

Proposed Rule 444.1 – PM Emission Reductions
from Forestry and Agricultural Waste (PR 444.1)

Proposed Amended Rule 404 – Particulate Matter -
Concentration (PAR 404)

Working Group Meeting #1

August 20, 2025

Join Zoom Meeting: <https://scaqmd.zoom.us/j/93495610487>

Meeting ID: 934 9561 0487

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Agenda

- ▶ South Coast AQMD Background
- PM2.5 Background
- PR 444.1 Background
- ACIs, Title V, Rule 444 and PAR 404 Background
- Overview of Proposed Rules and Rule Development Process
- Next Steps

South Coast Air Quality Management District

- Local air pollution control agency for Orange County and large portions of Los Angeles County, Riverside County, and San Bernardino County
 - Largest of the 35 local air agencies in CA and in the US
 - 10,743 square miles
 - ~17 million residents (45% of CA population)
- Responsibilities include:
 - Regulating emissions from stationary sources
 - Permitting and inspecting over 28,400 facilities
 - Developing and implementing plans to meet state/federal air quality standards
 - Administering over \$100 million of incentive funding annually



Key South Coast AQMD Activities



Air Quality Management Plan

- Blueprint to attain air standards



Rules and Regulations

- Reduce emissions from facilities or equipment



Permits to Operate

- Issue permits to limit equipment/ facility emissions



Compliance Inspections

- Periodic inspections to enforce rules and permits



Complaint Investigations

- Respond to air quality concerns from the public



Ambient Air Monitoring

- Quantify air quality including special studies (e.g. MATES)
- Monitor toxics and air emissions at facility fencelines

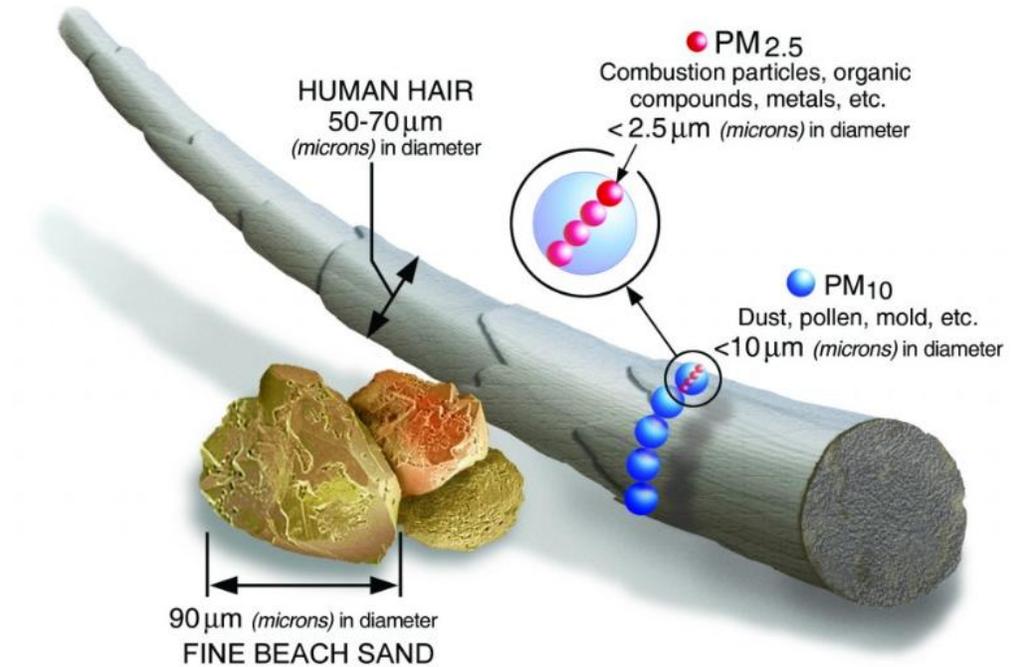
PM 2.5 Background

PM2.5 Background

- South Coast AQMD has some of the highest levels of particulate matter (PM) in the nation*
- PM2.5 is particulate matter $\leq 2.5 \mu\text{m}$ in diameter**
 - Fine inhalable particles found in the air
- Sources of PM2.5 include:**
 - Direct emissions – smoke, soot, road dust, dirt
 - Secondary formation from reactions of precursor pollutants in the atmosphere
 - Precursors include – nitrogen oxides, sulfur dioxides, ammonia, volatile organic compounds

* https://www.aqmd.gov/docs/default-source/clean-air-plans/pm2.5-plans/final-pm2.5-plan/chapter-1---introduction.pdf?sfvrsn=c7518a61_10

** <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>



Size comparisons for PM particles

Health Effects of Particulate Matter

- PM2.5 poses a health risk, as it penetrates deep into the lungs*
- Linked to adverse cardiovascular and respiratory health effects including:*

 - Asthma, coughing, or difficulty breathing
 - Irregular heartbeat
 - Premature death in people with heart or lung disease



National Ambient Air Quality Standards (NAAQS)

- U.S. EPA establishes NAAQS for six criteria air pollutants, including PM_{2.5}
- Air pollution control agencies, such as South Coast AQMD, develop plans to attain NAAQS if they are in non-attainment



South Coast AQMD
NAAQS Attainment Regions

South Coast AQMD Attainment Status with PM2.5 NAAQS

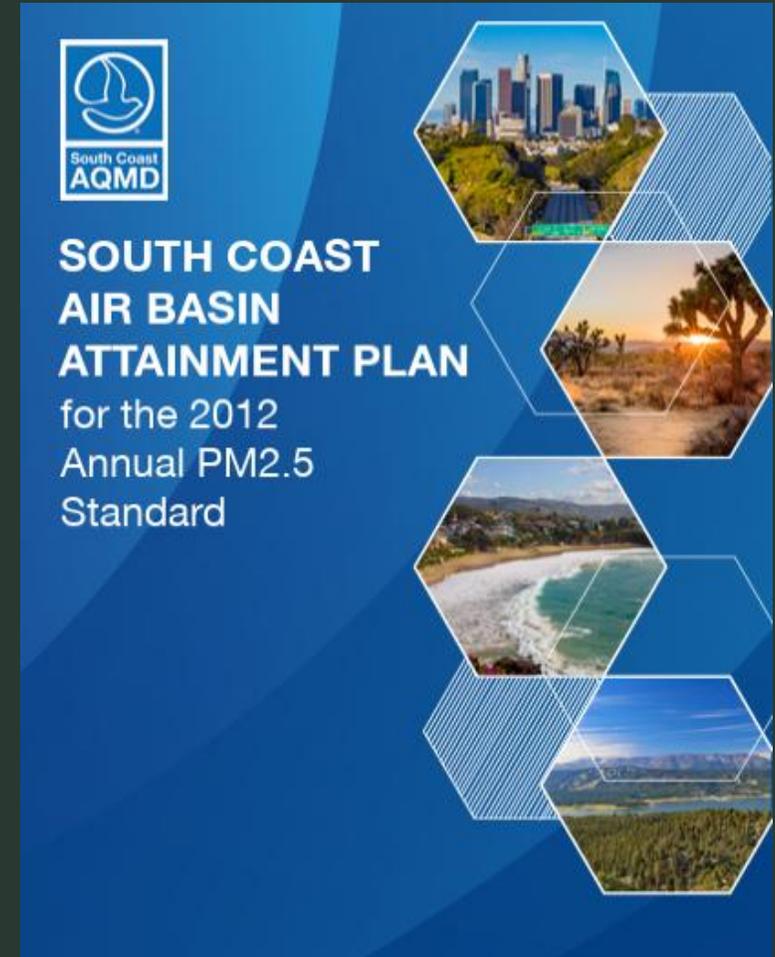
NAAQS Year	NAAQS Level	Averaging Time	South Coast Air Basin Classification
1997	65 $\mu\text{g}/\text{m}^3$	24- Hour	Attainment
	15 $\mu\text{g}/\text{m}^3$	Annual	Attainment
2006	35 $\mu\text{g}/\text{m}^3$	24-Hour	Serious Nonattainment
2012	12 $\mu\text{g}/\text{m}^3$	Annual	Serious Nonattainment
2024	9 $\mu\text{g}/\text{m}^3$	Annual	Designations expected in 2026

($\mu\text{g}/\text{m}^3$) = micrograms per cubic meter

Coachella Valley and the Riverside County portion of the Mojave Desert Air Basin are in attainment for the 2012 PM2.5 standard

South Coast Air Basin PM2.5 Attainment Plan

- PM2.5 Plan adopted in 2024 to meet 2012 annual NAAQS for PM2.5*
 - Includes Best Control Measure 20: Application of All Feasible Measures (BCM-20)
- Will partially implement BCM-20 by seeking to reduce PM2.5 emissions from forestry and agricultural waste burning





PR 444.1 Background



Reason & Purpose for PR 444.1

Wildfires and, more generally, the burning of biomass (e.g. wood or agricultural waste) create PM

- Staff recognizes certain types of open burning are necessary for wildfire prevention

By reducing the amount of vegetative fuels, such as dead trees, fires have less material to burn, making them less likely to spread quickly and intensely

PR 444.1 will aid in achieving attainment with PM_{2.5} NAAQS by establishing requirements for technologies that reduce forestry and agricultural waste

The following slides provide background on PR 444.1

Tree Mortality

- Dead trees and dry vegetation act as fuel, increasing the likelihood of wildfires
- About 237 million trees died in California between 2010 and 2023*
- Droughts exacerbated by climate change result in negative impacts to forests*
 - Trees are more vulnerable to diseases and pests, such as bark beetles, which can ultimately lead to tree mortality

* <https://oehha.ca.gov/climate-change/epic-2022/impacts-vegetation-and-wildlife/forest-tree-mortality>



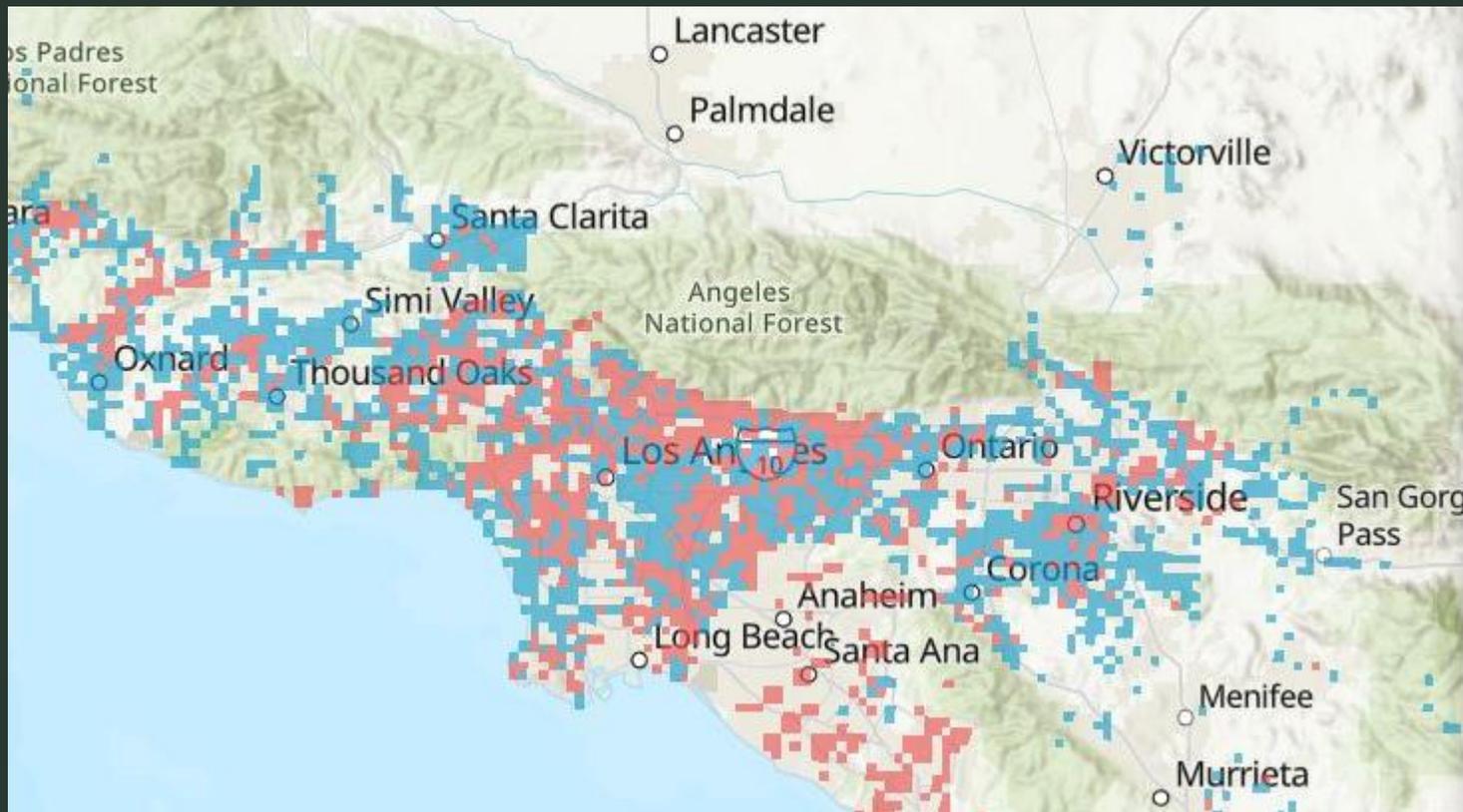
Bark Beetles

- Bark beetles are tiny insects that live under tree bark*
- Bark beetles damage trees by tunneling into bark and creating larval galleries*
 - Disrupt flow of water and nutrients
 - Many species introduce a fungus that further weaken the tree
- California hosts ~200 species of bark beetles*
 - 20 species are invasive, including invasive shot hole borers (ISHB)



Invasive Shot Hole Borer-Fusarium Dieback (ISHB-FD) Distribution in South Coast Basin

- ISHB spread fungus that causes disease Fusarium dieback*
 - Disease blocks water/nutrient flow
 - Leads to wilted/brown leaves, branch dieback, tree decline, and death
- ISHB-FD present in all four counties in South Coast AQMD**
- Disease killed thousands of trees in Southern California; ongoing threat to urban/natural forests***



* <https://ucanr.edu/site/invasive-shothole-borers/pest-overview>

** <https://ucanr.edu/site/invasive-shothole-borers/ishb-fd-distribution-california>

*** <https://ucanr.edu/sites/pshb/index.cfm#:~:text=ISHB%20introduce%20fungi%20that%20cause,our%20urban%20and%20natural%20forests>

2003 Bark Beetle Infestation

- Prolonged drought and bark beetle infestation killed millions of trees across more than 150,000 acres*
 - Increased wildfire risk to homes in San Bernardino and Riverside Counties, particularly Lake Arrowhead and Idyllwild
- Useable lumber could be trucked to a sawmill*
- Small branches, needles, and unmarketable wood waste needed an alternative disposal method*
 - Air curtain incinerators (ACIs) were identified

* <http://www3.aqmd.gov/hb/2003/March/030334a.html>



2003 Special Burn Permit

- South Coast AQMD approved a special burn permit which allowed the U.S. Forest Service to use ACIs for up to two years to dispose of ~500,000 tons of wood from trees killed by drought and bark beetle infestation*
- Special Burn Permit included conditions such as:*
 - Disposing of as much wood as possible without burning
 - Keeping ACIs at least one mile from towns, hospitals, and schools
 - Hosting community meetings to inform residents
- The permit was ultimately not utilized by the U.S. Forest Service



South Coast Air Quality Management District

March 7, 2003

[With Conditions to Minimize Air Pollution](#)

AQMD APPROVES SPECIAL BURN PERMIT TO PREVENT WILDFIRES

Responding to a serious fire danger near Lake Arrowhead and Idyllwild, the Southland's air quality agency today approved the burning of an estimated 500,000 tons of wood from trees killed by the drought and a bark beetle infestation.

"AQMD prohibits most open burning as it adds air pollution to our already smoggy region," said Barry Wallerstein, executive officer of the South Coast Air Quality Management District.

"However, due to the imminent threat of wildfire to thousands of homes, we are permitting the burning of wood to mitigate the fire hazard. We are also imposing several conditions and the use of a special device to minimize air pollution."

A prolonged drought and subsequent bark beetle infestation have killed millions of trees across more than 150,000 acres in San Bernardino and Riverside counties, particularly near the communities of Lake Arrowhead and Idyllwild. With fire season just around the corner, the number of dead and dying trees is rapidly increasing.

After dead trees are cut down, useable lumber will be trucked to a saw mill. But the sheer volume of small branches, needles and wood waste cannot be practicably disposed of in short order except by burning.

Following today's action, the U.S. Forest Service will be permitted to use a maximum of eight special incinerators to burn waste wood from felled trees for up to two years. The incinerators, known as air curtain destructors, blow a curtain of air over an open pit or above-ground container to minimize smoke and increase combustion efficiency.

The devices have been used effectively in such areas as Los Alamos, N.M., to prevent further wildfires following a devastating blaze there in 2000.

AQMD will require the Forest Service to follow conditions to minimize air pollution from the burning, including:

- Disposing of as much wood as possible without burning, including sending

Current Issue

Implementing fuel reduction strategies is critical for effective wildfire prevention

- Trees and vegetation near homes present an increasing wildfire risk
- Strategic measures are needed to prevent the spread of destructive beetle infestations

Currently, the majority of forestry and agricultural waste is disposed of through open burning, which is highly emissive due to uncontrolled combustion that generates elevated levels of PM and other pollutants

- ACIs are a potential alternative

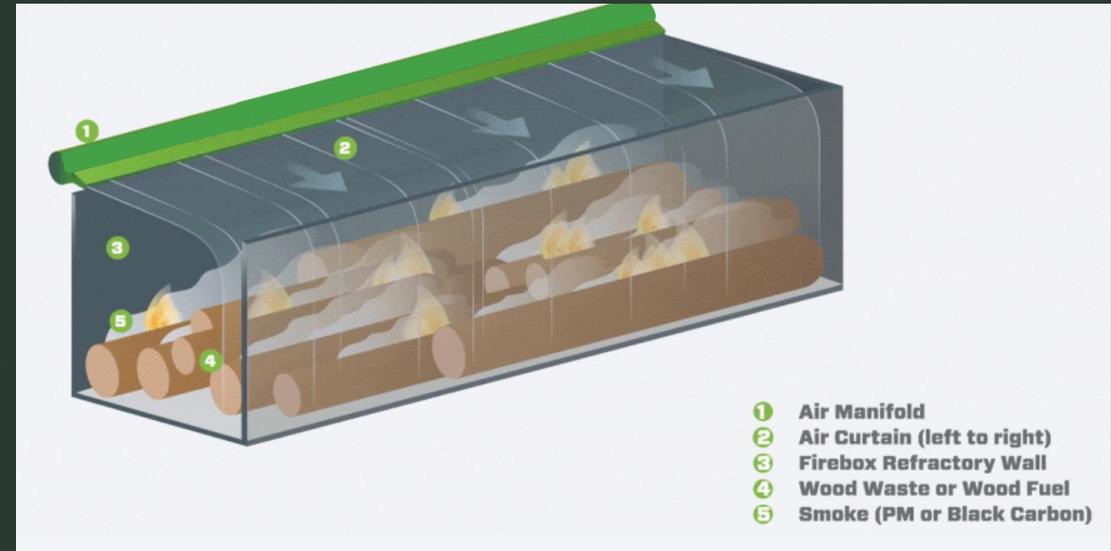
PR 444.1 will establish requirements for ACIs and/or other technologies to reduce emissions from forestry and agricultural waste



ACIs, Title V,
Rule 444 and
PAR 404
Background

Overview of Air Curtain Incinerators

- ACIs operate “by forcefully projecting a curtain of air across an open chamber or an open pit in which combustion occurs”*
- ACIs are either above or below ground and sometimes have refractory walls and a floor*
- The high-velocity air curtain ensures a constant supply of oxygen to the fire, promoting a more complete combustion process**
- ACIs emit high levels of PM but are a cleaner alternative to open burning**



<https://airburners.com/>

* <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-60/subpart-CCCC/subject-group-ECFR6098de6fd8d8775/section-60.2245>

** <https://www.fs.usda.gov/t-d/pubs/html/05511303/05511303.html>

Title V Requirements for ACIs

- U.S. EPA formerly required Title V permits for *all* ACIs due to high PM emissions*
- On April 17, 2024, the U.S. EPA removed Title V permit requirements for ACIs that burn less than 35 tons/day and only:
 - Wood waste
 - Clean lumber
 - Yard waste
 - Combination of the three
- In most cases, burning agricultural waste in an ACI requires a Title V permit*



* <https://www.federalregister.gov/documents/2024/04/17/2024-08270/other-solid-waste-incinerators-air-curtain-incinerators-title-v-permitting-provisions>

Rule 444 – Open Burning (Rule 444) Background

- Open burning does not require a Title V permit
- Open burning emits extremely high levels of PM and other pollutants
- Rule 444 regulates open burning activities
 - Specifies conditions and requirements for open burning
 - Prohibits open burning for many activities (e.g. residential burning)
- Rule 444 defines open burning combustion/open detonation as “outside of a combustion chamber”
- ACIs include a combustion chamber and therefore do not meet the definition of open burning
- Currently, Rule 444 allows for open burning to address forestry and agricultural waste

(Adopted October 8, 1976) (Amended October 2, 1981)
 (Amended October 2, 1987) (Amended December 21, 2001)
 (Amended November 7, 2008) (Amended May 3, 2013)
 (Amended July 12, 2013)

RULE 444. OPEN BURNING

- (a) Purpose
 The purpose of this rule is to ensure open burning in the District is conducted in a manner that minimizes emissions and impacts, and that smoke is managed consistent with state and federal law in order to protect public health and safety.
- (b) Applicability
 The provisions of this rule shall apply to any person conducting or allowing any open burning including, but not limited to:
- (1) Agricultural burning
 - (2) Disposal of Russian thistle (*Salsola kali* or “tumbleweed”)
 - (3) Prescribed burning
 - (4) Fire prevention/suppression training
 - (5) Open detonation or use of pyrotechnics
 - (6) Fire hazard removal
 - (7) Disposal of infectious waste, other than hospital waste
 - (8) Research of testing materials, equipment or techniques
 - (9) Disposal of contraband
 - (10) Residential burning
 - (11) Beach burning
- (c) Definitions
 (1) AGRICULTURAL BURNING means open burning of vegetative materials produced wholly from the growing and harvesting of crops in agricultural operations, including the burning of grass and weeds in fence rows, ditch banks and berms in non-tillage orchard operations, fields being prepared for cultivation, agricultural wastes, and the operation or maintenance of a system for the delivery of water for agricultural operations.

Prescribed Burning

- Rule 444 allows open burning for certain activities including:
 - Prescribed burning
 - Agricultural burning
 - Fire hazard removal
- Prescribed burning is planned open burning conducted by a public agency*; the two types are:
 - Broadcast Burn – Controlled burning of brush/understory vegetation confined to a predetermined area
 - Pile Burn – Controlled burning of debris (e.g. brush/ woody material) in a pile

* See complete definition in Rule 444



Broadcast Burning

- Broadcast burning, though a source of high PM emissions, plays a vital role in reducing wildfire risk and maintaining ecosystem health*
 - Mimics natural fire cycles
 - Reduces wildfire risk
 - Promotes native biodiversity
 - Manages invasive plant species
 - Restores wildlife habitat

*https://www.parks.ca.gov/?page_id=31646#:~:text=Almost%20all%20of%20California's%20landscapes,the%20management%20of%20invasive%20species



Pile Burning

- Pile burning is a common practice to dispose of forestry and agricultural waste
- ACIs and similar technologies are well-suited as an alternative to pile burning since waste materials are consolidated at a central location
- ACIs offer a cleaner alternative to traditional pile burning*
 - Help reduce smoke and air pollution
 - Provide faster burn rates and better control over combustion conditions



* <https://www.fs.usda.gov/t-d/pubs/html/05511303/05511303.html>

Rule 404 Background

- Pile burning is not subject to Rule 404 – Particulate Matter - Concentration (Rule 404)
- Rule 404 established PM concentration limits and was last amended in 1986
- Currently ACIs are not being operated within South Coast AQMD, as they have not demonstrated compliance with the PM limits in Rule 404

(Adopted May 7, 1976)(Amended October 5, 1979)
(Amended February 7, 1986)

RULE 404. PARTICULATE MATTER - CONCENTRATION

- (a) A person shall not discharge into the atmosphere from any source, particulate matter in excess of the concentration at standard conditions, shown in Table 404(a).

Where the volume discharged is between figures listed in the Table, the exact concentration permitted to be discharged shall be determined by linear interpolation.

The provisions of this subsection shall not apply to any equipment completed and put into service before July 1, 1976 in the Palo Verde and Joshua Tree areas.

Before July 1, 1983, liquid sulfur compounds shall not be included as particulate matter discharged from petroleum coke calciners.

- (b) A person shall not discharge into the atmosphere from any source, particulate matter in excess of 450 milligrams per cubic meter (0.196 grain per cubic foot) in discharged gas calculated as dry gas at standard conditions.

The provisions of this subsection shall apply only to any equipment completed and put into service before July 1, 1976 in the Palo Verde and Joshua Tree areas.

- (c) The provisions of this rule shall not apply to emissions resulting from the combustion of liquid or gaseous fuels in steam generators or gas turbines.

- (d) For the purposes of this rule, emissions shall be averaged over one complete cycle of operation or one hour, whichever is the lesser time period.

- (e) The provisions of this rule shall not apply to the use of equipment which complies with the emission limits specified in Rule 1112.1.

Cleaner Alternative to Pile Burning

ACIs demonstrated to create less PM than pile burning (currently allowed by Rule 444 for forestry waste and agricultural waste)

- An evaluation from San Dimas Technology and Development Center indicates ACIs result in approximately 95% reduction in PM_{2.5} emissions*
- Source test from 2023 indicates 65-83% reduction in PM/PM_{2.5}**

Staff will continue to evaluate ACI emission information and is working to conduct additional source tests

Considering Rule 404 amendments to enable ACIs and/or other technologies to be operated

* <https://www.fs.usda.gov/t-d/pubs/html/05511303/05511303.html>

** <https://www.oregon.gov/deq/aq/cao/Documents/caoACIresultsSum.pdf>

Overview of Proposed Rules and Rule Development Process

Overview of PR 444.1 and PAR 404

ACIs provide a much cleaner alternative to traditional pile burning by helping reduce smoke and air pollution

PAR 404/PR 444.1 will reduce:

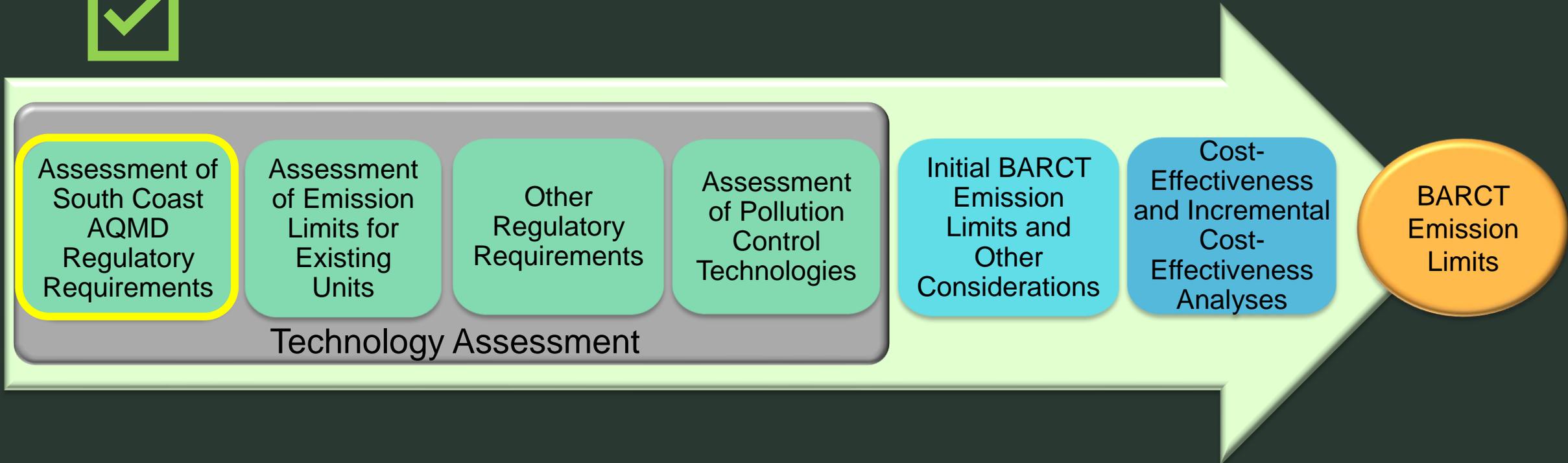
- PM emissions from forest waste disposal operations for wildfire prevention
- PM emissions from agricultural waste disposal operations

Staff will conduct a Best Available Retrofit Control Technology (BARCT) assessment as part of the rule development process

- Evaluate ACIs and other technologies/strategies as an alternative to pile burning to reduce PM emissions from forestry waste and agricultural waste

BARCT Assessment

BARCT is defined in the California Health and Safety Code Section 40406 as “...an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source”



Proposed Regulatory Approach for PR 444.1/ PAR 404

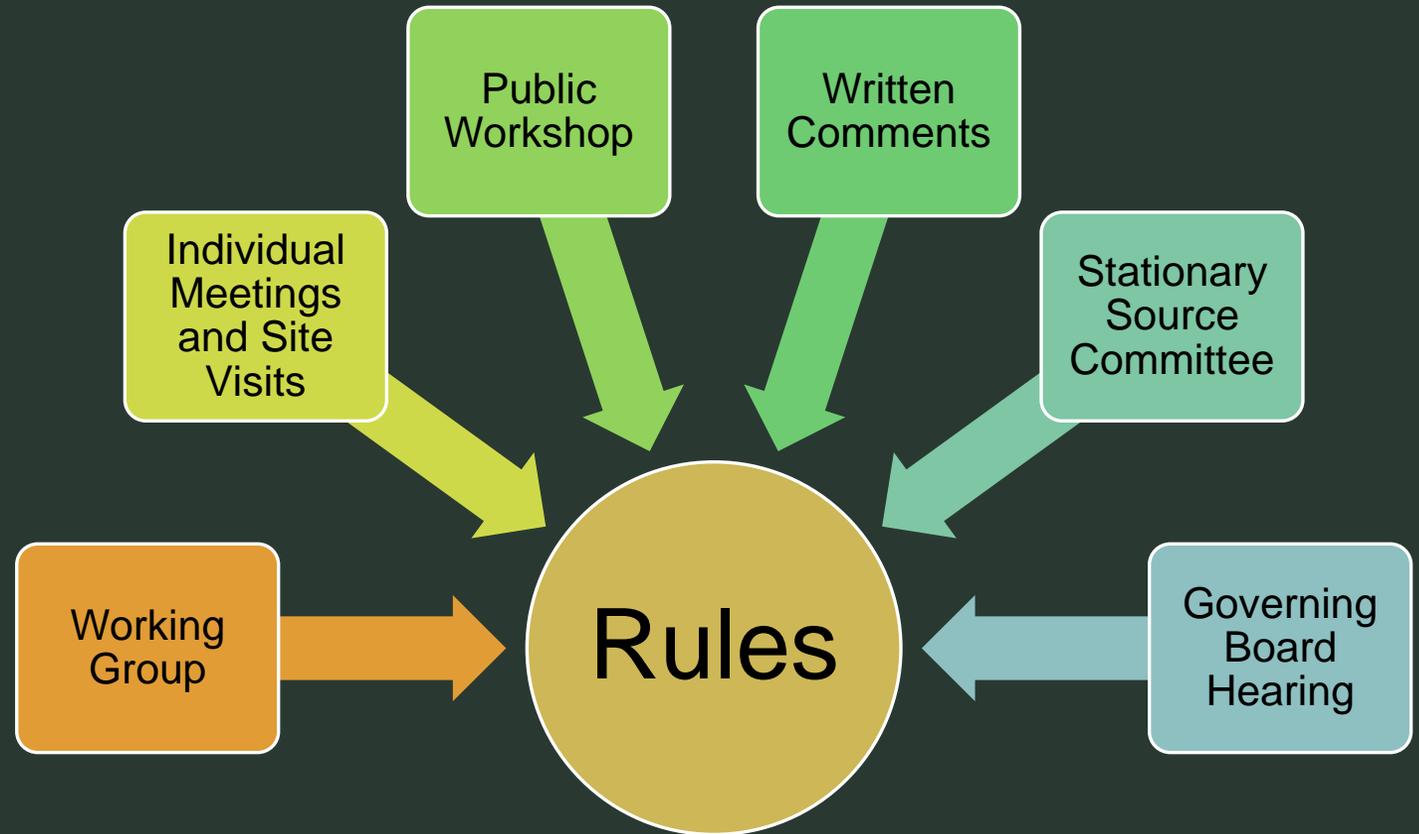
Staff is proposing the following regulatory approach to address emissions from agricultural and forestry waste:

- Establishing requirements for ACIs
- Seek opportunities for ACIs and/or other technologies to be used in lieu of pile burning in PR 444.1
- Amending Rule 404 to allow use of ACIs and/or other technologies regulated under PR 444.1

Staff is seeking stakeholder feedback on the proposed regulatory approach

Opportunities for Stakeholder Feedback

- Stakeholders consist of facilities, environmental groups, community members, and other agencies
- Stakeholders can provide input during Working Group Meetings and throughout the rulemaking process
 - Open to all members of the public
- Early input is strongly encouraged to help develop proposed rule amendments and address issues



Rule Development Process



Next Steps



Next Steps



Continued
Research



Next Working Group
Meeting

Tentatively
November 2025



Public Hearing
1st Quarter
2026

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Proposed Rules Page

<https://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book/proposed-rules/rule-404-and-444-1>

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