

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 #2

January 7, 2026

Join Zoom Meeting: <https://aqmd.zoomgov.com/j/1613343231>

Meeting ID: 1613343231

Dial in: +1 669-900-6833

Agenda

Summary of Working Group Meeting (WGM) #1

Key Takeaways from Site Visits

Update on Best Available Retrofit Control Technology (BARCT) Assessment

PR 444.1/PAR 404 Rule Concepts

Next Steps

Summary of Working Group Meeting #1

Provided background information on the proposed rules*

Provided an overview of air curtain incinerators (ACIs) and Title V requirements

Discussed proposed regulatory approach to reduce PM emissions from forestry and agricultural 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



Key Takeaways from Site Visits



Agricultural waste disposal in an ACI in Fresno, CA

- Visible emissions are common during initial startup period as combustion ramps up and until air curtain is fully engaged
- After startup, visible emissions are minimal; observations support premise that ACI operations are less emissive than pile burning



Forestry waste disposal in an ACI in Northern CA

- Woodchips, pine needles, and leaves are not ideal fuels because they burn rapidly and create unstable combustion leading to excess smoke
- Loaders which sift out dirt/debris reduce smoke and maintenance



Prescribed fire vehicle in Thousand Oaks, CA

- Technology can be used to burn brush/grasses near homes and along highways
- Observations support use as an alternative to broadcast burning

PR 444.1 will establish requirements for ACIs and prescribed fire vehicles, which are alternatives to both forms of prescribed burning, i.e., broadcast burning and pile burning

Update on BARCT Assessment

The following slides will discuss results of the technology assessment conducted as part of the BARCT assessment

- Overview of BARCT assessment provided in WGM #1

A full BARCT assessment will not be conducted for PR 444.1/PAR 404 due to limited or unavailable emission data for the technologies reviewed, some of which are still emerging

- ACI source test data is limited and the results of those source tests demonstrate considerable variability
 - 60% to 90+% cleaner than open pile burning**

PR 444.1 will establish requirements for best management practices, monitoring, and recordkeeping for ACIs and prescribed fire vehicles

- Descriptions and considerations of other technologies in the following slides are included for informational purposes

Emissions Test Results for Air Curtain Incinerators*

Material	Year	PM10 (lb/ton)	CO (lb/ton)
Wood/ cord wood	1968	13	-
Wood	2000	0.12	1.1
Forest vegetation	2002	1.1	2.6
Wood	2003	1.4	30
Wood	2003	0.13	0.61
Wood	2016	0.0064	4.2
Vegetative material	2016	7.7	6.9
Wood	2023	4.25	14.2

* <https://www.valleyair.org/media/dpipwseq/criteria-air-incinerator-ef-determination-analysis.pdf>

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

Overview of Vegetative Fuel Reduction Technologies



Chipping and Grinding



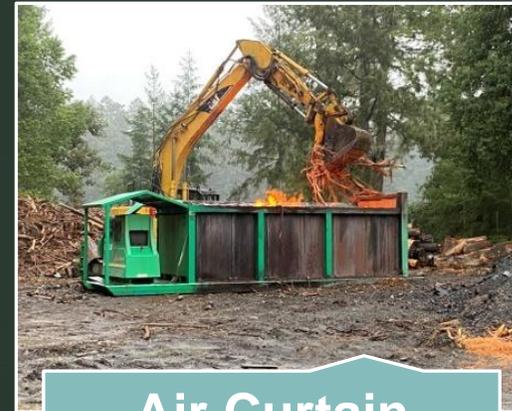
Gasification Technology



Pyrolysis System



Prescribed Fire Vehicle



Air Curtain Incinerators

Air Curtain Incinerators

- ACIs can be used to burn vegetative waste such as woody biomass and agricultural waste
- The high-velocity air curtain ensures a constant supply of oxygen to the fire, promoting a more complete combustion process*
- Requires support equipment for loading waste material, transportation of the unit itself, and ash removal
- ACIs emit high levels of PM but are a cleaner alternative (60% to 90+% cleaner) to open burning**



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

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

Chipping and Grinding

- Chipping and grinding can be used to process forestry and agricultural waste
 - Subsequently used for other processes such as composting and biomass power generation*
- High fuel consumption associated with chipping/grinding and transporting the materials
- Does not reliably eliminate invasive bark beetles
 - Surviving insects can be transported with processed material, increasing the risk of further spread



* https://www.aqmd.gov/docs/default-source/agendas/governing-board/2025/2025-sep5-031.pdf?sfvrsn=86dc6d7e_6

Gasification Technology

Thermo-catalytic gasification technology can convert vegetative waste into syngas fuel (pipeline quality renewable gas)*

- Converting vegetative waste into syngas helps divert material from landfills while producing fuel that can be used for electricity generation

An emerging technology still in the pilot stage

- Not yet mature for widespread end-user application

Requires substantial infrastructure for entire process from feedstock supply to energy generation and emission control

A reliable supply chain and transport network are necessary for continuous operation



* <https://tayloenergy.org/taylor-energys-test-facility/>

Pyrolysis System

- Pyrolysis is a thermo-chemical process that generates biochar
 - Biochar sequesters carbon into a stable form preventing it from decomposing into atmospheric carbon dioxide
 - Biochar also improves soil health by retaining water and nutrients
- Emissions are also associated with vegetative waste transport to equipment site
- Infrastructure needs include access to electricity and water



Prescribed Fire Vehicle

- Remote controlled prescribed burning vehicle used to burn grasses and low brush*
 - Can be operated on relatively wet or dry grass
 - Not effective at reducing dense vegetation, shrub, and tree waste
- Contains high temperature torches and fans to draw air in along the bottom of the burn chamber
 - High oxygen produces less smoke
- Precisely burns areas at tree lines adjacent to homes and buildings
- Equipment can be used for fire mitigation along highways



Federal Requirements for Vegetative Fuel Reduction Technologies

Title 40 Code of Federal Regulations (CFR)

Part 60 Subpart EEEE

- This subpart establishes performance standards for other solid waste incineration units (OSWI)*, which includes ACIs, pyrolysis, and gasification units
 - Includes requirements for emission limitations, operating limits, compliance requirements, and recordkeeping/reporting*
- ACIs that burn only wood waste, clean lumber, and yard waste are subject only to requirements in §§60.2970 through 60.2973*
 - Includes opacity limitation of 10% (6-minute average) and startup opacity limitation of 35% (6-minute average) using EPA Method 9*
 - Also includes recordkeeping and reporting requirements*

* <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-60/subpart-EEEE>

Emission Limitations for OSWI Units in 40 CFR Part 60 Subpart EEEE

PM Emission Limitations for OSWI Units*			
	PM Emission Limit	Averaging Time	EPA Method
OSWI units that commenced construction on or before August 31, 2020	0.013 grains per dry standard cubic foot (dscf)	Using 3-run average (1 hour minimum sample time per run)	Method 5 or 29 of Appendix A
OSWI units with capacities >10 tons/day commenced after August 31, 2020 or commenced reconstruction or modification on or after December 29, 2025	0.013 grains per dscf		
OSWI Units With Capacities ≤10 tons/day that commenced construction after August 31, 2020 or commenced reconstruction or modification on or After December 29, 2025	210 milligrams per dry standard cubic meter		

* <https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-60/subpart-EEEE>

PR 444.1/ 
PAR 404
Rule
Concepts

Proposed Regulatory Approach for PAR 404

Updated Slide

- PAR 404 will allow the use of ACIs and prescribed fire vehicles
 - PM limits in Rule 404 have not been demonstrated
- PAR 404 will include an exemption from PM limits for ACIs and prescribed fire vehicles regulated under PR 444.1
 - ACIs and prescribed fire vehicles that burn types of vegetative waste prohibited under PR 444.1 are required to meet Rule 404 PM limits
 - ACIs and prescribed fire vehicles that burn waste materials outside the scope of PR 444.1 must meet Rule 404 PM limits

16

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, 1978)
(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 (0.156 gram per cubic foot) as 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 1122.1.

404 - 1

PR 444.1 Purpose and Applicability

Purpose

- To establish requirements for ACIs and prescribed fire vehicles used to reduce vegetative waste and reduce PM emissions from forestry and agricultural waste management practices
- Vegetative waste includes wood waste, clean lumber, yard waste, and agricultural waste

Applicability

- PR 444.1 will apply to owners and operators of ACIs and prescribed fire vehicles



PR 444.1 No Burn Day Requirements

A “No Burn Day” means a day within South Coast AQMD’s jurisdiction in which burning is prohibited

- Occurs when daily PM_{2.5} air quality is forecasted to reach unhealthy levels due to air emissions and stagnant weather conditions

Consistent with current policy for open burning, the use of ACIs and prescribed fire vehicles will be restricted on a “No Burn Day” for elevations below 3,000 feet

- Restriction due to elevated PM emissions from these technologies which can affect PM attainment status for the South Coast Air Basin
- Above 3,000 feet, PM is dispersed due to meteorological conditions



PR 444.1 ACI Monitoring Concepts

Opacity limitations and monitoring requirements for ACIs will mirror those of 40 CFR Part 60, Subpart EEEE

The opacity limitation is 10 percent (6-minute average) except during the startup period, when the opacity limitation is 35 percent (6-minute average)

Must conduct an initial test for opacity, then conduct periodic testing for opacity at least once every 12 calendar months

- Must have a minimum of one person certified in the reading of visible emissions pursuant to EPA Method 9

PR 444.1 Additional Concepts

PR 444.1 will only allow burning of vegetative waste by government agencies and their contractors

Contraband burning will be prohibited in equipment subject to this rule

Reporting and recordkeeping requirements for operational and emissions data

Next Steps



Rule Development Process



Next Steps



Continue Outreach



Develop Rule Language



Conduct Public Workshop

Tentatively 1st
Quarter 2026

Stay Connected

Niyati Rami

Air Quality Specialist
nrami@aqmd.gov
909.396.2249

Isabelle Shine

Program Supervisor
ishine@aqmd.gov
909.396.3064

Michael Morris

Planning and Rules Manager
mmorris@aqmd.gov
909.396.3282

Michael Krause

Assistant Deputy Executive Officer
mkrause@aqmd.gov
909.396.2706

Proposed Rules Page

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

E-Newsletter Sign Up

<https://www.aqmd.gov/sign-up>