan concentrations using averages of the 10 sites data. The measurements indicate that December has the highest wood burning activities and July has the lowest. The CARB's method to allocate annual average emissions from wood combustion to each month is included for comparison in Figure 1. While levoglucosan data is still preliminary, it clearly indicates the presence of wood burning smoke during summer months. Therefore, the monthly allocation factors based on the levoglucosan data are used to estimate emission reductions benefits from the proposed rule amendment.



[1] CARB Methodology Updates: Residential Wood Combustion, 2015. Available at https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full7-1_2011.pdf

Figure 1. Monthly Allocation of Wood Combustion Emissions

Daily average VOC emissions for each month are provided in Table 1. The daily average emissions for each month follows the trend in levoglucosan concentrations shown in Figure 1, showing the highest wood combustion emissions in December and the lowest in July.

Table1. Calculation of 2017 daily average VOC emissions per month

Month	Number of days per month	Percent of Emissions Occurring in each Month (%)	VOC Emissions per Month (tons per year)	VOC Emissions per Day in each Month (tons per day)
1	31	17.53	15.5	0.501
2	28	11.06	9.8	0.350
3	31	6.64	5.9	0.190
4	30	3.23	2.9	0.095
5	31	1.84	1.6	0.053
6	30	1.79	1.6	0.053
7	31	1.41	1.2	0.040
8	31	2.84	2.5	0.081
9	30	2.06	1.8	0.061
10	31	3.48	3.1	0.099
11	30	18.05	16.0	0.533
12	31	30.07	26.6	0.859
Annual Total	365	100.00	88.6	0.243

1. Emission Reductions from the Proposed Rule Amendment

The proposed amendment expands the rule to the Coachella Valley. The season subject to the curtailment is September to April. The thresholds to trigger the curtailment are 80, 75 and 70 ppb, which will be used as needed to comply with clean air act requirements as listed in the rule.

In order to estimate emission reductions benefits from the amendment, the number of days exceeding a specific threshold were counted using 2016-2019 data (Table 2). These numbers are the average of the four-year data so they appear as a fraction of a day.

Table 2. The number of 8-hour ozone exceedance days per month

Month	Number of days exceeding 70 ppb	Number of days exceeding 75 ppb	Number of days exceeding 80 ppb
1	0.00	0.00	0.00

2	0.25	0.00	0.00
3	1.50	0.00	0.00
4	5.75	2.25	0.75
5	7.25	4.25	2.00
6	19.00	12.00	8.25
7	14.25	7.75	4.25
8	9.75	3.75	1.00
9	2.25	1.25	0.25
10	1.25	0.25	0.00
11	0.00	0.00	0.00
12	0.00	0.00	0.00

The number of exceedance days were multiplied by the daily average VOC emissions specified for each month, and multiplied by 0.75 to account for 75 percent compliance rate, to estimate emission reductions associated with each curtailment threshold (Table 3). Table 4 summarizes net VOC reductions with the expansion of curtailment season and ozone as curtailment trigger.

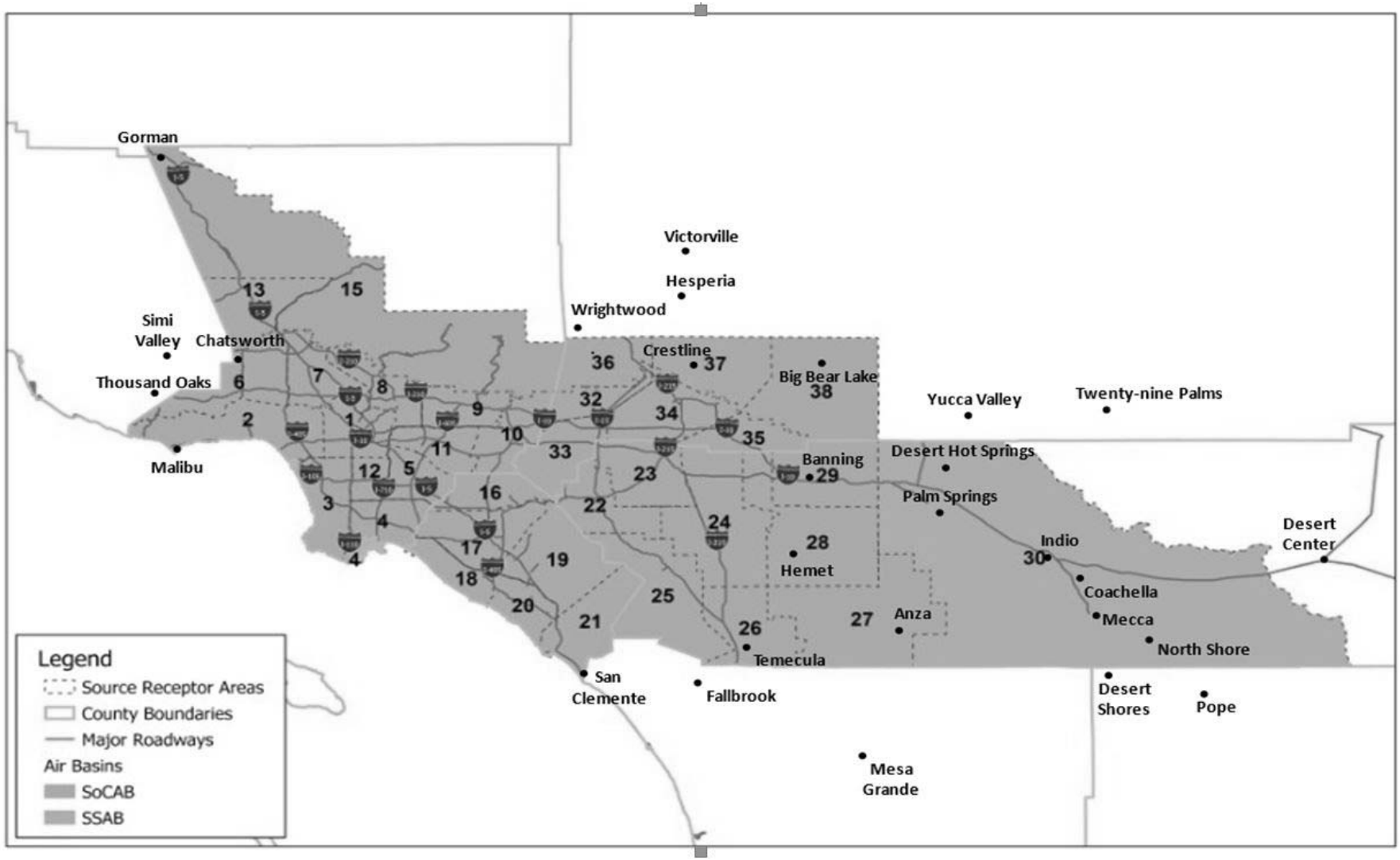
Table 3. VOC emission reductions per month (tons/month) for each curtailment threshold

Month	70ppb	75ppb	80ppb
Jan	0.00	0.00	0.00
Feb	0.07	0.00	0.00
Mar	0.21	0.00	0.00
Apr	0.41	0.16	0.05
May	0.29	0.17	0.08
Jun	0.75	0.48	0.33
Jul	0.43	0.23	0.13
Aug	0.59	0.23	0.06
Sep	0.10	0.06	0.01
Oct	0.09	0.02	0.00
Nov	0.00	0.00	0.00
Dec	0.00	0.00	0.00

Table 4. Cumulative VOC emission reductions expected during curtailment season (September through April) from the rule amendment.

Curtailment Threshold	**70ppb**	**75ppb**	**80ppb**
VOC Reductions (tons per year)	**0.89**	**0.24**	**0.07**

Source Receptor Areas (SRAs) in the South Coast Air Basin (SoCAB) and the Salton Sea Air Basin (SSAB). Note: unshaded areas are not subject to Rule 445 (including Desert Center located in the MDAB)



Appendix C – PM2.5 Emissions Reductions Expected from the Rule Amendment

1. Baseline Emissions

Annual average PM2.5 emissions developed for the 2016 AQMP were utilized to estimate reductions expected from the proposed amended Rule 445. Two emission categories subject to the rule are Residential Wood combustion for Wood Stoves and Fireplaces. The total PM2.5 emissions from the two categories are 4.944 tons per day (TPD) in 2017 in annual average emissions. Excluding mountainous areas with altitude higher than 3000 ft, the basin-wide total emissions subject to the rule is 4.416 TPD in annual average emissions.

Due to the South Coast Air Basin's failure to attain the 2006 24-hour PM2.5 NAAQS in 2019, the curtailment threshold for the Basin is lowered to 29 ug/m3 per the rule amendment adopted in June 5, 2020. To be consistent to the emission benefit calculations included in the recent rule amendments occurred in June and October 2020, 2017 annual average emissions are used in the current analysis. The rule base emissions in 2017 is 4.944

Residential wood burning has a distinctive seasonal signal with more activity during cold months and less in warm months. Winter day emissions were estimated using the methodology included in the South Coast AQMD staff reports[1]. 69% of PM2.5 emissions is estimated to occur during winter months (November through February) according to CARB's temporal allocation factors[2]. In addition, a 75 percent compliance rate was assumed as indicated in the staff report.

2. Emission Reductions from lowering the curtailment threshold

PM2.5 emission reductions associated with subsequent lower thresholds are provided in the Table 1. The number of days exceeding a given threshold in table is an average of 2016 to 2019.

Table 1, The number of days 24-hour PM2.5 exceeding the thresholds and PM2.5 emission reductions associated with additional curtailment days due to lowering threshold

Threshold (ug/m^3)	Number of Days Exceeding threshold	PM2.5 Reductions (tons per year)
29	26.75	185.9
28	29.75	206.8
27	31.75	220.7
26	34.50	239.8
25	37.00	257.2

[1] South Coast AQMD Governing Board Agenda No. 37, March 7, 2008, Staff Report.

South Coast AQMD Governing Board Agenda No. 26, June 5, 2020, Staff Report.

[2] CARB Methodology Updates: Residential Wood Combustion, 2015. Available at https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full7-1_2011.pdf

Appendix D – Estimated Cost-effectiveness of Rendering a Residential Open Hearth Fireplace Inoperable by Replacing/Retrofitting With a Less Polluting Device in the South Coast AQMD

Cost effectiveness (C/E) is a measure of the cost of pollutant reduction and is given as:

$$Cost\text{-}effectivness\ (C/E) = \frac{Present\ Value\ Cost\ (PVC)}{Lifetime\ Emissions\ Reduction\ (LER)} \quad (1)$$

This analysis considers the estimated C/E of converting an existing interior residential open-hearth fireplace (OHF) used primarily for ambience purposes, by either replacing or retrofitting (ROR) the OHF with a less polluting alternative (device).

Fireplaces and Wood-Burning Devices

A typical OHF in an interior space (space) or room consists of a front opening, an interior firebox constructed of firebrick where wood fuel is burned, with hot combustion gases vented through a chimney directly above the firebox to the exterior of the building. Heat is radiated into the space through the front of fireplace which also provides visual aesthetics. Other forms of interior residential wood-burning devices include wood-stoves, gas log sets, fireplace inserts, masonry fireplaces and pellet stoves. OHF's can be replaced with a free-standing unit such as for example a wood-burning stove, which typically requires dedicated venting, or retrofitted with devices that are situated inside the firebox such as a gas log set or a fireplace insert. OHF's, and similarly gas log sets, are the most inefficient types of residential wood-burning device since approximately 93% of the useful heat generated, is lost in the hot flue gases exhausted through the chimney.[28] In contrast, wood-stoves, fireplace inserts and other similar devices that typically use sealed combustion with venting (for more complete burning) and in some devices a fan (to move heated air into the space being heated) are far more efficient resulting in more space heating per unit of fuel (typically 68-78%). The increased efficiency of these other devices also results in less air pollution in contrast to an OHF, for the same amount of heat produced. In the South Coast AQMD wood-burning devices are operated mainly for ambience purposes, generally used for mood setting or decorative purposes, being lit occasionally, during the cooler seasons of the year. Space heating is typically provided by another primary source of heating such as, for example, a gas furnace. As such the OHF is both the most inefficient way to heat a space and results in the most air pollutant emissions when operated, and so is also almost exclusively used for ambience purposes.[29]

[28] https://www3.epa.gov/ttnchie1/efdocs/rwc_pm25.pdf; https://www.epa.gov/sites/production/files/2020-09/documents/woodstoveapp.pdf (Table 4)

[29] https://www.epa.gov/sites/production/files/2020-09/documents/1.9_residential_fireplaces.pdf

Emission Reduction

Emission reduction is measured as the difference between the pre- (Baseline) and post- (Controlled) emissions from the source. Affordability increases conversely to the cost-effectiveness value (so that the lower the cost-effectiveness value the more "cost effective' the control). Therefore, from equation (1) above:

- There is a direct correlation between baseline emissions and how "cost effective" or affordable the control is. The higher the Baseline, the more emissions reduction is realized for a given device or control at a set cost, and so the more cost effective the control. An OHF is the most polluting wood-burning device with the highest Baseline for PM2.5 emissions for a given time period of operation and is therefore the most conservative choice for the Baseline.
- There is an inverse correlation between the controlled emissions and how "cost effective" or affordable the control is. The more emissions are controlled or reduced; the more cost effective the control. Natural gas (gas) fueled fireplace log sets and inserts have minimal PM2.5 emissions and electric fireplace inserts are assumed to achieve 100% PM2.5 emissions reduction, as compared to an OHF. This analysis conservatively assumes a control factor of 100%. That is the ROR device eliminates all the OHF PM2.5.

Emission reductions are estimated over a unit of time. Typically, daily, annual or lifetime (LER) and these correlations apply in all cases.

Fuel

Cord wood,[30] and manufactured fire logs (typically 60% wax and 40% compressed sawdust) are the two types of OHF fuel. Fuel factors affecting C/E are:

- Manufactured fire logs: burn for a longer period of time and burn cleaner than cord wood resulting in lower emissions since less fuel is used for the same utilization period of an OHF.[31] Therefore, assuming cord wood as the OHF fuel in this analysis, is the most conservative assumption for estimating C/E since it results in higher controlled emissions as compared to manufactured fire logs. Note that while cord wood is a fuel; consumption of cord wood is often measured in the unit of cords. One cord of stacked wood typically has dimensions of 4 x 4 x 8 feet and has a volume of 128 cubic feet.[32]
- Thermal properties of cord wood: vary based on wood density which varies by wood species. Less wood is burned, resulting in less emissions for a set OHF utilization time, if a denser wood species is selected. The density of cord wood varies by state due to the variation in the regional tree species, with less dense wood species located in the southwest region of the US.[33] The US EPA Burnwise Air Quality Tool Emissions Calculator (AQTEC) shows the average wood density

[30] https://www.epa.gov/burnwise/cord-wood-and-crib-wood-testing

[31] https://www.epa.gov/sites/production/files/2020-09/documents/woodstoveapp.pdf (Table 4)

[32] US EPA AP-42 and https://www.thespruce.com/firewood-cord-storage-1907998

[33] https://www3.epa.gov/ttnchie1/efdocs/rwc_pm25.pdf

by state ranging from 1.02 to 1.39 Ton per Dry Cord, with an average value of 1.04 Ton per Dry Cord for California.

- Moisture content: increases density and also leads to incomplete combustion, resulting in increased emissions. For this analysis dry cord wood is assumed with a maximum moisture content of 20%.[34]
- Cord wood PM2.5 emission factor: as provided by the AQTEC is 22.2 lb per ton of any dry cord wood. CARB uses a slightly higher factor of 22.7 lb per ton of dry cord wood which is conservatively used in this analysis.[35]

Climate

The jurisdiction of the South Coast AQMD, below 3,000 feet above mean sea level, encompasses oceanside municipalities with a typically more temperate climate and narrower range of temperatures as well as inland communities with typically colder winter time weather and a larger range of temperature fluctuation. Correspondingly, temperatures vary across the jurisdiction both in the number of days and temperature variation/extremes. There is typically a positive correlation between the use or utilization of wood-burning devices, and colder days both for ambience and heating purposes. The AQTEC provides "climate zones" for the US ranging from 1 to 5, with 1 being the coldest and 5 being the mildest annual climate average. AQTEC also provides a Burn Rate, reflecting the amount of wood burned annually. Colder climates will have a higher burn rate as more wood fuel is consumed for heating, while milder climates will have a lower burn rate reflecting mostly ambience use. Burn rates are also dependent on the type of wood-burning device being used since more efficient devices (such as wood-burning stoves) require less wood fuel when operated for the same amount of time (to produce the same ambience effect or heat). The AQTEC climate zones are designated as either 4 or 5 for geographic locations in the jurisdiction of the South Coast AQMD (Los Angeles, Orange, Riverside and San Bernardino counties). This analysis uses the more conservative colder climate zone of 4, with a higher associated burn rate of 0.44 dry wood cord per year for fireplaces.

Fireplace Baseline Emissions

Based on the preceding, the annual Baseline PM2.5 emissions for a residential OHF burning dry cord wood in the South Coast AQMD jurisdiction is estimated as follows:

OHF PM2.5 Emissions =	PM2.5 Emissions Factor	X	Dry Cord Wood Density	X	Dry Cord Wood Burn Rate	X	lb per Ton

or,

[34] US EPA guidance and South Coast AQMD Rule 445 limit dry wood moisture content to ≤ 20%. https://www.epa.gov/sites/production/files/2020-11/documents/moisturemeter_flyer_02112020_v1_d35_print_opt.pdf

[35] https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full7-1_2011.pdf

$$= \frac{22.7\ lb\ PM2.5}{Ton} \times \frac{1.04\ Ton}{1\ cord\ dry\ wood} \times \frac{0.44\ cord\ dry\ wood}{year} \times \frac{1\ Ton}{2{,}000\ lb}$$

$$= \frac{0.00519\ Ton\ PM2.5}{year} \quad (2)$$

Approximately, 96.3% of PM10 is comprised of PM2.5, so that an equivalent Baseline PM10 is estimated as follows:

$$\text{OHF PM10 Emisisons} = \frac{0.00519\ Ton\ PM2.5}{year} \times \frac{1\ Ton\ PM10}{0.963\ Ton\ PM2.5} = \frac{0.00539\ Ton\ PM10}{year}$$

Conservatively, assuming that the Baseline emissions from the OHF are 100% controlled by the ROR device implies emissions reductions of 0.00519 TPY of PM2.5, or 0.00539 TPY of PM10.

Present Value Cost (PVC)

The PVC component of the cost-effectiveness equation (1) is calculated as the sum of the initial up-front or capital cost (C), plus the present value of the lifetime annual costs. It is assumed that an OHF can be replaced by a free-standing wood-burning device and the OHF rendered inoperable, or converted (or retrofitted) with an alternative device (such as for example a gas fireplace insert which is installed permanently inside the firebox area).

Capital Cost (C) is determined assuming three types of device options for ROR of an existing OHF, a:

1. Current US EPA certified wood-burning device,
2. Gaseous fueled (natural gas or gas) device, or
3. Electric device

This analysis conservatively assumes an idealized ROR device that incorporates each of the following features:

1. controls or achieves 100% PM2.5 emissions reduction;
2. the ROR device renders the OHF permanently inoperable such the OHF can no longer be used to burn wood;
3. has the lowest capital cost (even though it is unlikely that an OHF that is permanently rendered inoperable by installing a ROR device primarily used for ambiance heating and decorative purposes will be a basic model);

Fireplaces are typically classified based on the width of the front opening. While width can vary from as little as 24 inches to as large as 72 inches, and also include custom width's, a 36-inch width is considered standard in the industry and the most prevalent width for OHFs. There is a broad range in capital cost even for a 36-inch width, ROR device based on a variety of factors including:

- Fuel efficiency: as mentioned gas fireplace inserts, especially higher end models equipped with a blower fan have higher fuel/heating (typically 60 – 85%) efficiencies in contrast to an OHF or gas log set where about 93% of the heat is lost through the chimney.[36]
- Insert/gas log size: typically, 18" or 24";
- Availability and delivery: due to production and logistical issues limiting the selection to an available ROR device;
- Infrastructure: including availability of gas and electric utility lines, extending gas/electric lines to the device, potential structural modifications to walls, masonry or other necessary modifications for proper ROR device installation, and also rendering the OHF inoperable where applicable;
- Warranties: generally, range from 1 to 10 years and tend to correlate with the capital cost of the device. While devices typically last beyond the end of the warranty period, warranties are a good indicator of the guaranteed useful lifetime of the device. This analysis assumes that if a shorter lifetime (within the warranty period) is considered then, minimal maintenance and no repair costs are incurred (as shown in Table 1). Conversely, if a higher useful lifetime beyond the warranty period is assumed then higher maintenance and repair costs are incurred (as shown in Table 2).
- Optional safety features: basic ROR fossil fueled devices are match lit, however additional safety and optional convenience features include a standing pilot and electronic ignition;
- Flame appearance: which affects how closely the ROR device resembles a real wood fire in appearance is an important factor in decorative/ambience applications Electric ROR devices are un-popular due to a lack of this feature as compared to similar gas fired devices.

If OHF conversion to a ROR device is a rule requirement then, the emission reductions from the mandated ROR device must be permanent, verifiable, and practically enforceable. Due to the potential for dual fuel utilization therefore, a gas log set retrofit is not considered to be a qualifying option. Furthermore, while annual operational (fuel) cost may be lower, the emissions, capital cost, installation, and maintenance costs of a higher efficiency free standing wood-stove or wood-burning fireplace insert are all higher (and therefore the C/E) than for a comparable fireplace gas insert, so that the analysis of a gas or electric fireplace insert retrofit device provides the most conservative or cost effective device option.

Excluding, availability, infrastructure issues, and the addition of optional safety/convenience features the typical range of capital costs for retrofit device types (cost and installation) are shown in Table 1:

[36] Wood-burning devices: https://cfpub.epa.gov/oarweb/woodstove/index.cfm?fuseaction=app.about and Natural gas fired devices: https://www.heatilator.com/shopping-tools/blog/look-to-gas-fireplaces-for-home-heating-help and https://www.hgtv.com/design/remodel/mechanical-systems/gas-fireplaces-offer-efficient-heating-choices

Retrofit Device	Cost	Installation (not including infrastructure) [37]
Gas insert	$1,200 – 3,600	$750 – 950 (fit and finish work)
Electric insert[38]	$300[39] – 3,400	$50 - 200 (fit and finish work)

Annual costs (A), include operating (predominantly fuel), maintenance and repair costs, and are incurred in future years as the device is operated. Operating and manufacturers recommended maintenance costs are incurred annually while repair costs are typically incurred sporadically. The estimated repair cost is determined as an annual average of the estimated lifetime repair costs. Estimated annual average repair costs are assumed to be zero during the warranty period of the device but increase proportionally with a longer useful life. To assess the impact of future costs at the time of retrofit (Present) a discounted cash flow (DCF) methodology incorporating a Present Value Factor (PVF) is used to discount future estimated costs to a present value cost (PVC) based on a nominal or opportunity cost rate (i), inflation rate (f) and retrofit device lifetime (n). The discount rate (r) incorporates both the nominal and inflation rates so the equation for the PVF is given as:[40]

$$PVF = \frac{\left[1 - \frac{1}{(1+r)^n}\right]}{r}$$

So that, total or present value cost (PVC) is given as:

$$Present\ Value\ Cost\ (PVC) = C + (A \times PVF) \quad (3)$$

Operation (fuel) cost is directly correlated with usage. This analysis assumes that device utilization, for ambience purposes, is independent of the type of ROR device. That is regardless of the type of device, utilization is about the same amount of time each year (i.e., the ROR has the same utilization pattern or use profile being utilized during similar time periods as the OHF being displaced). Based on an

37 Based on delivery and installation by licensed professional installer and including work warranty. Telephone conversation with Jon Harman, San Bernardino Fireplace Woodstove & BBQ Specialties, February 2021. This vendor has completed numerous SCAQMD incentive funded device installations and has had to re-do many cheaper improper initial installations.

38 Lower cost models do not provide the same space heating which while not a primary purpose of the device is important since the device is operated during colder times and is expected to provide heat also.

39 Lower priced decorative models do not provide sufficient comparable space heating as provided by an OHF.

40 Where r = (i - f)/(1 + f), i = nominal interest rate, and f = inflation. South Coast AQMD BACT analysis uses a standard value of r = 4% which incorporates standard values for i and f. For conformity and comparative purposes the same rate is assumed in this analysis.

estimated average OHF burn rate of 6 lb dry cord wood per hour[41] the OHF annual number of hours of utilization, is estimated as follows:

$$\text{OHF annual hours of utilization} = \text{Dry cord wood hourly burn rate} \times \text{Dry cord wood Density} \times \text{Dry cord wood annual utilization rate} \times \text{lb per ton}$$

or,

$$= \frac{1\ hour\ of\ utilization}{6\ lb\ dry\ cord\ wood} \times \frac{1.04\ Ton\ dry\ cord\ wood}{1\ cord\ dry\ wood} \times \frac{0.44\ cord\ dry\ wood}{year} \times \frac{2{,}000\ lb}{1\ Ton}$$

$$= \frac{152.5\ hours\ of\ operation}{year}$$

Annual cost (A) is therefore an estimated lifetime average or annualized value for anticipated annual costs. For the retrofit device it is determined by subtracting the estimated annualized costs of the displaced OHF from the estimated annualized costs of the retrofit device, since after retrofitting, costs associated with the OHF will no longer be incurred:

$$\begin{aligned} Annual\ Cost\ = \ & (Device\ Annualized\ \ Operating\ Cost - OHF\ Annualized\ \ Operating\ Cost) \\ & + (Device\ Annualized\ \ Maintenance\ \ Cost - OHF\ Annualized\ \ Maintenance\ \ Cost) \\ & + (Device\ Annualized\ \ Repair\ Cost - OHF\ Annualized\ \ Repair\ Cost) \end{aligned}$$

Cost-effectiveness (C/E)[42]

Since there are many factors influencing C/E it is better estimated as a range since a single value is unlikely to be representative of the broad range of possible scenarios, especially if the rule were to have a provision mandating ROR of OHF. While any number of variables can alter the C/E estimate, in this analysis the anticipated useful lifetime (n) and as a result the annual cost (A) have a large impact. Tables 2 and 3 show the range of anticipated C/E values for n = 10 years and n = 30 years, respectively.

Table 2 provides an estimate of C/E for three replacement device scenarios, incorporating the following assumptions:

- OHF annualized cost.
- Lifetime (n) equivalent to the warranty period = 10 years.

41 https://www3.epa.gov/ttnchie1/efdocs/rwc_pm25.pdf (Houck)

42 For a good, concise reference on present value (cost) of a stream of future expenses see http://pages.stern.nyu.edu/~adamodar/New_Home_Page/PVPrimer/pvprimer.htm and also the South Coast AQMD procedures "Cost Effectiveness Values and Calculations" at https://www.aqmd.gov/home/permits/bact/cost-effectiveness-values

  - Device profiles for:1) a lower gas insert cost with lowest licensed professional installation cost, 2) a lower gas insert cost with a higher licensed professional installation cost, and 3) a lower cost electric insert with lowest professional installation cost. Higher installation cost includes potential property related estimated infrastructure costs, such as for example running a gas line to the device, but does not include potential off-property costs such as utility hook-up. Lowest cost for a comparable electric fireplace insert is a device that provides somewhat of an aesthetic/ambience effect and comparable secondary space heating.
- Devices have no additional options or extended features as discussed above.
- Utilization for ambiance use of the OHF and ROR device is the same number of hours annually.
- Device ratings (fuel/power consumption) affect the annual operating (fuel) cost of the device. The fireplace gas insert is assumed to be 70% more efficient than the gas log set an efficiency of 70% is assumed for the gas insert with a net overall efficiency of 64% compared to at, gas log set (60,000 Btu/hr), with a resulting lower operating cost.
- Manufacturer/industry guidelines recommend annual maintenance with costs ranging from $50 to $195 based on the complexity of the device. Anecdotal evidence however that maintenance typically performed on average every 3 years. A value of $17 per year is conservatively used reflecting this and the assumption that under this scenario devices have a shorter lifetime.[43] It is assumed that electric inserts require no maintenance during a 10-year lifetime. A comparable 3-year schedule for OHF maintenance (chimney sweeping at $100 each time) is assumed with an annual average cost of $11.
- Repair costs are assumed to be zero for the retrofit device while the unit is under an assumed 10-year warranty. While unlikely, the OHF being retrofitted is assumed to have had ongoing repair costs of approximately $20 annually, making the retrofit device more cost effective.
- South Coast AQMD BACT C/E Discount Cost Factor r= 4%, for a comparative analysis with current BACT C/E limits.

Table 3 is based on the same assumptions as in Table 2 except that:

- Lifetime (n) = 30 years
- Annual maintenance as recommend by manufacturer/industry guidelines with a lower end estimated cost of $50 annually. It is assumed that electric inserts require no maintenance during a 30-year lifetime. A 3-year schedule for OHF maintenance (chimney sweeping at $100 each time) is assumed with an annual average cost of $33 (during a 30-year term).
- Repair costs typically range from $300 to $600 per event and tend to happen between 3 to 7 years during the lifetime of the unit. Assuming $300 every 7 years results in a conservative annual average repair cost of approximately $42. The OHF being retrofitted is assumed to have had ongoing repair costs of approximately $20 annually (which results in the retrofit device more cost effective).[16] Based on empirical vendor/installer data electric inserts typically require a major

[43] Jon Harman, San Bernardino Fireplace Woodstove & BBQ Specialties, February 2021.

repair between 5 to 7 years which makes it cheaper to replace rather than repair the device. The repair cost here conservatively assumes that the unit will last 10 years since Table 2 assumes a lifetime warranty of 10 years, so that the value reflects the annual average cost of two additional retrofits over a 30-year term, for the purposes of comparison with the gas insert device option.

Following is a sample calculation for the lowest installation cost for a gas fireplace insert retrofit of an OHF using equation (3) and Table 3 data:

$$Present\ Value\ Cost\ (PV)\ of gas\ insert\ retrofit\ = \$1{,}950 + (\ (\ 132 - 141)\ \times 17.29\ )$$

$$= \$1{,}950 + (-\$161)$$

$$= \$1{,}789$$

Using equation (1):

$$PM2.5\ CE\ of\ retrofitting\ an\ OHF\ with\ a\ Gas\ \text{Log}\ Set = \frac{\$1{,}789}{\frac{0.00519\ Ton}{year} \times 30\ years}$$

$$= \frac{\$1{,}789}{0.1558\ tons}$$

$$= \$11{,}484\ per\ Ton\ of\ PM2.5\ reduced$$

and also,

$$PM10\ CE\ of\ retrofitting\ an\ OHF\ with\ a\ Gas\ \text{Log}\ Set = \frac{\$1{,}789}{0.1618\ Ton}$$

$$= \$11{,}060\ \ per\ Ton\ of\ PM10\ reduced$$

Conclusion

While the South Coast AQMD maximum average PM10 BACT C/E value is intended for commercial/industrial equipment permitting it provides a comparative threshold. All OHF retrofit options and by extension all ROR scenarios exceed the PM10 equivalent BACT maximum average C/E value of $7,002/ton.[44] C/E estimates developed here rely on the most conservative assumptions and

[44] https://www.aqmd.gov/docs/default-source/bact/cost-effectiveness-values/here.pdf?sfvrsn=6

represent lower bound C/E estimates for ROR devices. While the lowest C/E value for a gas fireplace insert is intended to be a lower bound for C/E, the higher C/E value for a gas fireplace insert does not represent an upper bound. As such, C/E values could range even higher than the estimates in Table 2 or Table 3. C/E can be lowered if cost is reduced. This could be achieved by, for example, an enhanced incentive program that provides financial assistance in the lowering the up-front, capital cost of the ROR device. Absent such a program a mandatory requirement to ROR an OHF is not cost-effective.

Table 2: Lower Bound C/E for the most cost effective OHF ROR options (Lifetime (n) = 10 years)

Cord Wood				
Emissions Factor (lb/ton)	22.7			
Averaged Density (ton/cord)	1.04			
Utilization (cord/year)	0.44			
Burn Rate (lb/hr)	6.00			
Annual PM2.5 Emissions (ton/yr)	0.00519			
Annual Utilization (hr/year)	152.5	Lowest Installation Cost	Higher Installation Cost	
Cost	OHF	Gas Fireplace Insert	Gas Fireplace Insert	Electric Fireplace Insert
Purchase Cost ($)	N/A	$1,200	$1,200	$1,500
Installation ($)	N/A	$750	$2,450	$175
Capital Cost = C ($)	N/A	$1,950	$3,650	$1,675
Fuel Cost per Unit	$200/cord	$1.41/therm	$1.41/therm	$0.29/KWh
Rating	N/A	18,000 Btu/hr	18,000 Btu/hr	1.90 KW/hr
Operating ($/yr)	88	39	39	84
Maintenance ($/yr)	11	17	17	0
Repair ($/yr)	20	0	0	0
Annual Cost = A ($/yr)	119	56	56	84
Emissions				
Lifetime = n (years)	10	10	10	10
Lifetime PM2.5 Emissions (tons)	0.0519	0.0519	0.0519	0.0519
Lifetime PM10 Emissions (tons)	0.0539	0.0539	0.0539	0.0539
r (%)	4%	4%	4%	4%
C/E				
PVF	8.11	8.11	8.11	8.11
A*PVF ($/lifetime)	965	452	452	682
C + A*PVF ($)	965	2,402	4,102	2,357
PVC (Device - OHF)	N/A	1,437	3,137	1,391
PM2.5 C/E	N/A	27,662	60,393	26,792
PM10 C/E (PM10 = PM2.5/0.963)	N/A	26,638	58,159	25,800

Table 3: Higher Bound C/E for the most cost effective OHF ROR options (Lifetime (n) = 30 years)

Cord Wood				
Emissions Factor (lb/ton)	22.7			
Averaged Density (ton/cord)	1.04			
Utilization (cord/year)	0.44			
Burn Rate (lb/hr)	6.00			
Annual PM2.5 Emissions (ton/yr)	0.00519			
Annual Utilization (hr/year)	152.5	Lowest Installation Cost	Higher Installation Cost	
Cost	OHF	Gas Fireplace Insert	Gas Fireplace Insert	Electric Fireplace Insert
Purchase Cost ($)	N/A	$1,200	$1,200	$1,500
Installation ($)	N/A	$750	$2,450	$175
Capital Cost = C ($)	N/A	$1,950	$3,650	$1,675
Fuel Cost per Unit	$200/cord	$1.41/therm	$1.41/therm	$0.29/KWh
Rating	N/A	18,000 Btu/hr	18,000 Btu/hr	1.90 KW/hr
Operating ($/yr)	88	39	39	84
Maintenance ($/yr)	33	50	50	0
Repair ($/yr)	20	43	43	112
Annual Cost = A ($/yr)	141	132	132	196
Emissions				
Lifetime = n (years)	**30**	30	30	30
Lifetime PM2.5 Emissions (tons)	0.1558	0.1558	0.1558	0.1558
Lifetime PM10 Emissions (tons)	0.1618	0.1618	0.1618	0.1618
r (%)	4%	4%	4%	4%
C/E				
PVF	17.29	17.29	17.29	17.29
A*PVF ($/lifetime)	2,438	2,277	2,277	3,384
C + A*PVF ($)	2,438	4,227	5,927	5,059
PVC (Device - OHF)	N/A	1,789	3,489	2,621
PM2.5 C/E	N/A	11,484	22,395	16,821
PM10 C/E (PM10 = PM2.5/0.963)	N/A	11,060	21,566	16,199