Appendix C

DISTRICT CONTROL MEASURE EVALUATIONS

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OVERVIEW

The San Joaquin Valley (Valley) faces significant challenges in meeting federal air quality standards (also called National Ambient Air Quality Standards, or NAAQS) for fine particulate matter (PM2.5) and ozone. The San Joaquin Valley Air Pollution Control District (District) has demonstrated leadership in developing and implementing groundbreaking regulatory strategies to reduce emissions. Tough and innovative rules, such as those for indirect source review, residential wood burning, glass manufacturing, and agricultural burning, have set benchmarks for California and the nation.

Over the years, the District's numerous air quality plans (State Implementation Plans, or SIPs) have been a primary vehicle for improving air quality in the Valley. Each plan builds upon the work of prior plans while establishing the path for continued air quality improvements. Consistent with this planning continuity, the District's control measure evaluation in this section is built upon analyses under the District's prior attainment plans, including but not limited to the *2007 Ozone Plan,*[1] *2008 PM2.5 Plan,*[2] *2012 PM2.5 Plan,*[3] *2013 Plan for the Revoked 1-Hour Ozone Standard,*[4] *2015 Plan for the 1997 PM2.5 Standard,*[5] *2016 Plan for the 2008 8-Hour Ozone Standard* (*2016 Ozone Plan*),[6] *2016 Moderate Area Plan for the 2012 PM2.5 Standard* (*2016 PM2.5 Plan*),[7] *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards* (*2018 PM2.5 Plan*),[8] and the *2022 Plan for the 2015 8-Hour Ozone Standard* (*2022 Ozone Plan*).[9]

This section reflects the comprehensive evaluation performed by the District to examine emissions sources in the Valley to ensure that the best available control measures (BACM) and most stringent measures (MSM) for directly emitted PM2.5 and all significant PM2.5 precursors are implemented as required for Serious PM2.5 nonattainment areas requesting an attainment date extension under Part D, Subpart 4 of the Clean Air Act (CAA).

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[1] SJVAPCD. *2007 Ozone Plan*. (April 30, 2007). Retrieved from: http://www.valleyair.org/air_quality_plans/docs/AQ_Ozone_2007_Adopted/2007_8HourOzone_CompletePlan.pdf
[2] SJVAPCD. *2008 PM2.5 Plan*. (April 30, 2008). Retrieved from: http://www.valleyair.org/Air_Quality_Plans/AQ_Final_Adopted_PM25_2008.htm
[3] SJVAPCD. *2012 PM2.5 Plan*. (December 20, 2012). Retrieved from: http://www.valleyair.org/Air_Quality_Plans/PM25Plan2012/CompletedPlanbookmarked.pdf
[4] SJVAPCD. *2013 Plan for the Revoked 1-Hour Ozone Standard*. (September 19, 2013). Retrieved from: https://www.valleyair.org/Air_Quality_Plans/OzoneOneHourPlan2013/AdoptedPlan.pdf
[5] SJVAPCD. *2015 Plan for the 1997 PM2.5 Standard*. (April 16, 2015). Retrieved from: http://www.valleyair.org/Air_Quality_Plans/PM25Plans2015.htm
[6] SJVAPCD. *2016 Ozone Plan for 2008 8-Hour Ozone Standard*. (June 16, 2016). Retrieved from: http://valleyair.org/Air_Quality_Plans/Ozone-Plan-2016/Adopted-Plan.pdf
[7] SJVAPCD. *2016 Moderate Area Plan for the 2012 PM2.5 Standard*. (September 15, 2016). Retrieved from: http://www.valleyair.org/Air_Quality_Plans/docs/PM25-2016/2016-Plan.pdf
[8] SJVAPCD. *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards*. (November 15, 2018). Retrieved from: https://www.valleyair.org/pmplans/documents/2018/pm-plan-adopted/2018-Plan-for-the-1997-2006-and-2012-PM2.5-Standards.pdf
[9] SJVAPCD. *2022 Plan for the 2015 8-Hour Ozone Standard*. (December 15, 2022). Retrieved from: https://ww2.valleyair.org/media/q55posm0/0000-2022-plan-for-the-2015-8-hour-ozone-standard.pdf

This section consists of a literature review and evaluation of emission reduction opportunities for stationary and area source categories. District staff in multiple departments with expertise in these various sectors contributed to this effort. The evaluations in this section are intended to capture relevant background information, examine emission reduction opportunities for technological and economic feasibility, make recommendations for appropriate District actions moving forward, solicit public input during the Plan development process, and demonstrate compliance with CAA control strategy requirements for PM2.5 nonattainment areas.

Clean Air Act Requirements

With respect to Plan requirements for Serious nonattainment areas, the CAA requires provisions for the implementation of BACM under Section 189(b)(1)(B), and MSM for Serious non-attainment areas seeking an extension under section 188(e). The guidelines for demonstrating compliance with these requirements are provided in the U.S. Environmental Protection Agency's (EPA) 2016 PM2.5 Implementation Rule.[10] Pursuant to the implementation rule, EPA requires the implementation of BACM no later than 4 years after the date an area is reclassified to Serious, and implementation of MSM as expeditious as practicable but no later than 1 year prior to the alternate Serious area attainment date. Thus, the District is required to implement BACM and MSM by 2025 and 2029, respectively.

Demonstration of BACM

The District and CARB developed the *Initial SIP Requirements for the 2012 Annual PM2.5 Standard* to address initial elements required by the CAA for Serious nonattainment areas, including a demonstration that BACM requirements continue to be satisfied in the Valley. These elements were adopted by the District Governing Board on October 19, 2023, and subsequently submitted to EPA through CARB.

Demonstration of MSM

EPA interprets the term MSM to mean "*the maximum degree of emission reduction that has been required or achieved from a source or source category in any other attainment plans or in practice in any other states and that can feasibly be implemented in the area seeking the extension.*" This Plan contains the necessary supporting information to demonstrate compliance with requirements for MSM, including the following:

[10] EPA. *Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements; Final Rule*. 81 Fed. Reg. 164, pp. 58010-58162. (August 24, 2016). (Codified at 40 CFR Parts 50, 51, and 93). Retrieved from: https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf

- ✓ A list of all emissions source categories, sources and activities in the nonattainment area that emit direct PM2.5 or any PM2.5 precursor (Appendix B)
- ✓ An analysis of all potential control measures achieved in practice or identified as potential MSM in other regions, as obtained from:
  - A comprehensive review of other air district plans and regulations;
  - A review of the RACT/BACT/LAER Clearinghouse;
  - A review of measures included in EPA's Menu of Control Measures document
- ✓ An analysis of measures rejected as BACM/BACT in previous District attainment plans to see if they were feasible for implementation given the longer time before the attainment date
- ✓ Evaluation of measures already implemented in the Valley to see if an increase in coverage of the measure would increase emission reductions from the source category
- ✓ A reasoned justification for any potential MSM which was found to be technologically or economically infeasible for implementation in the Valley by 2029

This appendix demonstrates all prohibitory stationary source measures currently in place meet or exceed MSM. Measures that go beyond MSM which were found to be technologically and economically feasible for implementation in the Valley are proposed as commitments for this Plan in Chapter 4.

Significant Precursors

Pursuant to CAA §189(e), the sole explicit reference to the regulation of precursors in CAA Subpart 4, the control requirements applicable under plans addressing a PM2.5 NAAQS shall apply to major stationary sources of PM2.5 precursors, except where EPA determines that such sources do not contribute significantly to PM2.5 levels which exceed the standard in the area. As provided in Appendix F of this document, modeling demonstrates that volatile organic compounds (VOC), ammonia, and sulfur oxides (SOx) are not significant precursors for the formation of PM2.5 in the Valley. Therefore, CARB and the District have excluded controls for VOC, SOx, and ammonia from this evaluation.

Although the District is not required to evaluate sources of ammonia as stated above, the District and CARB conducted a full analysis of the potential control of ammonia sources. This analysis is included within the precursor demonstration in Appendix F.

EVALUATION METHODOLOGY

Each stationary and area source control measure evaluation in this appendix follows a thorough and consistent analysis methodology, modeled after EPA's guidance for MSM requirements as described in the section above. This methodology includes sections for the following discussions and analyses:

- Emissions inventory
- Rule description
- Regulatory evaluation of federal, state, and local regulations, including an assessment of MSM
- Summary of potential emission reduction opportunities identified and the associated analyses of such opportunities
- Summary of the evaluation findings

Although the District follows this methodology for each individual stationary and area source control measure evaluation, additional sections may be added as appropriate to provide a more complete summary of the analyses performed. The following is a more detailed description of the sections in the control measure analyses.

Emissions Inventory

Each control measure evaluation contains an emissions inventory table that identifies PM2.5 and NOx emissions for the respective source category. The emissions data in each table is provided as an annual average, as well as a wintertime average (November through April), which is the period in which PM2.5 concentrations in the Valley are the highest. The data provided in this section is a compilation of the data sources identified in the emissions inventory section. See Appendix B (Emissions Inventory) for additional information.

Rule Description

This section provides an overview of the rule, including rule applicability, types of sources subject to rule requirements, rule adoption/amendment history, and any other additional pertinent details, as relevant to the control measure evaluation.

How does the District Rule compare with federal and state rules and regulations?

As part of the regulatory evaluation, District rules and source categories are compared to federal and state air quality regulations and standards. The following regulations and guidelines are referenced in the comparisons:

Federal Regulations
Federal regulations include the following regulations and guidance documents:

- Control Techniques Guidelines (CTG)[11]
- Alternative Control Techniques (ACT)[12]
- New Source Performance Standards (NSPS)[13]

State Regulations
Generally, state regulations are specific to mobile sources and consumer products. However, there are some California Health and Safety Code (CH&SC) requirements and CARB Airborne Toxic Control Measures (ATCM)[14] that apply to stationary and area sources. While most of the rules evaluated in this Plan do not have a state regulation associated with their source category, any relevant state guidelines are evaluated within this section.

How does the District Rule compare to rules in other air districts?

The District compared every control measure to analogous regulations adopted by California's most progressive air districts. Investigation of control strategies and measures in other air districts and agencies includes, but is not limited to, the following air districts:

- Bay Area Air Quality Management District (BAAQMD)[15]
- South Coast Air Quality Management District (SCAQMD)[16]
- Sacramento Metropolitan Air Quality Management District (SMAQMD)[17]
- Ventura County Air Pollution Control District (VCAPCD)[18]

Local and regional agencies tailor their regulations, analysis, and innovation based on their unique situations. Therefore, regional regulations will differ in language and structure due to differences in local needs and priorities. Thus, comparing individual lines of regulatory text from a range of jurisdictions out of context does not establish MSM on its own. Instead, the District carefully reviews differences between rules with focus on what the regulation as a whole accomplishes while acknowledging differences in regional situations.[19] All potential measures were thoroughly evaluated using the key

[11] EPA. Control Techniques Guidelines. Retrieved from: http://www.epa.gov/groundlevelozone/SIPToolkit/ctgs.html
[12] EPA. Alternative Control Techniques. Retrieved from: http://www.epa.gov/groundlevelozone/SIPToolkit/ctgs.html
[13] EPA. 40 CFR 60 – Standards of Performance for New Stationary Sources (NSPS). Retrieved from: http://www.tceq.state.tx.us/permitting/air/rules/federal/60/60hmpg.html
[14] CARB. Airborne Toxic Control Measures (ATCMs). Retrieved from: http://www.arb.ca.gov/toxics/atcm/atcm.htm
[15] Bay Area Air Quality Management District (BAAQMD). Rules and Regulations. Retrieved from: http://www.baaqmd.gov/Divisions/Planning-and-Research/Rules-and-Regulations.aspx
[16] South Coast Air Quality Management District (SCAQMD). Rules and Regulations. Retrieved from: http://www.aqmd.gov/home/regulations/rules/scaqmd-rule-book/table-of-contents
[17] Sacramento Metropolitan Air Quality Management District (SMAQMD). Rules and Regulations. Retrieved from: http://www.airquality.org/rules/
[18] Ventura County Air Pollution Control District (VCAPCD). Rules and Regulation. Retrieved from: http://www.vcapcd.org/Rulebook/RuleIndex.htm
[19] Similarly, when EPA acts on control measure analysis, EPA considers a rule "as a whole." See, e.g., EPA's Technical Support Document, *EPA Evaluation of BACM/MSM for the San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQS* at page 5, supporting final BACM/MSM approval available at 85 FR 44192.

factors identified in EPA's 2016 Implementation Rule[20] to determine if potential opportunities qualify as MSM for the Valley.

Potential Emission Reduction Opportunities

The District reviewed the following areas to identify any additional potential measures:

- Any emission reduction opportunities identified/considered in previously adopted District plans that were determined to be infeasible at that time.
- New emission reduction opportunities adopted in California SIPs, SIPs in other states, or achieved in practice in other areas.

All potential MSM identified were then thoroughly evaluated for technological and economic feasibility:

- **Technological feasibility** – The technological feasibility analysis determines if a potential opportunity to reduce emissions is viable for existing facilities and operators in the Valley, given their current operating needs and restrictions. This analysis includes a literature review of District permits; environmental and technological studies; EPA and CARB guideline documents; and other air districts' rules, regulations, and guidelines, to identify potential opportunities and determine the technological feasibility of any identified potential opportunities.
- **Economic feasibility** – To determine economic feasibility, the District conducts a cost effectiveness analysis to evaluate the economic reasonableness of an air pollution control measure or technology as it applies to entities/residents in the Valley. A cost effectiveness analysis examines the added cost, in dollars per year, of the control technology or technique, divided by the emissions reductions achieved, in tons per year (tpy).

The District reviewed staff reports and studies from other air districts, EPA technical guidance documents, and applicable study data from the scientific community to assist in evaluating the technological and economic feasibility of potential MSM.

Evaluation Findings

This section completes the control measure evaluation and provides a summary of the District's findings based on the control measure evaluation.

[20] EPA. *Fine Particulate Matter National Ambient Air Quality Standards: State Implementation Plan Requirements; Final Rule*. 81 Fed. Reg. 164, pp. 58010-58162. (August 24, 2016). (Codified at 40 CFR Parts 50, 51, and 93). Retrieved from: https://www.gpo.gov/fdsys/pkg/FR-2016-08-24/pdf/2016-18768.pdf

SUMMARY OF CONTROL MEASURES

The District's stringent regulations already adopted under previous attainment plans also serve as control measures for this Plan. These adopted regulations reduce directly emitted PM2.5 and NOx and contribute to the Valley's progress toward attainment of PM2.5 standards as they are fully implemented. Each control measure evaluated within this appendix and the District's resulting conclusion is summarized in Table C-1 below.

Table C-1 District Control Measures Evaluated for MSM

District Rule		Date Adopted or Last Amended	Conclusion
4103	Open Burning	6/17/2021	MSM
4104	Reduction of Animal Matter	12/17/1992	MSM
4106	Prescribed Burning and Hazard Reduction Burning	6/21/2001	MSM
4203	Particulate Matter Emissions from Incineration of Combustible Refuse	12/17/1992	MSM
4204	Cotton Gins	2/17/2005	MSM
4301	Fuel Burning Equipment	12/17/1992	MSM
4306/ 4320	Boilers, Steam Generators, and Process Heaters, >5 MMBtu/hr	12/17/2020	MSM
4307	Boilers, Steam Generators, and Process Heaters, 2-5 MMBtu/hr	4/21/2016	MSM
4308	Boilers, Steam Generators, and Process Heaters, 0.075-2 MMBtu/hr	11/14/2013	MSM
4309	Dryers, Dehydrators, and Ovens	12/15/2005	MSM
4311	Flares	12/17/2020	MSM
4313	Lime Kilns	3/27/2003	MSM
4352	Solid Fuel Fired Boilers, Steam Generators, and Process Heaters	12/16/2021	MSM
4354	Glass Melting Furnaces	12/16/2021	MSM
4550	Conservation Management Practices	8/19/2004	MSM
4692	Commercial Charbroiling	6/21/2018	MSM
4702	Internal Combustion Engines	8/19/2021	MSM
4703	Stationary Gas Turbines	9/20/2007	MSM
4901	Wood Burning Fireplaces and Wood Burning Heaters	5/18/2023	MSM
4902	Residential Water Heaters	3/19/2009	MSM
4905	Natural Gas-Fired, Fan-type Central Furnaces	12/16/2021	MSM
8011	General Requirements	8/19/2004	MSM
8021	Construction, Demolition Excavation, Extraction, and Other Earthmoving Activities	8/19/2004	MSM
8031	Bulk Materials	8/19/2004	MSM
8041	Carryout and Trackout	8/19/2004	MSM
8051	Open Areas	8/19/2004	MSM
8061	Paved and Unpaved Roads	8/19/2004	MSM
8071	Unpaved Vehicle/Equipment Traffic Areas	9/16/2004	MSM
8081	Agricultural Sources	9/16/2004	MSM

C.1 RULE 4103 (OPEN BURNING)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	9.20	9.14	9.05	1.79	1.78	1.77	1.77
NOx	6.55	6.51	6.44	1.48	1.47	1.46	1.46
	Winter Average - Tons per day						
PM2.5	12.47	12.38	12.25	2.45	2.43	2.42	2.42
NOx	8.84	8.78	8.69	2.00	1.99	1.98	1.97

District Rule 4103 Description

Historically, agricultural materials such as prunings and orchard removals have been disposed of through burning to prevent the spread of plant diseases and to control weeds and pests in an economical and timely manner. The District first adopted Rule 4103 (Open Burning) on June 18, 1992, to regulate and coordinate the use of open burning while minimizing smoke impacts on the public. The District has since amended and increased the stringency of Rule 4103 seven times. In 2003, California Senate Bill (SB) 705 (Florez, 2003), codified in CH&SC §§41855.5 and 41855.6, established a schedule to phase out the open burning of agricultural material, including consideration of technical and economic factors in implementing the phase-out. The District incorporated the phase-out requirements of SB 705 into Rule 4103.

Phase-Out of Agricultural Burning

The San Joaquin Valley is the only region in California and the nation with stringent requirements to phase out agricultural open burning. Through the implementation of state law under SB 705, the District has adopted prohibitions that have significantly reduced open burning, supported by continued efforts to identify and demonstrate new alternatives to reduce open burning. As the most recent activity in this ongoing effort, the District, in collaboration with CARB, adopted a final phase-out strategy in 2021 for remaining agricultural burning by the end of 2024.[21] This strategy is supported by significant new incentive funding to help offset the high cost associated with new alternatives to burning, with enhanced focus on smaller growing operations.

Since adoption of the District's final phase-out strategy, the Valley has seen a tremendous reduction in open burning through the adoption of new practices. In 2023, the reductions in agricultural open burning and use of alternatives reached record levels for the Valley since the institution of agricultural burning restrictions. Additional

[21] SJVAPCD. *Final Supplemental Report and Recommendations on Agricultural Burning.* (June 17, 2021). Retrieved from: https://ww2.valleyair.org/media/aldmsd0b/final-supplemental-report-and-recommendations-on-agricultural-burning.pdf

requirements for smaller growers implemented at the end of 2023 will continue to provide further reductions in open burning prior to the phase-out by the end of 2024.

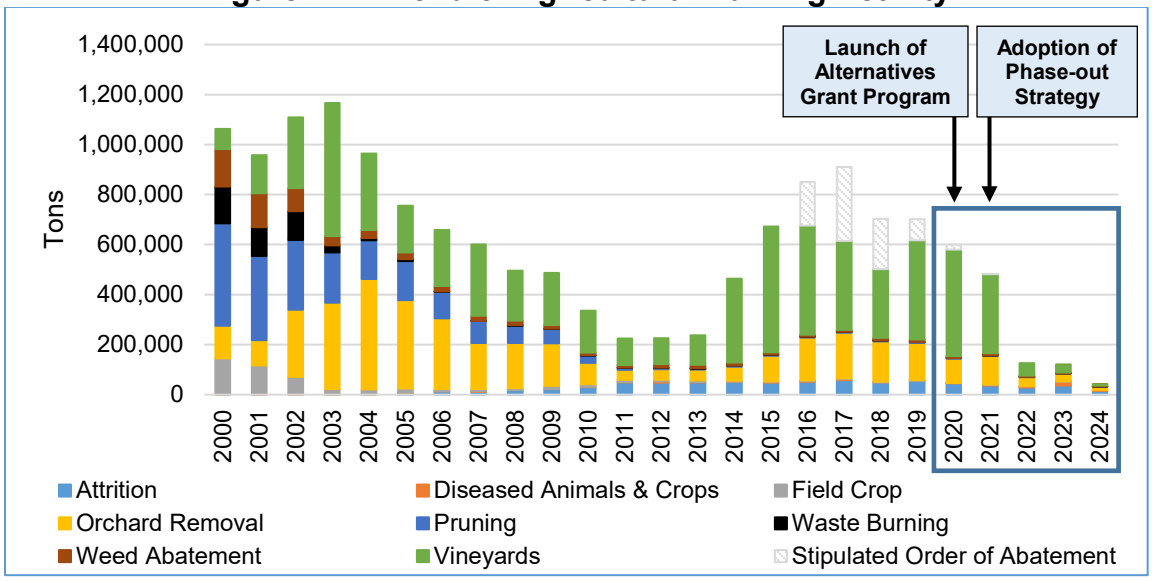
Alternatives to Open Agricultural Burning Incentive Program

To support the Valley's ongoing phase-out of agricultural open burning, in 2018, the District's Governing Board authorized the creation of the Alternatives to Agricultural Open Burning Incentive Program.[22] This program provides financial incentives to commercial agricultural operations located within the District boundaries to chip agricultural material. The chipped material is then used for soil incorporation or land application on agricultural land as an alternative to the open burning of the agricultural materials. Since 2018, the District Governing Board has allocated $25,309,504 in local District funding to this program.

On August 19, 2021, the District accepted $178,200,000 in additional state funding to be used in the District's Alternatives to Agricultural Open Burning Incentive Program.[23] This funding is the result of significant advocacy from the District and Valley agricultural stakeholders and is designated to assist the District in developing new alternative practices, increase fleet capacity for chipping in the Valley and offset the significant incremental cost of implementing new alternatives to open burning.

Overall, the program has resulted in the deployment of alternative practices at over 226,000 acres, for nearly 6,200,000 tons of agricultural materials, resulting in the reduction of 12,090 tons of NOx, 22,427 tons of PM and 19,045 tons of reactive organic gas (ROG) emissions.

Figure C-1 Trend of Agricultural Burning Activity



[22] SJVAPCD. District Alternatives to Agricultural Open Burning Incentive Program. Retrieved from: https://ww2.valleyair.org/grants/ag-burn-alternatives-grant-program/

[23] SJVAPCD. *Accept and Appropriate $178,200,000 in State Funding and Approve Enhancements to Alternatives to Agricultural Open Burning Incentive Program.* (August 19, 2021). Retrieved from: https://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2021/August/final/10.pdf

Smoke Management System

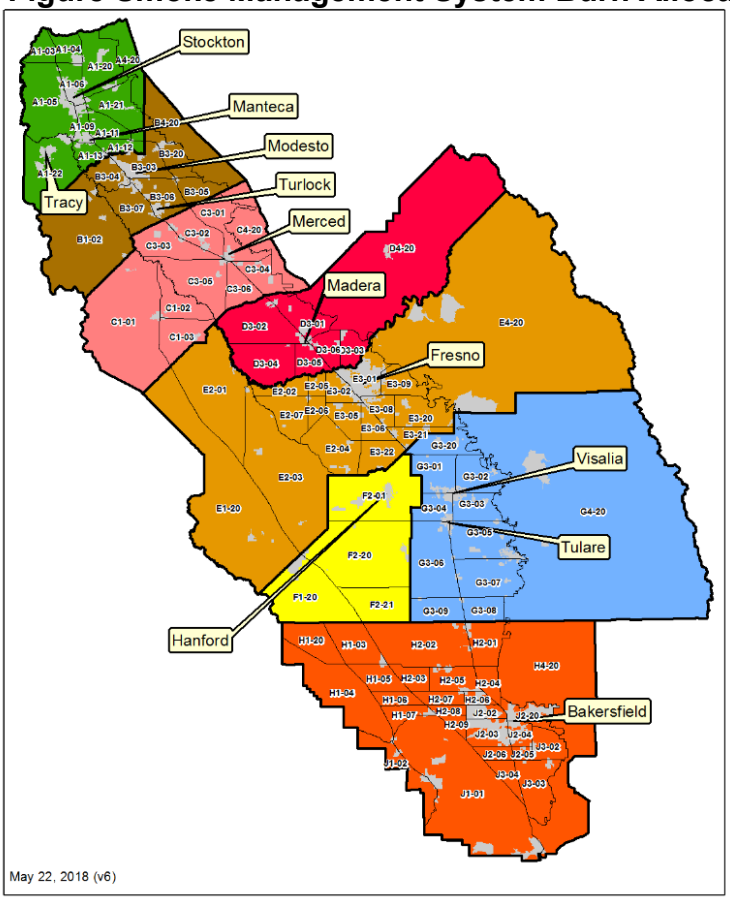
To implement SB 705 and enhance the effectiveness of the District's burn reduction efforts, in 2004, the District established the Smoke Management System (SMS), which the District uses to authorize or prohibit individual burns based on modeled smoke impacts.

Individuals requesting authorization to burn is required to complete the proper application to report the acreage, type of material, location, and date of the burn. The District uses SMS to calculate emissions by multiplying the tons of fuel burned by a crop-specific emission factor. SMS uses real-time meteorological information to analyze the impact of burning on air quality and appropriately limit burn allocations by area. The District only authorizes burns of allowable materials when the SMS emissions analysis indicates that the burn will not cause or contribute to exceedances of federal air quality standards, cause a public nuisance, or impact nearby smoke-sensitive areas. The District enforces these requirements through permits, project inspections, proactive surveillance, and complaint response.

Each year, open burning windows narrow due to unprecedented wildfires and stagnant winters with little precipitation. Open burning is strictly prohibited from November through February each year if there is an episodic residential wood burning curtailment under District Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters). These Rule 4901 curtailments are becoming increasingly frequent, with the majority of winter days now declared as No Burn days for residential wood burning, resulting in fewer agricultural open burn days each winter.

The District's SMS program divides the Valley into 97 allocation zones (see Figure C-2 below) based on a number of criteria, such as crop distribution throughout the Valley, historical burning activities, nearby sensitive receptors, and known geographic boundaries. The amount of burning allowed in a given zone on a specific day is based on factors such as the local meteorology, air quality conditions, atmospheric holding capacity, amount of burning already approved or happening in a given area, and potential impacts on downwind populations.

Figure C-2 Figure Smoke Management System Burn Allocation Zones



How does District Rule 4103 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category.

State Regulations

- *CH&SC §§41850-41866 (Agricultural Burning)*
- *17 California Code of Regulations (CCR) §§80100-80330 (Smoke Management Guidelines for Agricultural and Prescribed Burning)*

The District implements the above state regulation requirements through Rule 4103. In 2003, SB 705, incorporated into CH&SC §§41855.5 and 41855.6, required the District to regulate the burning of diseased crops, establish best management practices (BMP) for the maintenance and control of weeds, and phase out the open burning for numerous crop categories. SB 705 established a schedule for specific types of agricultural material to no longer be burned in the field, but provided for a postponement

of the phase-out where justified by technical and economic impediments. In addition to the requirements of CH&SC §41855.5, state law requires the District to postpone the burn prohibition dates for specific types of agricultural material if the District makes three specific determinations and CARB concurs.[24] The determinations are: (1) there are no economically feasible alternatives to open burning for that type of material; (2) open burning for that type of material will not cause or substantially contribute to a violation of an air quality standard; and (3) there is no long-term federal or state funding commitment for the continued operation of biomass facilities in the Valley or the development of alternatives to burning.

The District has complied with state requirements in preparing five reports on agricultural burning activities in the Valley since 2010. These reports have evaluated every crop category for feasible alternatives to open burning and provided recommendations for allowing or prohibiting the open burning of each crop category as outlined by SB 705. The most recent *Supplemental Report* established an updated schedule for the near-complete phase-out of remaining agricultural open burning in the Valley by January 1, 2025.

How does District Rule 4103 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4103 to comparable requirements in rules from the following California nonattainment areas:

- Bay Area AQMD Regulation 5 (Amended November 20, 2019)[25]
- Sacramento Metropolitan AQMD Rule 501 (Amended April 3, 1997)[26]
- South Coast AQMD Rule 444 (Amended July 12, 2013)[27]
- Ventura County APCD Rule 56 (Amended November 11, 2003)[28]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4103 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rule is demonstrated below.

[24] CH&SC §41855.6
[25] BAAQMD. *Regulation 5 (Open Burning).* (Amended November 25, 2019). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/regulation-5/documents/20191120_r0500_final-pdf.pdf?la=en&rev=51124978dd4b4e598ba56bfe2a1c23df
[26] SMAQMD. *Rule 501 (Agricultural Burning).* (Amended April 3, 1997). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule501.pdf
[27] SCAQMD. *Rule 444 (Open Burning).* (Amended July 12, 2013). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-444.pdf?sfvrsn=4
[28] VCAPCD. *Rule 56 (Open Burning).* (Amended November 11, 2003). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2056.pdf

Bay Area AQMD

- BAAQMD Regulation 5 (Open Burning)

	SJVAPCD Rule 4103	BAAQMD Reg 5
Applicability	Open burning, with the exception of prescribed burning and hazard reduction burning (regulated under Rule 4106).	Open burning.
Exemption	• Fires used for cooking, campfires, and religious fires where the fuel is clean, dry wood, or charcoal • Emergency burning by a fire agency, the respectful burning of an unserviceable American flag, bags used for agricultural chemicals, and raisin trays • Specific exemptions and provisions for burning contraband and emergency agricultural burns that would cause economic loss if denied	• Fires set only for cooking of food for human beings • Fires burning as safety flares or for the combustion of waste gases • Use of flame cultivation when the burning is performed with liquefied petroleum gas (LPG) or natural gas (NG) fired burners designed and used to kill seedling grass and weeds and the growth is such that the combustion will not continue without the burner • Fires set for the purposes of fire training using one gallon or less of flammable liquid per fire • Further requirements for conditional exemptions (similar to SJV)
Requirements	No burning of garbage or other materials. Burning shall be allocated by the APCO dependent on dispersion conditions and shall avoid negative impacts to receptors. No permit shall be issued for the burning of the following categories of agricultural waste, except under specific conditions in Rule, and approved by the District Governing Board and CARB: • Field Crops • Prunings • Weed Abatement, except for categories covered by Best Management Practices in Rule • Orchard Removals • Vineyard Removal Materials • Surface Harvested Prunings • Other Materials Additional requirements for burning times, drying times, contraband burning. Permit required for the burning of Russian Thistle, and a conditional burning permit required for diseased materials with specific requirements, burn plans required for fire suppression training, burning of contraband, BMP selection required for weed maintenance.	No specific crop phase-outs or bans. Recreational fires allowed on non-curtailment days. On permissive burn days the following fires are allowed with permission from the APCO (specific requirements for each category): disease and pest, crop replacement, orchard pruning and attrition, double cropping stubble, stubble, hazardous materials (hazard reduction burning), fire training, flood debris, irrigation ditches, flood control, range management, forest management, marsh management, contraband, filmmaking, and public exhibition.

BAAQMD Regulation 5 was last amended on November 20, 2019 to reduce potential cost barriers associated with prescribed burning in alignment with statewide efforts to prevent larger, more destructive wildfires through increased prescribed burning. Specifically, the amendments include exemptions for public agencies from paying Open Burning Fees when conducting prescribed burns for the purpose of wildfire prevention. The District evaluated the requirements contained within BAAQMD's Regulation 5 and found no requirements that were more stringent than those already in Rule 4103. District Rule 4103 is as stringent as or more stringent than BAAQMD Regulation 5.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District performed an extensive review of the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future. As demonstrated above, in adherence with applicable state laws instituted under SB 705, the Valley has the toughest restrictions on agricultural burning in the state. The District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

The District's robust agricultural burning rule and efforts to phase out agricultural burning to date, further made more stringent with the recent action to phase out of agricultural burning by January 1, 2025, support that the District's rule is the most stringent in the nation. Rule 4103 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.2 RULE 4104 (REDUCTION OF ANIMAL MATTER)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

District Rule 4104 Description

Adopted in 1992, District Rule 4104 limits the air contaminants from operations used for the reduction of animal matter by requiring gases, vapors, and gas-entrained effluent from the process to be incinerated at temperatures not less than 1,200 degrees Fahrenheit or processed in an equally effective manner. The reduction of animal matter source category includes rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration processes.

The criteria pollutant emissions from this category are relatively small. The primary cause of concern from this source category is odor, which rule requirements minimize with the use of a venturi scrubber, cyclone, or packed bed scrubber for PM control, followed by a thermal oxidizer for VOC control. These facilities generally use steam from a boiler (indirect-fired) or rotary dryer (direct-fired) for their operations, which generate NOx emissions. The emissions from these combustion units are controlled by and accounted for in other District rules.

How does District Rule 4104 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4104 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4104 to comparable requirements in rules from the following California nonattainment areas:

- Bay Area AQMD Regulation 12, Rule 2 (Adoption Date N/A)[29]
- Monterey Bay ARD Rule 414 (Amended August 21, 2002)[30]
- Sacramento Metropolitan AQMD Rule 410 (Amended August 3, 1977)[31]
- San Diego County APCD Rule 64 (Amended August 21, 1981)[32]
- South Coast AQMD Rules 472 (Adopted May 7, 1976)[33]
- Ventura County APCD Rule 58 (Amended May 23, 1972)[34]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4104 continues to implement requirements as stringent as or more stringent than these other areas.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District performed an extensive review of the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

PM2.5 Emission Control Technologies

Packed Bed Scrubbers

The District evaluated the potential opportunity to reduce emissions if facilities were to replace their thermal oxidizers with packed bed scrubbers. In certain installations, packed bed scrubbers may be more efficient at removing PM from the exhaust, and additionally do not generate NOx or SOx emissions. However, retrofitting an existing facility by replacing an existing thermal oxidizer with a packed bed scrubber system may take some design and experimentation on the part of the facility to ensure it does not cause an increase in nuisance and odors or effect the operation. The retrofit costs associated with the capture and control using a packed bed scrubber would be significant. Additionally, operators would need to replace the filter media used in the

[29] BAAQMD. *Regulation 12, Rule 2 (Rendering Plants).* (Adoption Date N/A, Approved by EPA 1981). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-12-rule-2-rendering-plants/documents/rg1202.pdf?la=en&rev=bdc8a980e3174c4b8b2f483142394f1e

[30] MBARD. *Rule 414 (Reduction of Animal Matter).* (Amended August 21, 2002). Retrieved from: https://ww2.arb.ca.gov/sites/default/files/classic/technology-clearinghouse/rules/RuleID1646.pdf

[31] SMAQMD. *Rule 410 (Reduction of Animal Matter).* (Amended August 3, 1977). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule410.pdf

[32] SDAPCD. *Rule 64 (Reduction of Animal Matter).* (Amended August 21, 1981). Retrieved from: https://www.sdapcd.org/content/dam/sdapcd/documents/rules/current-rules/Rule-64.pdf

[33] SCAQMD. *Rule 472 (Reduction of Animal Matter).* (Adopted May 7, 1976). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-472.pdf?sfvrsn=4

[34] VCAPCD. *Rule 58 (Reduction of Animal Matter).* (Amended May 23, 1972). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2058.pdf

scrubber periodically, adding to the cost of upkeep. Existing thermal oxidizer installations do not present similar issues. In addition, facilities subject to Rule 4104 produce only a very small amount of directly emitted PM2.5 and are otherwise already required to have a high level of control for emissions, as shown in the emissions inventory table at the beginning of this section.

Zero-Emission Opportunities

The District evaluated all available opportunities for reducing emissions from this source category and did not identify any available zero-emission technologies or any instances of zero-emission requirements for these operations. However, the District will continue to closely track the development of new zero-emissions technologies and control measures for this source category.

The District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

Rule 4104 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.3 RULE 4106 (PRESCRIBED BURNING AND HAZARD REDUCTION BURNING)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	4.01	6.95	4.17	4.17	4.17	4.18	4.18
NOx	0.35	0.65	0.32	0.33	0.33	0.33	0.33
	Winter Average - Tons per day						
PM2.5	3.37	8.73	2.61	2.61	2.62	2.62	2.62
NOx	0.30	0.83	0.25	0.25	0.25	0.26	0.26

District Rule 4106 Description

District Rule 4106, adopted in June 2001, is applicable to range improvement burning, forest management burning, wildland vegetation management burning, and hazard reduction burning within the Valley. Prescribed burning generally includes forest waste, fire hazard reduction, rangeland management, wildlife habitat improvement, and ecosystem (forest health) burning. The adoption of Rule 4106 incorporated provisions made necessary by the March 23, 2000 amendment of Title 17 of the California Code of Regulations. EPA approved Rule 4106 into the SIP in February 2002.[35]

Recognizing the importance of both prescribed burning and hazard reduction burning, the purpose of Rule 4106 is to permit, regulate, and coordinate the use of prescribed burning and hazard reduction burning while minimizing smoke impacts on the public. Through this rule, the District has expended considerable resources to ensure that the ignition of burn projects are only permitted when air quality and dispersion conditions are favorable, thus lessening health impacts on Valley citizens and on air quality in the Valley.

How does District Rule 4106 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Technique Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category.

[35] EPA. *Revisions to the California State Implementation Plan, San Joaquin Valley Unified Air Pollution Control District*. 67 FR 8894-8897. (Codified at 40 CFR Part 52). (February 27, 2002). Retrieved from: https://www.federalregister.gov/articles/2002/02/27/02-4526/revisions-to-the-california-state-implementation-plan-san-joaquin-valley-unified-air-pollution

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4106 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4106 to comparable requirements in rules from the following California nonattainment areas:

- Bay Area AQMD Regulation 5 (Amended November 20, 2019)[36]
- Placer County APCD Rule 301 (Amended August 9, 2018)[37]
- Placer County APCD Rule 303 (Amended February 9, 2012)[38]
- Sacramento Metropolitan AQMD Rule 501 (Amended April 3, 1997)[39]
- South Coast AQMD Rule 444 (Amended July 12, 2013)[40]
- Ventura County APCD Rule 56 (Amended November 11, 2003)[41]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4106 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

Bay Area AQMD

- BAAQMD Regulation 5 (Open Burning)

	SJVAPCD Rule 4106	BAAQMD Regulation 5
Applicability	All prescribed burning, and hazard reduction burning in wildland/urban interface.	Open burning.
Exemptions	None.	• Fires set only for cooking of food for human beings • Fires burning as safety flares or for the combustion of waste gases • Use of flame cultivation when the burning is performed with LPG or NG-fired burners designed and used to kill seedling grass and weeds and the

[36] BAAQMD. *Regulation 5 (Open Burning).* (Amended November 20, 2019). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/regulation-5/documents/20191120_r0500_final-pdf.pdf?la=en&rev=51124978dd4b4e598ba56bfe2a1c23df
[37] PCAPCD. *Rule 301 (Nonagricultural Burning Smoke Management).* (Amended August 9, 2018). Retrieved from: https://placerair.org/DocumentCenter/View/2221/Rule-301-PDF
[38] PCAPCD. *Rule 303 (Prescribed Burning Smoke Management).* (Amended February 9, 2012). Retrieved from: https://placerair.org/DocumentCenter/View/2223/Rule-303-PDF
[39] SMAQMD. *Rule 501 (Agricultural Burning).* (Amended April 3, 1997). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule501.pdf
[40] SCAQMD. *Rule 444 (Open Burning).* (Amended July 12, 2013). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-444.pdf?sfvrsn=4
[41] VCAPCD. *Rule 56 (Open Burning).* (Amended November 11, 2003). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2056.pdf

	SJVAPCD Rule 4106	BAAQMD Regulation 5
		growth is such that the combustion will not continue without the burner • Fire training using one gallon or less of flammable liquid per fire • Further requirements for conditional exemptions (similar to SJV)
Requirements	No burning of garbage or green waste. The District shall allocate burning based on the predicted meteorological conditions and whether the total tonnage to be emitted would allow the volume of smoke and other contaminants to impact smoke sensitive areas, or create or contribute to an exceedance of an ambient air quality standard. Specific requirements for minimizing smoke, using approved ignition devices, and having vegetation be free of dirt, soil, and moisture. **Prescribed Burning:** Prescribed burn conductors shall have taken a prescribed burning smoke management training class approved by the APCO. Additional prescribed burn requirements detailed by project size. **Hazard Reduction Burning:** No Hazard Reduction Burning shall take place without a permit. A permit shall be valid only on those days during which burning is not prohibited by CARB, the District, or other designated agencies. Further administrative requirements and Smoke Management Plan requirements are outlined by project size.	Recreational fires allowed on non-curtailment days; on permissive burn days the following fires are allowed with permission from the APCO (specific requirements for each category): disease and pest, crop replacement, orchard pruning and attrition, double cropping stubble, stubble, hazardous materials (hazard reduction burning), fire training, flood debris, irrigation ditches, flood control, range management, forest management, marsh management, contraband, filmmaking, and public exhibition.

The District evaluated the requirements contained within BAAQMD's Regulation 5 and concluded that District Rule 4106 is as stringent as or more stringent than BAAQMD Regulation 5.

Placer County APCD

- PCAPCD Rule 301 (Nonagricultural Burning Smoke Management)

	SJVAPCD Rule 4106	PCAPCD Rule 301
Applicability	All prescribed burning, and hazard reduction burning in wildland/urban interface.	All burning except where otherwise prohibited by a local jurisdiction.
Exemptions	None.	• Burning conducted pursuant to rules for: agricultural waste burning, prescribed burning, land development

	SJVAPCD Rule 4106	PCAPCD Rule 301
		burning, residential allowable burning, open burning of nonindustrial wood waste at designated disposal sites • Fire hazard or health hazard burning conducted under a Public Officer waiver • Recreational or cooking fire, provided not used for waste disposal purposes • Burning, in a respectful and dignified manner, of an unserviceable American flag that is no longer fit for display • Open burning conducted by Public Officers, if conducted under other rule requirements • Burning of standing green vegetation which is part of right-of-way clearing, levee, ditch, and reservoir maintenance • APCO may grant exemption to drying times requirements if denial of such burning would threaten imminent and substantial economic loss
Requirements	No burning of garbage or green waste. The District shall allocate burning based on the predicted meteorological conditions and whether the total tonnage to be emitted would allow the volume of smoke and other contaminants to impact smoke sensitive areas, or create or contribute to an exceedance of an ambient air quality standard. Specific requirements for minimizing smoke, using approved ignition devices, and having vegetation be free of dirt, soil, and moisture. **Prescribed Burning:** Prescribed burn conductors shall have taken a prescribed burning smoke management training class approved by the APCO. Additional prescribed burn requirements detailed by project size. **Hazard Reduction Burning:** No Hazard Reduction Burning shall take place without a permit. A permit shall be valid only on those days during which burning is not prohibited by CARB, the District, or other designated agencies. Further administrative requirements and Smoke Management Plan requirements are outlined by project size.	No person shall use an open outdoor fire (including the use of a burn barrel) for the purpose of disposal or burning of any disallowed combustibles. The only allowable combustibles is vegetation originating on the premises which is reasonably free of dirt, soil, and visible surface moisture. A person shall not ignite or allow open outdoor burning without first obtaining a valid burn permit for Fire Hazard Reduction, Mechanized Burner, Open Burning Conducted by Public Officers, Right of Way Clearing, Levee, Ditch and Reservoir Maintenance, subject to burn day validity requirements. Sources must comply with preparation and drying time requirements. Burns subject to ignition devices, wind, and other requirements. Other administrative and recordkeeping requirements.

The District evaluated the requirements contained within PCAPCD Rule 301 and found that District Rule 4106 is as stringent as or more stringent than PCAPCD Rule 301.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District reviewed the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

While there are many factors that need to be evaluated and addressed in the pursuit of minimizing fuel buildup, more effective use of prescribed burning is an area where the District has direct regulatory authority and can take action. The District has long been supportive of fuel reduction efforts including prescribed burns, advocating that reducing fuels in a responsible way will improve the health of the forests and improve future air quality by lessening the severity of wildfires. Despite these efforts, the forest fuel buildup has continued to increase at an alarming rate over the years due to decades of forest mismanagement, with fire danger being at an all-time high due to the recent catastrophic tree mortality from the drought and pest infestation. This long-term buildup of forest fuel poses a significant risk of large-scale wildfires with potential devastating impacts on air quality and public health. This has increased the need and urgency for greater forest fuel reductions. Based on direction received from the District's Governing Board in November 2015, and input from land management agencies, the District has become even more flexible when identifying permissive burn days for prescribed burning, which has assisted in a more rapid reduction of fuels. Additionally, in June 2019, the District's Governing Board authorized the District to enter into a Memorandum of Understanding (MOU) with the California Air Pollution Control Officers Association (CAPCOA) to participate in the new statewide Prescribed Burn Reporting and Monitoring Support Program in an effort to facilitate increased levels of prescribed burning across the state. These efforts have assisted in furthering the use of prescribed burning as a measure to prevent catastrophic wildfires while simultaneously minimizing health impacts for local residents.

Mechanical Removal of Forest Biomass

Given the catastrophic nature of wildfires, contradictory environmental concerns that preclude the use of mechanized equipment to dispose of fuel supplies need further examination. On one hand, there is concern that the transportation and operation of logging equipment can damage wildland ecosystems and impact endangered and threatened species, and that mechanical harvesting of vegetative fuel supplies could lead to overharvesting of the forests. On the other hand, if left unchecked, fuel buildup can lead to large wildfires that cause the destruction of the very species intended to be protected by policies such as those under the federal Wilderness Act, and in turn result in devastating public health impacts due to air pollution. The District will work with federal land managers and environmental stakeholders to ascertain the wildland areas where ecosystem and species impacts are of less concern, and support mechanical fuel reduction methods as appropriate.

The District analyzed the possibility of mechanical removal as an alternative to prescribed burning, but found that mechanical removal of forest biomass was infeasible as a required alternative to prescribed burning, due to the inaccessibility of mountain terrain and the extreme amount of forest acreage needing biomass management. However, the District will support the use of mechanical removal where feasible. Fire agencies are procuring and deploying chippers, portable saw mills, masticators and air curtain burners throughout the state, but primarily in the forested land surrounding the Valley. This process has been facilitated by emergency exemptions that have been invoked by CARB to waive the requirements for portable equipment and certain off-road equipment.

District Support of Forest-Specific Biomass Projects

The District will also explore other avenues to encourage and support forest-specific biomass projects, such as the North Fork Community Power project in Madera County. This 2 MW power plant will gasify hazard-reduction forest material, where the gas is then burned in an exhaust-controlled environment that produces very low levels of NOx. This project has been permitted and construction has commenced. The successful operation of this plant will be an important demonstration of gasification technology as a viable alternative to the open burning of forest debris. The operation of this project complements the Governor's October 30, 2015, State of Emergency Proclamation that directs state agencies to implement a number of measures to accelerate the removal of fuel in the state's forests, and which includes extending and expediting power purchase agreements with biomass facilities, seeking additional funding for biomass facilities to help offset higher feedstock costs, and exempting projects under the proclamation from California Environmental Quality Act requirements.

Due to the scale of acreage that requires management and due to access issues to remote forest areas, this is not a technologically feasible regulatory alternative to prescribed burning. However, the District will work to support forest-specific biomass projects in an effort to reduce transport emissions created from hauling forest biomass to the Valley floor for further processing.

Zero-Emission Opportunities

The District evaluated all available opportunities for reducing emissions from this source category and did not identify any available zero-emission technologies or any instances of zero-emission requirements for prescribed burning. However, the District will continue to closely track the development of new zero-emissions technologies and control measures for this source category.

The District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

Rule 4106 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in

practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.4 RULE 4203 (PARTICULATE MATTER EMISSIONS FROM INCINERATION OF COMBUSTIBLE REFUSE)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

District Rule 4203 Description

District Rule 4203 was originally adopted on May 21, 1992, and was subsequently amended on December 17, 1992. Rule 4203 limits the concentration of PM emissions based on process weight rates, and prohibits the discharge of visible emissions from the incineration of combustible refuse. The rule applies to any person, operation, or facility who uses an incinerator or other equipment to dispose of or process combustible refuse by incineration. The only Valley facility subject to this rule currently implements BACT level requirements, using a baghouse to control particulate emissions and lime slurry dry scrubber for the control of SO2 and acid gas emissions.

How does District Rule 4203 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Technique Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4203 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4203 to comparable requirements in rules from the following California nonattainment areas:

- South Coast AQMD Rule 473 (Adopted May 7, 1976)[42]
- Ventura County APCD Rule 57 (Amended January 11, 2005)[43]

Bay Area AQMD and Sacramento Metropolitan AQMD do not have analogous rules for this source category.

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4203 continues to implement requirements as stringent as or more stringent than these other areas.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District reviewed the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

Zero-Emission Opportunities

The District evaluated all available opportunities for reducing emissions from this source category and did not identify any available zero-emission technologies or any instances of zero-emission requirements for these operations. However, the District will continue to closely track the development of new zero-emissions technologies and control measures for this source category.

The District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

Particularly since the emissions inventory for this source category is zero, Rule 4203 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

[42] SCAQMD. *Rule 473 (Disposal of Solid and Liquid Wastes).* (Adopted May 7, 1976). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-473.pdf?sfvrsn=4
[43] VCAPCD. *Rule 57 (Incinerators).* (Amended January 11, 2005). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2057.pdf

C.5 RULE 4204 (COTTON GINS)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.05	0.05	0.05	0.05	0.05	0.05	0.06
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	0.07	0.07	0.07	0.08	0.08	0.09	0.09
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

District Rule 4204 Description

Rule 4204 was adopted on February 17, 2005, as part of the District's strategy to reduce PM10 emissions and to attain the federal standards for the *2003 PM10 Plan*. Rule 4204 limits particulate matter emissions from cotton ginning operations. Cotton ginning is the process of separating the lint from the seed. Cotton gins have been operating within the Valley for decades and have become a highly efficient industry producing millions of bales of cotton. Modern ginning uses pneumatic conveyance, in the form of fans blowing air, which moves the cotton material throughout the ginning process. PM emissions are the unwanted byproducts of this efficient means of transferring massive quantities of cotton material from one process to the next process, such as from the unloading stage to drying and cleaning stages. Since cotton gins use large quantities of air for conveying, cyclones are used for air pollution abatement. PM emissions from cotton ginning facilities occur mostly during a three-month period from October to December.

While the principle function of the cotton gin is to separate lint from seed, the gin must also be able to remove foreign matter, moisture, and other contaminants that significantly reduce the value of the ginned lint. Currently, all cotton gins in the Valley are required to operate using high-efficiency 1D3D cyclones.

How does District Rule 4204 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Technique Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category.

State Regulations

No California state regulations have been identified that are applicable to cotton gins. However, the District has identified regulations in other states that have requirements applicable to cotton gins. These include the following regulations:

- New Mexico Administrative Code (NMAC) 20.2.66.1 (Adopted April 7, 2005)[44]
- North Carolina Administrative Code (NCAC) Title 15A, Subchapter 2D, Section .0542 (Readopted November 1, 2020)[45]
- South Carolina Department of Health and Environmental Control (SCDHEC), Regulation 61-62.5, Standard No. 4, Section V (Amended September 23, 2016)[46]
- Oklahoma Department of Environmental Quality (ODEQ), Air Pollution Control, 252:100-23 (Amended June 15, 2007)[47]
- Texas Commission on Environmental Quality (TCEQ), Air Quality Standard Permit for Cotton Gin Facilities and Cotton Burr Tub Grinders (Adopted April 7, 2010)[48]

North Carolina Administrative Code Title 15A, Subchapter 2D, Section .0542 (Control of Particulate Emissions from Cotton Ginning Operations)

	SJVAPCD Rule 4204	15A NCAC 02D .0542
Applicability	All cotton ginning facilities.	All existing, new, and modified cotton ginning operations.
Exemption	Cotton ginning facilities used for research purposes and limited to throughputs of not more than 4,000 pounds of seed cotton processed per day (equivalent to 4 bales/day at a trash-to-cotton ratio of 1-to-1).	Existing facilities with a maximum rated capacity <20 bales/hour that do not have cyclones on lint cleaners and battery condensers are not required to add emission control devices to lint cleaning exhausts and/or batter condenser exhausts if emissions from the lint cleaning and/or battery condenser are controlled by fine mesh screens.
Requirements	All emission points shall be controlled by 1D3D cyclones or rotary drum filters. New cyclones or replacement parts of existing 1D3D cyclones shall have the dimensional characteristics of the Enhanced 1D3D cyclone, or the 1D3D with a 2D2D inlet and an expansion chamber trash outlet.	Control all high pressure exhausts and lint cleaning exhausts with an emission control system that includes: • One or more 1D3D or 2D2D cyclones to achieve 95% efficiency; or • A device with at least a 95% efficiency.

[44] NMAC. *Administrative Code 20.2.66.1 (Cotton Gins).* (Adopted April 7, 2005). Retrieved from: https://www.srca.nm.gov/parts/title20/20.002.0066.html
[45] NCAC. *Administrative Code Title 15A, Subchapter 2D, Section .0542 (Control of Particulate Emissions from Cotton Ginning Operations).* (Readopted November 1, 2020). Retrieved from: https://deq.nc.gov/media/17395/download
[46] SCDHEC. *Regulation 61-62.5, Standard No. 4, Section V (Cotton Gins).* (Amended September 23, 2016). Retrieved from: https://scdhec.gov/sites/default/files/Library/Regulations/R.61-62.5_Std.4.pdf
[47] ODEQ. *Title 252, Chapter 100, Subchapter 23 (Control of Emissions from Cotton Gins).* (Amended June 15, 2007). Retrieved from: https://www.deq.ok.gov/wp-content/uploads/deqmainresources/100.pdf
[48] TCEQ. *Air Quality Standard Permit for Cotton Gin Facilities and Cotton Burr Tub Grinders.* (Adopted April 7, 2010). Retrieved from: https://www.tceq.texas.gov/assets/public/permitting/air/NewSourceReview/ag/cotton_sp_final.pdf

	SJVAPCD Rule 4204	15A NCAC 02D .0542
	Drive-under or pull-through trash collection system for load-out purposes shall not load trash into a hopper or trailer unless one or more the following are utilized: • The trash loading area has an enclosure with four sides that are higher than the trash auger; at least two sides shall be solid and the remaining sides shall: have a flexible wind barrier, which extends below the top of the trash trailer sides; or have solid doors that remain shut while trash trailers are being loaded, except as necessary to accommodate trailer movement; or have a combination of flexible wind barriers and solid doors. • A solid-sided trailer is used when there is no enclosure, and the trash auger and opening of the loading device have a flexible shroud that extends just below the top of the trailer's solid sides, or • Fugitive PM10 emissions from load-out areas are reduced by an alternative method, which is approved by the APCO and EPA. An owner/operator shall not operate a trash conveyance system dumping directly into a pile unless it meets the following requirements: • Both sides of the trash auger shall be equipped with wind barriers that extend, as measured vertically prior to trash pile build-up, one foot above and three feet below the auger or with an alternative control approved by the APCO and EPA. • After the pile has built up to the height of the trash auger, removing material from the pile shall be performed in such a way as to prevent free-falling trash from the stockpiling system. Dust management plans for facilities are subject to the requirements in District Rules 8011, 8021, 8031, 8041, 8051, 8061, 8071, and 8081.	Control all low pressure exhausts, except lint cleaning exhausts, with an emission control system that includes: • One or more 1D3D or 2D2D cyclones to achieve 90% efficiency; or • A device with at least a 90% efficiency. Minimize fugitive emissions by designing and maintaining trash systems, the gin yard, and the traffic area according to the guidelines in the regulation.

The NCAC regulation requires the use of 2D2D or 1D3D cyclones while District Rule 4204 requires 1D3D cyclones. District Rule 4204 also requires that new cyclones be Enhanced 1D3D cyclones with high control efficiency, which exceeds the standard 1D3D cyclone control efficiency. For cyclones controlling exhaust on high-pressure

systems, the NCAC also specifies a 95% control efficiency. Texas A&M reports tested efficiencies of 97% for 1D3D cyclones and up to 99% for Enhanced 1D3D cyclones. Therefore, District Rule 4204 requiring the use of 1D3D cyclones on all systems, and also requiring that new cyclones be Enhanced 1D3D cyclones with PM control efficiency up to 99%, exceeds NCAC requirements for high-pressure systems with 95% PM control efficiency.

On low-pressure systems, the NCAC regulation requires the use of 2D2D or 1D3D cyclones and identifies a 90% PM control efficiency. As discussed above, District Rule 4204 requires the use of 1D3D cyclones or Enhanced 1D3D cyclones when installing new cyclones. As mentioned, Texas A&M reports tested efficiencies of 97% for 1D3D cyclones and up to 99% for Enhanced 1D3D cyclones. Therefore, District Rule 4204 requiring the use of 1D3D cyclones or new Enhanced 1D3D cyclones with PM control efficiency up to 99% exceeds NCAC requirements for low-pressure systems with 90% PM control efficiency.

The NCAC regulation also provides an exemption for operations processing less than 20 bales per hour, which could represent approximately 20,000 bales per season. Since the District rule does not have such exemption (only contains a research-targeted exemption at less than four bales/day), District Rule 4204 is more stringent in this area as well.

Therefore, overall, District Rule 4204 is more stringent than the NCAC 02D.0542 regulation applying to cotton gin operations.

South Carolina Department of Health and Environmental Control, Regulation 61-62.5, Standard No. 4, Section V (Cotton Gins)

	SJVAPCD Rule 4204	SCDHEC Reg §61-62.5.4.V
Applicability	All cotton ginning facilities.	All existing, new, and modified cotton ginning operations.
Exemption	Cotton ginning facilities used for research purposes and limited to throughputs of not more than 4,000 pounds of seed cotton processed per day (equivalent to 4 bales/day at a trash-to-cotton ratio of 1-to-1).	Existing facilities with a maximum gin stand rated capacity (or documented equipment limitation) of <20 bales/hour that do not have cyclones on lint cleaning system exhausts and battery condenser exhausts if emissions from these exhausts are controlled by fine mesh screens.
Requirements	All emission points shall be controlled by 1D3D cyclones or rotary drum filters. New cyclones or replacement parts of existing 1D3D cyclones shall have the dimensional characteristics of the Enhanced 1D3D cyclone, or the 1D3D with a 2D2D inlet and an expansion chamber trash outlet.	Each cotton ginning operation shall install and operate a particulate emission control system on all high- and low-pressure exhausts and lint cleaning system exhausts that includes one or more 1D3D or 2D2D cyclones. Trash stacker areas shall contain 1 of the following: • A 3-sided enclosure with a roof whose sides are high enough above the

	SJVAPCD Rule 4204	SCDHEC Reg §61-62.5.4.V
	Drive-under or pull-through trash collection system for load-out purposes shall not load trash into a hopper or trailer unless one or more the following are utilized: • The trash loading area has an enclosure with four sides that are higher than the trash auger; at least two sides shall be solid and the remaining sides shall: have a flexible wind barrier, which extends below the top of the trash trailer sides; or have solid doors that remain shut while trash trailers are being loaded, except as necessary to accommodate trailer movement; or have a combination of flexible wind barriers and solid doors. • A solid-sided trailer is used when there is no enclosure, and the trash auger and opening of the loading device have a flexible shroud that extends just below the top of the trailer's solid sides, or • Fugitive PM10 emissions from load-out areas are reduced by an alternative method, which is approved by the APCO and EPA. An owner/operator shall not operate a trash conveyance system dumping directly into a pile unless it meets the following requirements: • Both sides of the trash auger shall be equipped with wind barriers that extend, as measured vertically prior to trash pile build-up, one foot above and three feet below the auger or with an alternative control approved by the APCO and EPA. • After the pile has built up to the height of the trash auger, removing material from the pile shall be performed in such a way as to prevent free-falling trash from the stockpiling system. Dust management plans for facilities are subject to the requirements in District Rules 8011, 8021, 8031, 8041, 8051, 8061, 8071, and 8081.	opening of the dumping device to prevent wind from dispersing dust or debris; or • A device to provide wet suppression at the dump area of the trash cyclone and minimize free fall distance of waste material exiting the trash cyclone. Minimize fugitive emissions by designing and maintaining trash systems, the gin yard, and the traffic area according to the guidelines in the regulation.

The SCDHEC regulation requires the use of 2D2D or 1D3D cyclones, while District Rule 4204 requires 1D3D cyclones and requires that new cyclones be Enhanced 1D3D cyclones with high control efficiency. Texas A&M reports tested efficiencies of 97% for 1D3D cyclones and up to 99% for Enhanced 1D3D cyclones. Therefore, District Rule

4204 requirements result in higher PM control efficiency as compared to SCDHEC regulation requirements.

The SCDHEC regulation also provides an exemption for operations processing less than 20 bales per hour, which could represent approximately 20,000 bales per season. Since the District rule does not have such an exemption, District Rule 4204 is more stringent in this area as well.

While the SCDHEC regulation requires the trash stacker be contained in a three-sided enclosure, District Rule 4204 requires that the trash loading area be an enclosure with four sides higher than the trash auger, which is more stringent.

Therefore, District Rule 4204 is more stringent than the SCDHEC Regulation 62.5, Std. 4, Section V requirements applying to cotton gin operations.

How does District Rule 4204 compare to rules in other air districts?

Bay Area AQMD, Sacramento Metropolitan AQMD, South Coast AQMD, and Ventura County APCD do not have analogous rules for this source category.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District reviewed the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

PM2.5 Emission Control Technologies

Baghouses

The District evaluated baghouses as a potential control device, however, these technologies are generally not feasible for cotton ginning operations due to a number of factors. A typical cotton ginning operation relies on an air cleaning system handling fibrous materials such as cotton and cotton waste in a cotton gin. This air cleaning system uses high volumes of air to move the cotton throughout the ginning operation. Usually, these high volumes of air are much higher than any volumes of air passing through a baghouse. Throughout the various processes of the cotton gin operation, air velocities range from 1,500 ft/min to 5,000 ft/min.[49] Higher-than-average gas volumes and PM cause bag blinding,[50] where the increased velocity allows dust to penetrate into the fabric, and the cleaning system is unable to remove it.

In addition to the high volume of air, the baghouse would also see higher than normal temperature excursions, which can shorten bag life considerably. This same effect occurs when seed cotton is first dried in large dryers using heated air to reduce

[49] Reference Agriculture Handbook No. 503 – Cotton Ginners Handbook, July 1977, page 59.
[50] Blinding (*define*) – A closing of the filter medium pores which results in either a reduced gas flow or an increased pressure drop across the medium.

moisture content, and if the seed cotton requires additional drying, it is often run through a second or third dryer.

Excess moisture is common to cotton grown in the more humid regions of the Cotton Belt, while cotton produced in the Southwest can be too dry because of the region's arid climate. Lack of moisture at ginning can lower the quality of the fiber and contribute to ginning problems. For these reasons, moisture is added with a special humidifier that blows warm, humid air through the gin's conveyor pipes. Moisture on the bags tends to alter the adhesion of the dust cake on and within the fabric structure, and "mudding" or blinding of the bags may occur because the cleaning system cannot remove this dust.

The District determined that due to the requirements for high volumes of air, blinding from the fibrous material, temperature excursions across fabric filters, and introduction of moisture during the ginning operation, baghouses would not be a feasible control device for cotton ginning operations.

1D3D Cyclones with Expansion Chamber

Currently, all cotton gins in the Valley are required to operate using a 1D3D cyclone. There are currently 28 such units, and about two thirds of the 1D3D cyclones used in the Valley have an expanded chamber outlet. Research has shown that an expansion chamber allows for more air flow since it is not as narrow. In initial tests, a larger D/3 size expanded chamber exit produced PM10 emissions that were about 8% lower than those resulting from use of the standard, small-diameter (D/4) exit.[51] A USDA study[52] on PM2.5 emissions from cotton gins provided a PM2.5/PM10 ratio for emissions from cotton gins, however did not extend to the expected PM2.5 control efficiencies of control devices at cotton gins; the District has found no completed research indicating the effectiveness of reducing PM2.5 by installing an expansion chamber. As noted above, expansion chambers result in a minor increase in efficiency for PM10 emissions control, but PM2.5 is a very small fraction of the overall particulate in these systems and does not respond as well as PM10 to air flow changes, such as those induced by an expansion chamber. Therefore, expansion chambers would not be a feasible control for PM2.5.

Mechanical Conveyance

The District considered mechanical conveyance for the main trash handling system as a potential opportunity to reduce emissions, however it has only been demonstrated as feasible for newly constructed or rebuilt cotton gins. Mechanical conveyance reduces emissions from cotton gin trash handling exhaust streams, which are otherwise moved pneumatically. The cotton gin trash handling systems only comprise a fraction of the emissions that are released from the full cotton ginning process.

Newer or rebuilt cotton gins are able to accommodate a mechanical conveyance system since operators are able to design the cotton gin around the equipment and space

[51] Baker R.V. and Hughs S.E. (1998). *Influence of Air Inlet and Outlet Design and Trash Exit Size on 1D3D Cyclone Performance*. Transactions of the ASAE, vol. 42(1): 17-21.
[52] USDA, Agricultural Research Service. *Characterization of Cotton Gin Particulate Matter Emissions.* (2013). Retrieved from: http://buser.okstate.edu/air-quality/cotton-gin/national-study/

needed. Operators that have installed a mechanical conveyance system for their cotton gin have had to build a lower floor, below the main level containing the major cotton gin equipment, to house the mechanical conveyors. Therefore, as confirmed by equipment manufacturers, it is not technologically feasible to retrofit existing cotton gins with mechanical conveyance systems to replace existing trash handling equipment.

Zero-Emission Opportunities

The District evaluated all available opportunities for reducing emissions from this source category and did not identify any available zero-emission technologies or any instances of zero-emission requirements for these operations. However, the District will continue to closely track the development of new zero-emissions technologies and control measures for this source category.

Based on this review, the District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

Rule 4204 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.6 RULE 4301 (FUEL BURNING EQUIPMENT)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NOx	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	Winter Average - Tons per day						
PM2.5	n/a	n/a	n/a	n/a	n/a	n/a	n/a
NOx	n/a	n/a	n/a	n/a	n/a	n/a	n/a

The emission inventory is not specific to Rule 4301. See Rules 4306, 4307, 4308, 4309, and 4352 for the individual emissions inventories.

District Rule 4301 Description

District Rule 4301 applies to all types of fuel burning equipment, except air pollution control equipment. The purpose of this rule is to limit emissions of air contaminants from fuel burning equipment by specifying maximum emission rates for SOx, NOx, and PM (identified in the rule as combustion contaminant emissions). EPA finalized approval of the 1992 amendments to Rule 4301 on May 18, 1999.

Rule 4301 limits the concentration of combustion contaminants to 0.1 grain per standard cubic feet of gas and limits maximum emissions rates of SOx to 200 pounds per hour, NOx to 140 pounds per hour, and combustion contaminants to 10 pounds per hour from fuel burning equipment.

Rule 4301 has a very broad applicability, as it applies to all types of fuel burning equipment. Several District rules with more stringent NOx requirements for specific types of fuel burning equipment supersede this rule. See the control measure evaluations for Rules 4306, 4307, 4308, 4309, 4320, and 4352 for more specific information about the individual fuel burning equipment source categories.

How does District Rule 4301 compare with federal and state rules and regulations?

Facilities subject to Rule 4301 are subject to various state rules and federal requirements. However, several District rules have superseded Rule 4301 with more stringent requirements. The control measure evaluations for those rules include comparisons of those District rules to the applicable federal and state regulations.

How does District Rule 4301 compare to rules in other air districts?

Several District rules with more stringent NOx requirements for specific types of fuel burning equipment supersede this rule. See Rules 4306, 4307, 4308, 4309, 4320, and 4352 for comparisons of those rules to applicable rules in other air districts.

Potential Emission Reduction Opportunities

Several District rules with more stringent requirements have superseded Rule 4301. The control measure evaluations for those rules discuss any potential emission reduction opportunities for this source category.

Evaluation Findings

Several District rules with more stringent NOx requirements for specific types of fuel burning equipment supersede this rule. See the control measure evaluations for Rules 4306, 4307, 4308, 4309, 4320, and 4352.

C.7 RULE 4306 AND 4320 (BOILERS, STEAM GENERATORS, AND PROCESS HEATERS, GREATER THAN 5.0 MMBTU/HR)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	2.39	2.28	2.13	2.01	1.90	1.83	1.80
NOx	3.53	3.29	2.94	2.44	2.19	2.03	1.96
	Winter Average - Tons per day						
PM2.5	2.35	2.25	2.09	1.97	1.86	1.79	1.76
NOx	3.42	3.19	2.85	2.36	2.11	1.95	1.88

District Rules 4306 and 4320 Description

Rules 4306 and 4320 apply to any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a total rated heat input greater than 5 million British thermal units per hour (MMBtu/hr). The purpose of these rules is to limit emissions from boilers, steam generators, and process heaters of this size range. Facilities with units subject to these rules represent a wide range of industries, including but not limited to electrical utilities, cogeneration, oil and gas production, petroleum refining, manufacturing and industrial processes, food and agricultural processing, and service and commercial facilities.

The purpose of Rule 4306 is to limit emissions of NOx and carbon monoxide (CO) from applicable units. Rule 4320 establishes more stringent limits for NOx, CO, oxides of sulfur (SO2), and PM10, and provides Advanced Emission Reduction Options for rule compliance, where an operator can either meet the specific NOx emission and PM control requirements, or pay an annual emissions fee to the District and meet the PM control requirements.

The District Governing Board adopted amendments to Rules 4306 and 4320 on December 17, 2020, to reduce emissions from boilers, process heaters, and steam generators in the Valley. These amendments were based on a comprehensive technical analysis, in-depth review of local, state, and federal regulations, and a robust public process. Modifications to Rules 4306 and 4320 included lowering NOx emissions limits for a variety of unit classes and categories, and establishing dates for emission control plans, authorities to construct, and compliance deadlines. Additionally, the District updated the unit categories in Rule 4306 to account for differences in technologically achievable and cost effective limits, which vary between different types and sizes of units. Updated category groupings also establish consistency in the categories included in Rule 4306 as well as Rule 4320. The District also added definitions and updated test methods in Rules 4306 and 4320 to improve clarity, and reflect changes to rule requirements and the latest version of test methodology available.

In situations where a retrofit may not be the best option given the technology forcing nature of the limits, operators have the option of paying an annual emissions fee based on the actual emissions of the unit during the previous calendar year while the facility continually evaluates the feasibility of potential controls. These fees may then be used by the District to support cost effective emission reductions and other pollution reduction activities. Fees would be paid annually and continue until the unit complies with the applicable limit. The affected sources will have the option, on an annual basis, to stop the fee option and install controls specified in the rule. The amended Rules 4306 and 4320 include the most effective controls that are available and technologically feasible, and are the most stringent regulations in the country for the subject type of units.

How do District Rules 4306 and 4320 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines applicable to this source category.

A. Alternative Control Techniques (ACT)

- *Alternative Control Techniques Document – NOx Emissions from Process Heaters (EPA-453/R-93-034 1993/09)*

The District evaluated the requirements contained within the ACT for NOx Emissions from Process Heaters and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- *Alternative Control Techniques Document – NOx Emissions from Industrial/Commercial/Institutional Boilers (EPA-453/R-94-022 1994/03)*

The District evaluated the requirements contained within the ACT for NOx Emissions from Industrial/Commercial/Institutional Boilers and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- *Alternative Control Techniques Document – NOx Emissions from Utility Boilers (EPA-453/R-94-023 1994/03)*

The District evaluated the requirements contained within the ACT for NOx Emissions from Utility Boilers and found no requirements that were more stringent than those already in Rules 4306 and 4320.

B. New Source Performance Standards (NSPS)

- *40 CFR 60 Subpart D – Standards of Performance for Fossil-Fuel Fired Steam Generators (2007/06)*

The District evaluated the requirements contained within 40 CFR 60 Subpart D and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- *40 CFR 60 Subpart Db – Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units (2007/06)*

The District evaluated the requirements contained within 40 CFR 60 Subpart Db and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- *40 CFR 60 Subpart Dc – Standards of Performance for Small Industrial-Commercial-Institutional Steam Generating Units (2012/04)*

The District evaluated the requirements contained within 40 CFR 60 Subpart Dc and found no requirements that were more stringent than those already in Rules 4306 and 4320.

State Regulations

There are no state regulations applicable to this source category.

How do District Rules 4306 and 4320 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rules 4306 and 4320 to comparable requirements in rules from the following nonattainment areas:

- Bay Area AQMD Regulation 9, Rule 7 (Amended May 4, 2011)[53]
- Bay Area AQMD Regulation 9, Rule 10 (Amended November 3, 2021)[54]
- Bay Area AQMD Regulation 9, Rule 11 (Amended May 17, 2000)[55]

[53] BAAQMD. *Regulation 9, Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)*. (Amended May 4, 2011). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-7-nitrogen-oxides-and-carbon-monoxide-from-industrial-institutional-and-commercial-boiler/documents/rg0907.pdf?la=en&rev=ab95f36c2dd146528f1cf3c10596bce3

[54] BAAQMD. *Regulation 9, Rule 10 (Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators, and Process Heaters in Petroleum Refineries).* (Amended November 3, 2021). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/refinery-rules-definitions/rg0910_20211103-pdf.pdf?la=en&rev=6e3872940d924000b45ea05f05b5a309

[55] BAAQMD. *Regulation 9, Rule 11 (Nitrogen Oxides and Carbon Monoxide from Utility Electric Power Generating Boilers)*. (Amended May 17, 2000). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-

- Sacramento Metropolitan AQMD Rule 411 (Amended August 23, 2007)[56]
- South Coast AQMD Rule 1146 (Amended December 4, 2020)[57]
- South Coast AQMD Rule 1109.1 (Adopted November 5, 2021)[58]
- Ventura County APCD Rule 74.15 (Amended November 10, 2020)[59]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rules 4306 and 4320 continue to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

Bay Area AQMD

- BAAQMD Regulation 9, Rule 10 (Boilers, Steam Generators and Process Heaters in Refineries)

BAAQMD amended Regulation 9, Rule 10 on November 3, 2021. The 2021 amendments were administrative and did not affect the stringency of rule requirements implemented prior to EPA's approval of the District meeting BACM/MSM for the *2018 PM2.5 Plan*. The District found no requirements in BAAQMD Regulation 9, Rule 10 that were more stringent than those in Rules 4306 and 4320.

South Coast AQMD

- SCAQMD Rule 1146 (Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

	SJVAPCD Rules 4306 and 4320	SCAQMD Rule 1146
Applicability	Any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a total rated heat input >5 MMBtu/hr.	Boilers, steam generators, and process heaters of ≥5 MMBtu/hr rated heat input capacity used in industrial, institutional, and commercial operations.
Exemptions	• Units regulated by other District rules such as solid fuel fired units, dryers, glass melting furnaces, kilns, and smelters • Any units while burning any fuel other than PUC quality natural gas that: ○ Burns non-PUC gas no more than 168 hr/yr plus 48 hr/yr for equipment testing ○ NOx emissions do not exceed 150 ppm	• Boilers used by electric utilities to generate electricity • Boilers and process heaters with a rated heat input capacity >40 MMBtu/hr that are used in petroleum refineries • Sulfur plant reaction boilers

11-nitrogen-oxides-and-carbon-monoxide-from-utility-electric-power-generating-boilers/documents/rg0911.pdf?la=en&rev=cf79907f652d454c9b52a55ae3e95903

[56] SMAQMD. *Rule 411 (NOx from Boilers, Process Heaters, and Steam Generators).* (Amended August 23, 2007). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule411.pdf

[57] SCAQMD. *Rule 1146 (Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters).* (Amended December 4, 2020). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1146.pdf

[58] SCAQMD. *Rule 1109 (Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Operations).* (Amended December 4, 2020). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1109-1.pdf?sfvrsn=8

[59] VCAPCD. *Rule 74.15 (Boilers, Steam Generators, and Process Heaters).* (Amended November 10, 2020). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.15.pdf

	SJVAPCD Rules 4306 and 4320		SCAQMD Rule 1146
Requirements	**Rule 4306**	**Rule 4320**	
Category A Units 5-20 MMBtu/hr Except Categories C through G units	7 ppmv for fire tube units 9 ppmv for all other units	5 ppmv for fire tube units 9 ppmv for units at schools, units fired on digester gas, and thermal fluid heaters 5 ppmv for all other units	Non-RECLAIM 7 ppmv for fire tube units 9 ppmv for all other units RECLAIM 9 ppmv for fire tube units 12 ppmv for all other units
Category B Units >20 MMBtu/hr Except Categories C through G units	20-75 MMBtu/hr: 7 ppmv ≥75 MMBtu/hr: 5 ppmv	2.5 ppmv	20-75 MMBtu/hr: Non-RECLAIM 7 ppmv for fire tube units 9 ppmv (units with previous NOx limit ≤12 and >5 ppmv prior to 12/7/18) 5 ppmv (all other units) RECLAIM 9 ppmv for fire tube units 12 ppmv for all other units ≥75 MMBtu/hr: Non-RECLAIM: 5 ppmv RECLAIM: 9 ppmv
Category C.1 Oilfield Steam Generators 5-20 MMBtu/hr	9 ppmv	6 ppmv	SCAQMD Rule 1146 applies to Industrial, Institutional, and Commercial Units. Oilfield steam generators do not fall into these categories per definitions in the rule. Additionally, SCAQMD indicated there are no oilfield steam generators within their district.
Category C.2 Oilfield Steam Generators 20-75 MMBtu/hr	9 ppmv	5 ppmv	
Category C.3 Oilfield Steam Generators >75 MMBtu/hr	7 ppmv	5 ppmv	
Category C.4 Oilfield Steam Generators fired on <50% PUC quality gas	15 ppmv	5 ppmv	
Category D.1 Refinery Boilers 5-40 MMBtu/hr	30 ppmv 5 ppmv for replacement units	5 ppmv	SCAQMD Rule 1146 applies to Industrial, Institutional, and Commercial Units. Petroleum Refineries do not fall into these categories per definitions in the rule.
Category D.2 Refinery Boilers 40-110 MMBtu/hr	9 ppmv 5 ppmv for replacement units	5 ppmv	
Category D.3 Refinery Boilers >110 MMBtu/hr	5 ppmv	2.5 ppmv	
Category D.4 Refinery Process Heaters 5-40 MMBtu/hr	30 ppmv 9 ppmv for replacement units	5 ppmv	

	SJVAPCD Rules 4306 and 4320		SCAQMD Rule 1146
Category D.5 Refinery Process Heaters 40-110 MMBtu/hr	15 ppmv 9 ppmv for replacement units	5 ppmv	
Category D.6 Refinery Process Heaters >110 MMBtu/hr	5 ppmv	2.5 ppmv	
Category E Units with annual heat input >1.8 billion Btu/yr but <30 billion Btu/yr	No NOx limits for units ≤9 billion Btu/yr, must tune up twice a year. Other units: 30 ppmv	9 ppmv	No NOx limits for units ≤9 billion Btu/yr, must tune up twice a year. Other units would be subject to applicable category limits in rule.
Additional Categories Included in SCAQMD Rule 1146			
Atmospheric Units These units would be subject to the limits in Category A or B in District Rules	Category A 7 ppmv fire tube boilers 9 ppmv other units Category B 20-75 MMBtu/hr: 7 ppmv >75 MMBtu/hr: 5 ppmv enhanced	Category A 5 ppmv for fire tube units 9 ppmv for units at schools, units fired on digester gas, and thermal fluid heaters 5 ppmv for all other units Category B 2.5 ppmv	12 ppmv (natural gas)
Digester gas These units would be subject to the limits in Category A or B in District Rules			15 ppmv
Landfill gas These units would be subject to the limits in Category A or B in District Rules			25 ppmv
Other units fired on gaseous fuel Covered under multiple categories in District Rules			30 ppmv

District Rule 4306 generally contains limits equal to or more stringent than SCAQMD Rule 1146. For Category B units in the table above, SCAQMD requires a NOx limit of 5 ppmv only for units that were previously at limits higher than 12 ppmv. At the time of their rule amendment, SCAQMD determined that it was not cost-effective to require units with a NOx emission limit of 12 ppmv or less to meet a limit of 5 ppmv, and thus only required these units to meet a limit of 9 ppmv. Comparatively, for units of this category in the District, Rule 4306 previously required an already highly controlled level of 9 ppmv, and now requires a limit of 7 ppmv. Additionally, District Rule 4320 establishes an even more stringent limit of 2.5 ppmv for these units.

The District evaluated the requirements contained within SCAQMD's Rule 1146 and the District concludes that overall the requirements in Rules 4306 and 4320 are as stringent as or more stringent than SCAQMD Rule 1146.

- SCAQMD Rule 1109.1 (Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Operations)

	SJVAPCD Rules 4306 and 4320		SCAQMD Rule 1109.1
Applicability	Any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a total rated heat input >5 MMBtu/hr.		Owners or operators of facilities with units at petroleum refineries and facilities with related operations to petroleum refineries.
Exemptions	• Units regulated by other District rules such as solid fuel fired units, dryers, glass melting furnaces, kilns, and smelters. • Any units while burning any fuel other than PUC quality natural gas that: ○ Burns non-PUC gas no more than 168 hr/yr plus 48 hr/yr for equipment testing ○ NOx emissions do not exceed 150 ppm		• Boilers or process heaters ≤2 MMBtu/hr • Boilers and process heaters with a rated heat input capacity <40 MMBtu/hr that operate <200 hr/yr • Boilers and process heaters with a rated heat input capacity <40 MMBtu/hr that are fired at <15% maximum rated heat input capacity per year • Boilers or process heaters operating only the pilot prior to startup or after shutdown
Requirements	**Rule 4306**	**Rule 4320**	
Category A Units 5-20 MMBtu/hr Except Categories C through G units	7 ppmv for fire tube units 9 ppmv for all other units	5 ppmv for fire tube units 9 ppmv for units at schools, units fired on digester gas, and thermal fluid heaters 5 ppmv for all other units	SCAQMD Rule 1109.1 only applies to units at petroleum refineries
Category B Units >20 MMBtu/hr Except Categories C through G units	20-75 MMBtu/hr: 7 ppmv ≥75 MMBtu/hr: 5 ppmv	2.5 ppmv	SCAQMD Rule 1109.1 only applies to units at petroleum refineries
Category C.1 Oilfield Steam Generators 5-20 MMBtu/hr	9 ppmv	6 ppmv	SCAQMD Rule 1109.1 only applies to units at petroleum refineries
Category C.2 Oilfield Steam Generators 20-75 MMBtu/hr	9 ppmv	5 ppmv	
Category C.3 Oilfield Steam Generators >75 MMBtu/hr	7 ppmv	5 ppmv	
Category C.4 Oilfield Steam Generators fired on <50% PUC quality gas	15 ppmv	5 ppmv	
Category D.1 Refinery Boilers 5-40 MMBtu/hr	30 ppmv 5 ppmv for replacement units	5 ppmv	40 ppmv 5 ppmv after burner replacement

	SJVAPCD Rules 4306 and 4320		SCAQMD Rule 1109.1
Category D.2 Refinery Boilers 40-110 MMBtu/hr	9 ppmv 5 ppmv for replacement units	5 ppmv	Limits ranging from 5-50 ppmv due to conditional limits, interim limits, and alternative compliance options
Category D.3 Refinery Boilers >110 MMBtu/hr	5 ppmv	2.5 ppmv	Limits ranging from 5-50 ppmv due to conditional limits, interim limits, and alternative compliance options
Category D.4 Refinery Process Heaters 5-40 MMBtu/hr	30 ppmv 9 ppmv for replacement units	5 ppmv	40 ppmv 9 ppmv after replacement of burners
Category D.5 Refinery Process Heaters 40-110 MMBtu/hr	15 ppmv 9 ppmv for replacement units	5 ppmv	Limits ranging from 5-50 ppmv due to conditional limits, interim limits, and alternative compliance options
Category D.6 Refinery Process Heaters >110 MMBtu/hr	5 ppmv	2.5 ppmv	Limits ranging from 5-22 ppmv due to conditional limits, interim limits, and multiple alternative compliance options
Category E Units with annual heat input >1.8 billion Btu/yr but <30 billion Btu/yr	No NOx limits for units ≤9 billion Btu/yr, must tune up twice a year. Other units: 30 ppmv	9 ppmv	No NOx limit for boilers and process heaters with rated heat input capacity <40 MMBtu/hr that operate <200 hr/yr, or are fired <15% maximum rated heat input capacity per year

SCAQMD Rule 1109.1 has NOx emission limits for some categories of refinery units that could be seen as being more stringent than District Rule 4306. However, for these categories of units, SCAQMD Rule 1109.1 has higher conditional limits, higher interim limits, and multiple alternative compliance options are available, thus making the NOx limits less stringent than the firmly established NOx limits in Rule 4306. Additionally, Rule 4320 contains limits as stringent as or more stringent than limits in SCAQMD Rule 1109.1. The District concludes that overall Rules 4306 and 4320 are as stringent as or more stringent than SCAQMD Rule 1109.1.

Ventura County APCD

- VCAPCD Rule 74.15 (Boilers, Steam Generators, and Process Heaters)

	SJVAPCD Rules 4306 and 4320	VCAPCD Rule 74.15
Applicability	Any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a total rated heat input >5 MMBtu/hr.	Boilers, steam generators and process heaters, >5 MMBtu/hr used in all industrial, institutional and commercial operations.

Exemptions	• Units regulated by other District rules such as solid fuel fired units, dryers, glass melting furnaces, kilns, and smelters
	• Any units while burning any fuel other than PUC quality natural gas that:
	  ○ Burns non-PUC gas no more than 168 hr/yr plus 48 hr/yr for equipment testing
	  ○ NOx emissions do not exceed 150 ppm
		• Units fired on alternate fuel during natural gas curtailment
		• Emergency standby units
		• Cold Startup

	SJVAPCD Rules 4306 and 4320		VCAPCD Rule 74.15
Requirements	**Rule 4306**	**Rule 4320**	
Category A Units 5-20 MMBtu/hr Except Categories C through G units	7 ppmv for fire tube units 9 ppmv for all other units	5 ppmv for fire tube units 9 ppmv for units at schools, units fired on digester gas, and thermal fluid heaters 5 ppmv for all other units	40 ppmv After Jan. 1, 2027: 9 ppmv for boilers 12 ppmv for process heaters
Category B Units >20 MMBtu/hr Except Categories C through G units	20-75 MMBtu/hr: 7 ppmv ≥75 MMBtu/hr: 5 ppmv	2.5 ppmv	40 ppmv After Jan. 1, 2027: 9 ppmv for boilers 12 ppmv for process heaters
Category C.1 Oilfield Steam Generators 5-20 MMBtu/hr	9 ppmv	6 ppmv	
Category C.2 Oilfield Steam Generators 20-75 MMBtu/hr	9 ppmv	5 ppmv	40 ppmv After Jan. 1, 2027: 9 ppmv
Category C.3 Oilfield Steam Generators >75 MMBtu/hr	7 ppmv	5 ppmv	
Category C.4 Oilfield Steam Generators fired on <50% PUC quality gas	15 ppmv	5 ppmv	
Category D.1 Refinery Boilers 5-40 MMBtu/hr	30 ppmv 5 ppmv for replacement units	5 ppmv	40 ppmv After Jan. 1, 2027: 9 ppmv
Category D.2 Refinery Boilers 40-110 MMBtu/hr	9 ppmv 5 ppmv for replacement units	5 ppmv	40 ppmv After Jan. 1, 2027: 9 ppmv
Category D.3 Refinery Boilers >110 MMBtu/hr	5 ppmv	2.5 ppmv	40 ppmv After Jan. 1, 2027: 9 ppmv
Category D.4 Refinery Process Heaters 5-40 MMBtu/hr	30 ppmv 9 ppmv for replacement units	5 ppmv	40 ppmv After Jan. 1, 2027: 12 ppmv
Category D.5 Refinery Process Heaters 40-110 MMBtu/hr	15 ppmv 9 ppmv for replacement units	5 ppmv	40 ppmv After Jan. 1, 2027: 12 ppmv

	SJVAPCD Rules 4306 and 4320		VCAPCD Rule 74.15
Category D.6 Refinery Process Heaters >110 MMBtu/hr	5 ppmv	2.5 ppmv	40 ppmv After Jan. 1, 2027: 12 ppmv
Category E Units with annual heat input >1.8 billion Btu/yr but <30 billion Btu/yr	No NOx limits for units ≤9 billion Btu/yr, must tune up twice a year. Other units: 30 ppmv	9 ppmv	No NOx limits for units <9 billion Btu/yr, must tune up twice a year. Other units: 40 ppmv After Jan. 1, 2027: 9-30 billion Btu/yr: 9 ppmv for boilers 12 ppmv for process heaters

The District evaluated the requirements contained within VCAPCD's Rule 74.15 and the District concludes that overall Rules 4306 and 4320 are as stringent as or more stringent than VCAPCD Rule 74.15.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District reviewed the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

NOx Emission Control Technologies

The two primary methods of controlling NOx emissions from boilers, steam generators, and process heaters are either to change the combustion parameters (i.e., combustion modification) to reduce NOx formation, or to treat the NOx formed before it is emitted into the atmosphere with the use of selective catalytic reduction (SCR).

Through SCR, NOx is reduced to molecular nitrogen by adding a flue gas treatment system consisting of a catalyst module and a reagent injection system located after the boiler firebox. SCR units operate at a certain temperature range to effectively reduce NOx in the exhaust gas by injecting either ammonia stored in aqueous form, anhydrous form, generated on demand, or released from urea into the post-combustion zone of the boiler. SCR systems are generally paired with low-NOx burners (LNB).

While many operations have successfully installed SCR and other latest generation control systems through Rule 4306/4320 implementation and New Source Review BACT requirements, these control technologies have not yet been proven to be technologically feasible and cost effective as retrofit options for all source categories and applications, such as oilfield steam generators. For many facilities, this technology is not an option due to space constraints and other physical limitations.

SCR has significant initial capital costs, requires large footprints that impact other operations (resulting in significant additional costs), and requires additional construction

costs to accommodate the large size of the catalyst and the storage of the injection reagent (such as anhydrous ammonia). The temperature required for SCR units to function effectively (400-800 °F) in relation to existing exhaust temperatures (i.e. ~250 °F for oilfield steam generators) poses significant and potentially insurmountable feasibility and cost challenges to operators. For example, in many situations, steam generators would have to be cut open to retrofit an SCR unit into the convection section of the steam generator to operate the SCR system at the correct temperature. This would cause heat loss, preventing the production of the steam necessary for the oil field operation.

The District did not identify any additional NOx control requirements feasible for this source category at this time.

PM2.5 Emission Control Technologies

Baghouses (Pulse Jet[60]/Reverse Air,[61] Ceramic Dust Collectors[62])

Baghouses force exhaust through filters which capture PM by impingement. Filter media may be cloth/paper bags, pleated cloth in cartridge form, or even packed ceramic media within cages. Per EPA fact sheets for this technology, Cloth/paper filters can only control filterable PM. Per manufacturer data, ceramic media can only provide limited control (≤20%) of condensable PM.

Wet[63]/Dry[64] Electrostatic Precipitators

Electrostatic Precipitators (ESPs) use ionized gas and/or electromagnetic field to impart static charge to particles in the exhaust stream which are then attracted to collection plates held at high voltage. To clean the collection plates, dry ESPs use mechanical or acoustical methods, while wet ESPs use wash liquid. Per EPA fact sheets for this technology, dry ESPs can only control filterable PM and can have difficulty collecting particles with an aerodynamic diameter of 0.1 to 1 micron. Since all of the PM from NG-fuel combustion is assumed to be less than 1 micron in size, the PM2.5 control efficiency of a dry ESP is assumed to be 90%. Particle size is less of a factor for wet ESPs, however capital and operating costs are generally higher due to noncorrosive materials requirements, increased water usage, and treatment and disposal of waste water.

Venturi Scrubbers[65]

Venturi scrubbers introduce an atomized liquid into the exhaust stream upon which PM agglomerates. The liquid mist is subsequently removed by cyclonic separator and/or

[60] EPA-452/F-03-025 https://www3.epa.gov/ttnchie1/mkb/documents/ff-pulse.pdf
[61] EPA-452/F-03-026 https://www.epa.gov/sites/default/files/2020-10/documents/ff-revar.pdf
[62] Correspondence from Clean Air Systems
[63] EPA-452/F-03-029 https://www3.epa.gov/ttn/chief/mkb/documents/fwespwpi.pdf#:~:text=An%20ESP%20is%20a%20particulate%20%20control%20device%20that,effluent%20is%20collected%2C%20andoften%20treated%20on-%20site%20%28EPA%2C%201998%29
[64] EPA-452/F-03-027 https://www3.epa.gov/ttn/catc/dir1/fdespwpi.pdf
[65] EPA-452/F-03-017 https://www3.epa.gov/ttnchie1/mkb/documents/fventuri.pdf#:~:text=EPA-452%2FF-03-017%20Air%20Pollution%20Control%20Technology%20Fact%20Sheet%20Name,venturi%20jet%20scrubbers%2C% 20gas-atomizing%20spray%20scrubbers%2C%20and%20ejector-venturiscrubbers

mist eliminator. Venturi Scrubbers require high differential pressure (20 to 24 inches water column) which may require additional fans.

Table C-2 Typical Applications of Control Technologies

Control Technology	Recommended Inlet Loading (gr-PM2.5/ft^3)	Inlet Temp (°F)	PM2.5 Control Efficiency
Baghouse Cloth/Paper Filter	0.5 – 10	<500	99% of filterable, 0% of condensable
Baghouse Ceramic Filter	0.5 – 10	<800	99% of filterable, 20% of condensable
Wet ESP	0.5 – 5	<200	98% of total
Dry ESP	0.5 – 5	<500	90% of filterable, 0% of condensable
Venturi/Wet Scrubber	0.1 – 50	<750	99% of total

As shown in the table above, the recommended inlet PM2.5 loading concentrations where these control technologies are applied are orders of magnitude above the typical exhaust PM2.5 concentrations produced by NG-fired boilers and steam generators. As the control device must be sized to accommodate the airflow, these devices must be substantially oversized for the quantity of PM they will control. All of these control technologies are able to provide good control efficiency of filterable PM. However, since the majority of total PM2.5 from NG boilers and steam generators is condensable PM2.5, baghouses with cloth/paper/ceramic filter media and dry ESPs are not well suited to control PM2.5 emissions from NG-fired boilers and steam generators because these emission control technologies have minimal to no ability to control condensable PM2.5 emissions.

Nonetheless, cost analyses for all of these control technologies listed in Table C-2 above is presented in the following section.

Cost Effectiveness

Since the cost to deploy these technologies on a 50 MMBtu/hr boiler is similar to that of a 62.5 MMBtu/hr steam generator, a cost analysis is performed for each control technology for units at two heat input sizes: 20 MMBtu/hr and 62.5 MMBtu/hr. Purchased equipment costs were provided by equipment vendors.

20 MMBtu/hr NG-Fired Boiler Controlled by a Fabric Filter Baghouse

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	Western Pneumatics (7,300 acfm)	$100,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$5,000.00
C	Sales Tax	8.25% PEC	$8,250.00
D	Direct Installation Costs	25% PEC	$25,000.00
E	Total Direct Capital Costs	A+B+C+D	$138,250.00
	Indirect Capital Costs		
F	Facilities	5% PEC	$5,000.00
G	Engineering	10% PEC	$10,000.00
H	Process Contingency	5% PEC	$5,000.00
I	Total Indirect Capital Costs	F+G+H	$20,000.00
J	Project Contingency	20% PEC	$20,000.00
K	Total Capital Costs	E+I+J	$178,250.00
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$21,924.75
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	0.1694/kw-hr EPA Cost Manual (452/B-02-001), Section 6, Chapter 1, Formula 1.14	$10,196.00
R	Total Direct Annual Costs	M+N+O+P+Q	$54,680.38
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$2,000.00
U	Insurance	0.01 x PEC	$1,000.00
V	Property Tax	0.01 x PEC	$1,000.00
W	Capital Recovery	0.13 x PEC	$13,000.00
X	Total Indirect Annual Costs	S+T+U+V+W	$43,690.63
Total Annualized Cost		L+R+X	**$120,295.76**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	526
Z	Filterable PM10 (lb/year)	8760 hr/year x MMBtu/hr x 0.00075	131
AB	PM10 Captured by Baghouse (lb/year)	99% control of filterable	130
	PM10 Captured (tons/year)	AB/2000	**0.065**

Cost Effectiveness ($/ton)	**$1,850,704.00**

62.5 MMBtu/hr NG-Fired Boiler Controlled by a Fabric Filter Baghouse

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	Western Pneumatics (17,400 acfm)	$180,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$9,000.00
C	Sales Tax	8.25% PEC	$14,850.00
D	Direct Installation Costs	25% PEC	$45,000.00
E	Total Direct Capital Costs	A+B+C+D	$248,850.00
	Indirect Capital Costs		
F	Facilities	5% PEC	$9,000.00
G	Engineering	10% PEC	$18,000.00
H	Process Contingency	5% PEC	$9,000.00
I	Total Indirect Capital Costs	F+G+H	$36,000.00
J	Project Contingency	20% PEC	$36,000.00
K	Total Capital Costs	E+I+J	$320,850.00
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$39,464.55
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	0.1694/kw-hr EPA Cost Manual (452/B-02-001), Section 6, Chapter 1, Formula 1.14	$24,302.00
R	Total Direct Annual Costs	M+N+O+P+Q	$68,786.38
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$3,600.00
U	Insurance	0.01 x PEC	$1,800.00
V	Property Tax	0.01 x PEC	$1,800.00
W	Capital Recovery	0.13 x PEC	$23,400.00
X	Total Indirect Annual Costs	S+T+U+V+W	$57,290.63
Total Annualized Cost		L+R+X	**$165,541.56**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	1,643
Z	Filterable PM10 (lb/year)	8760 hr/year x MMBtu/hr x 0.00075	411
AB	PM10 Captured by Baghouse (lb/year)	99% control of filterable	407
	PM10 Captured (tons/year)	AB/2000	**0.204**

Cost Effectiveness ($/ton)	**$811,478.24**

20 MMBtu/hr NG-Fired Boiler Controlled by a Ceramic Filter Baghouse

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	Western Pneumatics (7,300 acfm)	$100,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$5,000.00
C	Sales Tax	8.25% PEC	$8,250.00
D	Direct Installation Costs	25% PEC	$25,000.00
E	Total Direct Capital Costs	A+B+C+D	$138,250.00
	Indirect Capital Costs		
F	Facilities	5% PEC	$5,000.00
G	Engineering	10% PEC	$10,000.00
H	Process Contingency	5% PEC	$5,000.00
I	Total Indirect Capital Costs	F+G+H	$20,000.00
J	Project Contingency	20% PEC	$20,000.00
K	Total Capital Costs	E+I+J	$178,250.00
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$21,924.75
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	0.1694/kw-hr EPA Cost Manual (452/B-02-001), Section 6, Chapter 1, Formula 1.14	$10,196.00
R	Total Direct Annual Costs	M+N+O+P+Q	$54,680.38
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$2,000.00
U	Insurance	0.01 x PEC	$1,000.00
V	Property Tax	0.01 x PEC	$1,000.00
W	Capital Recovery	0.13 x PEC	$13,000.00
X	Total Indirect Annual Costs	S+T+U+V+W	$43,690.63
Total Annualized Cost		L+R+X	**$120,295.76**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	526
Z	Filterable PM10 (lb/year)	8760 hr/year x MMBtu/hr x 0.00075	131
AA	Condensable PM10 (lb/year)	Y-Z	395
AB	PM10 Captured by Baghouse (lb/year)	0.99*Z+0.2*AA	209
	PM10 Captured (tons/year)	AB/2000	**0.105**

Cost Effectiveness ($/ton)	**$1,145,673.90**

62.5 MMBtu/hr NG-Fired Boiler Controlled by a Ceramic Filter Baghouse

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	Western Pneumatics (17,400 acfm)	$180,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$9,000.00
C	Sales Tax	8.25% PEC	$14,850.00
D	Direct Installation Costs	25% PEC	$45,000.00
E	Total Direct Capital Costs	A+B+C+D	$248,850.00
	Indirect Capital Costs		
F	Facilities	5% PEC	$9,000.00
G	Engineering	10% PEC	$18,000.00
H	Process Contingency	5% PEC	$9,000.00
I	Total Indirect Capital Costs	F+G+H	$36,000.00
J	Project Contingency	20% PEC	$36,000.00
K	Total Capital Costs	E+I+J	$320,850.00
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$39,464.55
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	0.1694/kw-hr EPA Cost Manual (452/B-02-001), Section 6, Chapter 1, Formula 1.14	$24,302.00
R	Total Direct Annual Costs	M+N+O+P+Q	$68,786.38
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$3,600.00
U	Insurance	0.01 x PEC	$1,800.00
V	Property Tax	0.01 x PEC	$1,800.00
W	Capital Recovery	0.13 x PEC	$23,400.00
X	Total Indirect Annual Costs	S+T+U+V+W	$57,290.63
Total Annualized Cost		L+R+X	**$165,541.56**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	1,643
Z	Filterable PM10 (lb/year)	8760 hr/year x MMBtu/hr x 0.00075	411
AA	Condensable PM10 (lb/year)	Y-Z	1,232
AB	PM10 Captured by Baghouse (lb/year)	0.99*Z+0.2*AA	653
	PM10 Captured (tons/year)	AB/2000	**0.327**

Cost Effectiveness ($/ton)	**$506,243.30**

20 MMBtu/hr NG-Fired Boiler Controlled by a Wet ESP

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	Envitech (7,000 acfm quencher & ESP)	$900,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$45,000.00
C	Sales Tax	8.25% PEC	$74,250.00
D	Direct Installation Costs	25% PEC	$225,000.00
E	Total Direct Capital Costs	A+B+C+D	$1,244,250.00
	Indirect Capital Costs		
F	Facilities	5% PEC	$45,000.00
G	Engineering	10% PEC	$90,000.00
H	Process Contingency	5% PEC	$45,000.00
I	Total Indirect Capital Costs	F+G+H	$180,000.00
J	Project Contingency	20% PEC	$180,000.00
K	Total Capital Costs	E+I+J	$1,604,250.00
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$197,322.75
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	Envitech 25kW; 0.1694/kw-hr	$37,098.60
R	Total Direct Annual Costs	M+N+O+P+Q	$81,582.98
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$18,000.00
U	Insurance	0.01 x PEC	$9,000.00
V	Property Tax	0.01 x PEC	$9,000.00
W	Capital Recovery	0.13 x PEC	$117,000.00
X	Total Indirect Annual Costs	S+T+U+V+W	$179,690.63
Total Annualized Cost		L+R+X	**$458,596.36**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	526
AB	PM10 Captured by ESP (lb/year)	98% control efficiency, Z*0.98	515
	PM10 Captured (tons/year)	AB/2000	**0.258**

Cost Effectiveness ($/ton)	**$1,777,505.27**

62.5 MMBtu/hr NG-Fired Boiler Controlled by a Wet ESP

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	Envitech (17,000 acfm quencher & ESP)	$1,125,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$56,250.00
C	Sales Tax	8.25% PEC	$92,812.50
D	Direct Installation Costs	25% PEC	$281,250.00
E	Total Direct Capital Costs	A+B+C+D	$1,555,312.50
	Indirect Capital Costs		
F	Facilities	5% PEC	$56,250.00
G	Engineering	10% PEC	$112,500.00
H	Process Contingency	5% PEC	$56,250.00
I	Total Indirect Capital Costs	F+G+H	$225,000.00
J	Project Contingency	20% PEC	$225,000.00
K	Total Capital Costs	E+I+J	$2,005,312.50
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$246,653.44
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	Envitech 50kW; 0.1694/kw-hr	$74,197.20
R	Total Direct Annual Costs	M+N+O+P+Q	$118,681.58
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$22,500.00
U	Insurance	0.01 x PEC	$11,250.00
V	Property Tax	0.01 x PEC	$11,250.00
W	Capital Recovery	0.13 x PEC	$146,250.00
X	Total Indirect Annual Costs	S+T+U+V+W	$217,940.63
Total Annualized Cost		L+R+X	**$583,275.65**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	1,643
AB	PM10 Captured by ESP (lb/year)	98% control efficiency, Z*0.98	1,610
	PM10 Captured (tons/year)	AB/2000	**0.805**

Cost Effectiveness ($/ton)	**$724,566.02**

20 MMBtu/hr NG-Fired Boiler Controlled by a Dry ESP

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	Envitech (7,000 acfm ESP)	$750,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$37,500.00
C	Sales Tax	8.25% PEC	$61,875.00
D	Direct Installation Costs	25% PEC	$187,500.00
E	Total Direct Capital Costs	A+B+C+D	$1,036,875.00
	Indirect Capital Costs		
F	Facilities	5% PEC	$37,500.00
G	Engineering	10% PEC	$75,000.00
H	Process Contingency	5% PEC	$37,500.00
I	Total Indirect Capital Costs	F+G+H	$150,000.00
J	Project Contingency	20% PEC	$150,000.00
K	Total Capital Costs	E+I+J	$1,336,875.00
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$164,435.63
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	Envitech 25kW; 0.1694/kw-hr	$37,098.60
R	Total Direct Annual Costs	M+N+O+P+Q	$81,582.98
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$15,000.00
U	Insurance	0.01 x PEC	$7,500.00
V	Property Tax	0.01 x PEC	$7,500.00
W	Capital Recovery	0.13 x PEC	$97,500.00
X	Total Indirect Annual Costs	S+T+U+V+W	$154,190.63
Total Annualized Cost		L+R+X	**$400,209.24**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	526
Z	Filterable PM10 (lb/year)	8760 hr/year x MMBtu/hr x 0.00075	131
AB	PM10 Captured by ESP (lb/year)	90% control of filterable	118
	PM10 Captured (tons/year)	AB/2000	**0.059**

Cost Effectiveness ($/ton)	**$6,783,207.46**

62.5 MMBtu/hr NG-Fired Boiler Controlled by a Dry ESP

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	Envitech (17,000 acfm ESP)	$750,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$37,500.00
C	Sales Tax	8.25% PEC	$61,875.00
D	Direct Installation Costs	25% PEC	$187,500.00
E	Total Direct Capital Costs	A+B+C+D	$1,036,875.00
	Indirect Capital Costs		
F	Facilities	5% PEC	$37,500.00
G	Engineering	10% PEC	$75,000.00
H	Process Contingency	5% PEC	$37,500.00
I	Total Indirect Capital Costs	F+G+H	$150,000.00
J	Project Contingency	20% PEC	$150,000.00
K	Total Capital Costs	E+I+J	$1,336,875.00
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$164,435.63
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	Envitech 50kW; 0.1694/kw-hr	$74,197.20
R	Total Direct Annual Costs	M+N+O+P+Q	$118,681.58
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$15,000.00
U	Insurance	0.01 x PEC	$7,500.00
V	Property Tax	0.01 x PEC	$7,500.00
W	Capital Recovery	0.13 x PEC	$97,500.00
X	Total Indirect Annual Costs	S+T+U+V+W	$154,190.63
Total Annualized Cost		L+R+X	**$437,307.84**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	4,161
Z	Filterable PM10 (lb/year)	8760 hr/year x MMBtu/hr x 0.00075	411
AB	PM10 Captured by ESP (lb/year)	90% control of filterable	370
	PM10 Captured (tons/year)	AB/2000	**0.185**

Cost Effectiveness ($/ton)	**$2,363,826.16**

20 MMBtu/hr NG-Fired Boiler Controlled by a Venturi Scrubber

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	EnviroCare Micromist (7,000 acfm)	$400,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$20,000.00
C	Sales Tax	8.25% PEC	$33,000.00
D	Direct Installation Costs	25% PEC	$100,000.00
E	Total Direct Capital Costs	A+B+C+D	$553,000.00
	Indirect Capital Costs		
F	Facilities	5% PEC	$20,000.00
G	Engineering	10% PEC	$40,000.00
H	Process Contingency	5% PEC	$20,000.00
I	Total Indirect Capital Costs	F+G+H	$80,000.00
J	Project Contingency	20% PEC	$80,000.00
K	Total Capital Costs	E+I+J	$713,000.00
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$87,699.00
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	0.1694/kw-hr EPA Cost Manual (452/B-02-001), Section 6, Chapter 1, Formula 1.14	$45,124.00
R	Total Direct Annual Costs	M+N+O+P+Q	$89,608.38
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$8,000.00
U	Insurance	0.01 x PEC	$4,000.00
V	Property Tax	0.01 x PEC	$4,000.00
W	Capital Recovery	0.13 x PEC	$52,000.00
X	Total Indirect Annual Costs	S+T+U+V+W	$94,690.63
Total Annualized Cost		L+R+X	**$271,998.01**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	526
AB	PM10 Captured by Baghouse (lb/year)	99% efficiency	521
	PM10 Captured (tons/year)	AB/2000	**0.261**

Cost Effectiveness ($/ton)	**$1,042,137.97**

62.5 MMBtu/hr NG-Fired Boiler Controlled by a Venturi Scrubber

	Item	Method of Calculation	Cost
	Direct Capital Costs		
A	Total Purchased Equip Cost	EnviroCare Micromist (20,000 acfm)	$520,000.00
B	Freight	5% Purchased Equip Cost (PEC)	$26,000.00
C	Sales Tax	8.25% PEC	$42,900.00
D	Direct Installation Costs	25% PEC	$130,000.00
E	Total Direct Capital Costs	A+B+C+D	$718,900.00
	Indirect Capital Costs		
F	Facilities	5% PEC	$26,000.00
G	Engineering	10% PEC	$52,000.00
H	Process Contingency	5% PEC	$26,000.00
I	Total Indirect Capital Costs	F+G+H	$104,000.00
J	Project Contingency	20% PEC	$104,000.00
K	Total Capital Costs	E+I+J	$926,900.00
L	**Annualized Capital Costs (10 Years @ 4%)**	0.123*K	$114,008.70
	Direct Annual Costs		
	Operating Costs		
M	Operator	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
N	Supervisor	15% of operator	$3,421.88
	Maintenance Costs		
O	Labor	0.5 hr/shift, $25/hr, 3 shifts/day	$13,687.50
P	Material	100% of Labor Cost	$13,687.50
	Utility Costs		
Q	Electricity Costs	0.1694/kw-hr EPA Cost Manual (452/B-02-001), Section 6, Chapter 1, Formula 1.14	$128,925.00
R	Total Direct Annual Costs	M+N+O+P+Q	$173,409.38
	Indirect Annual Costs		
S	Overhead	60% of O&M (M+N+O+P)	$26,690.63
T	Administrative	0.02 x PEC	$10,400.00
U	Insurance	0.01 x PEC	$5,200.00
V	Property Tax	0.01 x PEC	$5,200.00
W	Capital Recovery	0.13 x PEC	$67,600.00
X	Total Indirect Annual Costs	S+T+U+V+W	$115,090.63
Total Annualized Cost		L+R+X	**$402,508.71**

	Emission Reductions		
Y	Total PM10 Emissions (lb/year)	8760 hr/year x MMBtu/hrx 0.003	1,643
AB	PM10 Captured by Baghouse (lb/year)	99% efficiency	1,627
	PM10 Captured (tons/year)	AB/2000	**0.814**

Cost Effectiveness ($/ton)	**$494,482.44**

The cost effectiveness values above are based on assumed full time (8,760 hr/yr) operation at full capacity, which results in the largest possible PM2.5 emission reductions. In reality, boilers and steam generators typically do not operate 8,760 hr/yr. Reduction in operational hours would reduce PM2.5 emissions proportionally. Since the design capacity of these control devices must be suited to maximum flow, reductions in operational time would not reduce purchase and operational costs of the control device to the same extent. Therefore, the cost effectiveness values presented herein represent a lower limit, and the true cost of reductions are expected to be higher.

As discussed above, the typical exhaust PM2.5 concentration from NG-fired boilers and steam generators is significantly below the recommended range of inlet loading concentrations for all of the PM2.5 emission control technologies assessed. Further, with the exception of wet ESP and Venturi Scrubbers, these control technologies offer poor control of condensable PM2.5 and therefore poor control of total PM2.5 emissions from NG-fired boilers and steam generators.

Furthermore, this analysis shows that the cost of direct PM2.5 control on NG-fired boilers and steam generators with these technologies ranges between $494,482 and $6,783,207 per ton of PM2.5 emissions reduced. Therefore, use of these emission control technologies to control direct PM2.5 emissions from NG-fired boilers and steam generators is not cost effective.

Based on this review, the District did not identify additional emission reduction opportunities at this time. The District will continue to work with operators of boilers, steam generators, and process heaters to develop, demonstrate, and deploy new emission control technologies. As part of this continued effort, the District will evaluate any advancements in addressing the above feasibility issues.

Zero-Emission Opportunities

Electrification of Units

Electric boilers and process heaters are becoming more commercially available but not for all sizes and applications. The cost to operate on electricity is much higher than on natural gas. The District found that the electricity generation required to operate units larger than 5 MMBtu/hr would produce more NOx than units operating at the NOx limits in Rule 4306. For example, a 5 MMBtu/hr fire tube boiler would cost nearly seven times as much to operate on electricity compared to natural gas, and the NOx emitted from the electric utility grid to operate the unit would be twice as much as a natural gas fired unit operating at 7 ppmv NOx.

Currently, there are no electric steam generators capable of meeting the demands of conventional steam generators. One of the largest electric generators produces 4,882 lb/hr @ 135 pounds per square inch gauge (psig). This flow rate is only 1/10 of the rate needed from one conventional steam generator and the pressure rating of 135 psig is far below the needed pressure of 800-900 psig.

Furthermore, a typical conventional natural gas-fired steam generator is rated (designed) to burn up to 62.5 million Btu/hr of natural gas and consumes approximately 50 million Btu/hr (i.e. 80% firing rate). This will require, on average, 13.75 MW of electricity to replace one conventional steam generator. Therefore, the electricity needs to replace one conventional steam generator with electric steam generation would be the equivalent electricity demand of over 10,000 homes. To replace conventional steam generators operating in the Valley with electric steam generation would require approximately 5,160 MW, which would be the equivalent electricity demand of 3,800,000 homes. The immense amount of power needed to electrify all steam generators in the District would require significant infrastructure upgrades to California's power grid. Therefore, electric steam generators are not feasible at this time.

Solar Powered Oilfield Steam Generation

Emissions from oilfield steam generators that provide steam to reduce the viscosity of oil in thermally enhanced oil recovery operations have been significantly reduced through decades of increasingly stringent rule requirements. Instead of fuel oil, steam generators today are powered by natural gas or field gas which are significantly cleaner. To ensure that all potential emission reduction opportunities are evaluated, the District performed a comprehensive review of solar powered steam generators.

In the Valley, two small pilot projects were conducted to demonstrate the feasibility of solar powered steam generation technologies and found that such technologies were not feasible:

Berry Petroleum Company: This company installed a small pilot test facility designed to use solar energy to pre-heat feed water for the existing natural gas fired steam generators. The system consisted of mirrors in a glass greenhouse (supplied by Glasspoint Solar). The mirrors were designed to focus solar energy onto a pipe carrying water to heat the water. The heated water would then be sent to the input of the steam generators. The facility had a designed heat production of 300 kW. This project operated for a short time and was ultimately shut down based on the following shortcomings:

1) Significant heat loss: The heat losses to the water from the pipe runs from the solar installation to the actual steam generator locations were such that the water delivered to the steam generators was ambient or slightly warmer.
2) Excessively large footprint requirement: The footprint of the solar steam generators needed to provide the thermal output of one 85 MMBtu steam generator would be excessively large.
3) Inconsistent steam quality: The inability of the solar steam generators to consistently generate the quality of steam that is needed for injection that is currently supplied by the steam generators.
4) Unreliable power: The solar steam generators would still need to be supplemented by gas fired steam generators at night and during cloudy days.

Chevron: This company installed a pilot solar thermal steam plant near Coalinga, consisting of 7,600 mirrors that would direct solar energy towards a single solar

collector tower (supplied by Brightsource Energy). The heat collected in the tower would turn water into steam. The installation had a footprint of 100 acres. This system discontinued operation in 2014. Although information from Chevron on their findings on the performance of this project is unavailable, based on news articles,[66] the system was excessively costly. A news article referencing the manufacturer's SEC filings stated the company realized a 40 million dollar loss on the project.

Aera Energy: Despite the above-described challenges, in 2019, Aera Energy in collaboration with GlassPoint Solar considered the installation of a large 770-acre solar steam generation system adjacent to an Aera Energy oil production operation in western Kern County. However, in April of 2020, GlassPoint cancelled the project due to a lack of funding. This system would have generated the steam equivalent to approximately 10 gas-fired steam generators. The solar steam generators would still need to be supplemented by gas-fired steam generators at night and during cloudy days.

Based on discussions with Aera Energy, the project heavily relied on solar tax credits, the generation and sale of low carbon fuel standard credits, and the reduction in costs of greenhouse gas allowances for Aera. According to Aera Energy, there is no economic benefit to implementing such technologies. In fact, without the LCFS credits, the cost of steam using this solar technology would be as much as three times the current cost.

The project also faced technical challenges, similar to the above pilot projects. Furthermore, the gas-fired steam generators that are required to supplement the system could face difficulty meeting current rule limits due to the need to ramp up and down. There has not been a successful large scale implementation of such technologies.

In summary, solar powered oilfield steam generators are not yet feasible and still face significant technical and economic challenges as outlined below:

- **Costs:** The use of solar steam generation rely on a complex set of funding sources to make the operations economically feasible, including the Federal 30% tax credit, the value of California low-carbon fuel standards credits that may be generated as a result of using solar steam generation to produce oil, and a reduction in the costs for the oil producer of AB32 cap-and-trade credits required for their operations in California. The value of the GHG credits generated varies based on the price of credits on the open market. As the value of the credits is not fixed, the economic viability of a project may change depending on the value of the credits prior to construction and during operation. Even with available credits, the costs continue to be a challenge.

- **Land Availability:** Adequate open land next to the steam injection wells is needed to house the solar collectors. Both the amount of land and the distance

[66] http://www.naturalgasintel.com/articles/103562-potential-for-solar-assisted-eor-in-california-oilfield-still-unfulfilled and https://gigaom.com/2011/10/12/brightsources-solar-steam-project-went-way-over-budget/

of the land to the injection point are important factors. It is estimated that to create the steam needed to replace one steam generator would require 60 acres of solar generation. Finding the required amount of land available next to oilfield operations may be difficult. The solar systems have to be close to the steam injection wells. Otherwise, additional solar capacity will need to be developed to account for the heat loss because of travel distance.

- **Variability of Solar Steam Generation Output:** Solar steam generation plants need sunny days to be able to collect enough energy to make steam. During cloudy days and also during the night, the solar equipment would not make enough steam. Oilfield operators will need to supplement the solar operation with natural gas fired steam generators for when the solar equipment is not producing enough steam. On partly cloudy days, the natural gas steam generators would need to cycle on and off depending on the cloud cover. This may cause operational difficulties as the gas fired steam generators are tuned to operate at constant load. A variable load could cause emissions variability and potentially have emissions higher than that allowed in permit limits and/or District prohibitory rules.

Evaluation Findings

Rules 4306 and 4320 provide for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.8 RULE 4307 (BOILERS, STEAM GENERATORS, AND PROCESS HEATERS - 2.0 MMBTU/HR TO 5.0 MMBTU/HR)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	2.39	2.28	2.13	2.01	1.90	1.83	1.80
NOx	3.53	3.29	2.94	2.44	2.19	2.03	1.96
	Winter Average - Tons per day						
PM2.5	2.35	2.25	2.09	1.97	1.86	1.79	1.76
NOx	3.42	3.19	2.85	2.36	2.11	1.95	1.88

District Rule 4307 Description

The District adopted Rule 4307 on December 15, 2005, and subsequently amended the rule April 21, 2016. The purpose of Rule 4307 is to limit NOx and CO emissions from boilers, steam generators, and process heaters. The rule applies to any gaseous fuel or liquid fuel fired boiler, steam generator, and process heater with a rated heat input of 2.0 MMBtu/hr up to and including 5.0 MMBtu/hr. This source category includes a wide range of industries including but not limited to medical facilities, educational institutions, office buildings, prisons, military facilities, hotels, and industrial facilities, achieving emission limits as low as 9 ppmv NOx.

How does District Rule 4307 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines or New Source Performance Standards applicable to this source category.

A. Alternative Control Techniques (ACT)

- *Alternative Control Techniques Document – NOx Emissions from Process Heaters (EPA-453/R-93-034 1993/09)*

The District evaluated the requirements contained within the ACT for NOx Emissions from Process Heaters and found no requirements that were more stringent than those already in Rule 4307.

- *Alternative Control Techniques Document – NOx Emissions from Industrial/Commercial/Institutional Boilers (EPA-453/R-94-022 1994/03)*

The District evaluated the requirements contained within the ACT for NOx Emissions from Industrial/Commercial/Institutional Boilers and found no requirements that were more stringent than those already in Rule 4307.

- *Alternative Control Techniques Document – NOx Emissions from Utility Boilers (EPA-453/R-94-023 1994/03)*

The District evaluated the requirements contained within the ACT for NOx Emissions from Utility Boilers and found no requirements that were more stringent than those already in Rule 4307.

State Regulations

There are no state regulations that apply to this source category.

How does District Rule 4307 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4307 to comparable requirements in rules from the following California nonattainment areas:

- Bay Area AQMD Regulation 9, Rule 7 (Amended May 4, 2011)[67]
- Bay Area AQMD Regulation 9, Rule 10 (Amended November 3, 2021)[68]
- Sacramento Metropolitan AQMD Rule 411 (Amended August 23, 2007)[69]
- San Diego County APCD Rule 69.2.2 (Adopted September 9, 2021)[70]
- South Coast AQMD Rule 1146.1 (Amended December 7, 2018)[71]
- South Coast AQMD Rule 1150.3 (Adopted February 5, 2021)[72]

[67] BAAQMD. *Regulation 9, Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)*. (Amended May 4, 2011). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-7-nitrogen-oxides-and-carbon-monoxide-from-industrial-institutional-and-commercial-boiler/documents/rg0907.pdf?la=en&rev=ab95f36c2dd146528f1cf3c10596bce3

[68] BAAQMD. *Regulation 9, Rule 10 (Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators, and Process Heaters in Refineries)*. (Amended November 3, 2021). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/refinery-rules-definitions/rg0910_20211103-pdf.pdf?la=en&rev=6e3872940d924000b45ea05f05b5a309

[69] SMAQMD. *Rule 411 (NOx from Boilers, Process Heaters, and Steam Generators).* (Amended August 8, 2007). Retrieved from: https://www.airquality.org/ProgramCoordination/Documents/rule411.pdf

[70] SCAQMD. *Rule 69.2.2 (Medium Boilers, Process Heaters, and Steam Generators).* (Adopted September 9, 2021). Retrieved from: https://www.sdapcd.org/content/dam/sdapcd/documents/rules/current-rules/Rule-69.2.2.pdf

[71] SCAQMD. *Rule 1146.1 (Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters).* (Amended December 7, 2018). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1146-1.pdf

[72] SCAQMD. *Rule 1150.3 (Emissions of Oxides of Nitrogen from Combustion Equipment at Landfills).* (Amended February 5, 2021). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1150-3.pdf?sfvrsn=10

- Ventura County APCD Rule 74.15.1 (Amended June 23, 2015)[73]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4307 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

Bay Area AQMD

- BAAQMD Regulation 9, Rule 10 (Boilers, Steam Generators and Process Heaters in Refineries)

BAAQMD amended Regulation 9, Rule 10 on November 3, 2021. The 2021 amendments were administrative and did not affect the stringency of rule requirements implemented prior to EPA's approval of the District meeting BACM/MSM for the *2018 PM2.5 Plan*. The District found no requirements in BAAQMD Regulation 9, Rule 10 that were more stringent than those in Rule 4307.

San Diego County APCD

- SDAPCD Rule 69.2.2 (Medium Boilers, Process Heaters, and Steam Generators)

	SJVAPCD Rule 4307	SDAPCD Rule 69.2.2
Applicability	Gaseous fuel or liquid fuel fired boilers, steam generators and process heaters rated ≥2 MMBtu/hr to ≤5 MMBtu/hr.	Boilers, steam generator and process heaters >2 MMBtu/hr to <5 MMBtu/hr.
Exemptions	• Solid fuel fired units • Dryers and glass melting furnaces • Kilns, humidifiers, and smelters where products of combustion come in direct contact with material to be heated • Unfired or fired waste heat recovery boilers used to recover or augment heat from exhaust of combustion turbines or internal combustion engines • Burning other fuel during PUC quality natural gas curtailment as long as other fuel not be burned for more than 168 hr/yr plus 48 hr/yr for equipment testing, and NOx emissions shall not exceed 150 ppmv or 0.215 lb/MMBtu	• Waste heat recovery boilers • Furnaces, kilns, and any combustion equipment where the material being heated is in direct contact with the products of combustion • Thermal oxidizers and associated waste heat recovery equipment • Units which burn liquid fuel only during periods of natural gas curtailment, emergencies, or equipment testing for the purpose of maintaining the fuel oil back-up system

[73] VCAPCD. *Rule 14.15.1 (Boilers, Steam Generators, and Process Heaters).* (Amended June 23, 2015). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.15.1.pdf

	SJVAPCD Rule 4307	SDAPCD Rule 69.2.2
Requirements	***NOx Emission Limits:** New and Replacement units • 12 ppmv (atmospheric units) • 9 ppmv (non-atmospheric units) Existing units limited to 1.8 billion Btu/yr • Install and maintain non-resettable fuel flow meter; AND • Tune-up the unit twice per calendar year, OR • Operate and maintain the stack O2 concentrations at 3% by vol. or less on a dry basis, OR • Certify unit to comply with 30 ppmv NOx and 400 ppmv CO (gaseous fuel) when annual limit is exceeded; if unit is replaced then comply with limits of New and Replacement units Existing atmospheric units in oilfield or refinery; each glycol reboiler; or each unit with heat input >1.8 to <5 billion Btu/yr • 30 ppmv (gaseous fuel) • 40 ppmv (liquid fuel)	***NOx Emission Limits:** Existing or relocated units • Tune the unit once per year (no two tuning events shall occur within 90 days of each other) New Units (effective July 1, 2021) • 30 ppmv (gaseous fuel) • 40 ppmv (liquid fuel) • 400 ppmv CO
	PM Control Requirements: • Use PUC quality natural gas, propane, butane, LPG or a combination of such gases, OR • Limit fuel sulfur content to no more than 5 grains/100 scf of gas; OR • Install and operate control system that reduces SO2 emissions at least 95% by wt., or limit exhaust SO2 concentration to ≤9 ppmv @ 3% O2; AND • Liquid fuel shall be used only during a PUC quality natural gas curtailment period provided the fuel does not contain 15 ppmv sulfur	**PM Control Requirements:** None

*Unless otherwise stated, all ppmv values are on a dry basis and corrected to 3% stack oxygen by volume.

District Rule 4307 contains NOx limits for existing units, while SDAPCD Rule 69.2.2 does not, and District Rule 4307 contains more stringent NOx limits for new units. Therefore, District Rule 4307 is as stringent as or more stringent than SDAPCD Rule 69.2.2.

South Coast AQMD

- SCAQMD Rule 1146.1 (Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

	SJVAPCD Rule 4307	SCAQMD Rule 1146.1
Applicability	Gaseous fuel or liquid fuel fired boilers, steam generators and process heaters rated ≥2 MMBtu/hr to ≤5 MMBtu/hr.	Boilers, steam generator and process heaters >2 MMBtu/hr to <5 MMBtu/hr.
Exemptions	• Solid fuel fired units • Dryers and glass melting furnaces • Kilns, humidifiers, and smelters where products of combustion come in direct contact with material to be heated • Unfired or fired waste heat recovery boilers used to recover or augment heat from exhaust of combustion turbines or internal combustion engines • Burning other fuel during PUC quality natural gas curtailment as long as other fuel not be burned for more than 168 hr/yr plus 48 hr/yr for equipment testing, and NOx emissions shall not exceed 150 ppmv or 0.215 lb/MMBtu	• Units at a RECLAIM or former RECLAIM facility subject to a NOx limit in a different rule • Units at municipal sanitation service facility subject to a NOx emission limit in Reg XI adopted or amended after 12/7/18
Requirements	***NOx Emission Limits:** <u>New and Replacement units</u> • 12 ppmv (atmospheric units) • 9 ppmv (non-atmospheric units) <u>Existing units limited to 1.8 billion Btu/yr</u> • Install and maintain non-resettable fuel flow meter; AND • Tune-up the unit twice per calendar year, OR • Operate and maintain the stack O2 concentrations at 3% by vol. or less on a dry basis, OR • Certify unit to comply with 30 ppmv NOx and 400 ppmv CO (gaseous fuel) when annual limit is exceeded; if unit is replaced then comply with limits of New and Replacement units <u>Existing atmospheric units in oilfield or refinery; each glycol reboiler; or each unit with heat input >1.8 to <5 billion Btu/yr</u> • 30 ppmv (gaseous fuel) • 40 ppmv (liquid fuel)	***NOx Emission Limits:** <u>Existing units (in operation prior to 9/5/08, at non-RECLAIM facilities, or in operation prior to 12/7/19 at RECLAIM or former RECLAIM) limited to ≤1.8 billion Btu/yr</u> • Operate and maintain stack O2 concentrations at 3% by vol. or less for any 15-consecutive-minute averaging period, OR • Tune-in the unit twice per year (4 to 8 months apart) <u>All Other Units</u> • 30 ppmv for units not mentioned below: • 7 ppmv for any fire-tube boilers fired on natural gas, excluding units with <u>≤12 ppmv and >9 ppmv prior to 12/7/18</u>** • 9 ppmv for natural gas-fired units excluding fire-tube boilers subject to the above, atmospheric units, and thermal fluid heaters*** • 12 ppmv for natural gas-fired atmospheric units • 12 ppmv for natural gas-fired thermal fluid heaters**** • 15 ppmv for digester gas fired units • 25 ppmv for landfill gas fired units

	SJVAPCD Rule 4307	SCAQMD Rule 1146.1
		• Weight average limit for multi-fuel units (e.g., units using both natural gas and digester gas, etc.) ***Units with ≤9 ppmv NOx installed, modified, or issued permits prior to 12/7/18, at a non-RECLAIM facility will become subject to the 7 ppmv NOx limit when 50% or more of unit's burners are replaced, or by 12/7/33, whichever is earlier.* ****Units with ≤12 ppmv NOx and >9 ppmv NOx installed, modified or issued permits prior to 9/5/08, at a non-RECLAIM facility will become subject to the 9 ppmv NOx limit when 50% or more of unit's burners are replaced, or by 12/7/33, whichever is earlier.* *****Units with ≤30 ppmv NOx installed, modified, or issued permits prior to 12/7/18, at a non-RECLAIM facility will become subject to the 12 ppmv NOx limit when 50% or more of unit's burners are replaced, or by 12/7/33, whichever is earlier.*
	PM Control Requirements: • Use PUC quality natural gas, propane, butane, LPG or a combination of such gases, OR • Limit fuel sulfur content to no more than 5 grains/100 scf of gas; OR • Install and operate control system that reduces SO2 emissions at least 95% by wt., or limit exhaust SO2 concentration to ≤9 ppmv @ 3% O2; AND • Liquid fuel shall be used only during a PUC quality natural gas curtailment period provided the fuel does not contain 15 ppmv sulfur	**PM Control Requirements:** None

*Unless otherwise stated, all ppmv values are on a dry basis and corrected to 3% stack oxygen by volume.

SCAQMD Rule 1146.1 regulates NOx and CO emissions from small industrial, institutional, and commercial boilers, steam generators, and process heaters. The District compared the emission limits in District Rule 4307 with SCAQMD Rule 1146.1 and concluded that NOx requirements in the District rule are at least equivalent or more stringent than the SCAQMD rule limits for similarly rated units. Therefore, District Rule 4307 is as stringent as or more stringent than SCAQMD Rule 1146.1.

- SCAQMD Rule 1150.3 (Emissions of Oxides of Nitrogen From Combustion Equipment at Landfills)

This rule includes limits for units operating at landfills. The District does not currently have any applicable boilers, steam generators, or process heaters operating at landfills.

Ventura County APCD

- VCAPCD Rule 74.15.1 (Boilers, Steam Generators, and Process Heaters)

	SJVAPCD Rule 4307	VCAPCD Rule 74.15.1
Applicability	Gaseous fuel or liquid fuel fired boilers, steam generators and process heaters rated ≥2 MMBtu/hr to ≤5 MMBtu/hr.	Gaseous fuel or liquid fuel fired boilers, steam generators, or process heaters rated ≥1 MMBtu/hr and <5 MMBtu/hr.
Exemptions	• Solid fuel fired units • Dryers and glass melting furnaces • Kilns, humidifiers, and smelters where products of combustion come in direct contact with material to be heated • Unfired or fired waste heat recovery boilers used to recover or augment heat from exhaust of combustion turbines or internal combustion engines • Burning other fuel during PUC quality natural gas curtailment as long as other fuel not be burned for more than 168 hr/yr plus 48 hr/yr for equipment testing, and NOx emissions shall not exceed 150 ppmv or 0.215 lb/MMBtu	• Any unit operated on alternate fuel under following conditions: ○ Alternate fuel use required due to natural gas curtailment period. ○ Alternative fuel use is required to maintain the alternate fuel system, and in this case use shall not exceed 50 hr/yr • Portable oil well dewaxing process heater is not subject to 30 ppmv NOx, if annual heat input rate is <2.8 billion Btu
Requirements	***NOx Emission Limits:** <u>New and Replacement units</u> • 12 ppmv (atmospheric units) • 9 ppmv (non-atmospheric units) <u>Existing units limited to 1.8 billion Btu/yr</u> • Install and maintain non-resettable fuel flow meter; AND • Tune-up the unit twice per calendar year, OR • Operate and maintain the stack O2 concentrations at 3% by vol. or less on a dry basis, OR • Certify unit to comply with 30 ppmv NOx and 400 ppmv CO (gaseous fuel) when annual limit is exceeded; if unit is replaced then comply with limits of New and Replacement units <u>Existing atmospheric units in oilfield or refinery; each glycol reboiler; or each unit with heat input >1.8 to <5 billion Btu/yr</u> • 30 ppmv (gaseous fuel) • 40 ppmv (liquid fuel)	***NOx Emission Limits:** <u>Units with heat input rate ≥1.8 billion Btu/yr</u> • 30 ppmv <u>New and Replacement Units ≥1 to ≤2 MMBtu/hr</u> • 20 ppmv (natural gas-fired) <u>New and Replacement Units >2 to <5 MMBtu/hr</u> • 12 ppmv (natural gas, atmospheric) • 9 ppmv (natural gas, pressurized) • 25 ppmv (landfill gas) • 15 ppmv (biogas) • 20 ppmv (LPG) • 15 ppmv (produced oilfield gas, atmospheric) • 12 ppmv (produced oilfield gas, pressurized) <u>Units ≥0.3 billion Btu/yr and <1.8 billion Btu/yr</u> Comply with one of the following: • Units shall be tuned every 6 months or after 750 hours of operation, but in no case less than once per calendar year; OR • The unit shall comply with the emission and testing requirements (20-30 ppmv NOx)

	SJVAPCD Rule 4307	VCAPCD Rule 74.15.1
	PM Control Requirements: • Use PUC quality natural gas, propane, butane, LPG or a combination of such gases, OR • Limit fuel sulfur content to no more than 5 grains/100 scf of gas; OR • Install and operate control system that reduces SO2 emissions at least 95% by wt., or limit exhaust SO2 concentration to ≤9 ppmv @ 3% O2; AND • Liquid fuel shall be used only during a PUC quality natural gas curtailment period provided the fuel does not contain 15 ppmv sulfur	**PM Control Requirements:** None

*Unless otherwise stated, all ppmv values are on a dry basis and corrected to 3% stack oxygen by volume.

VCAPCD Rule 74.15.1 regulates NOx and CO emissions from boilers, steam generators, and process heaters. The District compared the emission limits in District Rule 4307 with VCAPCD and concluded that Rule 4307 is overall as stringent as VCAPCD Rule 74.15.1.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District reviewed the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

NOx Emission Control Technologies

Most units subject to Rule 4307 are fired on Public Utilities Commission (PUC) quality natural gas, and are able to install established control technologies. The following potential control techniques are evaluated to achieve further reductions:

Retrofitting with SCR

SCR technology is predominantly used to reduce NOx emissions from boilers, steam generators, and process heaters. While many of existing units already use SCR to control NOx emissions, enhanced SCR systems may be required to further reduce emissions. As confirmed by a local vendor, the cost of SCR systems to further reduce emissions including the SCR housing, catalyst, ammonia injection system, and ammonia flow control system could cost approximately $220,000. This information is used as a basis to estimate the annualized cost for this control technique.

Description of Cost	Cost Factor	Cost	Source
Direct Costs			
Purchase equipment costs (PE):			
SCR system	A	220,000	Boiler vendor
Instrumentation and controls	0.01 A	--	Included above

Description of Cost	Cost Factor	Cost	Source
Sales taxes	0.08 A	17,600	
Freight	0.05 A	11,000	OAQPS
Purchased equipment cost, PEC	B = 1.14 A	248,600	
Direct installation costs (DI):			
Foundation & supports	0.08 B	19,888	OAQPS
Handling and erection	0.14 B	34,804	OAQPS
Electrical	0.04 B	9,944	OAQPS
Piping	0.02 B	4,972	OAQPS
Insulation and ductwork:	0.01 B	2,486	OAQPS
Painting	0.01 B	2,486	OAQPS
Direct installation costs	0.30 B	74,580	
Site preparation	As required, SP	--	See table footnote
Buildings	As required, Bldg.	--	
Total Direct Costs, DC	1.30B + SP + Bldg.	323,180	
Indirect Costs (Installation)			
Engineering	0.10 B	24,860	OAQPS
Construction and field expenses	0.05 B	12,430	OAQPS
Contractor fees	0.10 B	24,860	OAQPS
Contingencies	0.03 B	7,458	OAQPS
Start-up	0.02 B	4,972	OAQPS
Performance test	0.01 B	2,486	OAQPS
Total indirect costs, IC	0.31 B	77,066	
Total Capital Investments (TCI = DC + IC):	**1.61 B + SP + Bldg.**	400,246	
Annualized TCI (10 years @ 10% interest)	0.1627 TCI	**65,120**	
Direct Annual Costs (DAC)			
Operating and supervisory labor	--	--	See table footnote
Maintenance costs (labor and material)	0.015 TCI	6,004	OAQPS
Reagent costs (anhydrous ammonia)		--	Not estimated
Electricity cost	$0.08848/kWH	--	Not estimated
Catalyst replacement	--	--	Catalyst presumed to last at least over 10 years
	Total DAC:	6,004	
Indirect Annual Costs (IAC)			
Overhead	--	--	See table footnote
Insurance	0.01 TCI	4,002	OAQPS
Property tax	--	--	See table footnote
Administrative	--	--	See table footnote
	Total IAC:	4,002	
Total Annual Cost (DAC + IAC)		10,006	
Total annual cost (Annualized TCI + Total annual cost)		**75,126**	

*Per EPA's Air Pollution Control Cost Manual (6th Edition), EPA/452/B-02-001 (1/02), operating and supervisory, overhead, administrative costs would be insignificant for an SCR system. In general, SCR does not require site preparation or additional buildings, and property taxes do not apply to capital improvements such as air pollution control equipment.

The potential NOx emission reduction for each category is determined by taking the difference between the potential emissions and the emissions that could be reliably achievable by an SCR system. SCR is expected to reliably achieve 5 ppmv NOx @ 3%

O2. The total cost for each category is determined by multiplying the number of units and $75,126 for a typical annual cost of an SCR system.

Type of unit	Number of units	Potential NOx Reductions with SCR Technology (tons/yr)	Total annualized cost of NOx Reductions with SCR Technology ($/yr)	Cost effectiveness ($/ton of emission reduction)
New and replacement units, 12 ppmv NOx	36 (35*+1**)	5.0 (4.9*+0.1**)	2,704,536	**$540,907/ton**
New and replacement units, 9 ppmv NOx	209 (192*+17**)	17.2 (15.8*+1.4**)	15,701,334	**$912,868/ton**
Existing units – gaseous fuel, 30 ppmv NOx	260 (244*+16**)	138.8 (132.4*+6.4**)	19,532,760	**$140,726/ton**
Existing units – gaseous fuel, low-use, ≤1.8 billion Btu/yr	102*	8.8*	7,662,852	**$870,779/ton**
Existing units – gaseous fuel, ≤5 billion Btu/yr	1*	--	--	--
Existing units – liquid fuel, ≤5 billion Btu/yr	1*	--	--	--
Existing units – gaseous fuel with diesel backup, 15 ppmv NOx	3**	0.8**	225,378	**$281,723/ton**
Existing units – gaseous fuel with diesel backup, 20 ppmv NOx	7**	2.7**	525,882	**$194,771/ton**
Miscellaneous – existing units with gaseous or liquid fuels	9**,***	--	--	--

*Active PEERs, **Active PTOs, ***4 units out of 9 units are dormant

Retrofitting with Ultra Low-NOx Burner

A boiler, steam generator, or process heater can be retrofitted with an ultra-low NOx burner (ULNB) to reliably achieve 9 ppmv NOx @ 3% O2. As provided by a local vendor, the cost of a ULNB would be about $70,000. However, retrofitting an existing boiler may not always be feasible and if feasible, it may involve upgrades to various systems such as fuel trains to comply with current codes, and upgrades to air intake fans, as these units require more air for the burner to operate at its optimum level. These additional items are not included in the calculations below, but can add considerable costs to the retrofit.

Description of Cost	Cost Factor	Cost	Source
Direct Costs			
Purchase equipment costs (PE):			
Burner system (replacement burner, controls, and fuel train systems)	A	77,000	Local vendor
Instrumentation and controls	0.01 A	--	Included above
Sales taxes	0.08 A	6,160	
Freight	0.05 A	3,850	OAQPS
Purchased equipment cost, PEC		87,010	
Direct installation costs (DI):			
Foundation & supports	0.08 B	--	See footnote

Description of Cost	Cost Factor	Cost	Source
Handling and erection	0.14 B	12,181	OAQPS
Electrical	0.04 B	3,480	OAQPS
Piping	0.02 B	1,740	OAQPS
Insulation and ductwork:	0.01 B	870	OAQPS
Painting	0.01 B	870	OAQPS
Direct installation costs		19,141	
Site preparation	As required, SP	--	See table footnote
Buildings	As required, Bldg.	--	
Total Direct Costs, DC		106,151	
Indirect Costs (Installation)			
Engineering	0.10 B	8,701	OAQPS
Construction and field expenses	0.05 B	4,351	OAQPS
Contractor fees	0.10 B	8,701	OAQPS
Contingencies	0.03 B	2,610	OAQPS
Start-up	0.02 B	1,740	OAQPS
Performance test	0.01 B	870	OAQPS
Total indirect costs, IC	0.31 B	26,973	
Total Capital Investments (TCI = DC + IC):		133,125	
Annualized TCI (10 years @ 10% interest)	0.1627 TCI	**21,659**	
Direct annual costs (DAC)			
Operating and supervisory labor	--	--	See table footnote
Maintenance costs (labor and material)	--	--	
Electricity cost	$0.08848/kWH	--	Not estimated
Indirect Annual Costs (IAC)			
Overhead	--	--	See table footnote
Insurance	--	--	See table footnote
Property tax	--	--	See table footnote
Administrative	--	--	See table footnote
Total Annual Cost (DAC + IAC)		--	
Total annual cost (annualized TCI + Total annual cost)		**21,659**	

*The existing foundation and supports will not be replaced; direct annual cost and indirect annual costs are presumed to be same as the existing burner

The potential NOx emission reduction for each category is determined by taking the difference between the potential emissions and the emissions that could be reliably achievable by a ULNB system. A ULNB is expected to reliably achieve 9 ppmv NOx @ 3% O2. Each unit is presumed to be operated for 8,760 hours per year at the maximum rated capacity. The total cost for each category is determined by multiplying the number of units and $21,659, a typical annual cost of a ULNB system.

Type of unit	Number of units	Potential NOx Reductions with ULNB Technology (tons/yr)	Total annualized cost of NOx Reductions with burner retrofit ($/yr)	Cost effectiveness ($/ton of emission reduction)
New and replacement units, 12 ppmv NOx	36 (35*+1**)	2.1 (2.1*+0.0*)	779,724	**$371,297/ton**
New and replacement units, 9 ppmv NOx	209 (192*+17**)	Not needed, units are already equipped with 9 ppmv burner		

Existing units – gaseous fuel, 30 ppmv NOx	260 (244*+16**)	116.6 (111.2*+5.4**)	5,631,340	**$48,296/ton**
Existing units – gaseous fuel, low-use, ≤1.8 billion Btu/yr	102*	8.3*	2,209,218	**$266,171/ton**
Existing units – gaseous fuel, ≤5 billion Btu/yr	1*	--	--	--
Existing units – liquid fuel, ≤5 billion Btu/yr	1*	--	--	--
Existing units – gaseous fuel with diesel backup, 15 ppmv NOx	3**	0.5**	64,977	**$129,954/ton**
Existing units – gaseous fuel with diesel backup, 20 ppmv NOx	7**	2.0**	151,613	**$75,807/ton**
Miscellaneous – existing units with gaseous or liquid fuels	9**,***	--	--	--

*Active PEERs, **Active PTOs, ***4 units out of 9 units are dormant

Replacing Older Unit with New Unit (Achieving 9 ppmv NOx)

Replacement of an older boiler in many cases may be the only way to reduce NOx emissions. New units can reliably achieve 9 ppmv NOx @ 3% O2. The cost of these units depends on the heat input rate, use of unit (steam, hot water, etc.), control system, and heat recovery systems (economizer etc.). Per a local vendor, the cost of a steam boiler rated at 5.0 MMBtu/hr (300 psi) would be $165,000. The majority (>90%) of the units are greater than 2.0 MMBtu/hr; therefore, it is reasonable to use this cost data for the cost effectiveness analysis.

Description of Cost	Cost Factor	Cost	Source
Direct Costs			
Purchase equipment costs (PE):			
Replacing an older unit	A	165,000	Local vendor
Instrumentation and controls	0.01 A	1,650	OAQPS
Sales taxes	0.08 A	13,200	
Freight	0.05 A	8,250	OAQPS
Purchased equipment cost, PEC		188,100	
Direct installation costs (DI):			
Foundation & supports	0.08 B	15,048	See footnote
Handling and erection	0.14 B	26,334	OAQPS
Electrical	0.04 B	7,524	OAQPS
Piping	0.02 B	3,762	OAQPS
Insulation and ductwork:	0.01 B	1,881	OAQPS
Painting	0.01 B	1,881	OAQPS
Direct installation costs		56,430	
Site preparation	As required, SP	--	See table footnote
Buildings	As required, Bldg.	--	
Total Direct Costs, DC		244,530	
Indirect Costs (Installation)			
Engineering	0.10 B	18,810	OAQPS
Construction and field expenses	0.05 B	9,405	OAQPS
Contractor fees	0.10 B	18,810	OAQPS

Description of Cost	Cost Factor	Cost	Source
Contingencies	0.03 B	5,643	OAQPS
Start-up	0.02 B	3,762	OAQPS
Performance test	0.01 B	1,881	OAQPS
Total indirect costs, IC	0.31 B	58,311	
Total Capital Investments (TCI = DC + IC):		302,841	
Annualized TCI (10 years @ 10% interest)	0.1627 TCI	**49,272**	
Direct annual costs (DAC)			
Operating and supervisory labor	--	--	See table footnote
Maintenance costs (labor and material)	--	--	
Electricity cost	$0.08848/kWH	--	Not estimated
Indirect Annual Costs (IAC)			
Overhead	--	--	See table footnote
Insurance	--	--	See table footnote
Property tax	--	--	See table footnote
Administrative	--	--	See table footnote
Total Annual Cost (DAC + IAC)		--	
Total annual cost (Annualized TCI + Total annual cost)		**49,272**	

*Direct annual cost and indirect annual costs are presumed to be same as the existing unit

The potential NOx emission reduction for each category is determined by taking the difference between the potential emissions and the emissions that could be reliably achievable by the use of a new unit equipped with a ULNB system. A ULNB is expected to reliably achieve 9 ppmv NOx @ 3% O2. Each unit is presumed to be operated for 8,760 hours per year at the maximum rated capacity. The total cost for each category is determined by multiplying the number of units and $49,272, a typical annual cost of a unit with a ULNB system.

Type of unit	Number of units	Potential NOx reductions w/ new unit equipped w/ ULNB Technology (tons/yr)	Total annualized cost of NOx reductions w/ new unit equipped w/ ULNB Technology ($/yr)	Cost effectiveness ($/ton of emission reduction)
New and replacement units, 12 ppmv NOx	36 (35*+1**)	2.1 (2.1*+0.0*)	1,773,792	**$844,663/ton**
New and replacement units, 9 ppmv NOx	209 (192*+17**)	Not needed, units equipped with 9 ppmv burner		
Existing units – gaseous fuel, 30 ppmv NOx	260 (244*+16**)	116.6 (111.2*+5.4**)	12,810,720	**$109,869/ton**
Existing units – gaseous fuel, low-use, ≤1.8 billion Btu/yr	102*	8.3*	5,025,744	**$605,511/ton**
Existing units – gaseous fuel, ≤5 billion Btu/yr	1*	--	--	--
Existing units – liquid fuel, ≤5 billion Btu/yr	1*	--	--	--

Existing units – gaseous fuel with diesel backup, 15 ppmv NOx	3**	0.5**	147,816	**$295,632/ton**
Existing units – gaseous fuel with diesel backup, 20 ppmv NOx	7**	2.0**	344,904	**$172,452/ton**
Miscellaneous – existing units with gaseous or liquid fuels	9**,***	--	--	--

*Active PEERs, **Active PTOs, ***4 units out of 9 units are dormant

Replacing Older Unit with New Unit and SCR System (Achieving 5 ppmv NOx)

The District confirmed with a boiler vendor that a boiler between 2.0-5.0 MMBtu/hr cannot achieve 5 ppmv NOx @ 3% O2 with the use of a ULNB alone. A new boiler must be equipped with an SCR system to reliably achieve 5 ppmv NOx for this heat input range. The capital cost of a new boiler with an SCR system is estimated to be at least $385,000.

Description of Cost	Cost Factor	Cost	Source
Direct Costs			
Purchase equipment costs (PE):			
New steam-boiler + SCR system to achieve 5 ppm	A	385,000	Local Vendor
Instrumentation and controls	0.01 A	3,850	OAQPS
Sales Taxes	0.08 A	30,800	
Freight	0.05 A	19,250	OAQPS
Purchased equipment cost, PEC		438,900	
Direct installation costs (DI):			
Foundation & supports	0.08 B	35,112	See footnote
Handling and erection	0.14 B	61,446	OAQPS
Electrical	0.04 B	17,556	OAQPS
Piping	0.02 B	8,778	OAQPS
Insulation and ductwork:	0.01 B	4,389	OAQPS
Painting	0.01 B	4,389	OAQPS
Direct installation costs		131,670	
Site preparation	As required, SP	--	See table footnote
Buildings	As required, Bldg.	--	
Total Direct Costs, DC		570,570	
Indirect Costs (Installation)			
Engineering	0.10 B	43,890	OAQPS
Construction and field expenses	0.05 B	21,945	OAQPS
Contractor fees	0.10 B	43,890	OAQPS
Contingencies	0.03 B	13,167	OAQPS
Start-up	0.02 B	8,778	OAQPS
Performance test	0.01 B	4,389	OAQPS
Total Indirect Costs, IC	0.31 B	136,059	
Total Capital Investments (TCI = DC + IC):		706,629	
Annualized TCI (10 years @ 10% interest)	0.1627 TCI	**114,969**	

Description of Cost	Cost Factor	Cost	Source
Direct Annual Costs (DAC)			
Operating and supervisory labor	--	--	See table footnote
Maintenance costs (labor and material)	--	--	
Electricity cost	$0.08848/kWH	--	Not estimated
Indirect Annual Costs (IAC)			
Overhead	--	--	See table footnote
Insurance	--	--	See table footnote
Property Tax	--	--	See table footnote
Administrative	--	--	See table footnote
Total Annual Cost (DAC + IAC)		--	
Total annual cost (Annualized TCI + Total annual cost)		**114,969**	

*Direct annual cost and indirect annual costs are presumed to be same as the existing unit

The potential NOx emission reduction for each category is determined by taking the difference between the potential emissions and the emissions that could be reliably achievable by the use of a new unit equipped with an SCR system. A unit with an SCR is expected to reliably achieve 5 ppmv NOx @ 3% O2. Each unit is presumed to be operated for 8,760 hours per year at the maximum rated capacity. The total cost for each category is determined by multiplying the number of units and $114,969, a typical annual cost of a unit with an SCR system.

Type of unit	Number of units	Potential NOx reductions w/ new unit equipped w/SCR Technology (tons/yr)	Total annualized cost of NOx reductions w/ new unit equipped w/ SCR Technology ($/yr)	Cost effectiveness ($/ton of emission reduction)
New and replacement units, 12 ppmv NOx	36 (35*+1**)	5.0 (4.9*+0.1**)	4,138,884	**$827,777/ton**
New and replacement units, 9 ppmv NOx	209 (192*+17**)	17.2 (15.8*+1.4**)	24,028,521	**$1,397,007/ton**
Existing units – gaseous fuel, 30 ppmv NOx	260 (244*+16**)	138.8 (132.4*+6.4**)	29,891,940	**$215,360/ton**
Existing units – gaseous fuel, low-use, ≤1.8 billion Btu/yr	102*	8.8*	11,726,838	**$1,332,595/ton**
Existing units – gaseous fuel, ≤5 billion Btu/yr	1*	--	--	--
Existing units – liquid fuel, ≤5 billion Btu/yr	1*	--	--	--
Existing units – gaseous fuel with diesel backup, 15 ppmv NOx	3**	0.8**	344,907	**$431,134/ton**
Existing units – gaseous fuel with diesel backup, 20 ppmv NOx	7**	2.7**	804,783	**$298,068/ton**
Miscellaneous – existing units with gaseous or liquid fuels	9**,***	--	--	--

*Active PEERs, **Active PTOs, ***4 units out of 9 units are dormant

Use of EMx System

The District researched post-combustion controls such as EMx, the second generation of the SCONOx technology that reduces NOx, SOx, CO, and VOC emissions. Per EmeraChem, manufacturer/vendor of the technology, this technology has not been achieved in practice for natural gas fired boilers. SCONOx and EMx systems have only been used by power plants for the control of turbine emissions. The cost of an EMx system would be anywhere from $3 to $5 million, or even up to $8 million in some cases for large power plant installations. Moreover, an EMx system is ideal for a new installation, but becomes extremely challenging and sometimes nearly impossible to retrofit to an existing unit. In fact, cost effectiveness analyses conducted by the District for the installation of SCONOx/EMx units on large power plant turbine installations within the Valley have shown that this technology is not cost effective. Given the high cost effectiveness demonstrated for turbines and lack of demonstrated practice with boilers, this technology is not feasible or cost effective for reducing emissions from this category.

Zero-Emission Opportunities

The District did not identify any feasible opportunities to require zero-emission technologies for units in the Valley. However, the District will continue to closely track the development of new zero-emissions technologies and control measures for this source category.

Based on this analysis, the District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

Rule 4307 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.9 RULE 4308 (BOILERS, STEAM GENERATORS, AND PROCESS HEATERS - 0.075 MMBTU/HR TO LESS THAN 2.0 MMBTU/HR)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	2.39	2.28	2.13	2.01	1.90	1.83	1.80
NOx	3.53	3.29	2.94	2.44	2.19	2.03	1.96
	Winter Average - Tons per day						
PM2.5	2.35	2.25	2.09	1.97	1.86	1.79	1.76
NOx	3.42	3.19	2.85	2.36	2.11	1.95	1.88

District Rule 4308 Description

The purpose of this rule is to limit NOx and CO emissions from units within this source category. As a point-of-sale rule, Rule 4308 achieves emissions reductions as operators with units subject to the rule replace their equipment over time. This point-of-sale approach allows the District to achieve NOx emission reductions without forcing immediate replacement of existing units to comply with rule requirements and thus placing an undo financial burden on the consumer. This rule has resulted in more than 93% control of emissions from this source category.

The District adopted Rule 4308 on October 20, 2005, to establish NOx emissions limits for units that were previously exempt from District regulations because of their small size. The rule was amended in December 2009 to lower the NOx emissions limits to 20 ppmv for units fired on natural gas, with the exception of instantaneous water heaters and pool heaters greater than or equal to 0.075 MMBtu/hr but less than or equal to 0.4 MMBtu/hr. The District subsequently amended Rule 4308 in 2013 to lower the NOx emission limit for instantaneous water heaters 0.075 MMBtu/hr to 0.4 MMBtu/hr to 20 ppmv.

How does District Rule 4308 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines or New Source Performance Standards applicable to this source category.

A. Alternative Control Techniques (ACT)

ACTs address potential emission control techniques for units with the potential to emit more than 25 tons of NOx per year. No units subject to District Rule 4308 have the potential to emit 25 tons per year; therefore, ACTs are not directly applicable to this

source category. However, ACTs do discuss various control technologies, so the District has examined them.

- *Alternative Control Techniques Document – NOx Emissions from Process Heaters) (EPA-453/R-93-034 1993/09)*

The District evaluated the ACT for NOx Emissions from Process Heaters and found no applicable control requirements. As such, Rule 4308 is more stringent.

- *Alternative Control Techniques Document – NOx Emissions from Industrial/Commercial/Institutional Boilers (EPA-453/R-94-022 1994/03)*

The District evaluated the ACT for NOx Emissions from Industrial/Commercial/Institutional Boilers and found no applicable control techniques that were more stringent than those already in Rule 4308.

- *Alternative Control Techniques Document – NOx Emissions from Utility Boilers (EPA-453/R-94-023 1994/06)*

The District evaluated the ACT for NOx Emissions from Utility Boilers and found no applicable control techniques that were more stringent than those already in Rule 4308.

State Regulations

There are no state regulations that apply to this source category.

How does District Rule 4308 compare to rules in other air districts?

The District compared the emission limits, optional control requirements, and work practice standards in District Rule 4308 to comparable requirements in rules from the following California nonattainment areas:

- Bay Area AQMD Regulation 9, Rule 6 (Amended March 15, 2023)[74]
- Bay Area AQMD Regulation 9, Rule 7 (Amended May 4, 2011)[75]
- Bay Area AQMD Regulation 9, Rule 10 (Amended November 3, 2021)[76]

[74] BAAQMD. *Regulation 9, Rule 6 (Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters).* (Amended March 15, 2023). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20230315_rg0906-pdf.pdf?la=en

[75] BAAQMD. *Regulation 9, Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)*. (Amended May 4, 2011). Retrieved from: https://www.baaqmd.gov/rules-and-compliance/rules/reg-9-rule-7-nitrogen-oxides-and-carbon-monoxide-from-industrial-institutional-and-commercial-boiler

[76] BAAQMD. *Regulation 9, Rule 10 (Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators, and Process Heaters in Petroleum Refineries).* (Amended November 3, 2021). Retrieved from: https://www.baaqmd.gov/rules-and-compliance/rules/reg-9-rule-10-nitrogen-oxides-and-carbon-monoxide-from-boilers-steam-generators-and-process-heaters

- Sacramento Metropolitan AQMD Rule 411 (Amended August 23, 2007)[77]
- Sacramento Metropolitan AQMD Rule 414 (Amended October 25, 2018)[78]
- San Diego County APCD Rule 69.2.1 (Adopted July 8, 2020)[79]
- South Coast AQMD Rule 1146.2 (Amended December 7, 2018)[80]
- South Coast AQMD Rule 1147 (Amended May 6, 2022)[81]
- Ventura County APCD Rule 74.11.1 (Amended September 11, 2012)[82]
- Ventura County APCD Rule 74.15.1 (Amended June 23, 2015)[83]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4308 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

Bay Area AQMD

- BAAQMD Regulation 9, Rule 6 (Natural Gas-Fired Boilers and Water Heaters)

	SJVAPCD Rule 4308	BAAQMD Reg 9, Rule 6
Applicability	Boilers, steam generators and process heaters with rated heat input capacity ≥0.075 MMBtu/hr and <2 MMBtu/hr.	Any person who sells, installs, or offers for sale a natural gas-fired water heater and any manufacturer who intends to sell or distribute for sale or installation a natural gas-fired water heater.
Exemptions	• Units installed in manufactured homes • Units installed in recreational vehicles • Hot water pressure washers	• Units with rated heat input capacity >2 MMBtu/hr • Units used in recreational vehicles • Water heaters using a fuel other than natural gas • Natural gas-fired pool/spa heaters with <0.4 MMBtu/hr rated heat input capacity used exclusively to heat swimming pools, hot tubs or spas
Requirements	***NOx Emission Limits:** Units ≥0.075 to ≤0.4 MMBtu/hr (except instantaneous water heaters and pool heaters below):	***NOx Emission Limits:** Natural gas-fired boilers and instantaneous water heaters >0.075 to ≤0.4 MMBtu/hr: • 14 ng/J (20 ppmv) for units manufactured after Jan. 1, 2013;

[77] SMAQMD. *Rule 411 (NOx from Boilers, Process Heaters, and Steam Generators)*. (Amended August 23, 2007). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule411.pdf
[78] SMAQMD. *Rule 414 (Water Heaters, Boilers, and Process Heaters Rated Less Than 1,000,000 BTU Per Hour)*. (Amended October 25, 2018). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule414.pdf
[79] SDAPCD. *Rule 69.2.1 (Small Boilers, Process Heaters, Steam Generators, and Large Water Heaters)*. (Adopted July 8, 2020). Retrieved from: https://www.sdapcd.org/content/dam/sdapcd/documents/rules/current-rules/Rule-69.2.1.pdf
[80] SCAQMD. *Rule 1146.2 (Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters)*. (Amended December 7, 2018). Retrieved from: http://www.aqmd.gov/home/rules-compliance/rules/support-documents/rule-1146-2-details
[81] SCAQMD. *Rule 1147 (NOx Reductions from Miscellaneous Sources)*. (Amended May 6, 2022). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1147.pdf?sfvrsn=4
[82] VCAPCD. *Rule 74.11.1 (Large Water Heaters and Small Boilers)*. (Amended September 11, 2012). Retrieved from: http://vcapcd.org/Rulebook/Reg4/RULE%2074.11.1.pdf
[83] VCAPCD. *Rule 74.15.1 (Boilers, Steam Generators, and Process Heaters)*. (Amended June 23, 2015). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.15.1.pdf

	SJVAPCD Rule 4308	BAAQMD Reg 9, Rule 6
	• PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Units >0.4 to <2 MMBtu/hr (except instantaneous water heaters and pool heaters below): • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 30 ppmv (0.036 lb/MMBtu) Instantaneous water heaters ≥0.075 to ≤0.4 MMBtu/hr: • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Instantaneous water heaters >0.4 to <2 MMBtu/hr: • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Pool heaters ≥0.075 to ≤0.4 MMBtu/hr: • PUC gas: 55 ppmv (0.068 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Pool heaters >0.4 to <2 MMBtu/hr: • PUC gas: 20 ppmv (0.068 lb/MMBtu); • Non-PUC or liquid: 30 ppmv (0.036 lb/MMBtu)	• 0.0 ng/J of heat output for units manufactured after Jan. 1, 2031 Natural gas-fired boilers and instantaneous water heaters >0.4 to ≤2 MMBtu/hr: • 14 ng/J (20 ppmv) for units manufactured after Jan. 1, 2013; • 0.0 ng/J of heat output for units manufactured after Jan. 1, 2031 Natural gas-fired pool/spa heaters >0.4 to ≤2 MMBtu/hr: • 14 ng/J (20 ppmv) for units manufactured after Jan. 1, 2013

*Unless otherwise stated, all ppmv values in the table are ppmv @ 3% O2

BAAQMD Regulation 9, Rule 6 regulates NOx and CO emissions from natural gas-fired boilers and water heaters. The District compared the emission limits in District Rule 4308 and BAAQMD's Regulation 9, Rule 6 and concluded that NOx emission limits in the District rule are equivalent to the BAAQMD rule limits for similarly rated units at this time. For units manufactured after January 1, 2031, BAAQMD's NOx limit will be more stringent than SJVAPCD Rule 4308 limit for natural gas-fired boilers and water heaters rated at greater than 0.075 to 2 MMBtu/hr. Notably, this limit takes effect beyond the 2029 date by which the District is required to implement MSM. BAAQMD selected this future compliance date for the zero-NOx limit due to the current lack of available zero-emission technologies, and the complexities of installations of units in this category. For these reasons, BAAQMD's future limit cannot be considered as establishing MSM at this time.

- BAAQMD Regulation 9, Rule 10 (Boilers, Steam Generators and Process Heaters in Refineries)

BAAQMD amended Regulation 9, Rule 10 on November 3, 2021. The 2021 amendments were administrative and did not affect the stringency of rule requirements implemented prior to EPA's approval of the District meeting BACM/MSM for the *2018 PM2.5 Plan*. The District found no requirements in BAAQMD Regulation 9, Rule 10 that were more stringent than those in Rule 4308.

Sacramento Metropolitan AQMD

- SMAQMD Rule 414 (Water Heaters, Boilers and Process Heaters Rated Less than 1 MMBtu/hr)

	SJVAPCD Rule 4308	SMAQMD Rule 414
Applicability	Boilers, steam generators and process heaters with rated heat input capacity ≥0.075 MMBtu/hr and <2 MMBtu/hr.	Boilers, steam generators, and process heaters fired on gaseous or non-gaseous fuels with a rated capacity <1 MMBtu/hr.
Exemptions	• Units installed in manufactured homes • Units installed in recreational vehicles • Hot water pressure washers	• Water heaters in recreational vehicles • Pool/spa heaters <0.075 MMBtu/hr • Water heaters, boilers and process heater fired on LPG fuel • Hot water pressure washers fired with gaseous or liquid fuels
Requirements	***NOx Emission Limits:** Units ≥0.075 to ≤0.4 MMBtu/hr (except instantaneous water heaters and pool heaters below): • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Units >0.4 to <2 MMBtu/hr (except instantaneous water heaters and pool heaters below): • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 30 ppmv (0.036 lb/MMBtu) Instantaneous water heaters ≥0.075 to ≤0.4 MMBtu/hr: • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Instantaneous water heaters >0.4 to <2 MMBtu/hr: • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Pool heaters ≥0.075 to ≤0.4 MMBtu/hr: • PUC gas: 55 ppmv (0.068 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Pool heaters >0.4 to <2 MMBtu/hr: • PUC gas: 20 ppmv (0.068 lb/MMBtu);	***NOx Emission Limits:** Units ≥0.075 to <0.4 MMBtu/hr: • Pool/spa units: 40 ng/J (55 ppmv); • All other units: 14 ng/J (20 ppmv) Units ≥0.4 to <1 MMBtu/hr: • 14 ng/J (20 ppmv)

	SJVAPCD Rule 4308	SMAQMD Rule 414
	• Non-PUC or liquid: 30 ppmv (0.036 lb/MMBtu)	

*Unless otherwise stated, all ppmv values in the table are ppmv @ 3% O2

The District evaluated the requirements contained within SMAQMD Rule 414, and found no requirements to be more stringent than those already in District Rule 4308. Therefore, District Rule 4308 is as stringent as or more stringent than SMAQMD Rule 414.

San Diego County APCD

- SDAPCD Rule 69.2.1 (Small Boilers, Process Heaters, Steam Generators, and Large Water Heaters)

	SJVAPCD Rule 4308	SDAPCD Rule 69.2.1
Applicability	Boilers, steam generators and process heaters with rated heat input capacity ≥0.075 MMBtu/hr and <2 MMBtu/hr.	Any person who manufactures, sells, offers for sale or distributes, or installs a new boiler, process heater, steam generator, or water heater with a heat input rating 75,000 Btu/hr to 2 MMBu/hr.
Exemptions	• Units installed in manufactured homes • Units installed in recreational vehicles • Hot water pressure washers	• Waste heat recovery boilers used to recover heat from the exhaust of gas turbines, internal combustion engines, or other combustion equipment • Furnaces, kilns, and any combustion equipment where the material being heated is in direct contact with the products of combustion • Thermal oxidizers and associated waste heat recovery equipment • Hot water pressure washers
Requirements	***NOx Emission Limits:** <u>Units ≥0.075 to ≤0.4 MMBtu/hr (except instantaneous water heaters and pool heaters below)</u>: • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) <u>Units >0.4 to <2 MMBtu/hr (except instantaneous water heaters and pool heaters below)</u>: • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 30 ppmv (0.036 lb/MMBtu) <u>Instantaneous water heaters ≥0.075 to ≤0.4 MMBtu/hr</u>: • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) <u>Instantaneous water heaters >0.4 to <2 MMBtu/hr</u>: • PUC gas: 20 ppmv (0.024 lb/MMBtu);	***NOx Emission Limits:** <u>Units ≥0.075 to ≤0.4 MMBtu/hr (except pool heaters)</u>: • PUC gas: 20 ppmv; • Non-PUC or liquid: 77 ppmv <u>Units >0.4 to <2 MMBtu/hr (except pool heaters)</u>: • PUC gas: 20 ppmv; • Non-PUC or liquid: 30 ppmv <u>Pool heaters ≥0.075 to ≤0.4 MMBtu/hr</u>: • PUC gas: 55 ppmv

	SJVAPCD Rule 4308	SDAPCD Rule 69.2.1
	• Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Pool heaters ≥0.075 to ≤0.4 MMBtu/hr: • PUC gas: 55 ppmv (0.068 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Pool heaters >0.4 to <2 MMBtu/hr: • PUC gas: 20 ppmv (0.068 lb/MMBtu); • Non-PUC or liquid: 30 ppmv (0.036 lb/MMBtu)	

*Unless otherwise stated, all ppmv values in the table are ppmv @ 3% O2

The District evaluated the requirements contained within SDAPCD Rule 69.2.1 and found no requirements to be more stringent than those already in District Rule 4308. Therefore, District Rule 4308 is as stringent as or more stringent than SDAPCD Rule 69.2.1.

South Coast AQMD

- SCAQMD Rule 1146.2 (Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters)

	SJVAPCD Rule 4308	SCAQMD 1146.2
Applicability	Boilers, steam generators and process heaters with rated heat input capacity ≥0.075 MMBtu/hr and <2 MMBtu/hr.	Natural gas-fired water heaters, boilers and process heaters with rated heat input capacity of ≤2 MMBtu/hr.
Exemptions	• Units installed in manufactured homes • Units installed in recreational vehicles • Hot water pressure washers	• Units used in recreational vehicles • Units subject to SCAQMD Rule 1121 (Control of NOx from Residential Type, Natural Gas-Fired Water Heaters) - applies to units rated at <0.075 MMBtu/hr • Units at a RECLAIM or former RECLAIM facility subject to a NOx limit in a different rule • Units at municipal sanitation service facility subject to a NOx limit in Reg XI adopted or amended after 12/07/18 • Exempt from some rule requirements: ○ Any residential unit* ○ Units with >0.4 and ≤2 MMBtu/hr, demonstrated to use <9,000 therms during every calendar year
Requirements	***NOx Emission Limits:** Units ≥0.075 to ≤0.4 MMBtu/hr (except instantaneous water heaters and pool heaters below): • PUC gas: 20 ppmv (0.024 lb/MMBtu) Units >0.4 to <2 MMBtu/hr (except instantaneous water heaters and pool heaters below):	***NOx Emission Limits:** Units >0.4 to ≤2 MMBtu/hr: • 14 ng/J (20 ppmv) Units ≤0.4 MMBtu/hr (except pool heaters): • 14 ng/J (20 ppmv)

	SJVAPCD Rule 4308	SCAQMD 1146.2
	• PUC gas: 20 ppmv (0.024 lb/MMBtu) Instantaneous water heaters ≥0.075 to ≤0.4 MMBtu/hr: • PUC gas: 20 ppmv (0.024 lb/MMBtu) Instantaneous water heaters >0.4 to <2 MMBtu/hr: • PUC gas: 20 ppmv (0.024 lb/MMBtu) Pool heaters ≥0.075 to ≤0.4 MMBtu/hr: • PUC gas: 55 ppmv (0.068 lb/MMBtu) Pool heaters >0.4 to <2 MMBtu/hr: • PUC gas: 20 ppmv (0.068 lb/MMBtu)	

*Unless otherwise stated, all ppmv values in the table are ppmv @ 3% O2

The District evaluated the requirements contained within SCAQMD Rule 1146.2, and found no requirements to be more stringent than those already in District Rule 4308. Therefore, District Rule 4308 is as stringent as or more stringent than SCAQMD Rule 1146.2.

- SCAQMD Rule 1147 (NOx Reductions from Miscellaneous Sources)

	SJVAPCD Rule 4308	SCAQMD 1147
Applicability	Boilers, steam generators and process heaters with rated heat input capacity ≥0.075 MMBtu/hr and <2 MMBtu/hr.	Manufacturers, distributors, retailers, installers, owners, and operators of gaseous and/or liquid fuel fired combustion equipment with NOx emissions that require a SCAQMD permit and when other SCAQMD Regulation XI rules are not applicable to the unit.
Exemptions	• Units installed in manufactured homes • Units installed in recreational vehicles • Hot water pressure washers	• Units rated <325,000 Btu/hr • Charbroilers or food ovens • Flares subject to SCAQMD Rules 1118 or 1118.1 • Flares, afterburners, degassing units, thermal or catalytic oxidizers or vapor incinerators in which a fuel is used only to maintain a pilot for vapor ignition or is used for ≤5 minutes to bring a unit up to Minimum Operating Temperature • Municipal solid waste incinerators with permit operating before 12/05/08 • Afterburner or vapor incinerator with permit operating before 12/05/08 that has an integrated thermal fluid heat exchanger that captures heat from the afterburner or vapor incinerator and an oven or furnace exhaust in order to reduce fuel consumption by an oven or the afterburner or vapor incinerator

	SJVAPCD Rule 4308	SCAQMD 1147
		• Flare, afterburner, degassing unit, remediation unit, thermal oxidizer, catalytic oxidizer or vapor incinerator process in which PM, air toxics, VOCs, landfill gas, digester gas or other combustible vapors are mixed in the unit's burner with combustion air or fuel, including but not limited to natural gas, propane, butane or LPG, prior to or at incineration in the unit, in order to maintain vapor concentration above the upper explosion limit or a manufacturer specified limit in order to maintain combustion or temperature in the unit • Solid fuel-fired combustion equipment
Requirements	***NOx Emission Limits:** Units ≥0.075 to ≤0.4 MMBtu/hr: • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Units >0.4 to <2 MMBtu/hr (except instantaneous water heaters below): • Non-PUC or liquid: 30 ppmv (0.036 lb/MMBtu) Instantaneous water heaters >0.4 to <2 MMBtu/hr: • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu)	***NOx Emission Limits:** All liquid fuel-fired units: <1,200°F: 40 ppmv (0.053 lb/ MMBtu) ≥1,200°F: 60 ppmv (0.073 lb/ MMBtu)

*Unless otherwise stated, all ppmv values in the table are ppmv @ 3% O2

The District evaluated the requirements contained within SCAQMD Rule 1147 for liquid fuel-fired units, and found no requirements to be more stringent than those already in District Rule 4308. Therefore, District Rule 4308 is as stringent as or more stringent than SCAQMD Rule 1147.

Ventura County APCD

- VCAPCD Rule 74.15.1 (Boilers, Steam Generators, and Process Heaters)

	SJVAPCD Rule 4308	VCAPCD Rule 74.15.1
Applicability	Boilers, steam generators and process heaters with rated heat input capacity ≥0.075 MMBtu/hr and <2 MMBtu/hr.	Any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a rated heat input capacity ≥1 MMBtu/hr and <5 MMBtu/hr.
Exemptions	• Units installed in manufactured homes • Units installed in recreational vehicles • Hot water pressure washers	• Any unit operated on alternate fuel under following conditions: ○ Alternate fuel use required due to natural gas curtailment period. ○ Alternative fuel use is required to maintain the alternate fuel system,

	SJVAPCD Rule 4308	VCAPCD Rule 74.15.1
		and in this case use shall not exceed 50 hr/yr • Portable oil well dewaxing process heater is not subject to 30 ppmv NOx, if annual heat input rate is <2.8 billion Btu
Requirements	***NOx Emission Limits:** Units ≥0.075 to ≤0.4 MMBtu/hr (except instantaneous water heaters and pool heaters below): • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Units >0.4 to <2 MMBtu/hr (except instantaneous water heaters and pool heaters below): • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 30 ppmv (0.036 lb/MMBtu) Instantaneous water heaters ≥0.075 to ≤0.4 MMBtu/hr: • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Instantaneous water heaters >0.4 to <2 MMBtu/hr: • PUC gas: 20 ppmv (0.024 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Pool heaters ≥0.075 to ≤0.4 MMBtu/hr: • PUC gas: 55 ppmv (0.068 lb/MMBtu); • Non-PUC or liquid: 77 ppmv (0.093 lb/MMBtu) Pool heaters >0.4 to <2 MMBtu/hr: • PUC gas: 20 ppmv (0.068 lb/MMBtu); • Non-PUC or liquid: 30 ppmv (0.036 lb/MMBtu)	***NOx Emission Limits:** Units ≥1.8 billion Btu/yr: • 30 ppmv Units ≥1 to ≤2 MMBtu/hr: • 20 ppmv (natural gas-fired) Units ≥0.3 billion Btu/yr and <1.8 billion Btu/yr: Comply with one of the following: • Units shall be tuned every 6 months or after 750 hours of operation, but not less than once per calendar year; OR • The unit shall comply with the emission and testing requirements

*Unless otherwise stated, all ppmv values in the table are ppmv @ 3% O2

The District evaluated the requirements contained within VCAPCD Rule 74.15.1, and found no requirements to be more stringent than those already in District Rule 4308. Therefore, District Rule 4308 is as stringent as or more stringent than VCAPCD Rule 74.15.1.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District has evaluated the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

NOx Emission Control Technologies

Use of SCR system

SCR technology is predominantly used to reduce NOx emissions from large boilers, steam generators, and process heaters. Presuming units between 0.075 to <2 MMBtu/hr can be equipped with SCR system, the total annualized cost of deploying such technology would be at least $75,126 per year.[84]

Assuming an SCR system reliably reduces NOx emissions from 20 ppmv @ 3% O2 to 5 ppmv @ 3% O2 for a 1.99 MMBtu/hr unit that operates 8,760 hours per year, the potential reductions would be 310 lb/year[85] (0.155 tons-NOx/yr).

The cost of achieving these potential NOx reductions would be at least $484,684/ton of emissions reduced. As such, this technology is not cost effective for reducing emissions from this category.

Use of ULNB technology

ULNBs can reliably achieve at least 9 ppmv NOx @ 3% O2 and are available for units rated between 2-5 MMBtu/hr. Presuming that this technology is also available for small size boilers for a given application, a unit may be equipped with a ULNB system. Per a local vendor, the cost of a 2 MMBtu/hr boiler would be $35,000 for a hot water boiler. The cost effectiveness analysis is included below for this technology.

Description of Cost	Cost Factor	Cost	Source
Direct Costs			
Purchase equipment costs (PE):			
Burner system	A	$35,000	Local vendor
Instrumentation and controls	0.01 A	$350	OAQPS
Sales taxes	0.08 A	$2,828	
Freight	0.05 A	$1,750	OAQPS
Purchased equipment cost, PEC		$39,928	
Direct installation costs (DI):			
Foundation & supports	0.08 B	$3,194	OAQPS
Handling and erection	0.14 B	$5,590	OAQPS
Electrical	0.04 B	$1,597	OAQPS
Piping	0.02 B	$799	OAQPS
Insulation and ductwork:	0.01 B	$399	OAQPS
Painting	0.01 B	$399	OAQPS
Direct installation costs		$51,906	

[84] See Rule 4307 control measure analysis. Note that there is no significant price difference for an SCR system on 2-5 MMBtu/hr unit or smaller units.

[85] Potential NOx reduction = (0.024-0.0062) lb-NOx/MMBtu x 1.99 MMBtu/hr x 8,760 hr/yr = 310 lb-NOx/yr

Site preparation	As required, SP	--	See table footnote
Buildings	As required, Bldg.	--	
Total Direct Costs, DC		$51,906	

Description of Cost	**Cost Factor**	**Cost**	**Source**
Indirect Costs (Installation)			
Engineering	0.10 B	$3,993	OAQPS
Construction and field expenses	0.05 B	$1,996	OAQPS
Contractor fees	0.10 B	$3,993	OAQPS
Contingencies	0.03 B	$1,198	OAQPS
Start-up	0.02 B	$799	OAQPS
Performance test	0.01 B	$399	OAQPS
Total indirect costs, IC	0.31 B	$12,378	
Total Capital Investments (TCI = DC + IC):		**$64,284**	
Annualized TCI (10 years @ 10% interest)	0.1627 TCI	**$10,459**	
Direct annual costs (DAC)			
Operating and supervisory labor	--	--	See table footnote
Maintenance costs (labor and material)	--	--	
Electricity cost	--	--	Not estimated
Indirect Annual Costs (IAC)			
Overhead	--	--	See table footnote
Insurance	--	--	See table footnote
Property Tax	--	--	See table footnote
Administrative	--	--	See table footnote
Total Annual Cost (DAC + IAC)		--	
Total annual cost (Annualized TCI + Total annual cost)		**$10,459**	

*Direct annual cost and indirect annual costs are presumed insignificant for new units and will likely be same when existing unit is being replaced

Assuming a ULNB system reliably reduces NOx emissions from 20 ppmv @ 3% O2 to 9 ppmv @ 3% O2 for a 1.99 MMBtu/hr unit that operates 8,760 hours per year, the potential reductions would be 227 lb/year[86] (0.114 tons-NOx/yr).

The cost of achieving these potential NOx reductions would be at least $91,746/ton of emissions reduced. As such, this technology is not cost effective for reducing emissions from this category.

Use of EMx System

The District researched post-combustion controls such as EMx, the second generation of the SCONOx technology that reduces NOx, SOx, CO, and VOC emissions. Per EmeraChem, manufacturer/vendor of the technology, this technology has not been AIP for natural gas fired boilers. SCONOx and EMx systems have only been used by power plants for the control of turbine emissions. The cost of an EMx system would be anywhere from $3 to $5 million or even up to $8 million in some cases for large power plant installations. Moreover, the EMx system is ideal for new installation, but becomes extremely challenging and sometimes nearly impossible to retrofit to an existing unit. In

[86] Potential NOx reduction = (0.024 – 0.011) lb-NOx/MMBtu x 1.99 MMBtu/hr x 8,760 hr/yr = 227 lb-NOx/yr

fact, cost effectiveness analyses conducted by the District for the installation of SCONOx/EMx units on large power plant turbine installations within the Valley have shown that this technology is not cost effective. Given the high cost effectiveness demonstrated for turbines and lack of demonstrated practice with boilers, especially very small boilers such as those covered by this rule, this technology is not feasible or cost effective for reducing emissions from this category.

PM2.5 Emission Control Technologies

The majority of units 0.075 to less than 2 MMBtu/hr in the Valley combust PUC quality natural gas; PUC quality natural gas contains a very low sulfur content and inherently has low emissions. Few boilers in the Valley use alternative fuels for their combustion processes, which include digester gas, produced gas, and liquid fuel. Units fired on digester gas or produced gas are already required to use inlet gas scrubbers to meet District rule requirements. The District also explored the feasibility of adding PM2.5 limits for units using liquid fuel to reduce PM emissions as part of this comprehensive control measure evaluation.

The District evaluated three technologies as potential control options for reducing PM emissions: baghouses, ESPs, and wet scrubbers. Baghouses control total PM and PM2.5 emissions by 90-99%; ESPs control total PM and PM2.5 emissions by 90-99%; and wet scrubbers control large particulates (>PM5) by 99% and PM2.5 emissions by approximately 50%. Baghouses are typically not used with liquid-fired boilers due to the potential clogging of the baghouse and are therefore not a recommended technology due to infeasibility and safety issues.[87] Furthermore, the District is unaware of installations of these types of controls on the small boilers covered by this regulation, generally due to the extraordinary cost associated with doing so. See below for cost and cost effectiveness calculations for the other two technologies.

Potential Emissions Reductions

The District calculated the potential PM emissions reductions that could result from the use of an ESP and scrubber. For the purposes of these calculations, the following assumptions were made:

1. The analysis will evaluate the cost effectiveness of these technologies for total PM reductions from liquid fuel fired units.
2. The PM combustion EF = 0.024 lb/MMBtu, based on maximum permitted EF for boilers 2-5 MMBtu/hr with option to use diesel fuel during natural gas curtailment.
3. Max rating of burner = 1.99 MMBtu/hr and assumed to operate 8,760 hours/yr.
4. The PM control efficiency of an ESP is 99%.
5. The PM control efficiency of a scrubber is 99%.
6. Due to lack of units in the Valley, the analysis is based on one known unit.

The potential PM emissions reductions were calculated as follows:

[87] Northeast States for Coordinated Air Use Management. *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* (November 2008). Retrieved from: https://www.nescaum.org/documents/ici-boilers-20081118-final.pdf

Potential Emissions Reductions $_{(ESP)}$ = (PM Emissions) x (Control Efficiency)
Potential Emissions Reductions $_{(ESP)}$ = (0.024 lb-PM/MMBtu x 1.99 MMBtu/yr x 8,760 hr/yr x ton/2,000 lb) tons/year x 0.99
Potential Emissions Reductions $_{(ESP)}$ = 0.209 tons/yr x 0.99
Potential Emissions Reductions $_{(ESP)}$ = 0.207 tons/year

Potential Emissions Reductions $_{(scrubber)}$ = (PM Emissions) x (Control Efficiency)
Potential Emissions Reductions $_{(scrubber)}$ = 0.209 tons/year x 0.99
Potential Emissions Reductions $_{(scrubber)}$ = 0.207 tons/year

Annualized Cost

The capital cost for the installation of an ESP for a 1-5 MMBtu/hr boiler ranges from $90,000-$100,000 and the annual maintenance cost ranges from $1,000-$2,000.[88] For the wet scrubber system, EPA estimated the annualized cost at $5,300-$102,000 per sm^3/sec at an average air flow rate of 0.7-47 sm^3/sec.[89] The following assumptions were made for this analysis:

1. The capital cost of an ESP is assumed to be the median of the range above ($95,000).
2. The annual maintenance cost of an ESP is assumed to be the median of the range above ($1,500).
3. The annualized cost of a wet scrubber system is assumed to be the median of the range above ($53,650 per sm^3/sec).
4. The average air flow rate for a wet scrubber system is assumed to be the median of the range above (23.85 sm^3/sec).
5. The total capital and maintenance cost of an ESP will be calculated by multiplying the cost of 1 unit by the total number of units.
6. The total annualized cost of a wet scrubber will be calculated by multiplying the annualized cost of 1 unit by the total number of units.
7. Lifetime of the ESP is 10 years at 10% interest. To account for this, the annualized capital cost will be calculated by multiplying the total capital cost by the capital recovery factor of 0.1627 and adding the annual maintenance costs.

The annualized cost of an ESP and Wet Scrubber was calculated as follows:

Annual Cost $_{(ESP)}$ = (Total Capital Cost) x (0.1627) + (Annual Maintenance Cost)
Annual Cost $_{(ESP)}$ = ($95,000 x 1) x (0.1627) + ($1,500 x 1)
Annual Cost $_{(ESP)}$ = $16,957/year

[88] Catherine Roberts. (March 2009). *Information on Air Pollution Control Technology for Woody Biomass Boilers.* Environmental Protection Agency Office of Air Quality Planning and Standards and Northeast States for Coordinated Air Use Management.
[89] EPA. (2002). *Air Pollution Control Technology Fact Sheet: Spray-Chamber/Spray-Tower Wet Scrubber.* Retrieved from: https://www3.epa.gov/ttncatc1/dir1/fsprytwr.pdf

Annual Cost $_{(scrubber)}$ = (Annualized Cost of 1 unit) x (Number of Units) x (Average Flow Rate)
Annual Cost $_{(scrubber)}$ = ($53,650/ sm^3/sec) x (1) x (23.85 sm^3/sec)
Annual Cost $_{(scrubber)}$ = $1,279,553/year

Cost Effectiveness
The cost effectiveness of an ESP and Wet Scrubber was calculated as follows:

Cost effectiveness = Annual Cost / Annual Emissions Reductions

Cost effectiveness $_{(ESP)}$ = ($16,957/year) / (0.207 tons/year)
Cost effectiveness $_{(ESP)}$ = $81,918/ton of PM

Cost effectiveness $_{(scrubber)}$ = ($1,279,553/year) / (0.207 tons/year)
Cost effectiveness $_{(scrubber)}$ = $6,181,413/ton of PM

As illustrated above, neither PM control technology is cost effective. Furthermore, the above calculations for ESP technology did not include costs of retrofitting equipment and/or the facility or compliance monitoring, thus the total costs for implementing this technology would be even higher than what is estimated here. The District concludes that this is not a feasible control measure for this source category.

Zero-Emission Opportunities

Electrification of Units

While electric alternatives to some water heaters and boilers are currently available, feasibility and cost issues have previously prevented widespread electrification around the nation given the significantly higher costs associated with electrical infrastructure and devices. To date, only one region (BAAQMD) has adopted zero-emission requirements for this category in their SIP and implementation does not begin until 2031, which is beyond the attainment date for this Plan. BAAQMD cites the complexities of installations in multifamily and larger commercial buildings where these units are typically installed as their reasoning for this delayed compliance date.[90] At this time, electrification requirements are not cost effective or feasible for sources subject to Rule 4308. Statewide action is critical for supporting the advancement and wide-scale deployment of zero-emission technologies.

In an effort to identify potential emission reduction opportunities, the District's *2022 Ozone Plan* includes a further study commitment to evaluate current and upcoming work from CARB and other agencies related to reducing emissions from residential and commercial combustion sources, and evaluate the feasibility of implementing zero-emission or low-NOx requirements for these sources in the Valley. Through this effort,

[90] BAAQMD. *Final Staff Report for the Proposed Amendments to Building Appliance Rules – Regulation 9, Rule 4: Nitrogen Oxides from Fan Type Residential Central Furnaces and Rule 6: Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters.* (March 2023). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20230307_fsr_rules0904and0906-pdf.pdf?la=en

the District will also evaluate opportunities to advocate for funding under the Inflation Reduction Act, Bipartisan Infrastructure Law, and other funding sources, which are prioritizing funding opportunities for electrification of appliances to reduce greenhouse gas emissions. The District will continue to closely track regulations being developed by CARB, SCAQMD, BAAQMD, and others. Additionally, the District remains committed to pursuing zero-emission opportunities, taking into consideration equitable and feasible strategies.

Based on this review, the District did not identify additional emission reduction opportunities for this source category at this time.

Evaluation Findings

Rule 4308 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.10 RULE 4309 (DRYERS, DEHYDRATORS, AND OVENS)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.78	0.77	0.76	0.75	0.74	0.74	0.74
NOx	0.29	0.29	0.29	0.28	0.28	0.28	0.28
	Winter Average - Tons per day						
PM2.5	0.78	0.77	0.76	0.74	0.73	0.73	0.74
NOx	0.26	0.26	0.26	0.26	0.25	0.25	0.25

District Rule 4309 Description

The District adopted Rule 4309 on December 15, 2005, to limit NOx and CO emissions from dryers, dehydrators, or ovens fired on gaseous, liquid, or gaseous and liquid fuel sequentially that have a total rated heat input for the unit of 5.0 MMBtu/hr or greater. The rule limits NOx emissions to between 3.5-12 ppmv for four categories of equipment. The adoption of Rule 4309 has considerably reduced NOx emissions from this source category.

How does District Rule 4309 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines or New Source Performance Standards applicable to this source category.

A. Alternative Control Techniques (ACT)

- *Alternative Control Techniques Document – NOx Emissions from Cement Manufacturing (EPA-453/R-94-004 1994/03)*

The District evaluated the requirements contained within the ACT for NOx Emissions from Cement Manufacturing and found no applicable requirements that would be more stringent than those already in Rule 4309.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4309 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4309 to comparable requirements in rules from the following California nonattainment areas:

- Sacramento Metropolitan AQMD Rule 419 (Amended October 25, 2018)[91]
- South Coast AQMD Rule 1147 (Amended May 6, 2022)[92]
- South Coast AQMD Rule 1147.1 (Adopted August 6, 2021)[93]
- Ventura County APCD Rule 74.34 (Adopted December 13, 2016)[94]

Bay Area AQMD does not have an analogous rule for this source category.

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4309 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

Sacramento Metropolitan AQMD

- SMAQMD Rule 419 (NOx from Miscellaneous Combustion Units)

	SJVAPCD Rule 4309	SMAQMD Rule 419
Applicability	Dryer, dehydrator, or oven that is fired on gaseous fuel, liquid fuel, or is fired on gaseous and liquid fuel sequentially, and the total rated heat input for the unit is ≥5 MMBtu/hr.	Any misc. combustion units and cooking units with a total rated heat input capacity of ≥2 MMBtu/hr located at a major stationary source of NOx, and any misc. combustion unit or cooking unit with a total rated heat input capacity of ≥5 MMBtu/hr not located at a major stationary source of NOx.
Exemptions	• Column-type or tower dryers used to dry grains, or tree nuts • Units to pre-condition onions or garlic prior to dehydration • Smokehouses or units used for roasting • Units to bake or fry food for human consumption • Charbroilers • Units used to dry lint cotton or cotton at cotton gins • Units with no stack for the exhaust gas and one or more sides open to the atmosphere	• Operations subject to SMAQMD rules for: ○ Boilers, process heaters, and steam generators ○ Stationary IC engines at major sources ○ Stationary gas turbines ○ Water heaters, boilers, and process heaters <1 MMBtu/hr • Units exempt from SMAQMD general permit requirements • Air pollution control devices • Duct burners • Specific combustion units: ○ Any unit that is used exclusively by an electric utility to generate electricity

[91] SMAQMD. *Rule 419 (NOx from Miscellaneous Combustion Units)*. (Amended October 25, 2018). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule419.pdf
[92] SCAQMD. *Rule 1147 (NOx Reductions from Miscellaneous Sources)*. (Amended May 6, 2022). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1147.pdf?sfvrsn=4
[93] SCAQMD. *Rule 1147.1 (NOx Reductions from Aggregate Dryers)*. (Adopted August 6, 2021). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1147-1.pdf?sfvrsn=7
[94] VCAPCD. *Rule 74.34 (NOx Reductions from Miscellaneous Sources)*. (Adopted December 13, 2016). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.34.pdf

<table>
<tr><th></th><th colspan="2">SJVAPCD Rule 4309</th><th colspan="2">SMAQMD Rule 419</th></tr>
<tr><td></td><td colspan="2">• Units subject to District Rules 4305, 4306, 4307, or 4351</td><td colspan="2">○ Gas flares
○ Internal combustion engines
○ Cooking units
○ Crematories
○ Dryers used in asphalt manufacturing operations
○ Furnaces
○ Incinerators
○ Kilns
○ Roasters</td></tr>
<tr><td rowspan="9">Requirements (NOx Limits)</td><td colspan="4">Gaseous Fuel-Fired Equipment</td></tr>
<tr><td colspan="2">ppmv corrected to 19% O2, dry unless otherwise specified</td><td colspan="2">ppmv corrected to 3% O2, dry unless otherwise specified</td></tr>
<tr><td>Dehydrators</td><td>-</td><td>Dehydrator, Dryer, Heater, or Oven</td><td><u><1,200°F</u>
30 ppmv or 0.036 lb/MMBtu (3.3 ppmvd @ 19% O2)

<u>≥1,200°F</u>
60 ppmv or 0.073 lb/MMBtu (6.5 ppmvd @ 19% O2)</td></tr>
<tr><td>Asphalt/Concrete Plants</td><td>4.3 ppmv (0.0492 lb/MMBtu)</td><td>-</td><td>-</td></tr>
<tr><td>Milk, Cheese and Dairy Processing (<20 MMBtu/hr)</td><td>3.5 ppmv (0.04 lb/MMBtu)</td><td rowspan="2">-</td><td rowspan="2">-</td></tr>
<tr><td>Milk, Cheese and Dairy Processing (≥20 MMBtu/hr)</td><td>5.3 ppmv (0.061 lb/MMBtu)</td></tr>
<tr><td>Other processes not described above</td><td>4.3 ppmv (0.0492 lb/MMBtu)</td><td>-</td><td>-</td></tr>
<tr><td colspan="4">Liquid Fuel-Fired Equipment</td></tr>
<tr><td>All Liquid Fuel-Fired Units</td><td>Varies from 3.5 ppmv to 12 ppmv (0.04 lb/MMBtu to 0.14 lb/MMBtu)</td><td>All misc. combustion units when liquid fuel-fired</td><td><u><1,200°F</u>
40 ppmv or 0.051 lb/MMBtu (4.3 ppmvd @ 19% O2)

<u>≥1,200°F</u>
60 ppmv or 0.073 lb/MMBtu (6.5 ppmvd @ 19% O2)</td></tr>
</table>

SMAQMD Rule 419 establishes emission limits based on the process temperature and does not consider the equipment categories, whereas District Rule 4309 does not consider the process temperature and instead establishes emissions limits based on the equipment categories. Under SMAQMD's Rule 419, the NOx limits vary from 3.3 to 6.5 ppmv at 19% O2 with an average of 4.9 ppmv, while District Rule 4309 limits NOx emissions from 3.5 to 5.3 ppmv with most categories limited to 4.3 ppmv at 19% O2, independent of the process temperature. Overall, District Rule 4309 is as stringent as or more stringent than SMAQMD Rule 419.

South Coast AQMD

- SCAQMD Rule 1147 (NOx Reductions from Miscellaneous Sources)

<table>
<tr><th></th><th colspan="2">SJVAPCD Rule 4309</th><th colspan="2">SCAQMD Rule 1147</th></tr>
<tr><td>Applicability</td><td colspan="2">Dryer, dehydrator, or oven that is fired on gaseous fuel, liquid fuel, or is fired on gaseous and liquid fuel sequentially, and the total rated heat input for the unit is ≥5 MMBtu/hr.</td><td colspan="2">Manufacturers, distributors, retailers, installers, owners, and operators of gaseous and/or liquid fuel fired combustion equipment with NOx emissions that require a SCAQMD permit and when other SCAQMD Regulation XI rules are not applicable to the unit.</td></tr>
<tr><td>Exemptions</td><td colspan="2">• Column-type or tower dryers used to dry grains, or tree nuts
• Units to pre-condition onions or garlic prior to dehydration
• Smokehouses or units used for roasting
• Units to bake or fry food for human consumption
• Charbroilers
• Units used to dry lint cotton or cotton at cotton gins
• Units with no stack for the exhaust gas and one or more sides open to the atmosphere
• Units subject to District Rules 4305, 4306, 4307, or 4351</td><td colspan="2">• Units rated <325,000 Btu/hr
• Charbroilers or food ovens
• Flares subject to SCAQMD Rules 1118 or 1118.1
• Flares, afterburners, degassing units, thermal or catalytic oxidizers or vapor incinerators in which a fuel is used only to maintain a pilot for vapor ignition or is used for ≤5 minutes to bring a unit up to Minimum Operating Temperature
• Municipal solid waste incinerators with permit operating before 12/05/08
• Afterburner or vapor incinerator with permit operating before 12/05/08 that has an integrated thermal fluid heat exchanger that captures heat from the afterburner or vapor incinerator and an oven or furnace exhaust in order to reduce fuel consumption by an oven or the afterburner or vapor incinerator
• Flare, afterburner, degassing unit, remediation unit, thermal oxidizer, catalytic oxidizer or vapor incinerator process in which PM, air toxics, VOCs, landfill gas, digester gas or other combustible vapors are mixed in the unit's burner with combustion air or fuel, including but not limited to natural gas, propane, butane or LPG, prior to or at incineration in the unit, in order to maintain vapor concentration above the upper explosion limit or a manufacturer specified limit in order to maintain combustion or temperature in the unit
• Solid fuel-fired combustion equipment</td></tr>
<tr><td rowspan="3">Requirements (NOx Limits)</td><td colspan="4">Gaseous Fuel-Fired Equipment</td></tr>
<tr><td colspan="2">(ppmv corrected to 19% O2, dry unless otherwise specified)</td><td colspan="2">(ppmv corrected to 3% O2, dry unless otherwise specified)</td></tr>
<tr><td>Dehydrators</td><td>-</td><td>Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank</td><td><u><1,200°F</u>:
20-30 ppmv (0.024-0.036 lb/ MMBtu)

<u>≥1,200°F</u>:
30-60 ppmv (0.036-0.073 lb/ MMBtu)</td></tr>
</table>

	SJVAPCD Rule 4309		SCAQMD Rule 1147	
	Asphalt/Concrete Plants	4.3 ppmv (0.0492 lb/MMBtu)	See evaluation for SCAQMD Rule 1147.1 below.	
	Milk, Cheese and Dairy Processing (<20 MMBtu/hr)	3.5 ppmv (0.04 lb/MMBtu)	Equipment not listed, so it would be subject to emission limits of other processes (the last category listed below)	
	Milk, Cheese and Dairy Processing (≥20 MMBtu/hr)	5.3 ppmv (0.061 lb/MMBtu)		
	Other processes not described above	4.3 ppmv (0.0492 lb/MMBtu)	Burn-off Furnace or Burnout Oven	30-60 ppmv (0.036-0.073 lb/MMBtu)
			Tenter Frame or Fabric or Carpet Dryer	20-30 ppmv (0.024-0.036 lb/MMBtu)
			Rotary Dryer	30 ppmv (0.036 lb/MMBtu)
			Other Unit or Process Temperature	<1,200°F: 30 ppmv (0.036 lb/MMBtu) ≥1,200°F: 60 ppmv (0.073 lb/MMBtu)
	Liquid Fuel-Fired Equipment			
	All Liquid Fuel-Fired Units	Varies from 3.5-12 ppmv (0.04-0.14 lb/MMBtu)	All Liquid Fuel-Fired Units	<1,200°F: 40 ppmv (0.053 lb/MMBtu) ≥1,200°F: 60 ppmv (0.073 lb/MMBtu)

District Rule 4309 has previously been established as being at least as stringent as SCAQMD Rule 1147. The recently adopted SCAQMD Rule 1147 (Adopted May 6, 2022) maintained previous emission limits for existing units, which are consistent with the District's limits, and established lower limits for some categories of units that are phased in based on a unit's age. These newer limits are required after July 1, 2023 when a unit reaches up to 32 years of age, extending the compliance date for these limits to as late as June 30, 2055. Notably, the emission levels established within SCAQMD Rule 1147 are not demonstrated to be achieved in practice or adopted in any other regions, and therefore go beyond MSM levels of control.

- SCAQMD Rule 1147.1 (NOx Reductions from Aggregate Dryers)

	SJVAPCD Rule 4309	SCAQMD Rule 1147.1
Applicability	Any dryer, dehydrator, or oven that is fired on gaseous fuel, liquid fuel, or is fired on gaseous and liquid fuel sequentially, and the total rated heat input for the unit is ≥5 MMBtu/hr.	Owners or operators of gaseous fuel-fired aggregate dryers with NOx emissions ≥1 lb/day with rated heat input ≥2 MMBtu/hr.

	SJVAPCD Rule 4309		SCAQMD Rule 1147.1	
Requirements	Asphalt/Concrete Plants	4.3 ppmvd @ 19% O2	Aggregate Dryers	30-40 ppmvd @ 3% O2 (3.3-4.3 ppmvd @ 19% O2)

District Rule 4309 has previously been established as being at least as stringent as SCAQMD Rule 1147. The recently adopted SCAQMD Rule 1147.1 (Adopted August 6, 2021) established separate requirements for gaseous-fueled aggregate dryers previously subject to SCAQMD Rule 1147. Rule 1147.1 maintained the previous emission limit for existing units, which is consistent with the District's limit, and established a lower limit to be phased in based on burner age. This newer limit is required when a unit reaches up to 32 years of age. Notably, the emission levels established within SCAQMD Rule 1147.1 are not demonstrated to be achieved in practice or adopted in any other regions, and therefore go beyond MSM levels of control.

Ventura County APCD

- VCAPCD Rule 74.34 (NOx Reductions from Miscellaneous Sources)

	SJVAPCD Rule 4309		VCAPCD Rule 74.34
Applicability	Dryer, dehydrator, or oven that is fired on gaseous fuel, liquid fuel, or is fired on gaseous and liquid fuel sequentially, and the total rated heat input for the unit is ≥5 MMBtu/hr.		Dryers, furnaces, heaters, incinerators, kilns, ovens, and duct burners. This rule applies to any unit where the total rated heat input for the unit is ≥5 MMBtu/hr.
Exemptions	• Column-type or tower dryers used to dry grains, or tree nuts • Units to pre-condition onions or garlic prior to dehydration • Smokehouses or units used for roasting • Units to bake or fry food for human consumption • Charbroilers • Units used to dry lint cotton or cotton at cotton gins • Units with no stack for the exhaust gas and one or more sides open to the atmosphere • Units subject to District Rules 4305, 4306, 4307, or 4351		• Combustion equipment whose primary function is to operate as an air pollution control device • Duct burners operating upstream of and controlled by a properly working SCR add-on NOx control unit • Gas flares • External combustion equipment subject to VCAPCD Rule 74.15 (Boilers, Steam Generators, and Process Heaters)
Requirements (NOx Limits)	**SJVAPCD Rule 4309**		**VCAPCD Rule 74.34**
	(ppmv corrected to 19% O2, dry unless otherwise specified)		(ppmv corrected to 3% O2, dry unless otherwise specified)
	Dehydrators	-	Dehydrators not listed under applicability of the rule.
	Asphalt/Concrete Plants	4.3 ppmv (0.0492 lb/MMBtu)	40 ppmv or 0.048 lb/MMBtu (4.3 ppmvd @ 19% O2)
	Milk, Cheese and Dairy Processing (<20 MMBtu/hr)	3.5 ppmv (0.04 lb/MMBtu)	Equipment not listed, so it would be subject to emission limits of other processes (the last category listed below).

	SJVAPCD Rule 4309		VCAPCD Rule 74.34	
	Milk, Cheese and Dairy Processing (≥20 MMBtu/hr)	5.3 ppmv (0.061 lb/MMBtu)		
	Other processes not described above	4.3 ppmv (0.0492 lb/MMBtu)	Sand and Gravel Processing (dryers)	40 ppmv or 0.048 lb/MMBtu (4.3 ppmvd @ 19% O2)
			Paper Products Manufacturing (Hot Air Furnace, Duct Burner, Paper Dryer)	
			Metal Heat Treatment/Metal Melting Furnace	60 ppmv or 0.072 lb/MMBtu (6.5 ppmvd @ 19% O2)
			Kiln	80 ppmv or 0.096 lb/MMBtu (8.7 ppmvd @ 19% O2)
			Oven, Dryer (besides asphalt, sand or paper dryer), Heater, Incinerator, Other Furnaces, or Other Duct Burner	<1,200°F: 30 ppmv or 0.036 lb/MMBtu (3.3 ppmvd @ 19% O2) ≥1,200°F: 60 ppmv or 0.072 lb/MMBtu (6.5 ppmvd @ 19% O2)

VCAPCD Rule 74.34 establishes emission limits based on the process temperature whereas District Rule 4309 does not consider the process temperature and instead establishes emissions limits based on the equipment categories. Where the rules can be compared, the District rule is more stringent in several categories, such as metal heat treatment, metal melting furnace, kiln, etc. In other categories, the NOx limits under the VCAPCD rule vary from 3.3 to 6.5 ppmv at 19% O2 with an average of 4.9 ppmv, while District Rule 4309 limits NOx emissions from 3.5 to 5.3 ppmv with most categories limited to 4.3 ppmv at 19% O2, independent of the process temperature. Therefore, overall, District Rule 4309 is as stringent as or more stringent than VCAPCD Rule 74.34.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District reviewed the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

Zero-Emission Opportunities

The District did not identify any instances of zero-emissions technology being required for these types of units. However, the District will continue to closely track the

development of new zero-emissions technologies and control measures for this source category.

Based on this review, the District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

Rule 4309 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.11 RULE 4311 (FLARES)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.17	0.17	0.17	0.13	0.13	0.13	0.13
NOx	0.52	0.51	0.50	0.30	0.30	0.30	0.30
	Winter Average - Tons per day						
PM2.5	0.17	0.17	0.17	0.13	0.13	0.13	0.13
NOx	0.52	0.51	0.50	0.30	0.30	0.30	0.30

District Rule 4311 Description

District Rule 4311 applies to any operation involving the use of a flare. This source category currently includes flares associated with oil and gas production, methane and VOC gases extracted from landfills, municipal sewage treatment, wastewater treatment at food production facilities, petroleum refining, and VOC control of blowing agents at plastics product manufacturing. Flaring is a high temperature oxidation process used to burn combustible components, mostly hydrocarbons, of waste gases from industrial operations. 95% of the waste gases flared are natural gas, propane, pentane, ethylene, propylene, butadiene, and butane. Rule 4311 contains operational requirements, flare minimization requirements for certain flares, and NOx and VOC emission limits for enclosed flares and any flare used over industry-based thresholds.

Based on a comprehensive technical analysis, in-depth review of local, state, and federal regulations, and a robust public process, the District adopted amendments to Rule 4311 in December 2020 to reduce emissions from flaring in the Valley. These amendments removed the exemptions for flares operating at non-major source facilities as well as at landfills, and established low-NOx emissions limits for multiple categories of facilities with flares used over specified annual flaring throughput thresholds.

The 2020 amendments to Rule 4311 were designed to encourage flare operators to find beneficial alternative uses of gas combusted, or to deploy the cleanest flaring technologies to achieve additional NOx emission reductions from this sector. Specific limits were established depending on the applicability of the ultra-low NOx (ULN) technology to different flaring processes with industry specific considerations. The installation of ULN flare technology is required for flares that combust the majority of gas in the Valley. This requires installation of ULN flares associated with 65% of total gas flared from all categories. Operators of flares subject to Rule 4311 are required to either demonstrate flare use below annual throughput thresholds specific to the type of facility, or meet flare emissions limits appropriate to the facility type.

The District evaluated various approaches to determining thresholds to require flare operators to take action to reduce emissions. The only other rule in the nation requiring ultra-low NOx flares is South Coast Air Quality Management District (SCAQMD) Rule

1118.1. SCAQMD Rule 1118.1 sets thresholds for action based on a percentage of capacity used annually. Applying a percentage-based approach would have excluded some of the most highly used flares in the Valley. As an alternative to this approach, the District evaluated a set of annual throughput thresholds by flare type, with the goal of achieving emissions reductions in greater quantity and more cost effectively than those achievable under the approach included in SCAQMD Rule 1118.1. The approach included in the District's amended rule is estimated to achieve a 37.2% reduction in NOx emissions and 19.4% reduction in PM2.5 emissions from flares. These emissions reductions are greater than reductions achieved by the approach included in SCAQMD Rule 1118.1 at approximately half the cost, by focusing on flares with the highest usage, resulting in a more effective rule.

The Rule 4311 emission limits were established based on the currently available control technologies that have been proven to be technologically feasible for each specific type of flaring operation, taking into consideration the gas composition and flow. Operators of flares that exceed the annual throughput thresholds must install a ULN flare/incinerator that meets these low emission limits, or else implement a beneficial use project to otherwise reduce flaring activity at the facility. Compliance dates within the rule ensure emission reductions are achieved in 2024 and 2025, as committed to in the *2018 PM2.5 Plan*, to support attainment of the PM2.5 standards.

The District adopted these amendments to reduce emissions from flaring in the Valley by requiring operators to install the cleanest ultra-low NOx flaring/incineration technology, and encouraging operators to seek beneficial uses for waste gas, rather than flaring in the most cost effective manner. The ultra-low NOx flaring technology represents the lowest emission flares/incinerators available, and this requirement makes Rule 4311 the most stringent flare rule in the nation.

How does District Rule 4311 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines or Alternative Control Techniques applicable to this source category.

A. New Source Performance Standards (NSPS)

- *40 CFR 60.18 – General Control Device and Work Practice Requirements (2008/12)*
- *40 CFR 65.147 – Flares (2000/12)*
- *40 CFR 60 Subpart OOOOa – Standards of Performance for Crude Oil and Natural Gas Facilities for Which Construction, Modification, or Reconstruction Commenced After September 15, 2015 (2016/06)*
- *40 CFR 60 Subpart Ja – Standards of Performance for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After May 14, 2007 (2013/12)*

The District evaluated the requirements contained within the NSPS above, and found no requirements that were more stringent than those already in Rule 4311.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4311 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4311 to comparable requirements in rules from the following nonattainment areas:

- Bay Area AQMD Regulation 12, Rule 11 (Amended November 3, 2021)[95]
- Bay Area AQMD Regulation 12, Rule 12 (Amended November 3, 2021)[96]
- San Diego County APCD Rule 69.7 (Adopted March 9, 2023)[97]
- Santa Barbara County APCD Rule 359 (Amended June 28, 1994)[98]
- South Coast AQMD Rule 1118 (Amended January 6, 2023)[99]
- South Coast AQMD Rule 1118.1 (Adopted January 4, 2019)[100]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4311 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

Bay Area AQMD

- BAAQMD Regulation 12, Rule 11 (Flare Monitoring at Refineries)
- BAAQMD Regulation 12, Rule 12 (Flares at Refineries)

The District's Rule 4311 includes requirements that correspond to both BAAQMD Regulation 12 Rules 11 and 12. Therefore, the following table compares District Rule 4311 to the requirements from both BAAQMD rules.

[95] BAAQMD. *Regulation 12, Rule 11 (Flare Monitoring at Refineries).* (Amended November 3, 2021). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/refinery-rules-definitions/rg1211_20211103-pdf.pdf?la=en&rev=694ca947de004a788d889ad213e7955b

[96] BAAQMD. *Regulation 12, Rule 12 (Flares at Refineries).* (Amended November 3, 2021). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/refinery-rules-definitions/rg1212_20211103-pdf.pdf?la=en&rev=7db93f23469747fc8eca3b3f2dc773ff

[97] SDAPCD. *Rule 69.7 (Landfill Gas Flares)*. (Adopted March 9, 2023). Retrieved from: https://www.sdapcd.org/content/dam/sdapcd/documents/rules/current-rules/Rule-69.7.pdf

[98] SBCAPCD. *Rule 359 (Flares and Thermal Oxidizers).* (Adopted June 28, 1994). Retrieved from: https://ww2.arb.ca.gov/sites/default/files/classic/technology-clearinghouse/rules/RuleID2475.pdf

[99] SCAQMD. *Rule 1118 (Control of Emissions from Refinery Flares).* (Amended January 6, 2023). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1118.pdf?sfvrsn=4

[100] SCAQMD. *Rule 1118.1 (Control of Emissions from Non-Refinery Flares).* (Adopted January 4, 2019). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/R1118-1.pdf?sfvrsn=9

	SJVAPCD Rule 4311	BAAQMD Reg 12, Rule 11 BAAQMD Reg 12, Rule 12
Applicability	All flares.	Flares used at refineries.
Exemptions	• Flares operated at municipal solid waste landfills that combust <2,000 MMscf of landfill gas per calendar year and that have ceased accepting waste • Flares that combust only propane, butane, or a combination of propane and butane • Flares used for well testing, tank degassing, and pipeline degassing operations • Flares that combust regeneration gas	• Flares and thermal oxidizers used for: ○ Emissions from organic liquid storage vessels (subj. to R. 8-5) ○ Emissions from loading racks (subj. to R. 8-6, 8-33, or 8-39) ○ Emissions from marine vessel loading terminals (subj. to R. 8-44) • Thermal oxidizers used for: ○ Emissions from wastewater treatment systems (subj. to R. 8-8) ○ Emissions from pump seals (subj. to R. 8-18) (except when emissions from pump are routed to flare header) <u>Reg 12, Rule 11 Only</u>: • Monitoring and reporting total HC or methane composition doesn't apply to flare that burns flexicoker gas if weekly sampling shows methane/non-methane content of vent gas flared is <2%/<1% by volume.
Requirements	Requires flare operators to limit flare operation not to exceed flare throughput threshold based on vocation for 2 consecutive years or meet NOx limits: • Flares used at oil and gas operations, and chemical operations: 25,000 MMBtu/yr or 0.005 lb-VOC/MMBtu, 0.018 lb-NOx/MMBtu; • Flares at landfill operations: 90,000 MMBtu/yr or 0.038 lb-VOC/MMBtu and 0.025 lb-NOx/MMBtu; • Flares at digester operations at a major source facility: 100,000 MMBtu/yr or 0.038 lb-VOC/MMBtu and 0.025 lb-NOx/MMBtu; • Flares at digester operations not at a major source facility: 100,000 MMBtu/yr or 0.060 lb-NOx/MMBtu; • Flares at organic liquid loading operations: 25,000 MMBtu/yr or 0.034 lb-NOx/MMBtu. Recordkeeping and reporting. Flare minimization plan for refinery flares or flares ≥5 MMBtu/hr at major sources of NOx or VOC, except landfill operations.	No emission limit requirements.

The District evaluated the requirements contained within BAAQMD's Regulation 12, Rules 11 and 12 and found no requirements that were more stringent than those in Rule

4311. Therefore, District Rule 4311 is as stringent as or more stringent than BAAQMD Regulation 12, Rule 11 and 12.

San Diego County APCD

- SDAPCD Rule 69.7 (Landfill Gas Flares)

	SJVAPCD Rule 4311	SDAPCD Rule 69.7
Applicability	All flares.	Landfill gas flares at a municipal solid waste landfill where emissions from such flares are at or above the federal major source threshold for NOx.
Exemptions	• Flares operated at municipal solid waste landfills that combust <2,000 MMscf of landfill gas per calendar year and that have ceased accepting waste • Flares that combust only propane, butane, or a combination of propane and butane • Flares used for well testing, tank degassing, and pipeline degassing operations • Flares that combust regeneration gas	• Existing open landfill gas flares are exempt from standards, test methods, and source test requirements of rule
Requirements	Requires flare operators to limit flare operation not to exceed flare throughput threshold based on vocation for 2 consecutive years or meet NOx limits: • Flares used at oil and gas operations, and chemical operations: 25,000 MMBtu/yr or 0.005 lb-VOC/MMBtu, 0.018 lb-NOx/MMBtu; • Flares at landfill operations: 90,000 MMBtu/yr or 0.038 lb-VOC/MMBtu and 0.025 lb-NOx/MMBtu; • Flares at digester operations at a major source facility: 100,000 MMBtu/yr or 0.038 lb-VOC/MMBtu and 0.025 lb-NOx/MMBtu; • Flares at digester operations not at a major source facility: 100,000 MMBtu/yr or 0.060 lb-NOx/MMBtu; • Flares at organic liquid loading operations: 25,000 MMBtu/yr or 0.034 lb-NOx/MMBtu. Recordkeeping and reporting. Flare minimization plan for refinery flares or flares ≥5 MMBtu/hr at major sources of NOx or VOC, except landfill operations.	A person shall not install and/or operate an enclosed landfill gas flare unless NOx emissions do not exceed 0.06 lbs/MMBtu. Operational, monitoring, recordkeeping, testing requirements.

The District evaluated the requirements contained within SDAPCD's Rule 69.7 and found no requirements that were more stringent than those in Rule 4311. In fact, District Rule 4311 includes requirements for flares in other facility types beyond

municipal solid waste. Therefore, District Rule 4311 is as stringent as or more stringent than SDAPCD Rule 69.7.

South Coast AQMD

- SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)

	SJVAPCD Rule 4311	SCAQMD Rule 1118
Applicability	All flares.	Flares used at petroleum refineries, sulfur recovery plants, and hydrogen production plants.

Exemptions	• Flares operated at municipal solid waste landfills that combust <2,000 MMscf of landfill gas per calendar year and that have ceased accepting waste
	• Flares that combust only propane, butane, or a combination of propane and butane
	• Flares used for well testing, tank degassing, and pipeline degassing operations
	• Flares that combust regeneration gas
		• Exempt from sampling and analyses for higher heating values and sulfur concentration for flare event that:
		  ○ Results from catastrophic event
		  ○ Is safety hazard to sampling personnel
		• SOx from flaring events caused by:
		  ○ External power curtailment beyond operator's control
		  ○ Natural disasters
		  ○ Acts of war or terrorism
		
		(Not exempt from flare monitoring system requirements)

Requirements	Limit flare operation not to exceed a flare throughput threshold based on vocation for two consecutive years or meet NOx limits: • Flares used at oil and gas operations, and chemical operations: 25,000 MMBtu/yr or 0.005 lb-VOC/MMBtu, 0.018 lb-NOx/MMBtu; • Flares at landfill operations: 90,000 MMBtu/yr or 0.038 lb-VOC/MMBtu and 0.025 lb-NOx/MMBtu; • Flares at digester operations at a major source facility: 100,000 MMBtu/yr or 0.038 lb-VOC/MMBtu and 0.025 lb-NOx/MMBtu; • Flares at digester operations not at a major source facility: 100,000 MMBtu/yr or 0.060 lb-NOx/MMBtu; • Flares at organic liquid loading operations: 25,000 MMBtu/yr or 0.034 lb-NOx/MMBtu. Recordkeeping and reporting. Flare minimization plan for refinery flares or flares ≥5 MMBtu/hr at major sources of NOx or VOC, except landfill operations.	No emission limit requirements.

The District evaluated the requirements contained within SCAQMD's Rule 1118 and found no requirements that were more stringent than those in Rule 4311. Therefore, District Rule 4311 is as stringent as or more stringent than SCAQMD Rule 1118.

South Coast AQMD

- SCAQMD Rule 1118.1 (Control of Emissions from Non-Refinery Flares)

	SJVAPCD Rule 4311	SCAQMD Rule 1118.1
Applicability	All flares.	Flares that require a SCAQMD permit used at non-refinery facilities, including, but not limited to oil and gas production facilities, wastewater treatment facilities, landfills, and organic liquid handling facilities.
Exemptions	• Flares operated at municipal solid waste landfills that combust <2,000 MMscf of landfill gas per calendar year and that have ceased accepting waste • Flares that combust only propane, butane, or a combination of propane and butane • Flares used for well testing, tank degassing, and pipeline degassing operations • Flares that combust regeneration gas	• Flares at asphalt plants, biodiesel plants, hydrogen production plants fueled in part with refinery gas, petroleum refineries, sulfuric acid plants, and sulfur recovery plants • Flares routing only natural gas to the burner that are subject to SCAQMD Misc. Source NOx rule • Flares combusting only propane, butane, or a combination of propane and butane • Flares at closed landfills collecting <2,000 MMscf of landfill gas per calendar year • Flares with a various location permit • Flares combusting regeneration gas • Flares emitting <30 lb-NOx/month • Flares with an annual throughput limit equivalent to 200 hr/year • Gas combusted during a utility pipeline curtailment is not used to calculate exceedance of use requirements
Requirements	Requires flare operators to limit flare operation not to exceed flare throughput threshold based on vocation for 2 consecutive years or meet NOx limits: • Flares used at oil and gas operations, and chemical operations: 25,000 MMBtu/yr or 0.005 lb-VOC/MMBtu, 0.018 lb-NOx/MMBtu; • Flares at landfill operations: 90,000 MMBtu/yr or 0.038 lb-VOC/MMBtu and 0.025 lb-NOx/MMBtu; • Flares at digester operations at a major source facility: 100,000 MMBtu/yr or 0.038 lb-VOC/MMBtu and 0.025 lb-NOx/MMBtu; • Flares at digester operations not at a major source facility: 100,000 MMBtu/yr or 0.060 lb-NOx/MMBtu;	Throughput limits for new or replacement flares of 110% of replaced flare or 45 MMscf/year. New flare emission limits based on type of gas flared: • Produced gas: 0.018 lb-NOx/MMBtu, 0.01 lb-CO/MMBtu, 0.008 lb-VOC/MMBtu; • Landfill gas, and digester gas at a major facility: 0.025 lb-NOx/MMBtu, 0.06 lb-CO/MMBtu, 0.038 lb-VOC/MMBtu; • Digester gas at a minor facility, and other flare gas: 0.06 lb-NOx/MMBtu; • Organic liquid storage: 0.25 lb-NOx/MMBtu, 0.37 lb-CO/MMbtu;

	SJVAPCD Rule 4311	SCAQMD Rule 1118.1
	• Flares at organic liquid loading operations: 25,000 MMBtu/yr or 0.034 lb-NOx/MMBtu. Recordkeeping and reporting. Flare minimization plan for refinery flares or flares ≥5 MMBtu/hr at major sources of NOx or VOC, except landfill operations.	• Organic liquid loading: 0.034 lb-NOx/1,000 gallons loaded, 0.05 lb-CO/1,000 gallons loaded. Establishes requirements for existing flares not meeting the above emission limits based on exceeding a vocation based fractional use of total capacity in two consecutive calendar quarters. Fraction limits are: 5% for produced gas or any open flare; 70% for digester gas; and 20% for landfill gas. Units exceeding these limits must reduce flaring or replace with a new flare meeting emission limit requirements.

The District evaluated the requirements contained within SCAQMD's Rule 1118.1 and found no requirements that were more stringent than those in Rule 4311. Therefore, District Rule 4311 is as stringent as or more stringent than SCAQMD Rule 1118.1.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District reviewed the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

Zero-Emission Opportunities

The District evaluated all available opportunities for reducing emissions from this source category and did not identify any available zero-emission technologies or any instances of zero-emission requirements for these operations. However, the District will continue to closely track the development of new zero-emissions technologies and control measures for this source category.

Based on this review, the District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

Rule 4311 currently provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.12 RULE 4313 (LIME KILNS)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

The emissions inventory for the lime kiln source category is 0.00 tpd because there are no lime kilns in operation in the Valley.

District Rule 4313 Description

District Rule 4313 was adopted in 2003 to limit NOx emissions from the operation of lime kilns. Lime kilns can be used in a variety of manufacturing and processing operations, including food and agriculture. At the time of rule adoption, there were a total of three lime kilns in operation in the Valley. These lime kilns were operated at two sugar processing plants; however, these plants have been non-operational since 2008. There are currently no lime kilns operating in the Valley. If any lime kilns were to begin operation in the Valley in the future they would be required to meet District BACT requirements, per District Rule 2201 (New and Modified Stationary Source Review Rule). There are no lime kilns currently going through the District's permitting process to become operational in the Valley, and the District does not expect any lime kilns to operate in the Valley in the future.

How does District Rule 4313 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Technique Guidelines or Alternative Control Techniques applicable to this source category.

A. New Source Performance Standards (NSPS)

- *40 CFR 60 Subpart HH – Standards of Performance for Lime Manufacturing Plants (1984/04)*

The District evaluated the requirements contained within 40 CFR 60 Subpart HH and found no requirements that were more stringent than those already in Rule 4313.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4313 compare to rules in other air districts?

Bay Area AQMD, Sacramento Metropolitan AQMD, South Coast AQMD, and Ventura County APCD do not have analogous rules for this source category.

Potential Emission Reduction Opportunities

There are currently no lime kilns in operation in the Valley. Therefore, the District did not identify any additional emission reduction opportunities at this time.

Evaluation Findings

There are no lime kilns in operation in the Valley, nor are any expected to be operated in the Valley in the future. However, if a lime kilns were to begin operating in the Valley, it would be required to meet District BACT requirements. As such, Rule 4313 meets or exceeds federal BACM and MSM requirements for this source category.

C.13 RULE 4352 (SOLID FUEL FIRED BOILERS, STEAM GENERATORS, AND PROCESS HEATERS)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.18	0.18	0.18	0.13	0.13	0.14	0.14
NOx	1.87	1.86	1.88	1.53	1.54	1.64	1.65
	Winter Average - Tons per day						
PM2.5	0.18	0.18	0.18	0.13	0.13	0.14	0.14
NOx	1.87	1.86	1.88	1.53	1.54	1.64	1.64

District Rule 4352 Description

The purpose of Rule 4352 is to limit NOx, CO, PM10, and SOx emissions from any boiler, steam generator or process heater fired on solid fuel. Operations use these units in a broad range of industrial, commercial, and institutional settings. These units have the ability to fire on a variety of solid fuels, including coal, petroleum coke, biomass, tire-derived fuel, and municipal solid waste (MSW). The District currently permits ten biomass fired units in the Valley; however, only five biomass fired units are currently operating. All five operating units generate electricity for electric utilities. The remaining five units are closed and dormant. Two solid fuel fired units permitted within the District use MSW as their energy source. The MSW fired units are located at a single facility that generates electricity for electric utilities.

The adoption of Rule 4352 on September 14, 1994, established NOx limits of 200 ppmv for MSW facilities, 0.35 lb/MMBtu for biomass facilities, and 0.20 lb/MMBtu for all other solid fuel fired units. The District has amended this rule four times since adoption.

The District Governing Board adopted the most recent amendments to Rule 4352 on December 16, 2021. Based on a comprehensive technical analysis, in-depth review of local, state, and federal regulations, and a robust public process, the District adopted several modifications to Rule 4352 to include even more stringent NOx limits, and to establish PM10 and SOx emission limits for applicable units operating in the Valley. The amendments to Rule 4352 also added language to clarify definitions, remove expired language, and establish compliance timelines.

Table C-3 Rule 4352 NOx, CO, PM10, and SOx Emission Limits

Fuel Type	Emission Limits effective on and after January 1, 2024			
	NOx	CO	PM10	SOx
MSW	110 ppmv corrected to 12% CO2 [A] 90 ppmv corrected to 12% CO2 [C]	400 ppmv corrected to 3% O2 [A]	0.04 lbs/MMBtu or 0.02 gr/dscf @ 12% CO2	0.03 lbs/MMBtu [C] or 12 ppmv @ 12% CO2 [C] 0.064 lbs/MMBtu [A] or 25 ppmv @ 12% CO2 [A]
Biomass	65 ppmv corrected to 3% O2 [A]		0.03 lbs/MMBtu	0.02 lbs/MMBtu [B] 0.035 lbs/MMBtu [A]
All Others	65 ppmv corrected to 3% O2 [A]		0.03 lbs/MMBtu	0.02 lbs/MMBtu [B] 0.035 lbs/MMBtu [A]

[A] Block 24-hour average
[B] Rolling 30-day average
[C] Rolling 12-month average

How does District Rule 4352 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines applicable to this source category.

A. Alternative Control Techniques (ACT)

- *Alternative Control Techniques Document – NOx Emissions from Industrial, Commercial, and Institutional Boilers (EPA-453/R-94-022 1994/03)*
- *Alternative Control Techniques Document – NOx Emissions from Utility Boilers (EPA-453/R-94-023 1994/03)*

The District evaluated the requirements contained within the ACT for NOx Emissions from Industrial/Commercial/Institutional Boilers and the ACT for NOx Emissions from Utility Boilers and found no requirements that were more stringent than those already in Rule 4352.

B. New Source Performance Standards (NSPS)

- *40 CFR 60 Subpart Cb – Emission Guidelines and Compliance Times for Large Municipal Waste Combustors that are Constructed On or Before September 20, 1994 (1995/12)*

The District evaluated the requirements contained within 40 CFR 60 Subpart Cb and found no requirements that were more stringent than those already in Rule 4352.

- *40 CFR 60 Subpart D – Standards of Performance for Fossil-Fuel-Fired Steam Generators (2007/06)*

The District evaluated the requirements contained within 40 CFR 60 Subpart D and found no requirements that were more stringent than those already in Rule 4352.

- *40 CFR 60 Subpart Da – Standards of Performance for Electric Utility Steam Generating Units (2013/04)*
- *40 CFR 60 Subpart Db – Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units (2007/06)*
- *40 CFR 60 Subpart Dc – Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units (2014/02)*

The District evaluated the requirements contained within the 40 CFR 60 Subpart Da, Db and Dc and found no requirements that were more stringent than those already in Rule 4352.

- *40 CFR 60 Subpart Ea – Standards of Performance for Municipal Waste Combustors for Which Construction is Commenced After December 20, 1989 and On or Before September 20, 1994 (1995/12)*
- *40 CFR 60 Subpart Eb – Standards of Performance for Municipal Waste Combustors for Which Construction is Commenced After September 20, 1994 or for Which Modification or Reconstruction is Commenced After June 19, 1996 (2007/03)*

The District evaluated the requirements contained within 40 CFR 60 Subparts Ea and Eb and found no requirements that were more stringent than those already in Rule 4352.

- *40 CFR 60 Subpart AAAA – Standards of Performance for Small Municipal Waste Combustion Units for Which Construction is Commenced After August 30, 1999 or for Which Modification is Commenced After June 6, 2001 (2003/01)*
- *40 CFR 60 Subpart BBBB – Standards of Performance for Small Municipal Waste Combustion Units Constructed On or Before August 30, 1999 (2003/01)*

The District evaluated the requirements contained within 40 CFR 60 Subparts AAAA and BBBB and found no requirements that were more stringent than those already in Rule 4352.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4352 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4352 to comparable requirements in rules from the following:

- Bay Area AQMD Regulation 9, Rule 7 (Amended May 4, 2011)[101]
- Bay Area AQMD Regulation 9, Rule 11 (Adopted May 17, 2000)[102]
- El Dorado County AQMD Rule 232 (Amended September 25, 2001)[103]
- Placer County APCD Rule 233 (Amended June 14, 2012)[104]
- Sacramento Metropolitan AQMD Rule 411 (Amended August 23, 2007)[105]
- South Coast AQMD Rule 1146 (Amended December 7, 2018)[106]
- Yolo-Solano AQMD Rule 2-43 (Amended November 10, 2010)[107]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4352 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

South Coast AQMD

- SCAQMD Rule 1146 (Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

	SJVAPCD Rule 4352	SCAQMD Rule 1146
Applicability	Any boiler, steam generator, or process heater fired on solid fuel.	Boilers, steam generators, and process heaters ≥5 MMBtu/hr rated heat input capacity used in all industrial, institutional, and commercial operations and fired on fossil fuels.
Exemptions	None	• Units with rated heat input capacity ≤5 MMBtu/hr • Units used exclusively to produce electricity
Requirements	**NOx emission limits** *Effective on and after Jan. 1, 2024* MSW 110 ppmv corrected to 12% CO_2[A] 90 ppmv corrected to 12% CO_2[C]	No applicable limits for units similar to those in the San Joaquin Valley.

[101] BAAQMD. *Regulation 9, Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters).* (Amended May 4, 2011). Retrieved from: https://www.baaqmd.gov/rules-and-compliance/rules/reg-9-rule-7-nitrogen-oxides-and-carbon-monoxide-from-industrial-institutional-and-commercial-boiler
[102] BAAQMD. *Regulation 9, Rule 11 (Nitrogen Oxides and Carbon Monoxide from Utility Electric Power Generating Boilers).* (Adopted May 17, 2000). Retrieved from: https://www.baaqmd.gov/rules-and-compliance/rules/reg-9-rule-11-nitrogen-oxides-and-carbon-monoxide-from-utility-electric-power-generating-boilers
[103] EDCAQMD. *Rule 232 (Biomass Boilers).* (Amended September 25, 2001). Retrieved from: https://ww2.arb.ca.gov/sites/default/files/classic/technology-clearinghouse/rules/RuleID819.pdf
[104] PCAPCD. *Rule 233 (Biomass Boilers).* (Amended June 14, 2012). Retrieved from: https://www.placerair.org/DocumentCenter/View/2205/Rule-233-PDF
[105] SMAQMD. *Rule 411 (NOx from Boilers, Process Heaters and Steam Generators).* (Amended August 23, 2007). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule411.pdf
[106] SCAQMD. *Rule 1146 (Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters).* (Amended December 7, 2018). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1146.pdf
[107] YSAQMD. *Rule 2-43 (Biomass Boilers).* (Amended November 10, 2010). Retrieved from: https://www.ysaqmd.org/wp-content/uploads/2020/05/2.43.pdf

	SJVAPCD Rule 4352	SCAQMD Rule 1146
	Biomass 65 ppmv NOx corrected to 3% O2[A] All others 65 ppmv NOx corrected to 3% O2[A] [A] Block 24-hour average [B] Rolling 30-day average [C] Rolling 12-month average **PM10 Emission Limits** *Effective on and after Jan. 1, 2024* MSW 0.04 lbs/MMBtu or 0.02 gr/dscf @ 12% CO2 Biomass 0.03 lbs/MMBtu All others 0.03 lbs/MMBtu	

SCAQMD Rule 1146 specifically exempts units that are used exclusively to produce electricity for sale. Therefore, this rule cannot be compared to District Rule 4352.

Potential Emission Reduction Opportunities

Zero-Emission Opportunities

The District evaluated all available opportunities for reducing emissions from this source category and did not identify any available zero-emission technologies or any instances of zero-emission requirements for these operations. Notably, the units in this source category produce electricity, and therefore cannot be electrified. However, the District will continue to closely track the development of new zero-emissions technologies and control measures for this source category.

Other Opportunities

On December 16, 2021, the District Governing Board adopted amendments to Rule 4352 that included even more stringent NOx emission limits for solid fuel fired boilers, steam generators, and process heaters operating in the Valley. As part of the rule development, the District conducted an incremental cost effectiveness analysis. The incremental cost effectiveness is the difference in cost between successively more effective controls divided by the additional emission reductions achieved.

Incremental cost-effectiveness is calculated as follows:

$$Incremental\ cost\text{-}effectiveness = (C_{alt} - C_{proposed}) / (E_{alt} - E_{proposed})$$

Where:
$C_{proposed}$ is the present worth value of the proposed control option;
$E_{proposed}$ are the emission reductions of the proposed control option;
C_{alt} is the present worth value of the alternative control option; and
E_{alt} are the emission reductions of the alternative control option

The District evaluated several technology options to lower the NOx emissions at the municipal solid waste facility in the District. The new NOx limit of 90 ppm requires the installation of Covanta LN technology. Other more stringent control options evaluated included SCR, Gore De-NOx, Covanta LN with SCR, and Covanta LN with Gore De-NOx. The incremental cost effectiveness for these control options is presented in the table below.

Table C-4: NOx Incremental Cost Effectiveness Analysis for Units fired on MSW

Evaluated Alternative Emissions Limit (ppm)	Potential Control Technology	Annualized Cost ($/year)	Annual Emission Reductions (tons/year)	Incremental Cost Effectiveness ($/ton)
60	Gore De-NOx	$7,533,966	130.5	$78,508
50	SCR	$7,673,984	156.9	$124,965
45	Covanta LN + SCR	$9,797,335	179.2	$82,634
35	Covanta LN + Gore De-NOx	$9,076,110	170.2	$82,911

The District also evaluated several technology options to lower the NOx emissions for biomass fueled units. Other more stringent control options evaluated included SCR, Gore De-NOx, new boilers with SCR, and new boilers with Gore De-NOx. The incremental cost effectiveness for these control options is presented in the table below.

Table C-5: NOx Incremental Cost Effectiveness Analysis for Units fired on Biomass

Evaluated Alternative Emissions Limit (ppm)	Technology	Annualized Cost ($/year)	Annual Emission Reductions (tons/year)	Incremental Cost Effectiveness ($/ton)
50	SCR	$24,742,095	329.5	$115,517
50	Gore De-Nox	$18,674,087	329.5	$86,972
40	New Boiler with SCR	$114,360,450	510.3	$289,568
40	New Boiler with Gore De-NOx	$101,744,410	510.3	$257,620

The incremental cost effectiveness analysis did not demonstrate that any of the alternative control technologies were cost effective. Facilities are still in the process of complying with the most recent amendments by January 1, 2024. The District did not identify any additional emission reduction opportunities at this time.

Evaluation Findings

Rule 4352 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.14 RULE 4354 (GLASS MELTING FURNACES)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.27	0.27	0.28	0.18	0.18	0.19	0.19
NOx	3.37	3.42	3.65	3.08	3.08	2.05	2.05
	Winter Average - Tons per day						
PM2.5	0.27	0.27	0.28	0.18	0.18	0.19	0.19
NOx	3.37	3.42	3.64	3.07	3.08	2.05	2.05

District Rule 4354 Description

The provisions of Rule 4354 are applicable to glass melting furnaces in the Valley. The purpose of this rule is to limit NOx, SOx, VOC, CO, and PM10 emissions from glass melting furnaces.

The District adopted Rule 4354 on September 14, 1994, and subsequently amended the rule seven times. The District most recently adopted amendments to Rule 4354 on December 16, 2021. These amendments implement even more stringent NOx, SOx, and PM emissions limits for glass melting furnaces, including NOx limits as low as 0.75 pounds of NOx per ton of glass pulled, establishing requirements that are more stringent than any other rule in non-attainment areas in California and the nation. Due to the high costs associated with the control technology necessary to comply with the proposed final NOx emissions limits, a phased compliance schedule was adopted in which operators must comply with Phase I NOx emissions limits by 2024, and then with final NOx emissions limits by 2030 or upon the completion of the next furnace rebuild, whichever is sooner.

How does District Rule 4354 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines applicable to this source category.

A. Alternative Control Techniques (ACT)

- *Alternative Control Techniques Document – NOx Emissions from Glass Manufacturing (EPA-453/R-94-37 1994/06)*

The District evaluated the requirements contained within the ACT for NOx Emissions from glass melting furnaces and found no requirements that were more stringent than those already required by Rule 4354.

B. New Source Performance Standards (NSPS)

- *40 CFR 60 Subpart CC – Standards of Performance for Glass Manufacturing Plants (2000/10)*

The District evaluated the requirements contained within 40 CFR 60 Subpart CC and found that none of the glass plants located within the Valley are subject to its requirements.

- *40 CFR 60 Subpart PPP – Standards of Performance for Wool Fiberglass Manufacturing Plants (2000/10)*

The District evaluated the requirements contained within Subpart PPP and found no requirements that were more stringent than those already in Rule 4354.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4354 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4354 to comparable requirements in rules from the following California nonattainment areas:

- Bay Area AQMD Regulation 9, Rule 12 (Adopted January 19, 1994)[108]
- South Coast AQMD Rule 1117 (Amended June 5, 2020)[109]

Sacramento Metropolitan AQMD and Ventura County APCD do not have an analogous rule for this source category.

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4354 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rule is demonstrated below.

[108] BAAQMD. *Regulation 9, Rule 12 (Nitrogen Oxides from Glass Melting Furnaces).* (Adopted January 19, 1994). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-12-nitrogen-oxides-from-glass-melting-furnaces/documents/rg0912.pdf?la=en&rev=29e7064c0e39439c9dee09b104af8dff

[109] SCAQMD. *Rule 1117 (Emissions from Container Glass Melting and Sodium Silicate Furnaces).* (Amended June 5, 2020). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1117.pdf?sfvrsn=4

South Coast AQMD

- SCAQMD Rule 1117 (Emissions of Oxides of Nitrogen from Container Glass Melting and Sodium Silicate Furnaces)

	SJVAPCD Rule 4354		SCAQMD Rule 1117
Applicability	Any glass melting furnace for the production of, container glass, fiberglass, and flat glass.		This rule limits the emission of NOx from facilities producing container glass and sodium silicate.
Exemption	• Furnaces which heat is provided by electric current from electrodes		• Furnaces which are limited by permit to 100 tons of product pulled per calendar year • Glass remelt facilities using exclusively glass cullet, marbles, chips, or similar feedstock in lieu of basic glass-making raw materials • Furnaces used in the melting of glass for the production of fiberglass exclusively
Requirements	**Container Glass:**		
	NOx Phase I (by no later than 12/31/2023)	1.1 lb/ton[B]	0.75 lb/ton[B]
	NOx Phase II (by no later than 12/31/2029)	0.75 lb/ton[B]	
	PM10 (Until 12/31/2023)	0.50 lb/ton[A]	No Limit Specified
	PM10 (On and after 1/1/2024)	0.20 lb/ton[A]	
	Fiberglass:		
	NOx	1.3 lb/ton[A, C]	No Limit Specified, Exempt from Rule
		3.0 lb/ton[A, D]	
	PM10	0.50 lb/ton[A]	No Limit Specified, Exempt from Rule
	Flat Glass:		
	NOx Phase I (by no later than 12/31/2023)	2.8 lb/ton[A]	No Limits Specified, Outside of Rule Applicability
		2.5 lb/ton[B]	
	NOx Phase II (by no later than 12/31/2029)	1.7 lb/ton[A]	
		1.5 lb/ton[B]	
	PM10 (Until 12/31/2023)	0.70 lb/ton[A]	No Limits Specified, Outside of Rule Applicability
	PM10 (On and after 1/1/2024)	0.20 lb/ton[A]	

[A] Block 24-hour average
[B] Rolling 30-day average
[C] Not subject to California Public Resources Code Section 19511
[D] Subject to California Public Resources Code Section 19511

The District evaluated the control requirements in SCAQMD Rule 1117, and found that District Rule 4354 is as stringent as or more stringent than SCAQMD Rule 1117.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District performed an extensive review of the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

Zero-Emission Opportunities

Electric Glass Melting Furnaces

The District considered the feasibility of using electric furnaces to reduce emissions. One of the container glass manufacturing facilities in the Valley is permitted to operate an electric glass melting furnace. However, this electric furnace has been out of glass production operation for more than ten years. During staff research, the District concluded that electric furnaces require a limited pull rate, and have a production capacity limited to a maximum of about 300 tons of glass per day. Furthermore, the District determined that electric furnace technology is only compatible with container glass manufacturing, and not compatible for flat glass production due to the technological design of electric furnaces and the need for a substantial float to provide heat insulation. The District did not identify any electric furnaces operating as the primary glass melting unit for flat glass manufacturing facilities. For container glass operations, multiple electric furnaces would need to be purchased to replace one existing natural-gas fired furnace, and operators would incur significant additional O&M costs, as compared to the operation of a furnace fired on natural gas. The typical electric furnace life is 4 years, compared to 10-12 years of that of a natural gas furnace with electric boost, further increasing the costs associated with operating an electric furnace in lieu of a natural gas-fired furnace.

Furthermore, electric furnaces consume more total energy per ton of glass, and would require much higher electricity capacity than is currently available from the electrical grid. For example, a modern 230 ton per day electric furnace has an electricity consumption rating of approximately 7.5 megawatts (MW), compared to a 430 ton per day natural gas furnace with electric boost where the maximum energy consumption is about 2.6 MW. More than 10 MW of additional electrical capacity at a glass production plant would be required to replace just one 430 ton per day furnace. The associated draw on the electrical grid to support required glass production levels for plants operating in the Valley would not be feasible or supported through the current electrical infrastructure or capacity in the region. While electric furnaces may be used for small production operations, or to provide additional heating boosts as an auxiliary unit at large manufacturing plants, the District determined that the use of electric furnaces as the primary glass melting furnace for large production operations is not currently feasible or cost effective due to the above considerations.

Based on this exhaustive review, the District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

Rule 4354 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.15 RULE 4550 (CONSERVATION MANAGEMENT PRACTICES)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	18.46	18.33	18.15	17.99	17.84	17.75	17.70
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	12.06	11.95	11.80	11.66	11.55	11.47	11.44
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

District Rule 4550 Description

Rule 4550 was adopted on August 19, 2004, to help bring the Valley into attainment of federal PM10 standards, and applies to on-field farming and agricultural operation sites located within the Valley. Rule 4550 was the first rule of its kind in the nation to target fugitive particulate emissions from agricultural operations, and it has served as a model for other regions. The District worked extensively with numerous stakeholders, growers, and the Agricultural Technical Committee for the San Joaquin Valleywide Air Pollution Study Agency (AgTech) for two years prior to developing the Conservation Management Practices (CMP) Rule. The District also worked with agricultural stakeholders and other agencies, such as the Natural Resources Conservation Service (NRCS), following rule adoption to ensure affected sources were assisted as much as possible in understanding and complying with the requirements of Rule 4550. Implementation of Rule 4550 by agricultural operations has resulted in the reduction of PM2.5 emissions through the reduction of passes of agricultural equipment and implementation of other conservation practices. Through this rule, PM10 emissions have been reduced by 35.3 tons per day. Rule 4550 has since served as a model for other regions seeking to reduce fugitive PM10 emissions from agricultural sources.

EPA finalized approval of Rule 4550 on February 14, 2006 and determined that the rule met BACM requirements.[110] Subsequent to EPA's approval of Rule 4550, two separate lawsuits were filed challenging EPA's approval of the rule as satisfying BACM. The Ninth District Court of Appeals, in both cases, agreed with EPA's approval and reaffirmed EPA's finding that the District's Rule 4550 meets BACM requirements.[111,112] Most recently, in April 2024, based on recommendations from the AgTech Committee, the District added Low-Dust Nut Harvesters to the CMP list for Nut Crops based on the

[110] 71 FR 7683-7688. *Revisions to the California State Implementation Plan; San Joaquin Valley Unified Air Pollution Control District*. (February 14, 2006). Retrieved from: http://www.gpo.gov/fdsys/pkg/FR-2006-02-14/pdf/06-1311.pdf
[111] U.S. Court of Appeals for the Ninth Circuit. *Latino Issues Forum v. EPA*. Retrieved from: http://njlaw.rutgers.edu/collections/resource.org/fed_reporter/NEWcircs/cir9/0671907_cir9.html
[112] SJVAPCD. *Court rules in favor of Air District ag rule.* (March 6, 2009). Retrieved from: https://www.valleyair.org/recent_news/Media_releases/2009/PR%20Court%20decision%20favors%20District%20ag%20rule.pdf

guidelines established by District Rule 4550.

In an effort to further reduce emissions from this source category, the District's *2018 PM2.5 Plan* included a commitment to evaluate the feasibility and effectiveness of CMPs on fallow lands that are tilled or otherwise worked with implements of husbandry to reduce windblown PM2.5 emissions from disturbed fallowed acreage. This evaluation would rely on additional research, in coordination with USDA-NRCS, agricultural sources, and researchers, which recognizes the Valley's unique soil characteristics and agricultural practices to ensure that Valley-specific solutions are considered in this process.

The District committed to undertake scientific research on the PM2.5 content, constituents, and stability during wind events of the many soil types found throughout the Valley. This research would be conducted in close coordination with USDA-NRCS, agricultural sources, researchers through established processes including the San Joaquin Valleywide Air Pollution Study Agency, Policy Committee, and Agricultural Technical Subcommittee.

The District is currently conducting a robust rule development process to evaluate these opportunities, working collaboratively with industry stakeholders, USDA-NRCS, and other agencies to develop proposed rule amendments.

Source Category

This rule is applicable to on-field farming and agricultural operation sites located within the Valley, and was adopted to reduce emissions of PM10 from such operations. Rule 4550 limits fugitive dust emissions from farming operations by requiring CMP plans for farms with 100 acres or more, dairies with 500 or more mature cows, cattle feedlots with 190 or more cows, turkey ranches with 55,000 or more turkeys, chicken ranches with 125,000 or more chickens, and chicken egg ranches with 82,000 or more laying hens.

Rule 4550 specifies that agricultural operations must select at least one CMP from each of the identified applicable CMP categories discussed below, and as many as three CMPs per category, to control PM10 emissions. There are five CMP categories for the cropland source category, four CMP categories for the dairy source category, four CMP categories for the feedlot source category, and five CMP categories for the poultry source category. Animal feeding operation (AFO) sources subject to Rule 4550 that also grow field crops must select CMPs for their field crops, as well as their AFO. The selected CMPs must be noted on the applications provided and then submitted to the District for approval. Completed applications constitute a CMP Plan once approved by the District.

Emissions from agricultural operations vary by many factors, some beyond the control of the agricultural operations. Particulate emissions (primarily PM10) are generated during land preparation activities, harvest activities, and post-harvest activities. Emissions are caused by the mechanical disturbance of the soil by implements and the tractors pulling them, resulting in the entrainment of soil or plant materials into the air.

Wind blowing across exposed agricultural land also causes the entrainment of particulates into the air. In addition, particulate emissions can also become entrained from vehicular travel over unpaved roads and unpaved parking/equipment areas. Conservation management practices fall into several broad categories and are intended to reduce emissions as follows:

- The reduction of soil or manure disturbance;
- Soil protection from wind erosion;
- Equipment modifications to physically produce less particulates; and
- Application of water or dust suppressants on unpaved roads and other travel areas to reduce emissions entrained by moving vehicles and equipment.

Fugitive PM2.5 Dust Emissions from Agricultural Operations

Rule 4550 was intended and designed to reduce PM10, and it has been successful in doing so, reducing 35.3 tons per day of PM10 from agricultural operations. However, as discussed in more detail below, recent studies have indicated that the PM2.5 fraction of emissions makes up a small portion of the total particulate emissions from agricultural operations, and therefore Rule 4550 and other conservation management-based rules are less effective at reducing PM2.5.

Additionally, particulate emissions from agricultural operations are geologic in nature (dust). Analysis of data from ambient PM2.5 monitors has demonstrated that these geologic particulate emissions make up a relatively small portion of the overall PM2.5 concentrations during the winter season.[113] In addition, these geologic particulate emissions in the San Joaquin Valley have relatively low toxicity relative to the organic carbon fraction of PM2.5 and to re-suspended road dust.[114]

Accordingly, particulate emissions from agricultural sources do not play a significant role with regard to attainment of the PM2.5 standards addressed by this plan, and Rule 4550 remains primarily a PM10 reduction strategy. For example, the latest available speciation analyses of PM2.5 from the Speciated Trends Network in Bakersfield, Fresno, Modesto, and Visalia found that the annual average geologic fraction during 2020-2022 was 12%, 10%, 8%, and 14%, respectively. Given that PM2.5 emissions from agricultural field operations are generally subject to deposition near their source,

[113] CARB. *Meeting PM2.5 Standards in the San Joaquin Valley.* Public Workshop. Fresno, CA. (December 1, 2016). Retrieved from: https://www.arb.ca.gov/planning/sip/sjvpm25/workshopslides.pdf; and
CARB. *Staff Report: Proposed Revision to the PM2.5 State Implementation Plan (SIP) for the San Joaquin Valley, Appendix B: Weight of Evidence Analysis.* Retrieved from: https://www.arb.ca.gov/planning/sip/sjvpm25/2012plan_appendix_b.pdf

[114] Veranth, J., Rielly, C.A., Veranth, M.M., Moss, T.A., Langelier, C.R., Lanza, D.L., & Yost, G.S. (2004). Inflammatory Cytokines and Cell Death in BEAS-2B Lung Cells Treated with Soil Dust, Lipopolysaccharide, and Surface-Modified Particles. *Toxicological Science 82(1)*, 88–96. Retrieved from: http://toxsci.oxfordjournals.org/content/82/1/88.full.pdf+html; and
Rogge, W. F., Hildemann, L. M., Mazurek, M. A., Cass, G. R. and Simoneit, B. R. T. (1993). *Sources of Fine Organic Aerosol—3. Road Dust, Tire Debris, and Organometallic Brake Lining Dust—Roads as Sources and Sinks*. Environmental Science & Technology 27(9), 1892-1904.

the predominant source of this geologic PM2.5 would be urban re-suspended road dust with relatively little contribution from agricultural activities.[115]

As discussed below, the most recent science has demonstrated that PM2.5 emissions from agricultural field operations had previously been significantly over-estimated in absolute terms due to species differences between the fine and coarse fractions of geologic emissions. For example, in 2003, Countess Environmental estimated the PM2.5/PM10 ratios for the predominant trace elements found in fugitive dust using Valley ambient measurements of such elements. The average ratio for aluminum and silicon was 0.05 and ranged between 0.10 to 0.16 for calcium, titanium, and iron. Based on the relative abundances of these elements in fugitive dust, the overall PM2.5/PM10 ratio was estimated to be 0.06 (6%).[116] This ratio estimate is substantially lower than the ratio of 0.20 that Midwest Research Institute (MRI) previously recommended, based on limited supporting data and broad assumptions, as an interim revision to the PM2.5/PM10 ratio for agricultural crops nationwide in 1996. Note that the MRI's 1996 interim revision to the PM2.5/PM10 ratios for fugitive dust sources was meant to improve the PM2.5/PM10 ratios that MRI had previously developed based on data from cascade impactors in the 1980's, which had also been shown to significantly overestimate PM2.5 emissions. As described by Thomas Pace of EPA at the 2005 US EPA Emissions Inventory Conference, MRI's 1996 interim revision to the PM2.5/PM10 ratios for fugitive dust still appeared to overestimate PM2.5 emissions. Pace's review of the most recent research on PM2.5/PM10 ratios nationally shows a consistent mid-point estimate of between 0.10 and 0.12, which is consistent with the higher-end values seen in the Valley. To summarize, PM2.5 comprises a small fraction of total PM10 emissions from agricultural field operations in the Valley, approximately 6% to 12%.

Pace concludes that both PM2.5 emissions from agricultural field operations as well as their contribution to ambient PM2.5 concentrations had previously been significantly overestimated. Factors that contributed to this previous overestimation of PM2.5 emissions from agricultural operations included: (1) the multiplier used to infer PM2.5 from PM10 emissions, (2) difficulty in obtaining activity data to apply to emission factor algorithms, and (3) modeling transport over-estimation (especially in the treatment of particles near their point of emissions).[117]

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[115] Countess, R. (2001). *Methodology for Estimating Fugitive Windblown and Mechanically Resuspended Road Dust Emissions Applicable for Regional Air Quality Modeling*, 10th Annual EPA Emissions Inventory Meeting, Denver, CO. May 1-3, 2001. Retrieved from: https://www3.epa.gov/ttnchie1/conference/ei10/fugdust/countess.pdf

[116] Countess, R. (2003). *Reconciling Fugitive Dust Emission Inventories with Ambient Measurements*, 12th Annual EPA Emissions Inventory Meeting, San Diego, CA. April 29-May 1, 2003. Retrieved from: https://www.epa.gov/ttn/chief/conference/ei12/fugdust/countess.pdf https://www.epa.gov/ttn/chief/conference/ei12/fugdust/present/countess.pdf

[117] Pace, T.G., US EPA. (2005). Examination of the Multiplier Used to Estimate PM2.5 Fugitive Dust Emissions from PM10, 14th Annual EPA Emissions Inventory Meeting, Las Vegas, Nevada, April 11 - 14, 2005. Retrieved from: https://www3.epa.gov/ttnchie1/conference/ei14/session5/pace.pdf https://www3.epa.gov/ttnchie1/conference/ei14/session5/pace_pres.pdf

In respect to over-estimation of PM2.5 transport, much of the ground level fugitive dust from soil disturbance is likely to be removed close to the source.[118] This is due to the low release height and turbulence which keeps particles temporarily close to the surface where they are subject to removal by impaction on nearby surfaces, including vegetation and structures. Equally significant in respect to the previous over-estimation of PM10 and PM2.5, earlier grid models ignored all removal processes in the grid cell where the emissions originate. Given that 4 kilometers is a typical grid dimension, a considerable fraction of PM2.5 emitted under normal field operations could and often would be deposited within that cell, but models ignored such deposition.

Wind-blown Dust in the Valley

Although the Valley may occasionally experience wind-blown dust events from time to time, these events typically do not coincide with the winter period in which the PM2.5 concentrations in the Valley are the highest. For example, both Fresno and Bakersfield have seasonal variation in wind speeds throughout the year with the highest average wind speeds in Fresno occurring from April to July with highest wind speeds in late May and early June, and the highest average wind speeds in Bakersfield occurring from late March to mid-July with the highest wind speeds typically in late May.[119] These high wind events are less likely to occur during the winter season, in which PM2.5 concentrations are elevated during stagnation events that are characterized by low wind speeds, moderate temperatures, vertical atmospheric stability, and high relative humidity.

These high wind events primarily cause higher PM10 concentrations, but rarely result in elevated PM2.5 concentrations. In addition to the rarity of elevated PM2.5 concentrations during high-wind events, the PM2.5 values recorded during the strong stagnation periods of the winter season are usually much higher than those recorded during wind events. Because of this, the Valley's PM2.5 design values are driven primarily by high winter-time concentrations, mostly due to organic carbon and the secondary formation of ammonium nitrate. Comparatively, the geologic component of the Valley's peak PM2.5 concentrations is only a fraction of the mass formed through secondary processes and other sources (less than 6%).[120]

As a result of the facts discussed above, the wind events experienced in the Valley are not a significant contributor to the 24-hr PM2.5 attainment challenges for the region, and have essentially no impact on annual PM2.5 averages.

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[118] Countess, R. (2001). *Methodology for Estimating Fugitive Windblown and Mechanically Resuspended Road Dust Emissions Applicable for Regional Air Quality Modeling*, 10th Annual EPA Emissions Inventory Meeting, Denver, CO. May 1-3, 2001. Retrieved from: https://www3.epa.gov/ttnchie1/conference/ei10/fugdust/countess.pdf; and Fitz, D., Pankratz, D., Philbrick, R., and Li, G. (2003). *Evaluation of Fugitive Dust Deposition Rates Using Lidar*, 12th Annual EPA Emissions Inventory Meeting, San Diego, CA. April 29-May 1, 2003. Retrieved from: https://www3.epa.gov/ttnchie1/conference/ei12/fugdust/fitz.pdf https://www.epa.gov/ttn/chief/conference/ei12/fugdust/present/fitz.pdf

[119] Retrieved from: https://weatherspark.com

[120] CARB. *Staff Report: Proposed Revision to the PM2.5 State Implementation Plan (SIP) for the San Joaquin Valley, Appendix B: Weight of Evidence Analysis.* (2012). Retrieved from: https://www.arb.ca.gov/planning/sip/sjvpm25/2012plan_appendix_b.pdf

How does District Rule 4550 compare with federal and state rules and regulations?

Federal Regulations

There are no Alternative Control Techniques, Control Techniques Guidelines, or New Source Performance Standards applicable to this source category.

State Regulations

There are no state regulations that are applicable to this source category.

How does District Rule 4550 compare to rules in other air districts?

Rule 4550 has served as a model for other regions seeking to reduce fugitive particulate emissions from agricultural sources. For this evaluation, the PM2.5 reduction requirements and applicability of Rule 4550 were compared to analogous rules in other air districts and states to determine the stringency of Rule 4550 compared to those other rules. The District found four analogous rules, in Arizona, Eastern Kern APCD, Imperial County APCD, and South Coast AQMD.

Notably, the District's examination found that each of these rules were developed to reduce PM10 emissions from agricultural operations in PM10 non-attainment areas. This was the situation for the District CMP rule, as well – in fact, the District believes that this ground-breaking CMP program was a significant contributor to the Valley's subsequent attainment of the PM10 standard.

None of these rules were developed or modified for the purpose of generating PM2.5 reductions, or as a part of a PM2.5 attainment planning process. As discussed above, PM2.5 is a small fraction of the PM10 from agricultural operations, and the effectiveness of controlling PM2.5 with such measures is not as well understood as the effectiveness of controlling PM10. Since the degree of effectiveness in controlling PM2.5 is not well understood, the corresponding cost effectiveness of implementing CMPs for the purposes of controlling PM2.5 is also unknown. Because of these factors, none of the three rules listed below can be considered as establishing BACM or MSM for PM2.5.

Nonetheless, the District compared emission limits, optional control requirements, and work practice standards in District Rule 4550 to comparable requirements in rules from the following areas:

- Arizona Department of Environmental Quality R18-2-610.01, R18-2-610.02, and R18-2-610.03 (Amended July 2, 2015, July 2, 2015, and November 3, 2021, respectively)[121]

[121] Arizona Department of Environmental Quality. Arizona Administrative Code Title 18, Chapter 2, pp. 22-2, pp. 90-97. Retrieved from: https://apps.azsos.gov/public_services/Title_18/18-02.pdf

- Eastern Kern APCD Rule 402.2 (Amended January 13, 2022)[122, 123]
- Imperial County APCD Rule 806 (Amended October 16, 2012)[124]
- South Coast AQMD Rule 403 (Amended June 3, 2005)[125]

In their 2020 approval of the District's *2018 PM2.5 Plan* for the 2006 PM2.5 NAAQS, EPA concluded that Rule 4550 continues to establish BACM and MSM control requirements for this source category. In their Technical Support Document,[126] EPA specifically cited the significantly superior enforcement mechanisms in Rule 4550, including:

- It is the only rule to require applications to be filed, specifying the CMPs to be employed;
- It requires an approval process of the chosen CMPs, unlike the other analogous rules; and
- It is the only rule to require owner/operators to maintain records for five years.

The District finds that Rule 4550 continues to implement the most stringent levels of control when compared to analogous rules from other areas. Therefore, no additional comparison is needed at this time.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District reviewed the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future. However, the District did not identify additional emission reduction opportunities at this time.

Evaluation Findings

Rule 4550 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

While attainment modeling has demonstrated that additional CMPs will not significantly contribute to our attainment efforts, to further develop the District's understanding of the

[122] EKAPCD. *Rule 402.2 (Agricultural Operations)*. (Amended January 13, 2022). Retrieved from: http://www.kernair.org/Rule%20Book/4%20Prohibitions/402_2%20Agricultural_Operations.pdf
[123] Note: EKAPCD Rule 402.2 was originally adopted in March 2015. EKAPCD withdrew the 2015 version of Rule 402.2 from the SIP through formal request on March 4, 2021, based on rule deficiencies identified by U.S. EPA. EKAPCD adopted the new version of Rule 402.2 on January 13, 2022.
[124] ICAPCD. *Rule 806 (Conservation Management Practices)*. (Amended October 16, 2012). Retrieved from: https://apcd.imperialcounty.org/wp-content/uploads/2020/05/1RULE806.pdf
[125] SCAQMD. *Rule 403 (Fugitive Dust)*. (Amended June 3, 2005). Retrieved from: https://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-403.pdf?sfvrsn=4
[126] EPA. *Technical Support Document*, *EPA Evaluation of BACM/MSM for the San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQS*, pp. 26-30. (February 2020). Retrieved from: https://www.regulations.gov/document/EPA-R09-OAR-2019-0318-0005

effectiveness of CMP measures on controlling PM2.5 emissions in the Valley, the District is committing to continue supporting and reviewing scientific research on the PM2.5 content, constituents, and stability during wind events of the many soil types found throughout the Valley. This ongoing evaluation will be conducted in close coordination with NRCS, agricultural sources, researchers through established processes including the San Joaquin Valleywide Air Pollution Study Agency, Policy Committee, and AgTech.

Although Rule 4550 already meets BACM and MSM for this source category, the District will go beyond MSM in this Plan and is committing to evaluate the feasibility and effectiveness of CMPs on fallow lands that are tilled or otherwise worked with implements of husbandry to reduce windblown PM2.5 emissions from disturbed fallowed acreage. This evaluation will rely on ongoing review of research, in coordination with NRCS, agricultural sources, and researchers, which recognizes the Valley's unique soil characteristics and agricultural practices to ensure that Valley-specific solutions are considered in this process. This commitment is being carried over from the District's *2018 PM2.5 Plan.* The District is currently conducting a robust rule development process to evaluate these opportunities, working collaboratively with industry stakeholders, NRCS, and other agencies to develop proposed rule amendments.

C.16 RULE 4692 (COMMERCIAL CHARBROILING)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	1.47	1.50	1.53	1.57	1.62	1.66	1.47
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	1.47	1.50	1.53	1.57	1.62	1.66	1.47
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

District Rule 4692 Description

District Rule 4692, adopted March 21, 2002, requires the installation and operation of PM control devices on chain-driven commercial charbroilers that cook 400 pounds of meat or more per week. Charbroiler exhaust transfers through the catalytic oxidizer with little loss of temperature. As high-temperature exhaust goes through the heated catalyst, PM and VOC are oxidized to carbon dioxide and water vapor. This chemical reaction releases energy that heats the catalyst and transfers it to a heat recovery system. Through current Rule 4692 requirements, affected chain-driven commercial charbroilers are required to have emissions control devices that achieve 83% control efficiency for PM and 86% control efficiency for VOC.

The District has attempted to impose similar requirements for underfired charbroiling operations, however the unavailability of a feasible and cost-effective control technology has been a barrier to establishing these requirements. Other air districts in California have encountered similar difficulties in identifying and requiring compliant control technologies for underfired charbroilers.

The District has contributed substantial time and effort into researching the emissions produced by underfired charbroilers in order to form a sound approach to controlling the emissions. Since 2009, the District has partnered with SCAQMD, BAAQMD, and EPA to further the research and evaluation of emission control technologies for underfired charbroilers. Through this effort, underfired charbroiler technology assessments have been conducted at UC Riverside College of Engineering's Center for Environmental Research & Technology (CE-CERT). The District provided in-kind technical support and the research was funded with over $500,000 in contributions from SCAQMD, BAAQMD, and EPA. This effort led to the establishment of published testing methodology, SCAQMD Method 5.1, which has been used as a benchmark methodology to standardize the testing of control efficiencies of kitchen exhaust pollution control units.

Rule 4692 was amended on June 21, 2018, to better understand emissions from underfired charbroilers in the Valley, and as an early measure in support of the District's commitment in the *2018 PM2.5 Plan*. The 2018 amendments added reporting and

registration requirements for commercial underfired charbroiler units, including Permit-Exempt Equipment Registration (PEER) requirements for units with a meat throughput greater than 400 pounds/week, or greater than 10,800 pounds/year, not to exceed 875 pounds/week. Upon adoption of the regulatory amendment, the District conducted outreach to affected restaurants, with the vast majority of restaurants subject to the reporting requirement now having submitted the required information. To date, the District has received over 4,100 one-time reports, of which 878 restaurants have reported operation of an underfired charbroiler. Of these 878 restaurants, 145 have reported a cooking throughput of at least 400 lbs of meat per week and have subsequently obtained a required PEER.

Additionally, the District created the Restaurant Charbroiler Technology Partnership (RCTP) program with the goal of reducing PM2.5 emissions from underfired commercial charbroilers. The program was initially allocated with $750,000 of incentive funding to fully cover all emissions control device installation costs as well as two years of device maintenance. RCTP initially struggled to find restaurants interested in participating in the program despite the program's willingness to cover all associated costs. Despite the District's efforts in promoting available funding under the RCTP program, the District has faced difficulty in finding restaurants willing to partner with the District to demonstrate new technologies. To date, only one restaurant, the Habit Burger Grill, has successfully completed two years of demonstration of a Molitron wet scrubber in their Stockton restaurant. Initially, the project experienced hood fan sizing issues, resulting in the restaurant being smoked out and forced to close temporarily. The Habit Burger Grill has subsequently installed these control devices on additional new restaurants, with some of these installations in the Valley.

In 2019, the District made an even larger concerted effort to conduct outreach to restaurants in the San Joaquin Valley regarding incentives available through RCTP. Through this outreach effort, the District received only 15 RCTP interest cards out of the over 4,200 restaurants that were contacted to comply with the 2018 Rule 4692 reporting and registration requirements. After discussing RCTP with these restaurants in more detail, none of these restaurants considered moving forward after this additional outreach.

In addition, the District tailored its approach and made direct contact with five prominent Valley restaurants, which resulted in a great deal of interest to evaluate the feasibility of installing the underfired emission control technology on their existing operations, with the understanding that all costs of the technology and two year maintenance would be covered through the RCTP program. District staff conducted multiple site visits to these operations, working with the restaurant owner/operator, engineering consultants, and technology vendors. Initial control system designs, quotes from vendors, and installation quotes from contractors were obtained and the feasibility of the technologies were fully assessed for each of the restaurants. However, after conducting a lengthy detailed analysis, none of the restaurants moved forward with the demonstration due to feasibility issues related to the installation of the control devices and local permitting challenges, as further described below, and concerns about the cost of maintenance

after the funded two-year demonstration period concluded under RCTP. The District is still actively pursuing restaurants for demonstration opportunities in the Valley.

How does District Rule 4692 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4692 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4692 to comparable requirements in rules from the following California nonattainment areas:

- Bay Area AQMD Regulation 6, Rule 2 (Amended December 5, 2007)[127]
- New York Department of Environmental Protection Title 24 of the Administrative Code, Section 24-149.4 (Amended November 6, 2016)[128]
- South Coast AQMD Rule 1138 (Adopted November 14, 1997)[129]
- Ventura County APCD Rule 74.25 (Adopted October 12, 2004)[130]

In their 2020 approval of the District's *2018 PM2.5 Plan* for the 2006 PM2.5 NAAQS, EPA found that Rule 4692 continues to establish BACM and MSM control requirements for this source category. In their Technical Support Document,[131] EPA stated the following:

> *"Rule 4692 implements the most stringent measures adopted or demonstrated to be technically and economically feasible for commercial chain-driven charbroilers, and we are not aware of control measures for existing under-fired*

[127] BAAQMD. *Regulation 6 Rule 2 (Commercial Cooking Equipment).* (Amended December 5, 2007). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-6-rule-2-commercial-cooking-equipment/documents/rg0602.pdf?la=en&rev=42fc0966398c43f9b585572708a5ea70

[128] New York Department of Environment Protection. *Title 24 of the Administrative Code, Section 24-149.4 (Commercial Char Broilers).* (Amended November 6, 2016). Retrieved from: https://www1.nyc.gov/assets/dep/downloads/pdf/air/air-pollution-control-code.pdf

[129] SCAQMD. *Rule 1138 (Control of Emissions from Restaurant Operations).* (Adopted November 14, 1997). Retrieved from: https://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1138.pdf?sfvrsn=4

[130] VCAPCD. *Rule 74.25 (Restaurant Cooking Operations).* (Adopted October 12, 2004). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.25.pdf

[131] EPA. *Technical Support Document*, *EPA Evaluation of BACM/MSM for the San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQS*, pp. 30-36. (February 2020). Retrieved from: https://www.regulations.gov/document/EPA-R09-OAR-2019-0318-0005

charbroilers that are technologically and economically feasible for implementation in the SJV."

The District reviewed all rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4692 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rule is demonstrated below.

New York Department of Environmental Protection (NYDEP)

- City of New York Title 24 of the Administrative Code, Section 24-149.4 (Emission Reduction Technologies for Char Broilers)

	SJVAPCD Rule 4692	NYDEP Title 24 §24-149.4
Applicability	Chain-driven charbroilers and underfired charbroilers at commercial cooking operations.	Chain-driven charbroilers and underfired charbroilers at commercial cooking operations.
Exemption	Charbroilers that cook <400 lbs of meat per week, or ≤10,800 lbs of meat per year and the total amount of meat cooked per week is <875 lbs.	Charbroilers that cook <875 lbs of meat per week.
Requirements	Requires that chain-driven charbroilers reduce PM emissions by 83% through the installation of an approved catalytic oxidizer. Registration requirements for under-fired charbroilers. Weekly record-keeping requirement for both charbroiler categories.	Requires catalytic oxidizer or control of PM10 by 75% for chain-driven charbroilers. Registration requirement for existing under-fired units. New under-fired units required to install control devices to limit PM emissions by 75% (currently unenforced).

The NYC DEP regulation, adopted in May 2016, requires the installation of control devices certified to provide at least 75% emissions reductions for new restaurants with underfired charbroilers that cook 875 pounds or more of meat per week. Based on staff-level discussions, NYC DEP does not currently have any known installations of these devices. Therefore, the requirements of District Rule 4692 are more stringent that those found in NYC's Section 24-149.4 for chain-driven charbroilers.

Potential Emission Reduction Opportunities

Although a variety of technologies for capturing emissions from underfired charbroilers have been tested over the years, ESPs and mechanical or media filtration are the most widely installed technologies for controlling particulate emissions from commercial underfired charbroilers. Below are general descriptions of each technology.

- **Electrostatic Precipitator (ESP):** This technology uses electrostatic processes to capture particles on electrically charged plates. ESPs are complex technology, but highly automated, and the operation costs include electricity and water usage. In addition, wastewater collection and discharge requirements must be met, which involves washing collection plates. ESPs are more expensive to install initially, but

have lower maintenance costs than the mechanical filtration units (generally about half of the maintenance costs of the filter units) and have a more effective control of the small particulates emitted by charbroiling.

- **Filtration (Mechanical or Media):** This technology uses groups of mechanical filters to capture particles. It is mechanically simpler than other technologies and the operation costs include electricity and filter replacements. Mechanical filtration units have been widely installed as pollution control devices for kitchen emissions, but maintenance of these units may be cost-prohibitive for mid-to high-volume underfired charbroiling operations due to the ongoing expense of changing the filters, and the large footprint of the units can make installation potentially infeasible.

- **Regenerative Filters:** Regenerative filters capture particles often on a catalyst surface, which then safely removes the particles during the regeneration process, thus allowing the filter to continue capturing particles with little maintenance or filter replacements. Regenerative filters are an emerging technology that has yet to be commercially proven in this source category. The District has had discussions with PureFlame and KhanTec to evaluate the feasibility of their technology. Notably, both technologies lack UL 8782 certification, and do not have installations in the United States.

- **Wool Filters:** Wool filters are another form of media filtration that uses wool instead of traditional filter media. A significant portion of PM2.5 produced by underfired charbroilers measure less than one micron, however, wool filters lack the ability to filter submicron particles at a high control efficiency thus rendering wool filters less efficient at reducing PM2.5.

The evaluation of installing emissions control technology on existing Valley restaurants through RCTP provided many insights as to the cost and technological feasibility of available controls. In addition to supporting and evaluating Valley-based underfired charbroiler control technology demonstrations, District staff has conducted an extensive review and assessment of underfired charbroiler control technology installations. This review included reaching out to other regulatory agencies in California and across the nation, technology manufacturers, and restaurants both inside and outside of the Valley to better understand the control technologies available for underfired charbroilers and real-world costs and experiences related to these technologies. While the District's evaluation has been successful in identifying potential underfired charbroiling control technologies, many questions remain with respect to understanding the feasibility and cost of these technologies, and whether restaurants can successfully operate and maintain these systems, as described in more detail below:

- **Installation cost of controls can be prohibitively expensive:** The cost of control units themselves are expensive, ranging from $42,500 up to $149,303 for the device itself. This does not take into account additional ducting, exhaust fan upgrades, or operation and maintenance costs. Recent discussions with control device manufacturers indicated that maintenance costs are significant and can quickly outweigh purchase costs within a few year. This fact is also supported by the

previous District demonstration project, which required $23,956 of annual maintenance.

- **Retrofitting controls on existing restaurants can be prohibitively expensive and technologically infeasible:** Based on discussions with restaurant operators, technology vendors, and other regulatory agencies, it can be extremely difficult and cost-prohibitive to add controls on existing restaurants. The installation process may require structural, electrical, or water-line modifications that substantially increase total project costs compared to new restaurants. In addition to significant purchase and installation costs, the installation process may require the restaurant to temporarily shut down, resulting in loss of revenue. The District's control strategy seeks to not disrupt business from being carried out, therefore adding another layer of cost and complexity to manage for existing restaurants. Furthermore, the existing restaurant may not have the authority to make changes to the building if the space is leased and the landlord is unwilling to accommodate any changes.

- **Maintenance of controls can be prohibitively expensive:** Regular maintenance of control devices is critical to ensure control effectiveness is maintained. All commercial technologies applicable to control underfired charbroilers are designed to capture PM2.5 and require regular maintenance to remove particles, ensure proper airflow, and maintain control efficiency. ESPs require regular cleaning of the plates capturing particles, as ESPs lose control efficiency when these plates are covered in grease particles and filters clog over time. Discussions with manufacturers indicate that maintenance costs are dependent on the control technology implemented and the type and volume of food cooked, and that most facilities require maintenance on a weekly to monthly basis.

- **Maintenance requires specially trained staff that may not be accessible to all restaurants:** Control device cleaning can be a complex process, requiring specially trained staff. Many manufacturers recommend that their staff or a trusted professional company perform maintenance. Training restaurant staff to perform this task are often not be feasible, and service companies capable of performing the maintenance may not be readily available nearby. Travel costs are another factor that needs be taken into account when determining maintenance costs. Any delays in required maintenance could cause significant economic impacts to restaurants.

- **Regenerative filters lack UL 8782 certification:** Regenerative filters appear to be a promising technology that seek to limit the amount of maintenance required to control PM2.5 since the device is self-cleaning by design. However, regenerative filters have not been commercially demonstrated to control underfired charbroiler emissions in the US. The lack of UL 8782 certification currently prevents two manufacturers, PureFlame and KhanTec, from entering the market. The District has had previous working relationship with KhanTec and struggled to install their device due to fire safety concerns since the device had not received UL 8782 certification. Discussions with PureFlame also present the same concerns, as well as lacking a fire suppression system. The District cannot recommend using a control device that may become a safety hazard.

Cost Analysis for New Restaurants

District Rule 4692 reduces emissions by requiring catalytic oxidizers for chain-driven charbroilers that meet rule applicability thresholds. Charbroiler exhaust transfers through the catalytic oxidizer with little loss of temperature. As high-temperature exhaust goes through the heated catalyst, PM and VOC are oxidized to carbon dioxide and water vapor. This chemical reaction releases energy that heats the catalyst and transfers it to a heat recovery system. Rule 4692 requires emission controls for chain-driven charbroilers that cook 400 pounds of meat or more per week.

A variety of technologies for capturing emissions from underfired charbroilers have been tested over the years, including ESPs, mechanical or media filtration, and wet scrubbers. ESPs and mechanical or media filtration are the most widely installed technologies for controlling PM from commercial underfired charbroilers. However, District analysis found no cost-effective technologies have been demonstrated as achieved in practice to date. As such, the rule currently does not have control requirements specific to underfired charbroilers.

This analysis uses the meat throughput data from each facility required to obtain a PEER for their operation, which cook over a threshold amount of meat and meat substitute products on an underfired charbroiler. According to the District's PEER data, 157 restaurants cooked at least 10,800 pounds of meat annually. Using the District's commercial cooking methodology,[132] the median PM2.5 emissions from each of these restaurants was 808 pounds annually.

The District conducted a cost analysis using the methods in EPA's Cost Manual.[133] The Cost Manual has relative estimates of all costs associated with ESPs including purchase price, installation, engineering, fabrication, contractors, and many more. The Cost Manual begins with the purchase price, then estimates all other costs based on a percentage of the purchase price.

The total capital investment required for ESPs was calculated using the formula in Table 3.16 of the Cost Manual. The formula from Table 3.16 was used to evaluate the lower and upper end of ESP purchase costs of $42,500 and $149,303 respectively. The Cost Manual estimates the total capital investment of $112,336 needed for ESPs with a purchase cost of $42,500. The total capital investment increases to $394,638 for devices with a $149,303 purchase cost. Notably, these capital costs do not include site preparation or building modifications, which would require additional investment from the facility.

When combined with operation and maintenance costs, even less expensive ESP devices are not cost effective solutions to reducing emissions from this source category.

[132] SJVAPCD. 2006 Area Source Emissions Inventory Methodology 690 – Commercial Cooking Operations. Retrieved from: https://www.valleyair.org/Air_Quality_Plans/EmissionsMethods/MethodForms/Current/CommercialCookin g2006.pdf

[133] EPA. *Air Pollution Control Cost Manual, Section 6, Particulate Matter Controls, Chapter 3: Electrostatic Precipitators*. (September 1999). Retrieved from: https://www.epa.gov/sites/default/files/2020-07/documents/cs6ch3.pdf

Based on previous District experience and discussions with manufacturers, the District estimates that $12,000 to $24,000 of annual operation and maintenance costs are required to keep pollution control devices performing properly. Maintenance typically includes but is not limited to media filter replacements, carbon filter replacements, duct or hood cleaning, or ESP plate cleaning. As one example, the District's demonstration of a wet scrubber with media filtration through the RCTP had reported $23,956 of annual maintenance costs. Notably, regular maintenance is required to keep ESPs control efficiency, which can drop to below 30% if not properly maintained. Although facilities are required to install a control device, it is only effective if maintenance is performed regularly. The District has recently had discussions with various vendors that have integrated automated cleaning functions; however, these units still require professional cleaning on a regular basis.

Table C-6 Direct Costs

	EPA Cost Manual Formula	Low Estimate	High Estimate
ESP + auxiliary equipment	1.0 A	$42,500	$149,303
Instrumentation	0.1 A	$4,250	$14,930
Sales Tax	0.03 A	$1,275	$4,479
Freight	0.05 A	$2,125	$7,465
Direct Cost Total	**B = 1.18 A**	**$50,150**	**$176,178**

Table C-7 Direct Installation Costs

	EPA Cost Manual Formula	Low Estimate	High Estimate
Foundations and Supports	0.04 B	$2,006	$7,047
Handling and Fabrication	0.50 B	$25,075	$88,089
Electrical	0.08 B	$4,012	$14,094
Piping	0.01 B	$502	$1,762
Insulation for Ductwork	0.02 B	$1,003	$3,524
Painting	0.02 B	$1,003	$3,524
Direct Installation Costs Total	**0.67 B**	**$33,601**	**$118,039**

Table C-8 Indirect Costs

	EPA Cost Manual Formula	Low Estimate	High Estimate
Engineering	0.20 B	$10,030	$35,236
Construction	0.20 B	$10,030	$35,236
Contractor	0.10 B	$5,015	$17,618
Start-up	0.01 B	$502	$1,762
Performance Test	0.01 B	$502	$1,762
Model Study	0.02 B	$1,003	$3,524
Contingencies	0.03 B	$1,505	$5,285
Total Indirect Costs	**0.57 B**	**$28,586**	**$100,421**

Table C-9 Other Costs

	EPA Cost Manual Formula	Low Estimate	High Estimate
Site Preparation	SP	As Required	As Required
Buildings	Bldg	As Required	As Required

Table C-10 Total Capital Investment

	EPA Cost Manual Formula	Low Estimate	High Estimate
Total	2.24 x B	**$112,336** *+ SP and Bldg*	**$394,638** *+ SP and Bldg*

The cost effectiveness was calculated twice to give a low and high total capital investment estimate by summing annualized one-time costs (annualized over a 10-year period using a 4 percent discount rate) and annual operation and maintenance costs. The District estimates a cost effectiveness of $74,424 per ton of PM2.5 controlled for ESP devices costing $42,500. These costs inflate to $209,180 per ton of PM2.5 controlled for ESP devices costing $149,303. As expected, the elevated purchase costs leads to excessive costs that will not be feasible for restaurant owners to incur an annual cost ranging from $25,850 to $72,655 of annual costs to control emissions. The average Valley restaurant only expects to profit $44,000 annually, which would require the owner to sacrifice approximately 2.80 to 9.87 years' worth of profits to cover the total capital investment.[134]

Table C-11 Cost Effectiveness Analysis for Underfired Charbroiler Controls

	Purchase Costs	Total Capital Investment	O&M (annual)	Annualized Cost	Cost Effectiveness (PEER Median Emissions)
Lowest Cost Estimate	$42,500	$112,336	$12,000	$25,850	**$74,424**
Highest Cost Estimate	$149,303	$394,638	$24,000	$72,655	**$209,180**

Cost Analysis for Existing Restaurants

Based on discussions with restaurant operators, technology vendors, and other regulatory agencies, it can be extremely difficult and cost-prohibitive to add controls on existing restaurants. The installation may require structural, electrical, or water-line modifications that may not be feasible. This makes installation costs much higher for existing restaurants compared to new restaurants that can integrate emissions controls into the design. The existing structure may not have the necessary space or structural support for the control unit. Furthermore, the existing restaurant may not have the authority to make changes to the building if the space is leased and the property owner is unwilling to accommodate. EPA's Cost Manual estimates that the total capital investment for existing restaurants would be 1.3 to 1.5 times more expensive than the total capital investment for new restaurants, with an estimated total capital investment ranging from $146,036 to $591,957, which would be far less cost effective than the already high cost effectiveness values shown previously for new restaurants.

District Commercial Underfired Charbroiling Emission Reductions Strategy

[134] SJVAPCD. *Proposed Commercial Underfired Charbroiling Emission Reduction Strategy*. (December 17, 2020). Retrieved from: https://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2020/December/final/11.pdf

In recognition of the above mentioned challenges, the District Governing Board adopted a multipronged strategy to promote emission reductions from this category, while minimizing the impact on restaurants during the COVID-19 pandemic. This strategy, approved by the Governing Board in December 2020, will require significant effort by the District through creating enhancements to the RCTP program, developing and providing guidance to local agencies for the development of ordinances, providing education to local agencies on the health impact of commercial cooking emissions, working with CARB as they consider developing a statewide Suggested Control Measure, working with CARB/EPA in making improvements to the emissions inventory for commercial underfired charbroiling, and formalizing the restaurant workgroup to stay in touch with current industry conditions and to continue to develop and deploy underfired charbroiler technology. In addition to this effort, the District continues to coordinate with CARB and EPA on feasibility of technology, and advocates for EPA and CARB to establish a new state/federal underfired charbroiler technology certification and demonstration program. To help address community impacts associated with commercial underfired charbroiling operations, this program would establish uniform certification requirements for vendors of emissions control technologies, and support the real-life demonstration of these technologies. Currently, there is no uniform certification program in place, and no technologies have been certified under regional programs. Given the community-level importance of reducing emissions from large underfired charbroiling operations, establishing a uniform certification and demonstration program would significantly accelerate the development and deployment of these technologies.

Evaluation Findings

Rule 4692 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

In addition to the existing emissions reductions already achieved through control requirements for chain-driven commercial charbroilers, the District continues to seek to achieve additional emission reductions from commercial underfired charbroilers. While there are ongoing improvements in the technology available for commercial cooking emissions, many technological and economic challenges remain, specifically for underfired charbroilers, as detailed above.

The need to reduce PM2.5 from commercial charbroiling continues to grow as EPA promulgates more stringent PM2.5 NAAQS. The lack of commercially available and feasibly demonstrated control technologies has been the primary barrier in moving forward with control strategies for reducing emissions from restaurants equipped with commercial charbroilers. Other air districts in California and other regions have encountered similar difficulties in identifying and requiring emissions control technologies for underfired charbroilers. Based on the importance of underfired charbroiling emissions as it relates to attainment of the federal PM2.5 standards in the future, collaborative work is needed to further understand the emissions from underfired

charbroiling, including potential control strategy opportunities to reduce emissions from this category.

The District has previously collaborated with other agencies including CARB, SCAQMD, and BAAQMD to evaluate and implement control strategies for underfired charbroilers. While significant work has been done, to date, barriers still exist to the commercial deployment of underfired charbroiler technology.

The District has recently formed the Charbroiler Collaborative Workgroup, consisting of the District, SCAQMD, BAAQMD, and CARB, to assist in overcoming all obstacles, including costs and emissions control issues preventing widespread control of underfired charbroilers. Through this collaborative and internally, the District commits to ongoing evaluation of potential controls for underfired charbroilers.

C.17 RULE 4702 (INTERNAL COMBUSTION ENGINES)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.36	0.34	0.31	0.28	0.26	0.24	0.24
NOx	6.68	6.26	5.52	4.86	4.36	4.02	3.93
	Winter Average - Tons per day						
PM2.5	0.29	0.28	0.25	0.24	0.22	0.21	0.21
NOx	5.02	4.74	4.20	3.72	3.38	3.14	3.08

District Rule 4702 Description

District Rule 4702 applies to any internal combustion (IC) engine rated at 25 brake horsepower (bhp) or greater. The purpose of this rule is to limit NOx, CO, VOC, PM, and SOx emissions from units subject to this rule. Facilities with units subject to this control measure represent a wide range of industries, including but not limited to oil and gas production, petroleum refineries, landfills, wastewater treatment plants, water districts, schools, and electrical power generation facilities.

Rule 4702 was adopted in August 2003, and has been amended several times. Most recently, on August 19, 2021, the District Governing Board adopted rule-strengthening amendments that were based on the results of a comprehensive review of the existing engine inventory in the Valley, available control technology, requirements in other air districts, and a cost-effectiveness analysis of requiring further controls for existing engines. As part of these regulatory efforts, hundreds of engines in the Valley have been equipped with the best available NOx and PM control technologies.

Rule 4702 contains stringent emission limits for NOx, CO, and VOCs, PM requirements for all categories of IC engines affected by the rule, and SOx control requirements for agricultural engines. Additionally, under Rule 4702, new and replacement compression ignition (CI) engines are required to be Tier 4, the cleanest certified engine available. As a result, Rule 4702 has significantly reduced emissions from non-agricultural and agricultural IC engines, with substantial investments made by the affected sources to comply with the rule.

How does District Rule 4702 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines applicable to this source category.

A. Alternative Control Techniques (ACT)

- *Alternative Control Techniques Document – NOx Emissions from Stationary Reciprocating Internal Combustion Engines (EPA-453/R-93-032 1993/07, updated 2000/09)*

The District evaluated the requirements contained within the ACT for Stationary Reciprocating Internal Combustion Engines and found no requirements that were more stringent than those already in Rule 4702.

B. New Source Performance Standards (NSPS)

- *40 CFR 60 Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (2020/12 and 2021/06)*

The District evaluated the requirements contained within Subpart IIII and found no requirements that were more stringent than those already in Rule 4702.

- *40 CFR 60 Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines (2020/12 and 2021/06)*

The District evaluated the requirements contained within Subpart JJJJ and found no requirements that were more stringent than those already in Rule 4702.

State Regulations

- *17 CCR §93114 – Airborne Toxic Control Measure to Reduce Particulate Emissions from Diesel-Fueled Engines—Standards for Nonvehicular Diesel Fuel (2003/07)*
- *17 CCR §93115 – Airborne Toxic Control Measure for Stationary Compression-Ignition Engines (2004/02)*

The District implements the requirements of 17 CCR §§93114 and 93115 through Rule 4702 and the District's new source review permitting program (Rule 2201).

- *17 CCR §93116 – Airborne Toxic Control Measure for Diesel Particulate Matter from Portable Engines Rated at 50 Horsepower and Greater (2018/08)*

The District evaluated the requirements contained within 17 CCR §93116 and found no requirements that were more stringent than those already in Rule 4702.

How does District Rule 4702 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4702 to comparable requirements in rules from the following nonattainment areas:

- Bay Area AQMD Regulation 9, Rule 8 (Amended July 25, 2007)[135]
- Sacramento Metropolitan AQMD Rule 412 (Adopted June 1, 1995)[136]
- San Diego County APCD Rule 69.4.1 (Adopted July 8, 2020)[137]
- South Coast AQMD Rule 1110.2 (Amended November 1, 2019)[138]
- Ventura County APCD Rule 74.9 (Amended November 8, 2005)[139]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4702 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

San Diego County APCD

- SDAPCD Rule 69.4.1 (Stationary Reciprocating Internal Combustion Engines)

	SJVAPCD Rule 4702	SDAPCD Rule 69.4.1
Applicability	IC engines rated at ≥25 bhp.	IC engines rated at ≥50 bhp.
Exemptions	• Limited to operate ≤100 hrs/yr • De-rated engine that has been physically limited and restricted by permit to an operational level of <50 hp not used in agricultural operation (prior to 06/01/04) • De-rated engine that has been physically limited and restricted by permit to an operational level of <50 bhp used in agricultural operation (prior to 06/01/05)	• Engines used exclusively in connection with a structure designed for and used as a dwelling for not more than four families • Engines used exclusively in agricultural operations for the growing of crops or the raising of fowl or animals • Any engine when operated exclusively within a permitted test cell solely for the research, development, or testing of gas turbine engines, reciprocating IC engines, or their components • Any engine used exclusively in conjunction with military tactical support equipment

[135] BAAQMD. *Regulation 9, Rule 8 (Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines)*. (Amended July 25, 2007). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-8-nitrogen-oxides-and-carbon-monoxide-from-stationary-internal-combustion-engines/documents/rg0908.pdf?la=en
[136] SMAQMD. *Rule 412 (Stationary Internal Combustion Engines Located at Major Stationary Sources of NOx)*. (Adopted June 1, 1995). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule412.pdf
[137] SDAPCD. *Rule 69.4.1 (Stationary Reciprocating Internal Combustion Engines)*. (Adopted July 8, 2020). Retrieved from: https://www.sdapcd.org/content/dam/sdapcd/documents/rules/current-rules/Rule-69.4.1.pdf
[138] SCAQMD. *Rule 1110.2 (Emissions from Gaseous- and Liquid-Fueled Engines)*. (Amended November 1, 2019). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1110-2.pdf
[139] VCAPCD. *Rule 74.9 (Stationary Internal Combustion Engines)*. (Amended November 8, 2005). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.9.pdf

	SJVAPCD Rule 4702		SDAPCD Rule 69.4.1
Requirements			
Non-Agricultural Operation IC Engines (ppmv @ *15% oxygen on a dry basis)*			
Rich-Burn	Waste Gas-Fueled	11	50
	Cyclic Loaded, Field Gas Fueled	11	No Such Category
	Limited Use	11	No Such Category
	Not Listed Above	11	Existing: 25 New/Replacement: 11
Lean-Burn	Limited Use	11	No Such Category
	Used for Gas Compression	40, or 93% reduction	No Such Category
	Waste Gas-Fueled	40, or 90% reduction	65
	Not Listed Above	11	65
Agricultural Operation Spark-Ignited IC Engines (ppmv @ *15% oxygen on a dry basis)*			
Rich-Burn[140]	11, or 0.15 g/bhp-hr		New/Replacement: 90
Lean-Burn[141]	43, or 0.6 g/bhp-hr		New/Replacement: 150
Agricultural Operation Compression-Ignited IC Engines[142] (ppmv @ *15% oxygen on a dry basis)*			
	Tier 3 or Tier 4 Certified IC Engine		Exempt

The District found the requirements contained within SDAPCD Rule 69.4.1 are not more stringent than those already in District Rule 4702. Therefore, District Rule 4702 is as stringent as or more stringent than SDAPCD Rule 69.4.1.

South Coast AQMD

- SCAQMD Rule 1110.2 (Emissions from Gaseous- and Liquid-Fueled Engines)

	SJVAPCD Rule 4702	SCAQMD Rule 1110.2
Applicability	IC engines rated at ≥25 bhp.	Stationary and portable IC engines rated >50 bhp.
Exemptions	• Limited to operate ≤100 hrs/yr • De-rated engine that has been physically limited and restricted by permit to an operational level of <50 hp not used in agricultural operation (prior to 06/01/04) • De-rated engine that has been physically limited and restricted by permit to an operational level of <50 bhp used in agricultural operation (prior to 06/01/05)	• Engines powering orchard wind machines • Emergency engines permitted to operate no more than 200 hrs/yr • Laboratory engines used in research and testing purposes • Engines operated for purposes of performance verification and testing • Auxiliary engines used to power other engines or gas turbines during start-ups

[140] There are only 2 rich-burn spark ignited engines operating in SCAQMD per discussions with SCAQMD staff.
[141] There are no lean-burn spark ignited ag engines operating in SCAQMD per discussions with SCAQMD staff.
[142] Information from SCAQMD indicates that there are no stationary non-emergency diesel IC engines that operate in the SCAQMD.

	SJVAPCD Rule 4702		SCAQMD Rule 1110.2
			• Portable engines that are registered under the state Portable Equipment Registration Program (PERP) • Engines operating on San Clemente Island • Tier 4 certified stationary agricultural IC engines for which the electric utility rejected an application for an electrical line extension to the engine location or that do not qualify for Carl Moyer Program funding • IC engine start-up periods, until sufficient operating temperatures are reached for proper operation of emission control equipment or for the tuning of the engines and/or emission control equipment, and engine shutdown periods. The periods shall not exceed 30 minutes, unless a longer period, not exceeding two hours, is approved in writing • IC engine start-ups, after an engine overhaul or major repair, or the replacement of catalytic emission control equipment, for a period not to exceed four operating hours • Initial commissioning of a new engine for a period not exceeding 150 operating hours • Engines rated ≤100 bhp used exclusively for electrical generation at remote two-way radio transmission towers where no utility, electricity, or natural gas is available within a ½ mile radius, and is fired exclusively on diesel #2, compressed natural gas, or LPG • NOx emissions from existing IC engines subject to SCAQMD RECLAIM Program (pursuant to SCAQMD Rule 2001 – RECLAIM Applicability) • Engines operated in either the Southern California Coastal Waters or Outer Continental Shelf Waters that power cranes and are certified to meet the Tier 4 Final emission standards • The facility operator of MM PRIMA DESHECHA ENERGY, LLC provided that a plan was submitted before 07/01/16, for the permanent shutdown of all subject equipment by 10/01/22 • Engines located at landfills or publicly owned treatment works that are subject to a NOx emission limit in a Regulation XI rule adopted/amended after 11/01/19
Requirements			
Non-Agricultural Operation IC Engines (ppmv @ *15% oxygen on a dry basis)*			
Rich-Burn	Waste Gas-Fueled	11	11
	Cyclic Loaded, Field Gas Fueled	11	No Such Category

	SJVAPCD Rule 4702		SCAQMD Rule 1110.2
	Limited Use	11	No Such Category
	Not Listed Above	11	11
Lean-Burn	Limited Use	11	No Such Category
	Used for Gas Compression	40, or 93% reduction	No Such Category
	Waste Gas-Fueled	40, or 90% reduction	11
	Not Listed Above	11	11
Agricultural Operation Spark-Ignited IC Engines (ppmv @ *15% oxygen on a dry basis)*			
Rich-Burn[143]	11, or 0.15 g/bhp-hr		11
Lean-Burn[144]	43, or 0.6 g/bhp-hr		11
Agricultural Operation Compression-Ignited IC Engines[145] (ppmv @ *15% oxygen on a dry basis)*			
	Tier 3 or Tier 4 Certified IC Engine		11, or Tier 4 Certified IC Engine

Many of the engine applications found in the San Joaquin Valley vary considerably from engine applications in SCAQMD. Outside of the few major urban centers, the vast majority of the 25,000 square miles of land in the Valley is rural land primarily used for agriculture. Agricultural IC engines can be located nearly anywhere in the Valley, including remote locations that are many miles away from the Valley's major urban centers. For example, some spark-ignited agricultural IC engines are located over 35 miles from an urbanized area, with engines operating in farms that may cover tens of thousands of acres of land. In contrast, SCAQMD is primarily an urban area with far fewer farms, with a very limited number of agricultural engines, and all natural gas fired agricultural engines operating within or very near urban areas.

A majority of the engines subject to District Rule 4702 are used in agricultural operations as described above, while there are only two rich-burn agricultural engines, and no lean-burn agricultural engines operating in SCAQMD. Due to the stark differences between the urban environment of the South Coast engines and the very rural and expansive environment of the Valley, the operation of these agricultural engines at a lower limit has not been achieved in practice as it relates to the conditions of the Valley. For comparable units, District Rule 4702 has similar limits to SCAQMD Rule 1110.2, and both rules have significantly lower emission limits than other California District rules. Therefore, District Rule 4702 is as stringent as or more stringent than SCAQMD Rule 1110.2.

[143] There are only 2 rich-burn spark ignited engines operating in SCAQMD per discussions with SCAQMD staff.
[144] There are no lean-burn spark ignited ag engines operating in SCAQMD per discussions with SCAQMD staff.
[145] Information from SCAQMD indicates that there are no stationary non-emergency diesel IC engines that operate in the SCAQMD.

Potential Emission Reduction Opportunities

Over the years, the District has adopted numerous generations of rules and rule amendments for engines that have significantly reduced NOx and VOC emissions from this source category. As part of these regulatory efforts, hundreds of engines in the Valley have been equipped with the best available NOx and VOC control technologies.

Most recently, in August 2021, the District Governing Board adopted amendments to Rule 4702 that included even more stringent emission limits for internal combustion engines operating in the Valley. Emissions limits were determined based on the results of a comprehensive review of the existing engine inventory in the Valley, available control technology (including BACT requirements), requirements in other air districts, and a cost-effectiveness analysis of requiring further controls for existing engines. The amendments included compliance deadlines of December 31, 2023, and December 31, 2029, depending on unit type; therefore facilities have either recently complied or are still in the process of complying with the recent amendments.

Zero-Emission Opportunities

To ensure that all potential emission reduction opportunities are evaluated, the District performed a review of electric and solar powered motors. Electric and solar powered motors are commercially available and generally cost about the same as similarly sized spark-ignited units. Economic impacts would also be influenced by the increasing cost of electricity in California as electricity rates rose 48% from 2010 to 2020 (9.8 cents/kW-hr to 14.55 cents/kW-hr) based on annual data for 2020 provided by the U.S. Energy Information Administration.[146] The California Energy Commission projects that electricity prices will further rise by an average of 15% between 2020 to 2035 across all sectors.[147] Additionally, for solar powered motors, there is an inconsistency to how much electricity can be produced at any location, based on the availability of direct sunlight and the amount of space a facility is able to designate towards solar panels. The specific consideration of crop land would come into play for engines that operate as a part of an agricultural facility, as many farmers would have difficulty designating space for the solar equipment. In addition, there is a lack of existing electric infrastructure in many areas of the Valley, including some farms and oil fields. There would be considerable costs associated with the line extension and other technology necessary to gain access to electricity or solar power in these remote locations.

For facilities that lack the infrastructure needed to connect to the electrical power grid, there are additional technologies that would be necessary in order to operate an electric or solar powered pump motor. These facilities could potentially incur much larger costs because of the need to install excess capacity, and water storage or batteries to store the electrical energy generated when the solar system was not generating electricity.

[146] U.S. Energy Information Administration, Form EIA-860, Annual Electric Generator Report, U.S. Energy Information Administration, Form EIA-861, Annual Electric Power Industry Report, U.S. Energy Information Administration, Form EIA-923, Power Plant Operations Report and predecessor forms.
[147] California Energy Commission. *Electricity Rate Scenarios*. September 30, 2021. Retrieved from: https://www.energy.ca.gov/sites/default/files/2021-09/1%20Electricity%20Rate%20Forecast%20Updates_ADA.pdf

The installation and maintenance of these systems could raise the costs of an electric engine/solar-system exponentially, with estimated cost effectiveness values of $150,000-$260,000, or higher, per ton of emissions reduced for each unit installed, depending on the size of the engine.

Due to technological and economic challenges, it is not feasible for the District to set a standard requiring engines to be replaced with electric motors or solar-powered motors at this time. However, the District has facilitated the voluntary replacement of thousands of high-polluting diesel agricultural irrigation pump engines with cleaner, zero or near-zero emission technology through the Agricultural Irrigation Pump Engine Repower Program. In fact, over the past 10 years alone, the District has replaced more than 900 older, high-polluting engines with cleaner technology, with a majority of those being replaced with electric motors. This program provides Valley growers up to 85% of the eligible costs associated with replacing older high-polluting diesel engines with the cleanest available diesel technology or zero-emission electric motors, including electric line extension costs. The program provides an economic benefit to Valley growers to upgrade to more efficient equipment while achieving significant, cost-effective emissions reductions from agricultural operations throughout the Valley. The District has partnered with the California Public Utilities Commission (PUC) and local utilities to provide additional incentives and for line extensions as well as beneficial electric rate schedules, to further incentivize the shift to cleaner technology. Eligible projects are funded with a variety of local, state, and federal sources, including but not limited to District Indirect Source Review mitigation fees, Carl Moyer Program funding, AB 923 funding, Federal Designated Funding, and Federal Diesel Air Shed Grant funding.

The District will continue to work with agricultural operations to further reduce NOx emissions from this source category through both an incentive-based and regulatory approach, as technologically and economically feasible.

Evaluation Findings

Rule 4702 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.18 RULE 4703 (STATIONARY GAS TURBINES)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	1.36	1.25	1.20	1.16	1.08	0.98	0.98
NOx	2.66	2.47	2.37	2.29	2.15	1.98	1.97
	Winter Average - Tons per day						
PM2.5	1.33	1.22	1.18	1.14	1.06	0.96	0.96
NOx	2.62	2.43	2.34	2.26	2.12	1.95	1.95

District Rule 4703 Description

District Rule 4703 limits NOx and CO emissions from stationary gas turbines with ratings equal to or greater than 0.3 MW or a maximum heat input of more than 3.0 MMBtu/hr. The main rule requirement is the limitation of NOx emissions. Laboratory units used in research and testing for the advancement of gas turbine technology, units limited by permit condition to be operated exclusively for firefighting and/or flood control, and emergency standby units limited by permit condition to operate less than 100 hours per calendar year for maintenance and testing purposes are not subject to the emission requirements of this rule.

How does District Rule 4703 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines applicable to this source category.

A. Alternative Control Techniques (ACT)

- *Alternative Control Techniques Document – NOx Emissions from Stationary Gas Turbines (EPA-453/R-93-007 1993/01)*

The District evaluated the requirements contained within the ACT for NOx Emissions from Stationary Gas Turbines and found no requirements that were more stringent than those already in Rule 4703.

B. New Source Performance Standards (NSPS)

- *40 CFR 60 Subpart GG – Standards of Performance for Stationary Gas Turbines (2009/03)*

The District evaluated the requirements contained within Subpart GG and found no emission requirements that were more stringent than those already in Rule 4703.

- *40 CFR 60 Subpart KKKK – Standards of Performance for Stationary Combustion Turbines*

The District evaluated the requirements contained within Subpart KKKK and found no emission requirements that were more stringent than those already in Rule 4703.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4703 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4703 to comparable requirements in rules from the following nonattainment areas:

- Bay Area AQMD Regulation 9, Rule 9 (Amended December 6, 2006)[148]
- Sacramento Metropolitan AQMD Rule 413 (Amended March 24, 2005)[149]
- San Diego County APCD Rule 69.3.1 (Adopted December 9, 2021)[150]
- South Coast AQMD Rule 1109.1 (Adopted November 5, 2021)[151]
- South Coast AQMD Rule 1134 (Amended February 4, 2022)[152]
- South Coast AQMD Rule 1135 (Amended January 7, 2022)[153]
- South Coast AQMD Rule 1150.3 (Adopted February 5, 2021)[154]

[148] BAAQMD. *Regulation 9, Rule 9 (Nitrogen Oxides from Stationary Gas Turbines).* (Amended December 6, 2006). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-9-nitrogen-oxides-and-carbon-monoxide-from-stationary-gas-turbines/documents/rg0909.pdf?la=en&rev=fed388c23f264d6ebd5e6e40096bdf79
[149] SMAQMD. *Rule 413 (Stationary Gas Turbines).* (Amended March 24, 2005). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule413.pdf
[150] SDAPCD. *Rule 69.3.1 (Stationary Gas Turbine Engines).* (Adopted December 9, 2021). Retrieved from: https://www.sdapcd.org/content/dam/sdapcd/documents/rules/current-rules/Rule-69.3.1.pdf
[151] SCAQMD. *Rule 1109.1 (Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Operations).* (Adopted November 5, 2021). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/r1109-1.pdf?sfvrsn=8
[152] SCAQMD. *Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines).* (Amended February 4, 2022). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1134.pdf?sfvrsn=4.
[153] SCAQMD. *Rule 1135 (Emissions of Oxides of Nitrogen from Electricity Generating Facilities).* (Amended January 7, 2022). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1135.pdf?sfvrsn=4
[154] SCAQMD. *Rule 1150.3 (Emissions of Oxides of Nitrogen from Combustion Equipment at Landfills).* (Adopted February 5, 2021). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1150-3.pdf?sfvrsn=10

- South Coast AQMD Rule 1179.1 (Adopted October 2, 2020)[155]
- Ventura County APCD Rule 74.23 (Amended November 12, 2019)[156]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4703 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

San Diego County APCD

- SDAPCD Rule 69.3.1 (Stationary Gas Turbine Engines)

	SJVAPCD Rule 4703	SDAPCD Rule 69.3.1
Applicability	Gas turbines ≥0.3 MW or a maximum heat input rating of 3 MMBtu/hr.	Stationary gas turbines ≥0.3 MW or greater.
Exemptions	• Laboratory turbines used in research and testing for the advancement of gas turbine technology • Units limited by permit condition to be operated exclusively for firefighting and/or flood control • Emergency standby turbines limited by permit condition to operate <100 hr/yr for maintenance and testing	• Gas turbine engine when operated exclusively for research, development, or testing of gas turbine engines • Any portable gas turbine engine • Any stationary gas turbine engine with power rating ≤0.4 MW used in conjunction with military tactical support equipment operated at military site, provided operations do not exceed 1,000 hr/yr • NOx limits do not apply to any emergency unit provided that operation for testing or maintenance to ensure operability in event of an emergency situation is ≤80 hr/yr
	***NOx Emission Limits:** **Units Rated <3 MW** Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv **Units Rated ≥3 MW and <10 MW** *Pipeline Gas*: Steady State - 8 ppmv Non-Steady State - 12 ppmv Liquid Fuel - 25 ppmv *<877 hr/yr*: Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv *≥877 hr/yr and not listed above*: Gas Fuel - 5 ppmv Liquid Fuel - 25 ppmv	***NOx Emission Limits:** **Units Rated ≥0.3 and <2.9 MW** Gas Fuel - 42 ppmv Liquid Fuel - 65 ppmv **Units Rated ≥2.9 and <10 MW** Gas Fuel - 25 ppmv Liquid Fuel - 65 ppmv **Units Rated <4 MW Operating <877 hr/yr** Gas Fuel - 42 ppmv Liquid Fuel - 65 ppmv **Units Rated ≥*10 MW*** *Without installed post-combustion air pollution control equipment* Gas Fuel - 15 ppmv Liquid Fuel - 42 ppmv

[155] SCAQMD. *Rule 1179.1 (Emission Reductions from Combustion Equipment at Publicly Owned Treatment Works Facilities)*. (Adopted October 2, 2020). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1179-1.pdf?sfvrsn=10

[156] VCAPCD. *Rule 74.23 (Stationary Gas Turbines)*. (Amended November 12, 2019). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.23.pdf

	SJVAPCD Rule 4703	SDAPCD Rule 69.3.1
	Units Rated ≥10 MW *Combined Cycle*: Gas Fuel - 5 ppmv (standard) Gas Fuel - 3 ppmv (enhanced) Liquid Fuel - 25 ppmv *Simple Cycle and ≥877 hr/yr*: Gas Fuel - 5 ppmv (standard) Gas Fuel - 3 ppmv (enhanced) Liquid Fuel - 25 ppmv *Simple Cycle and >200 hr/yr and <877 hr/yr*: Gas Fuel - 5 ppmv Liquid Fuel - 25 ppmv *Simple Cycle and ≤200 hr/yr*: Gas Fuel - 25 ppmv Liquid Fuel - 42 ppmv	*With installed post-combustion air pollution control equipment* Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv

*Referenced at 15% O2

The District evaluated the requirements contained within SDAPCD's Rule 69.3.1 and found no requirements that were more stringent than those already in Rule 4703. Therefore, District Rule 4703 is as stringent as or more stringent than SDAPCD Rule 69.3.1.

South Coast AQMD

- SCAQMD Rule 1109.1 (Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Operations)

This rule includes limits for gas turbines operating at petroleum refineries. The District does not currently have any gas turbines operating at petroleum refineries.

- SCAQMD Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines)

	SJVAPCD Rule 4703	SCAQMD Rule 1134
Applicability	Gas turbines rated ≥0.3 MW or with a maximum heat input rating of >3 MMBtu/hr.	Gas turbines rated ≥0.3 MW output or with a maximum heat input rating of >3 MMBtu/hr and operated on gaseous and/or liquid fuel.
Exemptions	• Laboratory turbines used in research and testing for the advancement of gas turbine technology • Units limited by permit condition to be operated exclusively for firefighting and/or flood control • Emergency standby turbines limited by permit condition to operate <100 hr/yr for maintenance and testing	• Laboratory turbines used in research and testing • Gas turbines used exclusively for firefighting and/or flood control • Emergency standby units used to provide electrical power, water pumping for flood control or firefighting, potable water pumping, or sewage pumping provided non-resettable engine hour requirement and operate <200 hr/yr • Gas turbines subject to SCAQMD rules for NOx emissions from electricity generating

	SJVAPCD Rule 4703	SCAQMD Rule 1134	
		facilities; petroleum refineries and related operations, landfills, or publicly owned treatment works facilities • Combined cycle gas turbines installed prior to 04/05/19 have conditional exemptions • Low use installed prior to 04/05/19 have specific exemptions and subject to NOx limits at 12 ppmv	
Requirements	***NOx Emission Limits:** **Units Rated <3 MW** Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv **Units Rated ≥3 MW and <10 MW** *Pipeline Gas*: Steady State - 8 ppmv Non-Steady State - 12 ppmv Liquid Fuel - 25 ppmv *<877 hr/yr*: Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv *≥877 hr/yr and not listed above*: Gas Fuel - 5 ppmv Liquid Fuel - 25 ppmv **Units Rated ≥10 MW** *Combined Cycle*: Gas Fuel - 5 ppmv (standard) Gas Fuel - 3 ppmv (enhanced) Liquid Fuel - 25 ppmv *Simple Cycle and ≥877 hr/yr*: Gas Fuel - 5 ppmv (standard) Gas Fuel - 3 ppmv (enhanced) Liquid Fuel - 25 ppmv *Simple Cycle and >200 hr/yr and <877 hr/yr*: Gas Fuel - 5 ppmv Liquid Fuel - 25 ppmv *Simple Cycle and ≤200 hr/yr*: Gas Fuel - 25 ppmv Liquid Fuel - 42 ppmv	***NOx Emission Limits:** *Prior to Jan. 1, 2024:* **Units Rated <2.9 MW** Gas Fuel - 25 ppmv **Units Rated ≥2.9 MW and <10 MW** *No SCR* Gas Fuel - 15 ppmv *With SCR* Gas Fuel - 9 ppmv **Units Rated ≥10 MW** *No SCR* Gas Fuel - 12 ppmv *With SCR* Gas Fuel - 9 ppmv	*After Jan. 1, 2024:* *Natural Gas – Combined Cycle/Cogeneration Turbine* 2 ppmv or 2.5 ppmv if currently at that limit *Natural Gas – Simple Cycle Turbine* 2.5 ppmv *Produced Gas* 9 ppmv *Other Gas Turbine* 12.5 ppmv *Natural Gas – Compressor Gas Turbine* 3.5 ppmv Shall not burn liquid fuel in a stationary gas turbine except for: • Those located in the Outer Continental Shelf (NOx limit of 30 ppmv) • Those providing power for health facility during force majeure natural gas curtailment (no limit specified)

*Referenced at 15% O2

In EPA's evaluation of BACM/MSM for the *2018 PM2.5 Plan*,[157] District Rule 4703 requirements were compared to the requirements in SCAQMD Rule 1134, and it was

[157] EPA. *Technical Support Document, Evaluation of BACM/MSM, San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQS.* (February 2020). Retrieved from: https://www.regulations.gov/document/EPA-R09-OAR-2019-0318-0005

determined that Rule 4703 implemented BACM and MSM for this source category. SCAQMD recently implemented lower limits on January 1, 2024, from previous limits ranging from 9 ppmv to 25 ppmv. Notably, many units were excluded from previous rule requirements. For these reasons, at the time of SCAQMD's rule amendments, a majority of units were permitted at high limits; thus limits as low as 2 ppmv were demonstrated to be cost-effective and feasible. District Rule 4703 currently requires units to meet limits as low as 3 ppmv, and as such, adopting the slightly lower SCAQMD limits would in many cases result in only a 1 ppmv marginal improvement in NOx emission reductions and therefore would not be cost-effective. South Coast also made a similar determination in their rulemaking, and thus included a near-limit exemption for units that have limits close to the new limit.

- SCAQMD Rule 1135 (Emissions of Oxides of Nitrogen from Electricity Generating Facilities)

	SJVAPCD Rule 4703	SCAQMD Rule 1135	
Applicability	Gas turbines rated ≥0.3 MW or with a maximum heat input rating of >3 MMBtu/hr.	Electric Generating Units at a facility owned or operated by an investor-owned electric utility or a publicly owned electric utility that has one or more electric generating units, or has electric generating units with a combined generation capacity ≥50 MW of electric power for distribution in the state or local electric grid system. Includes gas turbines with the exception of cogeneration units.	
Exemptions	• Laboratory turbines used in research and testing for the advancement of gas turbine technology • Units limited by permit condition to be operated exclusively for firefighting and/or flood control • Emergency standby turbines limited by permit condition to operate <100 hr/yr for maintenance and testing	• Combined cycle gas turbines installed prior to 11/02/18 have conditional exemptions if they have a 2.5 ppmv permit limit for NOx as of 11/02/18 • Low use units installed prior 11/02/18 have conditional exemptions if they maintain an annual capacity factor below 25% in each calendar year and average calendar year capacity factor below 10% on a 3-year rolling basis	
Requirements	***NOx Emission Limits:** **<u>Units Rated <3 MW</u>** Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv **<u>Units Rated ≥3 MW and <10 MW</u>** <u>*Pipeline Gas*</u>: Steady State - 8 ppmv Non-Steady State - 12 ppmv Liquid Fuel - 25 ppmv <u>*<877 hr/yr*</u>: Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv	***NOx Emission Limits:** *Prior to Jan. 1, 2024:* <u>*For Southern Cal Edison*</u> 0.15 lb/MWh <u>*For City of Glendale*</u> 0.20 lb/MWh <u>*For City of Burbank*</u> 0.20 lb/MWh <u>*For City of Pasadena*</u> 0.20 lb/MWh	*After Jan. 1, 2024:* ***For units constructed after 11/02/18:*** <u>*Combined Cycle*</u>: Gas Fuel - 2 ppmv on 60 minute rolling average <u>*Simple Cycle*</u>: Gas Fuel - 2.5 ppmv on 60 minute rolling average

	SJVAPCD Rule 4703	SCAQMD Rule 1135	
	≥877 hr/yr and not listed above: Gas Fuel - 5 ppmv Liquid Fuel - 25 ppmv **Units Rated ≥10 MW** Combined Cycle: Gas Fuel - 5 ppmv (standard) Gas Fuel - 3 ppmv (enhanced) Liquid Fuel - 25 ppmv Simple Cycle and ≥877 hr/yr: Gas Fuel - 5 ppmv (standard) Gas Fuel - 3 ppmv (enhanced) Liquid Fuel - 25 ppmv Simple Cycle and >200 hr/yr and <877 hr/yr: Gas Fuel - 5 ppmv Liquid Fuel - 25 ppmv Simple Cycle and ≤200 hr/yr: Gas Fuel - 25 ppmv Liquid Fuel - 42 ppmv		***For units where operator applied for initial ATC prior to 11/02/18:*** Same limits as above, with limited exceptions to be at 2.5 ppmv for combined cycle along with using the rolling average time requirements specified in the PTO on 11/02/18

*Referenced at 15% O2

Similar to the above discussion regarding SCAQMD Rule 1134, the new limits in SCAQMD Rule 1135 were only recently implemented on January 1, 2024. Many units in South Coast, such as combined and simple cycle units, either met the proposed limit or were exempt from retrofitting due to the low-use exemption in Rule 1135. District Rule 4703 currently requires units to meet limits as low as 3 ppmv, and as such, adopting the slightly lower SCAQMD limits would in many cases result in only a 1 ppmv marginal improvement in NOx emission reductions and therefore would not be cost-effective. South Coast also made a similar determination in their rulemaking, and thus included a near-limit exemption for units that have limits close to the new limit.

- SCAQMD Rule 1150.3 (Emissions of Oxides of Nitrogen from Combustion Equipment at Landfills

This rule includes limits for gas turbines operating at landfills. The District does not currently have any gas turbines operating at landfills.

- SCAQMD Rule 1179.1 (Emission Reductions from Combustion Equipment at Publicly Owned Treatment Works Facilities).

This rule includes limits for gas turbines operating at publicly owned treatment works facilities. The District does not currently have any permitted gas turbines operating at publicly owned treatment works facilities.

Ventura County APCD

- VCAPCD Rule 74.23 (Stationary Gas Turbines)

	SJVAPCD Rule 4703	VCAPCD Rule 74.23
Applicability	Gas turbines ≥0.3 MW or a maximum heat input rating of 3 MMBtu/hr.	Gas turbines ≥0.3 MW or greater.
Exemptions	• Laboratory turbines used in research and testing for the advancement of gas turbine technology • Units limited by permit condition to be operated exclusively for firefighting and/or flood control • Emergency standby turbines limited by permit condition to operate <100 hr/yr for maintenance and testing	• Laboratory units used in research and testing for the advancement of gas turbine technology • Units operated exclusively for firefighting and/or flood control • Units operated <200 hr/yr • Emergency standby units operating during either an emergency or maintenance operation. Maintenance operation is limited to 104 hr/yr
Requirements	***NOx Emission Limits:** **Units Rated <3 MW** Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv **Units Rated ≥3 MW and <10 MW** *Pipeline Gas*: Steady State - 8 ppmv Non-Steady State - 12 ppmv Liquid Fuel - 25 ppmv *<877 hr/yr*: Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv *≥877 hr/yr and not listed above*: Gas Fuel - 5 ppmv Liquid Fuel - 25 ppmv **Units Rated ≥10 MW** *Combined Cycle*: Gas Fuel - 5 ppmv (standard) Gas Fuel - 3 ppmv (enhanced) Liquid Fuel - 25 ppmv *Simple Cycle and ≥877 hr/yr*: Gas Fuel - 5 ppmv (standard) Gas Fuel - 3 ppmv (enhanced) Liquid Fuel - 25 ppmv *Simple Cycle and >200 hr/yr and <877 hr/yr*: Gas Fuel - 5 ppmv Liquid Fuel - 25 ppmv *Simple Cycle and ≤200 hr/yr*: Gas Fuel - 25 ppmv	***NOx Emission Limits:** *Prior to Jan. 1, 2024:* **Units Rated <2.9 MW** Gas Fuel - 42 ppmv Liquid Fuel - 65 ppmv **Units Rated ≥2.9 MW and <10 MW** Gas Fuel - 42 ppmv Liquid Fuel - 65 ppmv **Units Rated ≥10 MW** *<877 hr/yr*: Gas Fuel - 42 ppmv Liquid Fuel - 65 ppmv *No SCR* Gas Fuel - 15 ppmv Liquid Fuel - 42 ppmv *With SCR* Gas Fuel - 9 ppmv Liquid Fuel - 25 ppmv *After Jan. 1, 2024:* Liquid Fuel - 30 ppmv Natural Gas - 2.5 ppmv Digester Gas - 9 ppmv Rule also includes a provision for alternative means of producing equivalent emission reductions at the facility site or in the community for units where compliance with the below limits would exceed the established cost effectiveness thresholds of the district.

	SJVAPCD Rule 4703	VCAPCD Rule 74.23
	Liquid Fuel - 42 ppmv	

*Referenced at 15% O2

VCAPCD amended Rule 74.23 in November 2019 to lower NOx emission limits only recently implemented on January 1, 2024. At the time of VCAPCD's rule amendments, a majority of units were permitted at high limits; thus limits as low as 2.5 ppmv were demonstrated to be cost-effective and feasible. District Rule 4703 currently requires units to meet limits as low as 3 ppmv, and as such, adopting the slightly lower VCAPCD limit would in many cases result in only a 0.5 ppmv marginal improvement in NOx emission reductions and therefore would not be cost-effective. Furthermore, VCAPCD's Rule 74.23 includes an alternative compliance option for facilities that exempts units from meeting the limits under certain conditions, including unfavorable cost effectiveness.

Potential Emission Reduction Opportunities

Beyond the review of current regulations and rule requirements, the District reviewed the feasibility of technologies and measures implemented in other regions and potential new technologies and measures that may be feasible for implementation in the near future.

NOx Emission Control Technologies

The District has adopted numerous rule amendments to Rule 4703 that have successfully and significantly reduced NOx emissions from this source category in the Valley. In an effort to identify potential NOx emission reduction opportunities, the District has evaluated the economic feasibility of requiring limits as low as 2 ppmv NOx @ 15% O2 for combined-cycle gas turbines and 2.5 ppmv NOx @ 15% O2 for simple cycle gas turbines.

SCR Systems

Most of the gas turbines in the San Joaquin Valley are already equipped with SCR systems to reduce NOx emissions. An SCR operates as an external control device where flue gases and ammonia reagent are passed through an appropriate catalyst. Ammonia is injected upstream of the catalyst where it reacts and reduces NOx, over the catalyst bed, to form elemental nitrogen and other by-products. In simple-cycle turbines, SCR is placed downstream of a dilution fan and oxidation catalyst (CO control device), whereas, in combined-cycle configuration, SCR is placed downstream of multiple pieces of equipment (e.g. duct burner, heat recovery steam generator (HRSG), oxidation catalyst, etc.).

Typically there is enough room available in a simple cycle power plants to retrofit the unit with a modern SCR system capable of meeting 2.5 ppmv NOx without moving other components. In contrast, combined-cycle power plants are compact and will usually require system components to be moved in order to accommodate a modern SCR system capable of meeting 2.0 ppmv NOx.

To achieve NOx limits of 2 or 2.5 ppmv, an existing SCR system would either have to be expanded or replaced with a new modern SCR system. The SCR system typically involves SCR housing, catalyst, ammonia injection system, an ammonia flow monitor and control system, and ammonia tanks.

To be consistent with the existing categories in Table 5-3 of Rule 4703, the District has conducted cost effectiveness analyses to retrofit existing gas turbines with SCR systems for the following four scenarios:

1. Retrofit cost for a modern SCR system for units less than 3 MW unit to comply with 2 ppmvd NOx @ 15% O2*
2. Retrofit cost for a modern SCR system for units between 3 MW to 10 MW to comply with 2 ppmvd NOx @ 15% O2*
3. Retrofit cost of an SCR system for units greater than 10 MW simple cycle unit to comply with 2.5 ppmvd NOx @ 15% O2
4. Retrofit cost of an SCR system for units greater than 10 MW combined cycle to comply with 2 ppmvd NOx @ 15% O2

* Nearly all the permitted units rated less than 10 MW are cogeneration units. Therefore, the cost analyses for #1 and #4 above assume the turbine is a cogeneration unit.

Calculation Methodology

First, total annual cost is calculated using the SCR retrofit cost for each category. Then, the potential NOx emission reduction for each turbine category is determined by taking the difference between the potential emissions and the emissions that could be reliably achievable by retrofitting the system with the latest SCR technology capable of achieving 2.0 ppmv NOx @ 15% O2 for cogeneration turbines and 2.5 ppmv NOx @ 15% O2 for simple cycle turbines. Each unit is conservatively assumed to be operated for 8,760 hours per year at the maximum rated heat input capacity (MMBtu/hr).

NOx Reductions (tons/yr)
= (Current NOx Emission Factor – Potential NOx Emission Factor) ppmv (@ 15% O2) x 10^{-6} x 46 lb-NO2/lb-mol x 8,578 ft^3-exhaust/MMBtu x (20.95/(20.95 – 15)) x 1 lb-mol/379.5 ft^3-exhaust x Heat Input Rate (MMBtu/hr) x Operating Hours (hr/yr) x ton/2,000 lbs

Cost Effectiveness ($/ton)
= Total Annual Cost ($/yr) ÷ NOx Reductions (tons/yr)

1. Retrofit cost of units less than 3 MW unit with an SCR system capable of achieving 2 ppmv NOx @ 15% O2

Item	Value	Units/Source	Cost
Turbine Rating	2	MW	
SCR Cost/KW	475	$/kW, District facility*	
Operating Hours	8,760	hr/yr	
Direct Capital Costs			

Item	Value	Units/Source	Cost
Total Purchased Equip Cost (PEC)	$/kW x 1000 kW		$950,000
Freight	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$47,500
Sales Tax	8.25% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$78,375
Direct Installation Costs	25% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$237,500
Total Direct Capital Costs			$1,313,375
Indirect Capital Costs			
Facilities	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$47,500
Engineering	10% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$95,000
Process Contingency	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$47,500
Total Indirect Capital Costs			$190,000
Project Contingency	20% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$190,000
Total Capital Costs (TCC)	Direct Capital + Indirect Capital + Project Contingency		$1,693,375
Annualized Capital Costs (10 years @ 4% interest)	0.1233 TCC		$208,793
Direct Annual Costs			
Operating Costs			
Operator	0.5 hr/shift, $25/hr	OAQPS	$13,688
Supervisor	15% of operator cost	OAQPS	$2,053
Maintenance Costs			
Labor	0.5 hr/shift, $25/hr	OAQPS	$13,688
Materials	100% of labor cost	OAQPS	$13,688
Utility Costs			
Electricity Costs		not included	
Catalyst Replacement		not included	
Catalyst Disposal		not included	
Ammonia		not included	
NH3 Injection Skid		not included	
Total Direct Annual Costs			$43,116
Indirect Annual Costs			
Overhead	60% of operating and maintenance	OAQPS	$25,869
Administrative	2% PEC	OAQPS	$19,000
Insurance	1% PEC	OAQPS	$9,500
Property Tax	1% PEC	OAQPS	$9,500
Capital Recovery	0.13 x PEC (10% int. rate, 15 yr. period)	OAQPS	$123,500
Total Indirect Annual Costs			$187,369

Item	Value	Units/Source	Cost
Total Annual Costs	Annualized capital + Direct Annual + Indirect Annual		**$439,278**

**Per power consultant (Former SCR designer for John Zink), cost to retrofit is highly variable, ranging from $100 to $850 per kW. Large range because cost is highly dependent upon on how much equipment needs to be moved. Most units in valley are cogeneration units which would require equipment to be reconfigured. Thus, $475/kw average cost was chosen for the average retrofit.*

Cost Effectiveness Results

Type of Installation	Power Rating MW	Heat Input Rate MMBtu/hr	Current NOx Emission Factor (ppmvd @ 15% O2)	Potential NOx Emission Factor (ppmvd @ 15% O2)	NOx Reduction (tons/yr)	Total Annual Cost ($)	Cost Effectiveness ($/ton)
SCR system on a cogen system	2	30	9	2	1.26	$439,278	**$348,633.33**

2. Retrofit cost of an SCR system for units between 3 MW to 10 MW to comply with 2 ppmvd NOx @ 15% O2

Item	Value	Units/Source	Cost
Turbine Rating	3.5	MW	
SCR Cost/KW	475	$/kW, District facility*	
Operating Hours	8,760	hr/yr	
Direct Capital Costs			
Total Purchased Equip Cost (PEC)	$/kW x 1000 kW		$1,662,500
Freight	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$83,125
Sales Tax	8.25% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$137,156
Direct Installation Costs	25% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$415,625
Total Direct Capital Costs			$2,298,406
Indirect Capital Costs			
Facilities	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$83,125
Engineering	10% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$166,250
Process Contingency	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$83,125
Total Indirect Capital Costs			$332,500
Project Contingency	20% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$332,500
Total Capital Costs (TCC)	Direct Capital + Indirect Capital + Project Contingency		$2,963,406
Annualized Capital Costs (10 years @ 4% interest)	0.1233 TCC		$365,388

Item	Value	Units/Source	Cost
Direct Annual Costs			
Operating Costs			
Operator	0.5 hr/shift, $25/hr	OAQPS	$13,688
Supervisor	15% of operator cost	OAQPS	$2,053
Maintenance Costs			
Labor	0.5 hr/shift, $25/hr	OAQPS	$13,688
Materials	100% of labor cost	OAQPS	$13,688
Utility Costs			
Electricity Costs		not included	
Catalyst Replacement		not included	
Catalyst Disposal		not included	
Ammonia		not included	
NH3 Injection Skid		not included	
Total Direct Annual Costs			$43,116
Indirect Annual Costs			
Overhead	60% of operating and maintenance	OAQPS	$25,869
Administrative	2% PEC	OAQPS	$33,250
Insurance	1% PEC	OAQPS	$16,625
Property Tax	1% PEC	OAQPS	$16,625
Capital Recovery	0.13 x PEC (10% int. rate, 15 yr. period)	OAQPS	$216,125
Total Indirect Annual Costs			$308,494
Total Annual Costs	Annualized capital + Direct Annual + Indirect Annual		**$716,998**

**Per power consultant (Former SCR designer for John Zink), cost to retrofit is highly variable, ranging from $100 to $850 per kW. Large range because cost is highly dependent upon on how much equipment needs to be moved. Most units in valley are cogeneration units which would require equipment to be reconfigured. Thus, $475/kw average cost was chosen for the average retrofit.*

Cost Effectiveness Results

Type of Installation	Power Rating MW	Heat Input Rate MMBtu/hr	Current NOx Emission Factor (ppmvd @ 15% O2)	Potential NOx Emission Factor (ppmvd @ 15% O2)	NOx Reduction (tons/yr)	Total Annual Cost ($)	Cost Effectiveness ($/ton)
SCR system on a cogen system	3.5	51.7	5	2	0.93	$716,998	**$770,965.59**

3. Retrofit cost of an SCR system for units greater than 10 MW simple cycle unit to comply with 2.5 ppmvd NOx @ 15% O2

Item	Value	Units/Source	Cost
Turbine Rating	50	MW, Simple Cycle	
SCR Cost	4,100,000	From SCR Consultant*	
Operating Hours	8,760		
Direct Capital Costs			
Total Purchased Equip Cost (PEC)		See Above	$4,100,000

Item	Value	Units/Source	Cost
Freight	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$205,000
Sales Tax	8.25%PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$338,250
Direct Installation Costs	25% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$1,025,000
Total Direct Capital Costs			$5,668,250
Indirect Capital Costs			
Facilities	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$205,000
Engineering	10% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$410,000
Process Contingency	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$205,000
Total Indirect Capital Costs			$820,000
Project Contingency	20% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$820,000
Total Capital Costs (TCC)	Direct Capital + Indirect Capital + Project Contingency		$7,308,250
Annualized Capital Costs (10 years @ 4% interest)	0.1233 TCC		$901,107
Direct Annual Costs			
Operating Costs			
Operator	0.5 hr/shift, $25/hr	OAQPS	$13,688
Supervisor	15% of operator cost	OAQPS	$2,053
Maintenance Costs			
Labor	0.5 hr/shift, $25/hr	OAQPS	$13,688
Materials	100% of labor cost	OAQPS	$13,688
Utility Costs			
Electricity Costs		not included	$0
Cat Replacement, Ammonia Reagent, and Loss of Power from Backpressure		EPA Combustion Turbine NOx Technology Memo (Jan. 2022)	$70,000
Total Direct Annual Costs			$113,116
Indirect Annual Costs			
Overhead	60% of operating and maintenance	OAQPS	$25,869
Administrative	2% PEC	OAQPS	$82,000
Insurance	1% PEC	OAQPS	$41,000
Property Tax	1% PEC	OAQPS	$41,000
Capital Recovery	"0.13 x PEC		
(10% int. rate, 15 yr. period)"	OAQPS	$533,000	
Total Indirect Annual Costs			**$722,869**

Item	Value	Units/Source	Cost
Total Annual Costs	Annualized capital + Direct Annual + Indirect Annual		**$1,737,092**

**Per power consultant (Former SCR designer for John Zink), cost to retrofit is highly variable, ranging from $100 to $850 per kW. Large range because cost is highly dependent upon on how much equipment needs to be moved. Most units in valley are cogeneration units which would require equipment to be reconfigured. Thus, $475/kw average cost was chosen for the average retrofit.*

Cost Effectiveness Results

Type of Installation	Power Rating MW	Heat Input Rate MMBtu/hr	Current NOx Emission Factor (ppmvd @ 15% O2)	Potential NOx Emission Factor (ppmvd @ 15% O2)	NOx Reduction (tons/yr)	Total Annual Cost ($)	Cost Effectiveness ($/ton)
Retrofit - Simple Cycle	50	500	5	2.5	7.48	$1,737,092	**$232,231.55**

4. Retrofit cost of an SCR system for units greater than 10 MW combined cycle to comply with 2 ppmvd NOx @ 15% O2

Item	Value	Units/Source	Cost
Turbine Rating	90	MW, Simple Cycle	
SCR Cost	6,200,000	Combustion Turbine NOx Technology Memo (Jan. 2022)	
Operating Hours	8,760		
Direct Capital Costs			
Total Purchased Equip Cost (PEC)		See Above	$6,200,000
Freight	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$310,000
Sales Tax	8.25% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$511,500
Direct Installation Costs	25% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$1,550,000
Total Direct Capital Costs			$8,571,500
Indirect Capital Costs			
Facilities	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$310,000
Engineering	10% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$620,000
Process Contingency	5% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$310,000
Total Indirect Capital Costs			$1,240,000
Project Contingency	20% PEC	2015 Plan for the 1997 PM 2.5 Standard - Rule 4703 Control Measure Analysis	$1,240,000
Total Capital Costs (TCC)	Direct Capital + Indirect Capital + Project Contingency		$11,051,500
Annualized Capital Costs (10 years @ 4% interest)	0.1233 TCC		$1,362,650

Item	Value	Units/Source	Cost
Direct Annual Costs			
Operating Costs			
Operator	0.5 hr/shift, $25/hr	OAQPS	$13,688
Supervisor	15% of operator cost	OAQPS	$2,053
Maintenance Costs			
Labor	0.5 hr/shift, $25/hr	OAQPS	$13,688
Materials	100% of labor cost	OAQPS	$13,688
Utility Costs			
Electricity Costs		not included	$0
Cat Replacement, Ammonia Reagent, and Loss of Power from Backpressure		EPA Combustion Turbine NOx Technology Memo (Jan. 2022)	$300,000
Total Direct Annual Costs			$343,116
Indirect Annual Costs			
Overhead	60% of operating and maintenance	OAQPS	$25,869
Administrative	2% PEC	OAQPS	$124,000
Insurance	1% PEC	OAQPS	$62,000
Property Tax	1% PEC	OAQPS	$62,000
Capital Recovery	"0.13 x PEC		
(10% int. rate, 15 yr. period)"	OAQPS	$806,000	
Total Indirect Annual Costs			$1,079,869
Total Annual Costs	Annualized capital + Direct Annual + Indirect Annual		**$2,785,635**

**Per power consultant (Former SCR designer for John Zink), cost to retrofit is highly variable, ranging from $100 to $850 per kW. Large range because cost is highly dependent upon on how much equipment needs to be moved. Most units in valley are cogeneration units which would require equipment to be reconfigured. Thus, $475/kw average cost was chosen for the average retrofit.*

Cost Effectiveness Results

Type of Installation	Power Rating MW	Heat Input Rate MMBtu/hr	Current NOx Emission Factor (ppmvd @ 15% O2)	Potential NOx Emission Factor (ppmvd @ 15% O2)	NOx Reduction (tons/yr)	Total Annual Cost ($)	Cost Effectiveness ($/ton)
Retrofit - Combined Cycle	90	1,100	5	2	19.74	$2,785,635	**$141,116.26**

As demonstrated above, the District determined that the cost effectiveness of achieving these lower NOx limits ranges from $141,116.26/ton - $770,965.59/ton, depending on the specifications of the unit.

Zero-Emission Opportunities

Potential zero-emission opportunities for this source category include the replacement of turbines with fuel cells or electrification of facility operations. The District did not identify any instances of fuel cells or electrification being required for these types of

units. However, the District will continue to closely track the development of new zero-emissions technologies and control measures for this source category.

Evaluation Findings

Rule 4703 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.19 RULE 4901 (WOOD BURNING FIREPLACES AND WOOD BURNING HEATERS)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	2.82	2.58	2.53	2.53	2.53	2.53	2.53
NOx	0.42	0.38	0.38	0.38	0.38	0.38	0.38
	Winter Average - Tons per day						
PM2.5	5.47	5.02	4.92	4.92	4.92	4.92	4.92
NOx	0.81	0.74	0.73	0.73	0.73	0.73	0.73

District Rule 4901 Description

The District's residential wood burning emission reduction strategy includes wood burning curtailments implemented through District Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters), in conjunction with the District's incentive grant program for fireplace and woodstove change-outs, and robust public education and outreach efforts. This approach is designed to improve public health by reducing toxic wood smoke emissions in Valley neighborhoods during the peak PM2.5 winter season (November through February), and has proven to be extremely effective in advancing the District's objectives to attain the PM2.5 federal standards and protect public health. Commitments in the District's *2018 PM2.5 Plan* included rulemaking for Rule 4901 to further lower wood burning curtailment levels, as well as enhancements to the District's incentive grant funding levels, public outreach and education, enforcement, and air quality forecasting programs.

Through the District's Residential Wood Smoke Reduction Program, which is based on Rule 4901, the District has declared and enforced episodic wood burning curtailments, also called "No Burn" days, since 2003. The District's Residential Wood Smoke Reduction Program and District Rule 4901 reduce harmful species of PM2.5 when and where those reductions are most needed, in impacted urbanized areas when the local weather is forecast to hamper particulate matter dispersion.

Rule 4901 was first adopted in 1993, and has been subsequently amended five times. The 1993 adoption of Rule 4901 established a public education program on techniques to reduce wood burning emissions. It also enforced EPA Phase II requirements for new wood burning heaters, prohibited the sale of used wood burning heaters, established a list of prohibited fuel types, and required the District to request voluntary curtailment of wood burning on days when the ambient air quality was unhealthy.

In 2003, the rule was amended to add episodic wood burning curtailments when air quality was forecast to be at 150 or higher on the air quality index (AQI), which was equivalent to a PM2.5 concentration of 65 µg/m³ at the time; restrictions on the

installation of wood burning devices in new residential developments, based on housing density; and a requirement that during the transfer of a residential property, sellers provide a statement of compliance to the District and buyer for residential real properties with non-compliant wood burning devices.

In 2008, the rule was amended and lowered the mandatory curtailment level to a PM2.5 concentration of 30 µg/m^3, and added an attainment plan contingency measure that would lower the wood burning curtailment level to 20 µg/m^3 if EPA were to find that the Valley did not attain the 1997 PM2.5 NAAQS in 2014.

In 2014, Rule 4901 was amended again to lower the No Burn threshold for high polluting wood burning heaters and fireplaces from 30 µg/m^3 to 20 µg/m^3 and establish a separate No Burn threshold for cleaner certified wood burning devices. The amendment doubled the number of No Burn days for high polluting units that were the source of over 95% of the wintertime residential wood smoke emissions.

In 2019, the District amended Rule 4901 to lower the curtailment threshold from 20 to 12 µg/m^3 for older, higher-polluting wood burning heaters, open hearth fireplaces, and non-registered wood burning heaters in the Hot Spot counties of Madera, Fresno, and Kern. Within these same Hot Spot counties, the cleaner, registered wood burning heaters are allowed to burn when air quality is forecast to be between 12 and 35 µg/m^3. In these counties, no wood burning is allowed when air quality is forecast to be above 35 µg/m^3. In the remaining Valley counties, the previous curtailment thresholds remain in place. The more stringent curtailment thresholds established in the Hot Spot counties are with increased *Fireplace and Woodstove Change-Out Program* incentives amounts to cover nearly the entire cost of replacing high polluting wood burning units with natural gas units. To complement the regulatory and incentives changes, the District has implemented an education and outreach campaign to increase public awareness of the program, along with focused rule enforcement efforts in Hot Spot counties and in areas of concern. The District also continues to investigate and employ the latest air quality modeling tools and techniques to support the air quality forecasting component of the program.

Following these amendments, EPA recognized in their February 2020 evaluation of BACM and MSM for the *2018 PM2.5 Plan* for the 2006 PM2.5 NAAQS that Rule 4901 implements BACM and MSM levels of control.[158] In July 2020, EPA took final action to approve the 2019 amendments to Rule 4901 and provide SIP credit for emissions reductions achieved through the strategy.[159]

Most recently, on May 18, 2023, the District amended Rule 4901 to establish a sequence of increasingly stringent contingency curtailment thresholds for all counties that would be triggered upon 60 days after the issuance of a final determination by EPA,

[158] EPA. *Technical Support Document, Evaluation of BACM/MSM, San Joaquin Valley PM2.5 Plan for the PM2.5 Plan for the 2006 PM2.5 NAAQS*. (February 2020). Retrieved from: https://www.regulations.gov/document/EPA-R09-OAR-2019-0318-0005

[159] EPA. *Air Plan Approval; California; San Joaquin Valley Unified Air Pollution Control District*. 85 FR 44206-44209. (July 22, 2020). Retrieved from: https://www.govinfo.gov/content/pkg/FR-2020-07-22/pdf/2020-14298.pdf

pursuant to 40 CFR §51.1014(a), that the District has failed to meet any of the following elements for any of the PM2.5 NAAQS to:

1. Meet any RFP requirement;
2. Meet any quantitative milestone in an approved attainment plan;
3. Submit a quantitative milestone report; or
4. Attain the applicable PM2.5 NAAQS by the applicable attainment date.

The following table depicts the sequence of increasingly stringent contingency curtailment thresholds to be enforced following each contingency trigger.

Table C-12 District Contingency Curtailment Thresholds

Contingency Concept	Hot-Spot County (µg/m^3)		Non Hot-Spot County (µg/m^3)	
	Level 1	Level 2	Level 1	Level 2
Current Requirements	12	35	20	65
Contingency Measure 1	12	35	12	35
Contingency Measure 2	11	35	11	35

Hot-spot counties: Madera, Fresno, Kern
Non Hot-spot counties: San Joaquin, Stanislaus, Merced, Kings, Tulare

The contingency provisions, if triggered, would achieve 0.69 tpd of PM2.5 and 0.10 tpd NOx on an annual average basis, as calculated in the *PM2.5 Contingency Measure State Implementation Plan Revision*.[160]

Incentives and Outreach

The District's *Fireplace and Woodstove Change-Out Program* plays a key role in reducing emissions from residential wood burning by encouraging a transition from the use of higher polluting wood burning heaters and fireplaces to cleaner alternatives. Through the program, the District offers financial incentives for the change-out of old, high-polluting open-hearth fireplaces or uncertified devices with new cleaner, certified units. The program has provided the resources necessary for thousands of Valley resident to make positive changes in their residential wood-burning practices and is a significant part of the District's overall strategy to reduce the impacts of residential wood burning. The *Fireplace and Woodstove Change-Out Program* also continues to offer higher incentives for low-income households throughout the Valley (up to $4,150 for a new gas device, and up to $5,000 for an electric heat pump) to provide additional assistance towards the purchase of a new, cleaner unit. Since 2009, the District has issued over 30,000 vouchers with more than $64.3 million in program funding allocated to date.

To complement the regulatory and incentives changes, the District has implemented an education and outreach campaign to increase public awareness of the program, along with focused rule enforcement efforts in Hot Spot counties and in areas of concern. The

[160] SJVAPCD. *Proposed San Joaquin Valley Contingency Measure State Implementation Plan Revision.* (April 18, 2023). Retrieved from: https://www.valleyair.org/Workshops/postings/2023/05-18-23_r4901/proposed-sip.pdf?v=04.19.23

District also continues to investigate and employ the latest air quality modeling tools and techniques to support the air quality forecasting component of the program.

Residential Wood Burning Survey

Given the significant public health benefits that can be realized cost effectively from reductions in wood smoke emissions and to ensure continued effectiveness of the rule enhancements, on June 15, 2017, the District entered into a contract with Gomez Research to conduct a bilingual scientific survey in late 2017 to assess residential wood burning behaviors in the Valley.[161] Gomez Research surveyed over 1,500 Valley residents through an approach that consisted of both a general, random population of residents throughout the Valley as well as a supplemental sample, or "high-incidence area," of 500 residents living in targeted zip codes believed to have higher concentrations of wood burning devices. Overall, the large survey response by Valley residents provides statistically significant results that can be relied upon to enhance our understanding of residential wood burning behavior in the San Joaquin Valley. The survey results, as detailed in the District's Final Draft Staff Report from the 2018 rule amendments,[162] supported lowering the residential wood burning curtailment thresholds, coupled with enhanced public outreach and increased incentive amounts for the *Fireplace and Woodstove Change-Out Program*.

How does District Rule 4901 compare with federal and state rules and regulations?

There are no Control Techniques Guidelines or Alternative Control Techniques applicable to this source category.

A. New Source Performance Standards (NSPS)

- *40 CFR Part 60 Subpart AAA – Standards of Performance for New Residential Wood Heaters (2020/04)*

The District evaluated the requirements contained within Subpart AAA and found no emission requirements that were more stringent than those already in Rule 4901.

State Regulations

No California state regulations have been identified that are applicable to this source category. However, the District has identified regulations in other states that have wood burning requirements. These include the following regulations:

[161] Gomez Research. *Residential Wood Burning Survey*. (January 18, 2018). Retrieved from: http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2018/January/final/10.pdf
[162] SJVAPCD. *Final Draft Staff Report with Appendices for Proposed Amendments to District's Residential Wood Burning Emission Reduction Strategy*, pp. 20-22. (June 20, 2019). Retrieved from: https://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2019/June/final/13.pdf

- ***Puget Sound Clean Air Agency (PSCAA) Regulation I, Article 13: Solid Fuel Burning Device Standards (Amended October 25, 2012)[163]***

	SJVAPCD Rule 4901	PSCAA Reg I, Article 13
Sole Source Exemption	Those for whom a wood burning fireplace or wood burning heater is the sole available source of heat in a residence are not subject to level 1 and level 2 episodic wood burning curtailment requirements. This includes times of temporary service outages, as determined by the gas or electrical utility service.	A residence or commercial building that has no adequate source of heat other than a solid fuel heating device and the building: • was constructed or substantially remodeled after July 1, 1992; and • is outside an urban growth area; and • is outside an area designated as a PM2.5 or PM10 nonattainment area.
No Burn Day (Nov-Feb)	**Level 1 Curtailment** • For the counties of San Joaquin, Stanislaus, Merced, Kings, and Tulare, the APCO shall declare a Level 1 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to equal or exceed 20 µg/m³ but not exceed 65 µg/m³ for the geographic region. • For the counties of Madera, Fresno, and Kern, the APCO shall declare a Level 1 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to equal or exceed 12 µg/m³ but not exceed 35 µg/m³ for the geographic region. • Registered wood burning heater may be operated provided it's fired on approved fuel, maintained, and operated according to manufacturer instructions, and has no visible smoke. **Level 2 Curtailment** • For the counties of San Joaquin, Stanislaus, Merced, Kings, and Tulare, the APCO shall declare a Level 2 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to exceed 65 µg/m³ or a PM10 concentration is forecast to equal or exceed 135 µg/m³ for the geographic region. • For the counties of Madera, Fresno, and Kern, the APCO shall declare a Level 2 Episodic Wood Burning	No person in a residence or commercial establishment shall operate a solid fuel burning device under any of the following conditions: • Whenever the Agency has declared the first stage of impaired air quality for a geographical area. • New solid fuel shall be withheld from any solid fuel burning device already in operation for the duration of the first stage of impaired air quality if that device is restricted from operating. • Smoke visible from a chimney, flue, or exhaust duct after three hours has elapsed from the declaration of a first stage of impaired air quality shall constitute prima facie evidence of unlawful operation of a solid fuel burning device if that solid fuel burning device is restricted from operating during a first stage of impaired air quality. This presumption may be refuted by demonstration that the smoke was not caused by a solid fuel burning device. • Whenever the Agency has declared the **second stage** of impaired air quality for a geographical area. • New solid fuel shall be withheld from any solid fuel burning device already in operation for the duration of the second stage of impaired air quality if device is restricted from operating. • Smoke visible from a chimney, flue, or exhaust duct after three hours has elapsed from the declaration of a second stage of impaired air quality shall constitute prima facie evidence

[163] Puget Sound Clean Air Agency. *Regulation I, Article 13 (Solid Fuel Burning Device Standards).* (Amended October 25, 2012). Retrieved from: https://pscleanair.gov/DocumentCenter/View/161/Regulation-I-Section-1303-PDF?bidId

	SJVAPCD Rule 4901	PSCAA Reg I, Article 13
	Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to exceed 35 µg/m³ or a PM10 concentration is forecast to equal or exceed 135 µg/m³ for the geographic region.	of unlawful operation of a solid fuel burning device if that solid fuel burning device is restricted from operating during a second stage of impaired air quality. This presumption may be refuted by demonstration that the smoke was not caused by a solid fuel burning device.
Sale, Resale, or Installation of Wood-Burning Devices	Sale or transfer of wood burning heaters: • New: No person shall advertise, sell, offer for sale, supply, install, or transfer a new wood burning heater unless it is either EPA certified under the NSPS at the time of purchase or installation and at least as stringent as EPA Phase II requirements, or a pellet-fueled wood burning heater that is exempt from EPA certification pursuant to requirements in the NSPS, until such time that amendments to the NSPS are finalized to remove exemptions for pellet-fueled wood burning heaters, then all new wood burning heaters must comply with the above. • Used: No person shall advertise, sell, offer for sale, supply, install, or transfer a used wood burning heater unless it has been rendered permanently inoperable, satisfies NSPS, or is a low mass fireplace, masonry heater, or other wood burning device of a make and model that meets all federal requirements and has been approved in writing by the APCO. Limitations on wood burning fireplaces or wood burning heaters • At elevations below 3,000 feet in areas with natural gas service, no person shall install a wood burning fireplace, low mass fireplace, masonry heater, or wood burning heater. • At elevations at or above 3,000 feet or in areas without natural gas service, no more than two EPA certified wood burning heaters, that meet NSPS at time of installation, shall be installed per acre. ○ No person shall install more than one EPA certified wood burning heater, that meets NSPS at time of installation, per dwelling unit.	A person shall not advertise to sell, offer to sell, sell, bargain, exchange, give away, or install a solid fuel burning device unless it meets both of the following: • It has been certified and labeled in accordance with procedures and criteria specified in "40 CFR 60 Subpart AAA - Standards of 12/12 13-7 Regulation I Performance for Residential Wood Heaters" as amended through July 1, 1990; and • It meets the following particulate air contaminant emission standards and the test methodology of EPA in effect on Jan. 1, 1991, or an equivalent standard under any test methodology adopted by EPA subsequent to such date: ○ Two and one-half grams per hour for catalytic woodstoves; and ○ Four and one-half grams per hour for all other solid fuel burning devices. **Fireplaces.** A person shall not advertise to sell, offer to sell, sell, bargain, exchange, give away, or install a factory-built fireplace unless it meets the 1990 EPA standards for wood stoves or an equivalent standard that may be established by the state building code council by rule.

	SJVAPCD Rule 4901	PSCAA Reg I, Article 13
	○ No person shall install a wood burning fireplace, low mass fireplace, masonry heater, or non-certified wood burning heater.	
Requirements for Non-Certified Units	Rule requires only EPA certified units be sold in the area.	Any person who owns or is responsible for a wood stove that is both (a) not a certified wood stove and (b) is located in the Tacoma, Washington PM2.5 nonattainment area must remove and dispose of it or render it permanently inoperable by Sept. 30, 2015. Any person who owns or is responsible for a coal-only heater located in the Tacoma, Washington fine particulate nonattainment area must remove and dispose of it or render it permanently inoperable by Sept. 30, 2015. Removal and disposal requirements for non-certified wood stoves located in the Tacoma, Washington PM2.5 nonattainment area do not apply to: • A person in a residence or commercial establishment that does not have an adequate source of heat without burning wood; or • A person with a shop or garage that is detached from the main residence or commercial establishment that does not have an adequate source of heat in the detached shop or garage without burning wood. The owner or person responsible for removing or rendering permanently inoperable a wood stove or a coal-only heater must provide documentation of the removal and disposal or rendering permanently inoperable to the Agency using the Agency's procedures within 30 days of the removal or rendering permanently inoperable. If the EPA makes written findings below, the use of wood stoves not meeting the standards set forth in the emission performance standards for solid fuel burning devices shall be prohibited within the area determined by the Agency to have contributed to the violation. This provision shall take effect one year after such a determination. • An area has failed to attain or maintain the NAAQS for PM10, and

	SJVAPCD Rule 4901	PSCAA Reg I, Article 13
		• In consultation with Ecology and the Agency, finds that the emissions from solid fuel burning devices are a contributing factor to such failure to attain or maintain the standard
Visible Emissions	• Under normal operating conditions, no person shall cause or allow any visible smoke from a registered wood burning heater. • Under normal operating conditions, no person shall cause or allow from a wood burning fireplace or nonregistered wood burning heater a visible emission of any air contaminant, other than uncombined water vapor, that exceeds No. 1 on the Ringelmann Chart or 20% opacity for a period or periods aggregating more than 3 minutes in any 1 hour.	A person shall not cause or allow emission of a smoke plume from any solid fuel burning device to exceed an average of 20% opacity for 6 consecutive minutes in any 1-hour period.
Prohibited Fuels	No person shall cause or allow any of the following materials to be burned in a wood burning fireplace, wood burning heater, or outdoor wood burning device: garbage, treated wood, non-seasoned wood, plastic products, rubber products, waste petroleum products, paints and paint solvents, coal, or any other material not intended by a manufacturer for use as a fuel in a wood burning fireplace, wood burning heater, or outdoor wood burning device.	A person shall cause or allow only the following materials to be burned in a solid fuel burning device: • Properly seasoned fuel wood; or • An amount of paper necessary for starting a fire; or • Wood pellets; or • Biomass fire logs intended for burning in wood stove or fireplace; or • Coal with sulfur content <1.0% by weight burned in a coal-only heater. All other materials are prohibited from being burned.

The District evaluated the requirements contained within Puget Sound Clean Air Agency Article 13 and found that District Rule 4901 is more stringent.

- ***Albuquerque City Ordinance § 9-5***

	SJVAPCD Rule 4901	Albuquerque City Ordinance § 9-5
EPA Certified Exemption	EPA certified units are not exempt from rule requirements.	Certified heaters may be operated during a no burn period provided that no visible emissions are produced beyond a 20-minute startup period.
Sole Source Exemption	Those for whom a wood burning fireplace or wood burning heater is the sole available source of heat in a residence are not subject to level 1 and level 2 episodic wood burning curtailment requirements. This includes times of temporary service outages, as determined by the gas or electrical utility service.	• If wood burning device is the sole source of heat • Medical necessity of a wood burning device • Low income status

	SJVAPCD Rule 4901	Albuquerque City Ordinance § 9-5
Limited Exemption: Loss of NG and/or Electrical Power	Those for whom a wood burning fireplace or wood burning heater is the sole available source of heat in a residence are not subject to level 1 and level 2 episodic wood burning curtailment requirements. This includes times of temporary service outages, as determined by the gas or electrical utility service.	Emergency situations such as failure of residence's primary heating system.
Wood Burning Season	November through February	October through February
No Burn Day	**Level 1 Curtailment** • For the counties of San Joaquin, Stanislaus, Merced, Kings, and Tulare, the APCO shall declare a Level 1 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to equal or exceed 20 µg/m³ but not exceed 65 µg/m³ for the geographic region. • For the counties of Madera, Fresno, and Kern, the APCO shall declare a Level 1 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to equal or exceed 12 µg/m³ but not exceed 35 µg/m³ for the geographic region. • Registered wood burning heater may be operated provided it's fired on approved fuel, maintained, and operated according to manufacturer instructions, and has no visible smoke. **Level 2 Curtailment** • For the counties of San Joaquin, Stanislaus, Merced, Kings, and Tulare, the APCO shall declare a Level 2 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to exceed 65 µg/m³ or a PM10 concentration is forecast to equal or exceed 135 µg/m³ for the geographic region. • For the counties of Madera, Fresno, and Kern, the APCO shall declare a Level 2 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to exceed 35 µg/m³ or a PM10 concentration is forecast to equal or exceed 135 µg/m³ for the geographic region.	No burn periods shall be declared by the Director upon review of available meteorological data and a determination that expected atmospheric conditions will not reasonably disperse wood smoke.

	SJVAPCD Rule 4901	Albuquerque City Ordinance § 9-5
Visible Emissions	• Under normal operating conditions, no person shall cause or allow any visible smoke from a registered wood burning heater. • Under normal operating conditions, no person shall cause or allow from a wood burning fireplace or nonregistered wood burning heater a visible emission of any air contaminant, other than uncombined water vapor, that exceeds No. 1 on the Ringelmann Chart or 20% opacity for a period or periods aggregating more than 3 minutes in any one (1) hour.	Certified wood heaters may be operated during a no burn period provided that no visible emissions are produced beyond a 20-minute start up period.

The District evaluated the requirements contained within Albuquerque City Ordinance §9-5 and found that District Rule 4901 is as stringent as or more stringent than the ordinance.

How does District Rule 4901 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4901 to comparable requirements in rules from the following nonattainment areas:

- South Coast AQMD Rule 445 (Amended October 27, 2020)[164]
- Sacramento Metropolitan AQMD Rule 417 (Adopted October 26, 2006)[165]
- Sacramento Metropolitan AQMD Rule 421 (Amended September 24, 2009)[166]
- Bay Area AQMD Regulation 6, Rule 3 (Amended November 20, 2019)[167]

Ventura County APCD does not have an analogous rule for this source category.

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4901 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

[164] SCAQMD. *Rule 445 (Wood-Burning Devices).* (Amended October 27, 2020). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/rule-iv/rule-445.pdf?sfvrsn=4
[165] SMAQMD. *Rule 417 (Wood Burning Appliances).* (Adopted October 26, 2006). Retrieved from: https://www.airquality.org/ProgramCoordination/Documents/rule417.pdf
[166] SMAQMD. *Rule 421 (Mandatory Episodic Curtailment of Wood and Other Solid Fuel Burning).* (Amended September 24, 2009). Retrieved from: https://www.airquality.org/ProgramCoordination/Documents/rule421.pdf
[167] BAAQMD. *Regulation 6, Rule 3 (Wood-Burning Devices).* (Amended November 20, 2019). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/regulation-6-rule-3/documents/20191120_r0603_final-pdf.pdf?la=en&rev=cbb545815c15468cb98f8c1b23c083d2

South Coast AQMD

- SCAQMD Rule 445 (Wood Burning Devices)

	SJVAPCD Rule 4901	SCAQMD Rule 445
Applicability	• Any person who manufactures, sells, offers for sale, or operates a wood burning fireplace, wood burning heater, or outdoor wood burning device. • Any person who sells, offers for sale, or supplies wood intended for burning in a wood burning fireplace or wood burning heater. • Any person who sells or transfers a real property. • Any person who installs a wood burning fireplace or wood burning heater.	• Any person that manufacturers, sells, offers for sale, or installs a wood-burning device. • Any commercial firewood seller that sells, offers for sale, or supplies wood or other wood-based fuels intended for burning in a wood-burning-device or portable outdoor wood-burning device. • Any property owner or tenant that operates a wood-burning device or portable outdoor wood-burning device.
General Exemptions	• Devices that are exclusively gaseous-fueled. • Cook stoves, as described in 40 CFR §60.531. • Any burning occurring on the ground is open burning and is subject to requirements of District Rule 4103.	• Wood-fired cooking devices designed and used for commercial purposes. • The provisions for new or used permanently installed indoor or outdoor wood-burning devises or gaseous-fueled devices shall not apply to an indoor or outdoor wood-burning device that is permanently installed and included in the sale or transfer of any existing development. • The provisions for new or used permanently installed indoor or outdoor wood-burning devises or gaseous-fueled devices shall not apply to properties that are registered as a historical site, or are contributing structures located in a Historic Preservation Overlay Zone, as determined by the applicable, federal, State, or local agency. Contributing structures are those buildings which are examples of the predominate styles of the area, built during the time period when the bulk of the structures were built in the Historic Preservation Overlay Zone. • The no burn provisions for any product not intended for use as fuel in a wood-burning device shall not apply to manufactured firelogs. • The labeling and sell-through provision shall not apply to wood-based fuel intended for the cooking, smoking, or flavoring of food. • The provisions of the wood-burning season PM2.5 mandatory burning curtailment, PM2.5 contingency

	SJVAPCD Rule 4901	SCAQMD Rule 445
		measures, and ozone contingency measures shall not apply under the following circumstances: ○ Residential or commercial properties where a wood-burning device is the sole source of heat; or ○ A low income household; or ○ Residential or commercial properties where there is no existing infrastructure for natural gas service within 150 feet of property line; or ○ Residential or commercial properties located 3,000 or more feet above mean sea level; or ○ Ceremonial fires exempted under Rule 444 (Open Burning).
Natural Gas Exemption	Locations where natural gas is not available are not subject to episodic curtailments (propane and butane are not considered natural gas).	Installation requirements for new developments shall not apply to new developments where there is no existing infrastructure for natural gas service within 150 feet of the property line or those 3,000 or more feet above mean sea level.
Sole Source Exemption	Those for whom a wood burning fireplace or wood burning heater is the sole available source of heat in a residence are not subject to level 1 and level 2 episodic wood burning curtailment requirements. This includes times of temporary service outages, as determined by the gas or electrical utility service.	The provisions of the wood-burning season PM2.5 mandatory burning curtailment, PM2.5 contingency measures, and ozone contingency measures shall not apply to residential or commercial properties where a wood-burning device is the sole source of heat.
No Burn Day (Nov-Feb)	**Level 1 Curtailment** • For the counties of San Joaquin, Stanislaus, Merced, Kings, and Tulare, the APCO shall declare a Level 1 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to equal or exceed 20 µg/m³ but not exceed 65 µg/m³ for the geographic region. • For the counties of Madera, Fresno, and Kern, the APCO shall declare a Level 1 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to equal or exceed 12 µg/m³ but not exceed 35 µg/m³ for the geographic region. • Registered wood burning heater may be operated provided it's fired on approved fuel, maintained, and operated according to manufacturer	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 (No-Burn) 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: • Basin-wide if the daily PM2.5 air quality forecast for any source receptor area exceeds 30 µg/m³, or • Subsequent to a determination by U.S. EPA, pursuant to 40 CFR §51.1014(a) of a failure to comply with either a referenced PM2.5 standard or reporting requirement; the applicable daily PM2.5 air quality forecast as set

	SJVAPCD Rule 4901	SCAQMD Rule 445
	instructions, and has no visible smoke. **<u>Level 2 Curtailment</u>** • For the counties of San Joaquin, Stanislaus, Merced, Kings, and Tulare, the APCO shall declare a Level 2 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to exceed 65 µg/m³ or a PM10 concentration is forecast to equal or exceed 135 µg/m³ for the geographic region. • For the counties of Madera, Fresno, and Kern, the APCO shall declare a Level 2 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to exceed 35 µg/m³ or a PM10 concentration is forecast to equal or exceed 135 µg/m³ for the geographic region.	forth in the PM2.5 Contingency Measures requirements. Prohibitions on Permissive Burn Days or restrictions on Marginal Burn Days shall be in effect only if a No-Burn day is declared during any of the consecutive months of November, December, January, or February.
Sale, Resale, or Installation of Wood-Burning Devices	Sale or transfer of wood burning heaters: • New: No person shall advertise, sell, offer for sale, supply, install, or transfer a new wood burning heater unless it is either EPA certified under the NSPS at the time of purchase or installation and at least as stringent as EPA Phase II requirements, or a pellet-fueled wood burning heater that is exempt from EPA certification pursuant to requirements in the NSPS, until such time that amendments to the NSPS are finalized to remove exemptions for pellet-fueled wood burning heaters, then all new wood burning heaters must comply with the above. • Used: No person shall advertise, sell, offer for sale, supply, install, or transfer a used wood burning heater unless it has been rendered permanently inoperable, satisfies NSPS, or is a low mass fireplace, masonry heater, or other wood burning device of a make and model that meets all federal requirements and has been approved in writing by the APCO.	• No person shall sell, offer for sale, supply, or install, a new or used permanently installed indoor or outdoor wood-burning device or gaseous-fueled device unless it is one of the following: ○ EPA Certified wood-burning heater; or ○ Pellet-fueled wood-burning heater; or ○ A masonry heater; or ○ A dedicated gaseous-fueled fireplace
Requirements for Real Property	No person shall sell or transfer any real property which contains a wood burning heater without first assuring that each	EPA certification requirements do not apply to:

	SJVAPCD Rule 4901	SCAQMD Rule 445
	wood burning heater included in the real property: • Meets certification under the NSPS at the time of purchase or installation and is at least as stringent as EPA Phase II requirements, • Is a pellet-fueled wood burning heater that was exempt from EPA certification pursuant to requirements in the NSPS at the time of purchase or installation, or • Is rendered permanently inoperable and removed from property. Upon the sale or transfer of any residential real property in the San Joaquin Valley, the seller shall provide to the buyer of the real property and to the APCO, documentation certifying the following: • The type(s) and number(s) of wood burning heaters and wood burning fireplaces included in the real property transaction. If no wood burning heaters or wood burning fireplaces are included in the real property transaction, this should be documented. • Any action(s) taken to comply with the above requirements for sale or transfer of real property. • Documents required shall be retained by the seller and shall again be made available to the APCO upon request.	• Indoor or outdoor wood-burning device that is permanently installed and included in the sale or transfer of any existing development. • Properties that are registered as a historical site, or are contributing structures located in a Historic Preservation Overlay Zone, as determined by the applicable, federal, State, or local agency. Contributing structures are those buildings which are examples of the predominate styles of the area, built during the time period when the bulk of the structures were built in the Historic Preservation Overlay Zone.
Requirements for Remodels	Remodel of wood burning fireplace or chimney where total cost exceeds $15,000, local building permit is required, and application for building permit is submitted on or after Jan. 1, 2020: • A person may only install a gas-fueled, electric, exempt, or EPA certified wood burning heater that meets requirements of NSPS at the time of installation.	None.
Requirements for Buildings	Limitations on wood burning fireplaces or wood burning heaters • At elevations below 3,000 feet in areas with natural gas service, no person shall install a wood burning fireplace, low mass fireplace, masonry heater, or wood burning heater. • At elevations at or above 3,000 feet or in areas without natural gas service, no more than two EPA certified wood	No person shall permanently install a wood-burning device into any new development.

	SJVAPCD Rule 4901	SCAQMD Rule 445
	burning heaters, that meet NSPS at time of installation, shall be installed per acre. ○ No person shall install more than one EPA certified wood burning heater, that meets NSPS at time of installation, per dwelling unit. ○ No person shall install a wood burning fireplace, low mass fireplace, masonry heater, or non-certified wood burning heater.	
Solid Wood Fuel or Wood Sale	Advertising Requirements for Sale of Wood • No person shall sell, offer for sale, or supply any wood which is orally or in writing, advertised, described, or in any way represented to be "seasoned wood" unless the wood has a moisture content of ≤20% by weight. • The APCO may delegate another person or agency the authority to test wood for moisture content and determine compliance.	• A commercial firewood seller shall only sell seasoned wood from July 1 through the end of February the following year. Any commercial firewood seller may sell seasoned as well as non-seasoned wood during the remaining months. • No commercial firewood seller shall sell, offer for sale, or supply wood-based fuel without first attaching a permanently affixed indelible label to each package or providing written notice to each buyer at the time of purchase of bulk firewood that at a minimum states the following: "Use of this and other solid fuel products may be restricted at times by law. Please check (1-877-4NO-Burn) or (www.8774NOBURN.org) before burning." Labeling requirements do not apply to wood-based fuel intended for cooking, smoking, or flavoring of food. The Executive Officer shall specify guidelines for the aforementioned labeling requirements.
Prohibited Fuels	No person shall cause or allow any of the following materials to be burned in a wood burning fireplace, wood burning heater, or outdoor wood burning device: garbage, treated wood, non-seasoned wood, plastic products, rubber products, waste petroleum products, paints and paint solvents, coal, or any other material not intended by a manufacturer for use as a fuel in a wood burning fireplace, wood burning heater, or outdoor wood burning device.	No person shall burn any product not intended for use as fuel in a wood-burning device including, but not limited to, garbage, treated wood, particle board, plastic products, rubber products, waste petroleum products, paints, coatings or solvents, or coal. Manufactured logs are exempt from this requirement.

The District evaluated the requirements contained within SCAQMD Rule 445 and found that overall District Rule 4901 is as stringent as or more stringent than SCAQMD Rule 445.

Bay Area AQMD

- BAAQMD Regulation 6, Rule 3 (Wood-Burning Devices)

	SJVAPCD Rule 4901	BAAQMD Reg 6, Rule 3
Natural Gas Exemption	Locations where natural gas is not available are not subject to episodic curtailments (propane and butane are not considered natural gas).	No exemption.
Sole Source Exemption	Those for whom a wood burning fireplace or wood burning heater is the sole available source of heat in a residence are not subject to level 1 and level 2 episodic wood burning curtailment requirements. This includes times of temporary service outages, as determined by the gas or electrical utility service.	Any person whose sole source of heat is an EPA certified wood-burning device that is registered with the District per the requirements for registration of EPA certified wood heaters and registration renewal and who does not have available to them a permanently-installed NG, propane, or electric heating device. Any person seeking this exemption under must have previously registered their EPA certified wood heater in the District's registration program and must maintain documentation that the device is operated according to manufacturer's specifications. The following wood heaters are eligible to registered: • Wood heaters that are EPA certified to meet performance and emission standards of 7.5 g/hr or less • A pellet-fueled wood heater exempt from EPA certification requirements pursuant to 40 CFR 60 AAA at the time of purchase or installation
Limited Exemption: Loss of NG and/or Electrical Power	Those for whom a wood burning fireplace or wood burning heater is the sole available source of heat in a residence. This includes times of temporary service outages, as determined by the gas or electrical utility service are exempt from wood burning curtailments.	Mandatory burn bans shall not apply to a person whose dwelling is in an area that has a temporary loss of gas and/or electric utility service and there is no alternate form of heat available. Qualification for exemption is subject to verification.
Limited Exemption: Non- Functional Permanently Installed Heater	Those for whom a wood burning fireplace or wood burning heater is the sole available source of heat in a residence are not subject to level 1 and level 2 episodic wood burning curtailment requirements. This includes times of temporary service outages, as determined by the gas or electrical utility service.	Mandatory burn bans do not apply to any person whose only non-wood burning, permanently installed source of heat is non-functional and requires repair to resume operations. A dwelling may qualify for a 30-day exemption if there is no alternate form of heat and the non-functional heater is repaired to resume function within 30 days. Qualification for this exemption is subject to verification and must be supported by documentation of repair, which must be submitted to the District within 10 days of a receipt of a request for such records.

	SJVAPCD Rule 4901	BAAQMD Reg 6, Rule 3
No Burn Day (Nov-Feb)	**Level 1 Curtailment** • For the counties of San Joaquin, Stanislaus, Merced, Kings, and Tulare, the APCO shall declare a Level 1 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to equal or exceed 20 µg/m³ but not exceed 65 µg/m³ for the geographic region. • For the counties of Madera, Fresno, and Kern, the APCO shall declare a Level 1 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to equal or exceed 12 µg/m³ but not exceed 35 µg/m³ for the geographic region. • Registered wood burning heater may be operated provided it's fired on approved fuel, maintained, and operated according to manufacturer instructions, and has no visible smoke. **Level 2 Curtailment** • For the counties of San Joaquin, Stanislaus, Merced, Kings, and Tulare, the APCO shall declare a Level 2 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to exceed 65 µg/m³ or a PM10 concentration is forecast to equal or exceed 135 µg/m³ for the geographic region. • For the counties of Madera, Fresno, and Kern, the APCO shall declare a Level 2 Episodic Wood Burning Curtailment for a geographic region whenever the potential for a PM2.5 concentration is forecast to exceed 35 µg/m³ or a PM10 concentration is forecast to equal or exceed 135 µg/m³ for the geographic region.	Any period during which the air quality is forecast by the District to be unhealthy due to ambient levels of particulate matter exceeding 35 µg/m^3 and burning wood or any solid fuels is illegal in the Bay Area. A Mandatory Burn Ban is announced through a Spare the Air Alert. • No person shall operate or combust wood or solid-fuel products in any wood-burning device during a Mandatory Burn Ban.
Wood Heater Manufacturers & Retailers	Sale or transfer of wood burning heaters: • New: No person shall advertise, sell, offer for sale, supply, install, or transfer a new wood burning heater unless it is either EPA certified under the NSPS at the time of purchase or installation and at least as stringent as EPA Phase II requirements, or a	No manufacturer or retailer shall advertise, sell, offer for sale or resale, supply, install or transfer a new or used wood-burning device unless the device meets or exceeds 40 CFR 60 AAA • Any wood heater that is manufactured or sold at retail must meet an emissions rating of 2.5 g/hr if crib tested, or 2.0 g/hr if cordwood tested

	SJVAPCD Rule 4901	BAAQMD Reg 6, Rule 3
Sale, Resale, or Installation of Wood-Burning Devices	pellet-fueled wood burning heater that is exempt from EPA certification pursuant to requirements in the NSPS, until such time that amendments to the NSPS are finalized to remove exemptions for pellet-fueled wood burning heaters, then all new wood burning heaters must comply with the above. • Used: No person shall advertise, sell, offer for sale, supply, install, or transfer a used wood burning heater unless it has been rendered permanently inoperable, satisfies NSPS, or is a low mass fireplace, masonry heater, or other wood burning device of a make and model that meets all federal requirements and has been approved in writing by the APCO.	No person shall advertise, sell, offer for sale or resale, supply, install or transfer a new or used wood-burning device unless it meets 60 CFR 60 AAA. This requirement does not apply if a wood-burning device is an installed fixture in the sale or transfer of any real property.

	SJVAPCD Rule 4901	BAAQMD Reg 6, Rule 3
Requirements for Real Property	No person shall sell or transfer any real property which contains a wood burning heater without first assuring that each wood burning heater included in the real property: • Meets certification under the NSPS at the time of purchase or installation and is at least as stringent as EPA Phase II requirements, • Is a pellet-fueled wood burning heater that was exempt from EPA certification pursuant to requirements in the NSPS at the time of purchase or installation, or • Is rendered permanently inoperable and removed from property. Upon the sale or transfer of any residential real property in the San Joaquin Valley, the seller shall provide to the buyer of the real property and to the APCO, documentation certifying the following: • The type(s) and number(s) of wood burning heaters and wood burning fireplaces included in the real property transaction. If no wood burning heaters or wood burning fireplaces are included in the real property transaction, this should be documented. • Any action(s) taken to comply with the above requirements for sale or transfer of real property • Documents required shall be retained by the seller and shall again be made available to the APCO upon request.	Any person selling, renting or leasing a real property shall provide sale or rental disclosure documents that describe the health hazards of PM2.5 (in accordance with BAAQMD guidance) from burning wood or any solid fuel as a source.
Requirements for Rental Properties	None.	All real property offered for lease or rent in areas with natural gas service shall have a permanently-installed form of heat that does not burn solid fuel.

	SJVAPCD Rule 4901	BAAQMD Reg 6, Rule 3
Requirements for Buildings	Limitations on wood burning fireplaces or wood burning heaters: • At elevations below 3,000 feet in areas with natural gas service, no person shall install a wood burning fireplace, low mass fireplace, masonry heater, or wood burning heater. • At elevations at or above 3,000 feet or in areas without natural gas service, no more than two EPA certified wood burning heaters, that meet NSPS at time of installation, shall be installed per acre. ○ No person shall install more than one EPA certified wood burning heater that meets NSPS at time of installation, per dwelling unit. ○ No person shall install a wood burning fireplace, low mass fireplace, masonry heater, or non-certified wood burning heater.	No person or builder shall install a wood-burning device in a new building construction.
Requirements for Remodeling a Fireplace or Chimney	Remodel of wood burning fireplace or chimney where total cost exceeds $15,000, local building permit is required, and application for building permit is submitted on or after Jan. 1, 2020: • A person may only install a gas-fueled, electric, exempt, or EPA certified wood burning heater that meets requirements of NSPS at the time of installation.	No person shall remodel a fireplace or chimney unless a gas-fueled, electric, or EPA certified device is installed that meets requirements of 40 CFR 60 AAA. This requirement is triggered by a fireplace or chimney remodel where a total cost exceeds $15,000 and requires a local building permit.
Visible Emissions	• Under normal operating conditions, no person shall cause or allow any visible smoke from a registered wood burning heater. • Under normal operating conditions, no person shall cause or allow from a wood burning fireplace or nonregistered wood burning heater a visible emission of any air contaminant, other than uncombined water vapor, that exceeds No. 1 on the Ringelmann Chart or 20% opacity for a period or periods aggregating more than 3 minutes in any one (1) hour.	No person shall cause or allow a visible emission that exceeds Ringlemann 1 (20% opacity) for a period or periods aggregating more than 3 minutes in any hour. Visible emissions from startup shall not exceed 20 consecutive minutes in any consecutive four-hour period.

	SJVAPCD Rule 4901	BAAQMD Reg 6, Rule 3
Public Awareness Information	Retailers selling or offering for sale new wood burning heaters shall supply public awareness information with each sale in the form of pamphlets, brochures, or fact sheets on the following: proper installation, operation, and maintenance, fuel, health effects, weatherization methods for the home, proper sizing of wood burning heaters, and Burn Curtailments.	Any person offering for sale, selling or installing a new or used wood-burning device shall provide public awareness information to each purchaser of a wood-burning device in the form of pamphlets, brochures, or fact sheets. The information shall include the following statement: "Wood smoke contains harmful PM which is associated with numerous negative health impacts."
Solid Wood Fuel or Wood Sale	Advertising Requirements for Sale of Wood • No person shall sell, offer for sale, or supply any wood which is orally or in writing, advertised, described, or in any way represented to be "seasoned wood" unless the wood has a moisture content of ≤20% by weight. • The APCO may delegate another person or agency the authority to test wood for moisture content and determine compliance.	Any person offering for sale, selling or providing solid fuel or wood intended for use in a wood-burning device shall: • Attach a label to each package of solid fuel or wood sold that states "Use of this and other solid fuels may be restricted at times by law. Please check 1877-4-NO-BURN or www.8774noburn.org before burning." • If wood is seasoned (not to include manufactured logs), then the label must also state: "This wood meets air quality regulations for moisture content to be less then 20% by weight for cleaner burning." • If wood is NOT seasoned "This wood does NOT meet air quality regulations for moisture content and must be properly dried before burning."
Prohibited Fuels	No person shall cause or allow any of the following materials to be burned in a wood burning fireplace, wood burning heater, or outdoor wood burning device: garbage, treated wood, non-seasoned wood, plastic products, rubber products, waste petroleum products, paints and paint solvents, coal, or any other material not intended by a manufacturer for use as a fuel in a wood burning fireplace, wood burning heater, or outdoor wood burning device.	No person shall cause or allow any of the following materials to be burned in a wood-burning device: garbage, treated wood, non-seasoned wood, used or contaminated wood pallets, plastic products, rubber products, waste petroleum products, paints and paint solvents, coal, animal carcasses, glossy or colored paper, salt water driftwood, particle board, and any material not intended by the manufacturer for use as a fuel in a wood-burning device.

The District evaluated the requirements contained within BAAQMD Regulation 6, Rule 3 and found that District Rule 4901 is as stringent as or more stringent than BAAQMD Regulation 6, Rule 3.

Potential Emission Reduction Opportunities

Additional Requirements for Uncertified Devices

As previously referenced, Rule 4901 has been approved by EPA as the Most Stringent Measure in the nation for reducing residential wood burning emissions through a combination of enforceable requirements, coupled with strong education and incentive programs, aimed at eliminating the sale, transfer, and use of wood burning heaters and fireplaces. While a few cities have adopted local requirements or ordinances aimed at reducing the use of uncertified heaters, these requirements are generally limited to fairly small jurisdictions with little to no enforceability, and are not coupled with the much more stringent curtailment requirements imposed in the San Joaquin Valley that eliminate burning often for the vast majority of the winter in PM2.5-challenged regions of the Valley. While the District's regulation is the most stringent in the nation, the District will continue to evaluate additional options for developing enforceable mechanisms for reducing emissions from uncertified devices while also considering the stringent No Burn curtailments already imposed under the current regulation.

Extension of Wood Burning Season

Currently, the District's wood burning curtailment period as specified in Rule 4901 is implemented during the peak PM2.5 winter season (November through February), and has proven to be extremely effective in advancing the District's objectives to attain the PM2.5 federal standards and protect public health. Extending the curtailment period through March would result in additional emission reductions beyond what is currently achieved by the rule. The District has determined that this opportunity is both technologically and economically feasible for implementation in the Valley.

Evaluation Findings

Rule 4901 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

While the District meets or exceeds BACM and MSM requirements for this source category, given the enormity of reductions needed to demonstrate attainment with the 2012 annual PM2.5 standard, the District commits to evaluating potential opportunities to further reduce PM2.5 emissions from wood burning fireplaces and heaters by extending the wood burning season through March 31.

C.20 RULE 4902 (RESIDENTIAL WATER HEATERS)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.20	0.20	0.20	0.20	0.20	0.21	0.21
NOx	1.32	1.31	1.22	1.16	1.17	1.19	1.19
	Winter Average - Tons per day						
PM2.5	0.26	0.27	0.27	0.27	0.27	0.27	0.27
NOx	1.76	1.74	1.62	1.55	1.56	1.58	1.58

District Rule 4902 Description

Adopted July 17, 1993, District Rule 4902 is a point-of-sale rule that limits NOx emissions from natural gas-fired residential water heaters with heat input rates less than or equal to 75,000 Btu/hr. The original rule enforced a NOx emissions limit of 40 nanograms of NOx per Joule of heat output (ng/J). Amendments in March 2009 strengthened the rule by enforcing a limit of 10 ng/J for new or replacement water heaters and a limit of 14 ng/J for instantaneous, or tankless, water heaters.

As a point-of-sale rule, Rule 4902 affects water heater manufacturers, plumbing wholesalers, retail home supply stores, plumbers and contractors, and homeowners. This source category encompasses several types of water heaters, including conventional storage water heaters, demand water heaters, heat pump water heaters, solar water heaters, and tankless coil and indirect water heaters. Water heater options also vary by fuel type, which includes electricity, fuel oil, geothermal energy, natural gas, propane, and solar energy.

Conventional storage water heaters are the most common. They have an insulated tank sized from 20 to 80 gallons and natural gas-fired units have a gas burner under the tank regulated by a thermostat. Demand water heaters, also known as instantaneous or tankless water heaters, heat water as it is required and do not use a storage tank. As soon as there is a demand for hot water, a gas burner heats cold water as it travels through a pipe in the unit. Natural gas-fired units generally provide hot water at a rate upwards of 5 gallons per minute.

A tankless coil water heater heats water flowing through a heat exchanger installed in a furnace or boiler. Similar to the tankless coil water heater, an indirect water heater uses a furnace or boiler. Fluid heated by the furnace or boiler circulates through a heat exchanger in a storage tank.

Manufacturers have focused on combustion modifications to meet the lower NOx limit, as required in other California air districts. Combustion modification systems reduce thermal NOx formation by changing the flame characteristics to reduce peak flame temperature. Different burner designs, such as low-NOx and ultra-low NOx burners,

achieve combustion modification for residential water heaters. Some of the design principles used in low-NOx and ultra-low NOx burners include staged air burners, staged fuel burners, pre-mix burners, internal recirculation, and radiant burners.

Statewide Zero-Emission Standards for Building Appliances

CARB's *2022 State Strategy for the State Implementation Plan* (*2022 State SIP Strategy*) includes a commitment to develop and propose a zero-emissions standard for space and water heaters sold in the state to go into effect in 2030.[168] This goal is in alignment with California's climate strategy, which includes efforts towards building decarbonization, as laid out in CARB's *2022 Scoping Plan for Achieving Carbon Neutrality* (*2022 Scoping Plan*).[169] CARB has committed to conduct an extensive investigation into this measure, develop a proposed rule through meaningful public engagement, and bring the proposed rule before their Board by 2025. Upon fulfilling these commitments, the State expects to experience significant air quality and public health benefits.

In the development of the *2022 State SIP Strategy* and the *2022 Scoping Plan*, CARB examined the many factors involved in the transition to zero-emission appliances, and outlined the necessary process ahead to achieve building decarbonization. CARB's *2022 Scoping Plan* details a number of aspects that must be considered before implementing zero-emission appliance standards, including technical feasibility, costs and affordability, and consumer acceptance, adoption, awareness, and readiness. Additionally, CARB acknowledged the concerted effort needed across all levels of government, utilities, appliance manufacturers, developers, contractors, households, and businesses to achieve this goal successfully and equitably across the state.

CARB began the public process for the development of zero-emission appliance standards with a public workshop on May 10, 2023.[170] The District continues to support CARB in the development and implementation of this measure, as it will result in direct air quality and public health benefits for the Valley.

Zero-Emission Requirements in Other Areas

Other air districts around the State are considering strategies that are similar to that adopted by CARB under the *2022 Scoping Plan* and *2022 State SIP Strategy*. For example, on March 15, 2023, Bay Area AQMD adopted zero-emission requirements for new residential and commercial furnaces and water heaters, with compliance dates ranging from 2027-2031, depending on unit type and size. Similarly, South Coast AQMD has committed to adopt the zero-emission standard developed by CARB for new space and water heaters in new constructions and equipment replacement by 2030 in

[168] CARB. *2022 State Strategy for the State Implementation Plan*, pp. 101-103. September 22, 2022. Retrieved from: https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf
[169] CARB. *2022 Scoping Plan for Achieving Carbon Neutrality*. December 15, 2022. Retrieved from: https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf
[170] CARB Zero-Emission Appliance Standards Webpage, Meetings & Workshops. Retrieved from: https://ww2.arb.ca.gov/our-work/programs/building-decarbonization/zero-emission-appliance-standards/meetings-workshops

their *2022 Air Quality Management Plan*, in addition to low-NOx and incentive-based strategies.[171]

Over 70 cities and counties in California have adopted local ordinances requiring varying degrees of electrification for new buildings. The first of these ordinances, passed in the City of Berkeley in August 2019, enacted a building code prohibiting natural gas piping into buildings. However, this ordinance was overturned on April 17, 2023, when the U.S. Ninth Circuit Court of Appeals issued a ruling that cities and states cannot ban natural gas hookups in new buildings, because such action is preempted by the U.S. Energy Policy Conservation Act, which "expressly preempts state and local regulations concerning the energy use of many natural gas appliances, including those used in household and restaurant kitchens." The City of Berkeley filed a petition for *en banc* review of this ruling on May 31, 2023, but the request was denied on January 2, 2024. The court held that the ban on natural gas was preempted by federal energy efficiency laws, setting precedent that blocks local government from using similar bans to combat climate change.[172] Following this ruling, a number of cities and counties with adopted natural gas bans have suspended enforcement of their ordinances.

How does District Rule 4902 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4902 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4902 to comparable requirements in rules from the following California nonattainment areas:

- Bay Area AQMD Regulation 9, Rule 6 (Amended March 15, 2023)[173]

[171] SCAQMD. *2022 Air Quality Management Plan*. (December 2, 2022). Retrieved from: http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=10
[172] U.S. Courts for the Ninth Circuit. California Restaurant Association v. City of Berkeley. Retrieved from: https://www.ca9.uscourts.gov/cases-of-interest/california-restaurant-association-v-city-of-berkeley/
[173] BAAQMD. *Regulation 9, Rule 6 (Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters).* (Amended March 15, 2023). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20230315_rg0906-pdf.pdf?la=en

- Sacramento Metropolitan AQMD Rule 414 (Amended October 25, 2018)[174]
- San Diego County APCD Rule 69.5.1 (Adopted June 24, 2015)[175]
- South Coast AQMD Rule 1121 (Amended September 3, 2004)[176]
- Ventura County APCD Rule 74.11 (Amended January 12, 2010)[177]

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4902 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

Bay Area AQMD

- BAAQMD Regulation 9, Rule 6 (Nitrogen Oxide Emissions from Natural Gas-Fired Boilers and Water Heaters)

	SJVAPCD Rule 4902	BAAQMD Reg 9, Rule 6
Applicability	Manufacturers, distributors, retailers, and installers of PUC quality natural gas-fired residential water heaters with heat input rates ≤75,000 Btu/hr.	Any person who sells, installs, or offers for sale a natural gas-fired water heater for use within the District and any manufacturer who intends to sell or distribute for sale or installation a natural gas-fired water heater for use within the District.
Exemptions	• PUC quality natural gas fired water heaters with rated heat input of >75,000 Btu/hr • Water heaters using fuels other than PUC quality natural gas • Water heaters used exclusively in recreational vehicles	The requirements below shall not apply to the following: • Natural gas-fired boilers and water heaters with a rated heat input capacity >2,000,000 Btu/hr • Natural gas-fired water heaters used in recreational vehicles • Water heaters using a fuel other than natural gas • Natural gas-fired pool/spa heaters with <400,000 Btu/hr rated heat input capacity used exclusively to heat swimming pools, hot tubs or spas
Requirements	No person shall manufacture for sale, distribute, sell, offer for sale, or install within the District any PUC quality natural gas-fired: • Water heater (excluding mobile home water heaters, instantaneous water heaters, and pool heaters) unless	No person shall sell, install, or offer for sale within the District any natural gas-fired boiler or water heater that emits more than the following NOx limits: • ≤75,000 Btu/hr: ○ 10 ng/J; ○ 0 ng/J for new units after Jan. 1, 2027 • Mobile home water heater: ○ 40 ng/J

[174] SMAQMD. *Rule 414 (Water Heaters, Boilers, and Process Heaters Rated Less than 1,000,000 BTU Per Hour).* (Amended October 25, 2018). Retrieved from: http://www.airquality.org/ProgramCoordination/Documents/rule414.pdf
[175] SDAPCD. *Rule 69.5.1 (Natural Gas-Fired Water Heaters).* (Adopted June 24, 2015). Retrieved from: https://www.sdapcd.org/content/dam/sdapcd/documents/rules/current-rules/Rule-69.5.1.pdf
[176] SCAQMD. *Rule 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters).* (Amended September 3, 2004). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1121.pdf?sfvrsn=4
[177] VCAPCD. *Rule 74.11 (Natural Gas-Fired Water Heaters).* (Revised January 12, 2010). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.11.pdf

	SJVAPCD Rule 4902	BAAQMD Reg 9, Rule 6
	certified to a NOx emission level of ≤10 ng/J • Instantaneous water heater unless certified to a NOx emission level of ≤14 ng/J • Mobile home water heater unless certified to a NOx emission level of ≤40 ng/J • Pool heater unless certified to a NOx emission level of ≤40 ng/J	• Pool/spa heater 400,001 to 2,000,000 Btu/hr: ○ 14 ng/J

Currently, applicable water heaters in the Bay Area are subject to the same 10 ng/J NOx limit as units subject to District Rule 4902. Recent amendments to BAAQMD Regulation 9, Rule 6 established a zero-NOx standard for new residential water heaters, set to begin in 2027. BAAQMD acknowledges that there are uncertainties in their proposed implementation timeline for zero-NOx requirements, and has stated that their Governing Board may choose to consider amending the compliance dates should it be later determined that sufficient zero-NOx technologies are not available.[178] The District is closely tracking BAAQMD's efforts.

Sacramento Metropolitan AQMD

- SMAQMD Rule 414 (Water Heaters, Boilers and Process Heaters Rated Less than 1,000,000 BTU Per Hour)

	SJVAPCD Rule 4902	SMAQMD Rule 414
Applicability	Manufacturers, distributors, retailers, and installers of PUC quality natural gas-fired residential water heaters with heat input rates ≤75,000 Btu/hr.	Any person who manufactures, distributes, offers for sale, sells, or installs any type of water heater (such as tank or tankless/instantaneous), boiler or process heater, with a rated heat input capacity <1,000,000 Btu/hr, fired with gaseous or nongaseous fuels, for use in this District.
Exemptions	• PUC quality natural gas fired water heaters with rated heat input of >75,000 Btu/hr • Water heaters using fuels other than PUC quality natural gas • Water heaters used exclusively in recreational vehicles	• Water heaters used in recreational vehicles • Pool/spa heaters with a heat input rating <75,000 Btu/hr • Water heaters, boilers and process heaters fired with LPG • Hot water pressure washers fired with gaseous or liquid fuels
Requirements	No person shall manufacture for sale, distribute, sell, offer for sale, or install within the District any PUC quality natural gas-fired:	A person shall only distribute, offer for sale, sell, or install a water heater, boiler, or process heater with certified NOx and CO emissions less than or equal to the following limits:

[178] BAAQMD. *Final Staff Report for the Proposed Amendments to Building Appliance Rules – Regulation 9, Rule 4: Nitrogen Oxides from Fan Type Residential Central Furnaces and Rule 6: Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters.* (March 2023). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20230307_fsr_rules0904and0906-pdf.pdf?la=en

	SJVAPCD Rule 4902	SMAQMD Rule 414
	• Water heater (excluding mobile home water heaters, instantaneous water heaters, and pool heaters) unless certified to a NOx emission level of ≤10 ng/J • Instantaneous water heater unless certified to a NOx emission level of ≤14 ng/J • Mobile home water heater unless certified to a NOx emission level of ≤40 ng/J • Pool heater unless certified to a NOx emission level of ≤40 ng/J	• <75,000 Btu/hr: ○ Mobile home: 40 ng/J; ○ All others: 10 ng/J • 75,000 to <400,000 Btu/hr: ○ Pool/Spa: 40 ng/J; ○ All others: 14 ng/J • 400,000 to <1 million Btu/hr: ○ All types: 14 ng/J NOx and 400 ppmv CO @ 3% O2

The District evaluated the requirements contained within SMAQMD Rule 414 and found no requirements that were more stringent than those already in District Rule 4902. Therefore, District Rule 4902 is as stringent as or more stringent than SMAQMD Rule 414.

San Diego County APCD

- SDAPCD Rule 69.5.1 (Natural Gas-Fired Water Heaters)

	SJVAPCD Rule 4902	SDAPCD Rule 69.5.1
Applicability	Manufacturers, distributors, retailers, and installers of PUC quality natural gas-fired residential water heaters with heat input rates ≤75,000 Btu/hr.	Manufacturers, distributors, retailers, and installers of natural gas-fired water heaters, with heat input rates <75,000 Btu/hr.
Exemptions	• PUC quality natural gas fired water heaters with rated heat input of >75,000 Btu/hr • Water heaters using fuels other than PUC quality natural gas • Water heaters used exclusively in recreational vehicles	• Water heaters with a rated heat input capacity of ≥75,000 Btu/hr • Water heaters used in recreational vehicles • Water heaters used exclusively to heat swimming pools and hot tubs • Water heaters using fuels other than natural gas • Instantaneous water heaters • Existing or relocated water heaters
Requirements	No person shall manufacture for sale, distribute, sell, offer for sale, or install within the District any PUC quality natural gas-fired: • Water heater (excluding mobile home water heaters, instantaneous water heaters, and pool heaters) unless certified to a NOx emission level of ≤10 ng/J • Instantaneous water heater unless certified to a NOx emission level of ≤14 ng/J • Mobile home water heater unless certified to a NOx emission level of ≤40 ng/J	• No person shall manufacture for sale, distribute, sell, offer for sale, or install any gas-fired water heaters unless it is certified to a NOx emission level of ≤10 ng/J; or 15 ppmv at 3% O2, dry • No person shall manufacture for sale, distribute, sell, offer for sale, or install any gas-fired mobile home water heater unless it is certified to a NOx emission level of ≤40 ng/J; or 55 ppmv at 3% O2, dry

	SJVAPCD Rule 4902	SDAPCD Rule 69.5.1
	• Pool heater unless certified to a NOx emission level of ≤40 ng/J	

The District evaluated the requirements contained within SDAPCD Rule 69.5.1 and found no requirements that were more stringent than those already in District Rule 4902. Therefore, District Rule 4902 is as stringent as or more stringent than SDAPCD Rule 69.5.1.

Potential Emission Reduction Opportunities

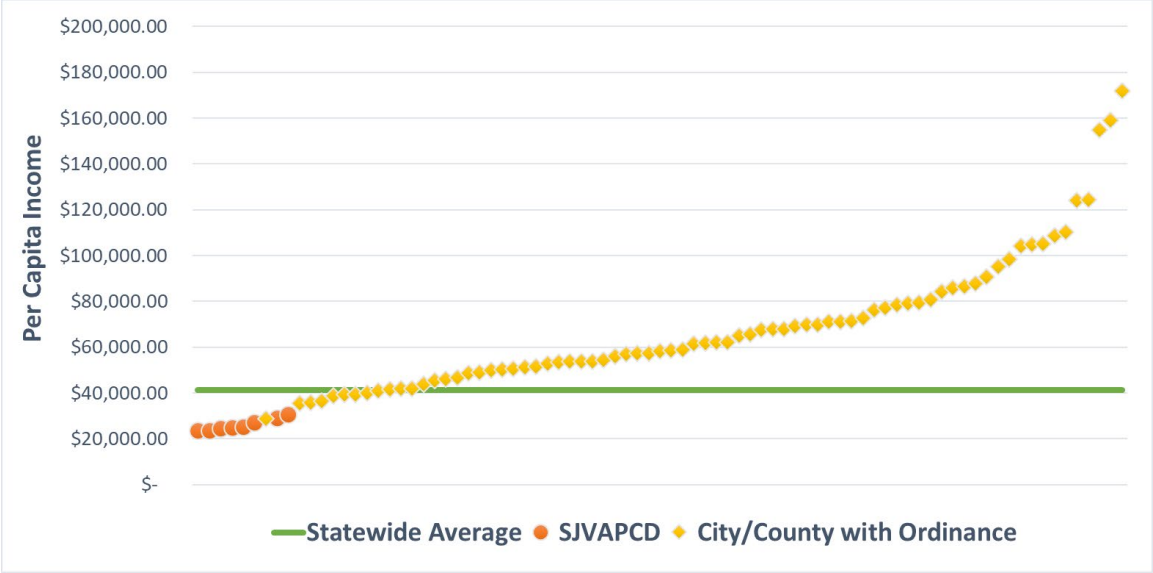
Zero-Emission Opportunities

While electric alternatives to natural gas-fired residential water heaters are currently available, feasibility and cost issues have previously prevented widespread electrification around the nation, particularly with respect to lower income households, given the significantly higher cost associated with electrical infrastructure and devices. As building electrification requirements pose potential significant impacts to low-income residents, careful equity considerations must be taken into account as new measures are developed. Though some areas in California have started implementing electrification requirements, given the number of region-specific factors that must be considered in adopting these requirements, it cannot be assumed that these policies are feasible for immediate implementation in all areas. Additionally, the Berkeley lawsuit, as discussed above, adds uncertainty to the implementation of electrification requirements.

The socioeconomic profiles of the cities and counties with building electrification requirements are vastly different from those found within the District. Based on recent U.S. Census Bureau estimates,[179] the per capita income for each District resident averaged $26,114 while cities and counties with building electrification ordinances averaged a per capita income of $68,845. The per capita income for each of the eight District counties and 76 cities and counties with building electrification ordinances is represented in Figure C-3 below, shown in comparison to the statewide average.

[179] U.S. Census Bureau. *Quick Facts*. Retrieved from: https://www.census.gov/quickfacts/fact/table/US/PST045222

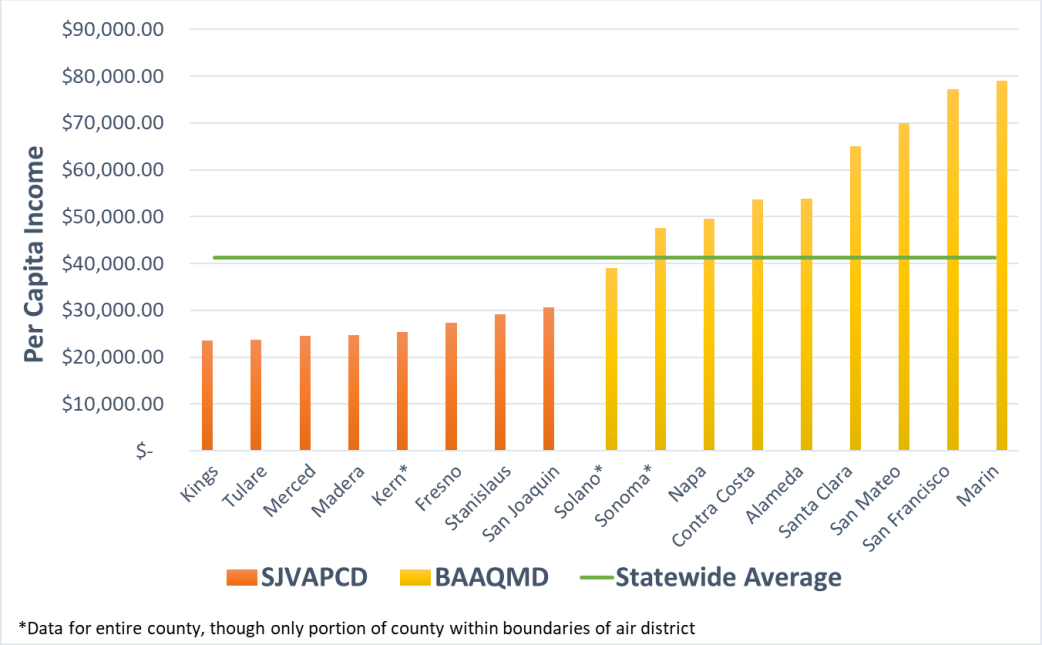
Figure C-3 Per Capita Income (in 2021 dollars), 2017-2021 for Cities and Counties with Building Electrification Ordinances



Through their rulemaking process, Bay Area evaluated the economic feasibility of these regulations under conditions specific to their region. Notably, the average income of Bay Area counties compared to that of Valley counties closely resembles the comparison made above to the cities and counties with building electrification ordinances (many of which fall within BAAQMD boundaries). According to recent U.S. Census Bureau estimates,[180] the per capita income in District counties averaged $26,114.38, while Bay Area counties averaged a per capita income of $59,443.67. Moreover, all eight counties within the District's jurisdiction fall under the average per capita income in California, and well below that of the nine counties within BAAQMD (Figure C-4). This disparity in income is an important consideration when comparing the feasibility of requiring zero-emission appliances in the Bay Area with that in the District, and demonstrates that economic feasibility in the Bay Area does not directly imply that a similar measure would be economically feasible to implement in the Valley within the same timeframe.

[180] U.S. Census Bureau. *Quick Facts*. Retrieved from: https://www.census.gov/quickfacts/fact/table/US/PST045222

Figure C-4 Per Capita Income (in 2021 dollars), 2017-2021 for San Joaquin Valley APCD and Bay Area AQMD Counties



CARB's *2022 Scoping Plan*[181] identifies costs and cost-savings of building decarbonization, which vary by end use and whether it is undertaken in new construction or in existing buildings. As part of this evaluation, CARB considered appliance and equipment capital costs, energy costs, new construction and retrofit costs, and the implications of such costs on low-income and disadvantaged communities. While CARB found that electric alternatives to gas appliances are becoming increasingly cost-competitive, their overall cost evaluation demonstrated that additional retrofit expenses and higher energy costs will place a disproportionate burden on lower-income households. As stated in the document, due to the higher upfront costs and financial challenges, low-income customers are less likely to adopt electric appliances first. Furthermore, as households begin to transition away from using fossil gas, "*those remaining on the fossil gas system are likely to pay an increasingly larger share of system wide costs, which could further widen the affordability gap between households that are able to decarbonize early and those that are not*."

Given the potential significant impacts to low-income residents, careful equity considerations must be taken into account as new measures are developed. The District must cautiously consider the specific economic challenges that exist in the Valley that may create significant barriers to adoption of a zero-emission standard for residential water heaters sooner than CARB's proposed measure.

[181] CARB. *2022 Scoping Plan for Achieving Carbon Neutrality*, *Appendix F: Building Decarbonization.* December 15, 2022. Retrieved from: https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp-appendix-f-building-decarbonization.pdf

Existing District Commitments

In an effort to identify potential emission reduction opportunities, the District's *2022 Ozone* Plan includes a further study commitment to evaluate current and upcoming work from CARB and other agencies related to reducing emissions from residential and commercial combustion sources, and evaluate the feasibility of implementing zero-emission or low-NOx requirements for these sources in the Valley. Through this effort, the District will also evaluate opportunities to advocate for funding under the Inflation Reduction Act, Bipartisan Infrastructure Law, and other funding sources, which are prioritizing funding opportunities for electrification of appliances to reduce greenhouse gas emissions. The District will continue to closely track regulations being developed by CARB, South Coast AQMD, BAAQMD, and others. Additionally, although the District currently implements the most stringent measures feasible, the District remains committed to pursuing zero-emission opportunities, taking into consideration equitable and feasible strategies.

Evaluation Findings

Rule 4902 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

The District continues to support CARB in the development and implementation of a statewide zero-NOx appliances measure, as it will result in direct air quality and public health benefits for the Valley. Additionally, as part of this Plan, the District commits to further evaluating potential opportunities to reduce NOx emissions from natural gas building appliances in the Valley. As part of this evaluation, the District will consider the implementation of zero-NOx requirements earlier than CARB's statewide measure, to the extent that measures are technologically and economically feasible in the Valley. The District will collaborate with utilities, agencies, and organizations to help leverage funding and coordinate incentives with existing programs.

C.21 RULE 4905 (NATURAL GAS-FIRED, FAN-TYPE CENTRAL FURNACES)

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.28	0.29	0.29	0.29	0.29	0.29	0.29
NOx	3.45	3.39	3.11	2.84	2.58	2.41	2.32
	Winter Average - Tons per day						
PM2.5	0.35	0.37	0.37	0.37	0.37	0.37	0.37
NOx	4.37	4.30	3.94	3.60	3.26	3.05	2.94

District Rule 4905 Description

District Rule 4905 is a point of sale rule that applies to any person who sells, offers for sale, installs or solicits the installation of natural-gas-fired, fan-type central furnaces for use in the Valley with a rated heat input capacity of less than 175,000 Btu/hour, and for combination heating and cooling units with a rated cooling capacity of less than 65,000 Btu/hour. Adopted on October 20, 2005, Rule 4905 established NOx limits for residential central furnaces supplied, sold, or installed in the Valley. January 2015 amendments lowered the NOx emission limit for residential units from 40 ng/J (0.093 lb/MMBtu) to 14 ng/J, and expanded rule applicability to include commercial units with a NOx emission limit of 14 ng/J and units installed in manufactured homes with a NOx emission limit of 40 ng/J to be lowered to 14 ng/J in 2018. The amendments allowed for the sale of non-compliant units during an initial 36-month implementation period in exchange for the payment of an emissions fee for each non-compliant unit sold, distributed, or installed in the Valley. EPA approved these amendments into the SIP effective April 28, 2016.[182]

The District has subsequently amended District Rule 4905 several times to extend the implementation period for certain unit types as a response to the limited number of certified compliant units available by the compliance deadline dates. This allowed additional time necessary to continue technology development and the certification process, while providing strong incentive for accelerated deployment of compliant units.

The most common type of heating system for residential and commercial buildings are furnaces fueled by natural gas that use forced air distribution. A thermostat controls the central furnace, which sends a signal to turn the unit on or off when the building temperature does not match a chosen set point. A valve then opens to send natural gas to the burners, which combusts the gas directly into the heat exchangers. A blower pulls air from inside the building through a filter, across the heat exchanger, and through

[182] EPA. *Approval of California Air Plan Revisions, San Joaquin Valley Unified Air Pollution Control District and South Coast Air Quality Management District. Final Rule*. 81 FR 17390. (March 29, 2016). (Codified at 40 CFR Part 52). Retrieved from: https://www.gpo.gov/fdsys/pkg/FR-2016-03-29/pdf/2016-06962.pdf

a series of ducts and vents to different areas of the building. Exhaust from the combustion exits the building through a separate duct.

Condensing units use an additional heat exchanger to extract the latent heat in the flue (exhaust) gas by cooling the combustion gasses to near ambient temperature and thereby increase the heating efficiency by up to 10%. The water vapor in the flue gas is condensed, collected, and drained.

Units installed in manufactured homes use the same types of materials and operating principles as commercial and residential units; however, significant differences exist. Furnaces installed in manufactured homes use sealed combustion, pre-heat the air typically to 50-60°F, use a concentric vent, and exhaust gases are vented through the inside core of the vent pipe. Furnaces installed in manufactured homes also have to comply with strict space restrictions.[183]

Statewide Zero-Emission Standards for Building Appliances

CARB's *2022 State SIP Strategy* includes a commitment to develop and propose a zero-emissions standard for space and water heaters sold in the state to go into effect in 2030.[184] This goal is in alignment with California's climate strategy, which includes efforts towards building decarbonization, as laid out in CARB's *2022 Scoping Plan*.[185] CARB has committed to conduct an extensive investigation into this measure, develop a proposed rule through meaningful public engagement, and bring the proposed rule before their Board by 2025. Upon fulfilling these commitments, the State expects to experience significant air quality and public health benefits.

In the development of the *2022 State SIP Strategy* and the *2022 Scoping Plan*, CARB examined the many factors involved in the transition to zero-emission appliances, and outlined the necessary process ahead to achieve building decarbonization. CARB's *2022 Scoping Plan* details a number of aspects that must be considered before implementing zero-emission appliance standards, including technical feasibility, costs and affordability, and consumer acceptance, adoption, awareness, and readiness. Additionally, CARB acknowledged the concerted effort needed across all levels of government, utilities, appliance manufacturers, developers, contractors, households, and businesses to achieve this goal successfully and equitably across the state.

CARB began the public process for the development of zero-emission appliance standards with a public workshop on May 10, 2023.[186] The District continues to support

[183] U.S. Department of Energy. *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnace Fans.* (July 7, 2014). Retrieved from: https://www.federalregister.gov/articles/2014/07/03/2014-15387/energy-conservation-program-for-consumer-products-energy-conservation-standards-for-residential

[184] CARB. *2022 State Strategy for the State Implementation Plan*, pp. 101-103. (September 22, 2022). Retrieved from: https://ww2.arb.ca.gov/sites/default/files/2022-08/2022_State_SIP_Strategy.pdf

[185] CARB. *2022 Scoping Plan for Achieving Carbon Neutrality*. (December 15, 2022). Retrieved from: https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf

[186] CARB Zero-Emission Appliance Standards Webpage, Meetings & Workshops. Retrieved from: https://ww2.arb.ca.gov/our-work/programs/building-decarbonization/zero-emission-appliance-standards/meetings-workshops

CARB in the development and implementation of this measure, as it will result in direct air quality and public health benefits for the Valley.

Zero-Emission Requirements in Other Areas

Other air districts around the State are considering strategies that are similar to that adopted by CARB under the *2022 Scoping Plan* and *2022 State SIP Strategy*. For example, on March 15, 2023, Bay Area AQMD adopted zero-emission requirements for new residential and commercial furnaces and water heaters, with compliance dates ranging from 2027-2031, depending on unit type and size. Similarly, South Coast AQMD has committed to adopt the zero-emission standard developed by CARB for new space and water heaters in new constructions and equipment replacement by 2030 in their *2022 Air Quality Management Plan*, in addition to low-NOx and incentive-based strategies.[187]

Over 70 cities and counties in California have adopted local ordinances requiring varying degrees of electrification for new buildings. The first of these ordinances, passed in the City of Berkeley in August 2019, enacted a building code prohibiting natural gas piping into buildings. However, this ordinance was overturned on April 17, 2023, when the U.S. Ninth Circuit Court of Appeals issued a ruling that cities and states cannot ban natural gas hookups in new buildings, because such action is preempted by the U.S. Energy Policy Conservation Act, which "expressly preempts state and local regulations concerning the energy use of many natural gas appliances, including those used in household and restaurant kitchens." The City of Berkeley filed a petition for *en banc* review of this ruling on May 31, 2023, but the request was denied on January 2, 2024. The court held that the ban on natural gas was preempted by federal energy efficiency laws, setting precedent that blocks local government from using similar bans to combat climate change.[188] Following this ruling, a number of cities and counties with adopted natural gas bans have suspended enforcement of their ordinances.

How does District Rule 4905 compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category.

State Regulations

There are no state regulations applicable to this source category.

[187] SCAQMD. *2022 Air Quality Management Plan*. (December 2, 2022). Retrieved from: http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=10

[188] U.S. Courts for the Ninth Circuit. California Restaurant Association v. City of Berkeley. Retrieved from: https://www.ca9.uscourts.gov/cases-of-interest/california-restaurant-association-v-city-of-berkeley/

How does District Rule 4905 compare to rules in other air districts?

The District compared emission limits, optional control requirements, and work practice standards in District Rule 4905 to comparable requirements in rules from the following California nonattainment areas:

- Bay Area AQMD Regulation 9, Rule 4 (Amended March 15, 2023)[189]
- San Diego County APCD Rule 69.6 (Adopted June 17, 1998)[190]
- South Coast AQMD Rule 1111 (Amended September 1, 2023)[191]
- Ventura County APCD Rule 74.22 (Adopted November 9, 1993)[192]

Sacramento Metropolitan AQMD does not have an analogous rule for this source category.

The District reviewed rule requirements implemented prior to EPA's approval of BACM/MSM for the *2018 PM2.5 Plan*, and found that District Rule 4905 continues to implement requirements as stringent as or more stringent than these other areas. The District's evaluation of the more recently amended rules is demonstrated below.

Bay Area AQMD

- BAAQMD Regulation 9, Rule 4 (Nitrogen Oxides from Fan Type Residential Central Furnaces)

	SJVAPCD Rule 4905	BAAQMD Reg 9, Rule 4
Applicability	Residential and commercial furnaces with rated heat input capacity of <175,000 btu/hr or <65,000 btu/hr for combination heating and cooling units.	Any person who sells, installs, or offers for sale a natural gas-fired furnace and any manufacturer who intends to sell or distribute for sale or installation a natural gas-fired furnace, with rated heat input capacity of <175,000 btu/hr.
Exemptions	Natural gas furnace not exceeding NOx emissions of 40 ng/J and installed with propane conversion kit for propane firing only.	Furnaces used for mobile homes.

[189] BAAQMD. *Regulation 9, Rule 4 (Nitrogen Oxides from Fan Type Residential Central Furnaces).* (Amended December 7, 1983). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/documents/rg0904.pdf?la=en&rev=e67bf6e164d94de39b44caa30ce17fd7

[190] SDAPCD. *Rule 69.6 (Natural Gas-Fired Fan Type Central Furnaces).* (Adopted June 17, 1998). Retrieved from: https://www.sdapcd.org/content/dam/sdapcd/documents/rules/current-rules/Rule-69.6.pdf

[191] SCAQMD. *Rule 1111 (Reduction of NOx Emissions from Natural-Gas-Fired, Fan-Type Central Furnaces).* (Amended September 1, 2023). Retrieved from: http://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1111.pdf?sfvrsn=4

[192] VCAPCD. *Rule 74.22 (Natural Gas-Fired, Fan-Type Central Furnaces).* (Amended November 9, 1993). Retrieved from: http://www.vcapcd.org/Rulebook/Reg4/RULE%2074.22.pdf

	SJVAPCD Rule 4905	BAAQMD Reg 9, Rule 4
Requirements	Furnaces must not exceed a NOx limit of 14 ng/J.	A person shall not sell, install, or offer for sale any natural gas-fired fan type central furnace that emits more than: • 40 ng/J; • 14 ng/J for new units after Jan. 1, 2024; • 0.0 ng/J for new units after Jan. 1, 2029

Currently, applicable furnaces in the Bay Area are subject to the same 14 ng/J NOx limit as units subject to District Rule 4905. Recent amendments to BAAQMD Regulation 9, Rule 4 established a future zero-NOx standard for new furnaces that is set to begin in 2029. BAAQMD acknowledges that there are uncertainties in their proposed implementation timeline for zero-NOx requirements, and has stated that their governing board may choose to consider amending the compliance dates should it be later determined that sufficient zero-NOx technologies are not available.[193] The District is closely tracking BAAQMD's efforts.

South Coast AQMD

- SCAQMD Rule 1111 (Reduction of NOx Emissions from Natural-Gas-Fired, Fan-Type Central Furnaces)

	SJVAPCD Rule 4905	SCAQMD Rule 1111
Applicability	Residential and commercial furnaces with rated heat input capacity of <175,000 btu/hr or <65,000 btu/hr for combination heating and cooling units.	Residential and commercial furnaces with rated heat input capacity of <175,000 btu/hr or <65,000 btu/hr for combination heating and cooling units.
Exemptions	Natural gas furnace not exceeding NOx emissions of 40 ng/J and installed with propane conversion kit for propane firing only.	• Furnaces installed in mobile homes before Oct. 1, 2012 • Natural gas furnace installed with propane conversion kit for propane firing only • Downflow and large-sized (≥100,000 btu/hr) condensing and noncondensing furnaces, replacing existing furnaces in the high-altitude areas
Requirements	Furnaces must not exceed a NOx limit of 14 ng/J.	Furnaces must not exceed a NOx limit of 14 ng/J.

The District evaluated the requirements contained within SCAQMD Rule 1111 and found no requirements that were more stringent than those already in District Rule 4905. Therefore, District Rule 4905 is as stringent as or more stringent than SCAQMD Rule 1111.

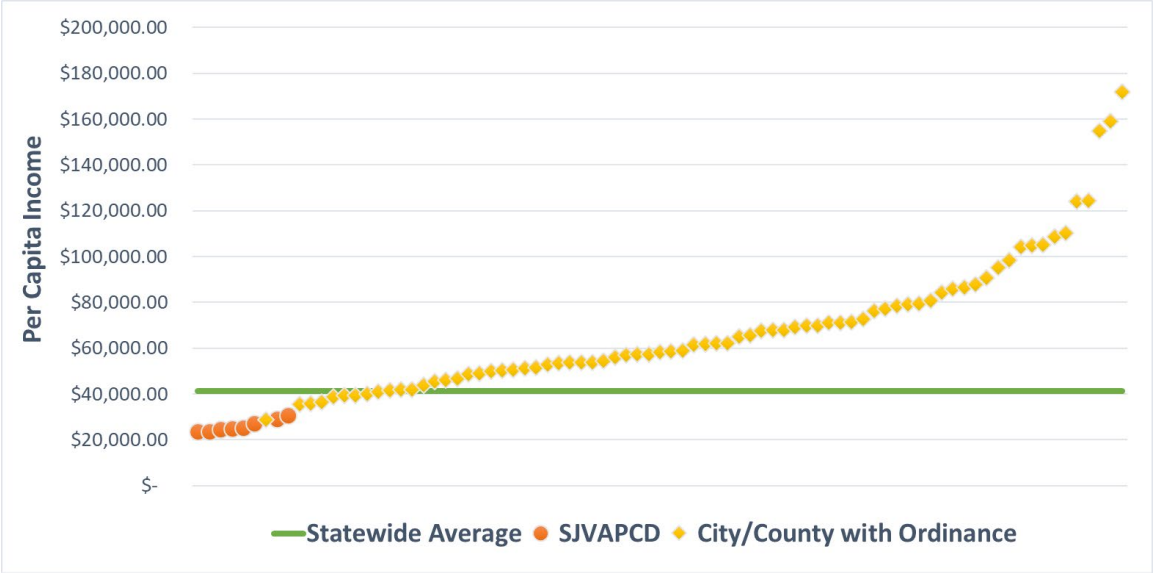
[193] BAAQMD. *Final Staff Report for the Proposed Amendments to Building Appliance Rules – Regulation 9, Rule 4: Nitrogen Oxides from Fan Type Residential Central Furnaces and Rule 6: Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters.* (March 2023). Retrieved from: https://www.baaqmd.gov/~/media/dotgov/files/rules/reg-9-rule-4-nitrogen-oxides-from-fan-type-residential-central-furnaces/2021-amendments/documents/20230307_fsr_rules0904and0906-pdf.pdf?la=en

Potential Emission Reduction Opportunities

While electric alternatives to natural gas-fired furnaces are currently available, feasibility and cost issues have previously prevented widespread electrification around the nation, particularly with respect to lower income households, given the significantly higher cost associated with electrical infrastructure and devices. As building electrification requirements pose potential significant impacts to low-income residents, careful equity considerations must be taken into account as new measures are developed. Though some areas in California have started implementing electrification requirements, given the number of region-specific factors that must be considered in adopting these requirements, it cannot be assumed that these policies are feasible for immediate implementation in all areas. Additionally, the Berkeley lawsuit, as discussed above, adds uncertainty to the implementation of electrification requirements.

The socioeconomic profiles of the cities and counties with building electrification requirements are vastly different from those found within the District. Based on recent U.S. Census Bureau estimates,[194] the per capita income for each District resident averaged $26,114 while cities and counties with building electrification ordinances averaged a per capita income of $68,845. The per capita income for each of the eight District counties and 76 cities and counties with building electrification ordinances is represented in Figure C-3 below, shown in comparison to the statewide average.

Figure C-5 Per Capita Income (in 2021 dollars), 2017-2021 for Cities and Counties with Building Electrification Ordinances

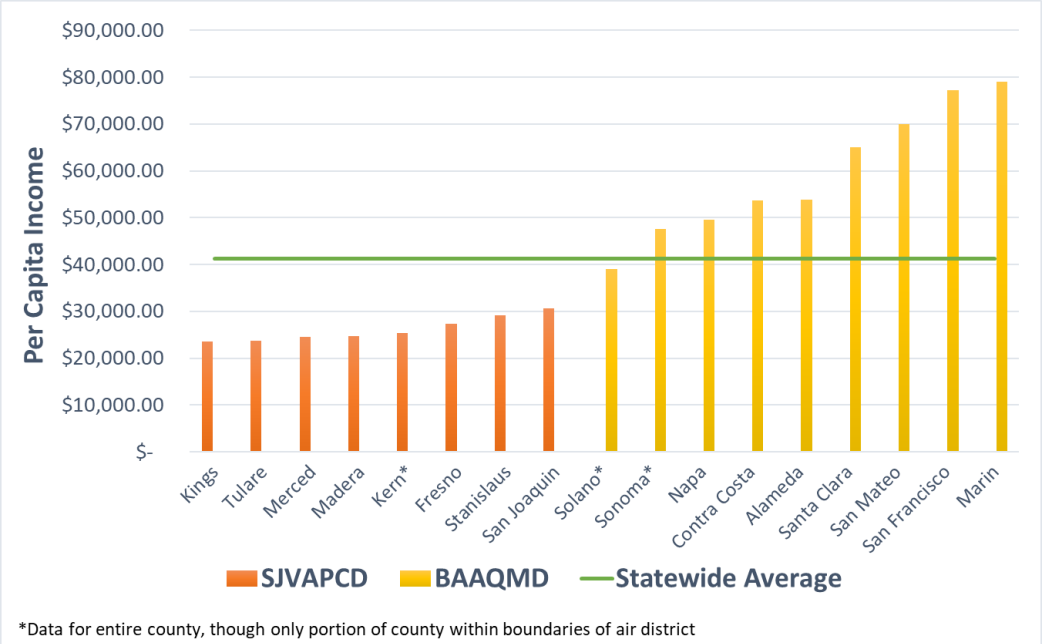


Through their rulemaking process, Bay Area evaluated the economic feasibility of these regulations under conditions specific to their region. Notably, the average income of Bay Area counties compared to that of Valley counties closely resembles the comparison made above to the cities and counties with building electrification

[194] U.S. Census Bureau. *Quick Facts*. Retrieved from: https://www.census.gov/quickfacts/fact/table/US/PST045222

ordinances (many of which fall within BAAQMD boundaries). According to recent U.S. Census Bureau estimates,[195] the per capita income in District counties averaged $26,114.38, while Bay Area counties averaged a per capita income of $59,443.67. Moreover, all eight counties within the District's jurisdiction fall under the average per capita income in California, and well below that of the nine counties within BAAQMD (Figure C-4). This disparity in income is an important consideration when comparing the feasibility of requiring zero-emission appliances in the Bay Area with that in the District, and demonstrates that economic feasibility in the Bay Area does not directly imply that a similar measure would be economically feasible to implement in the Valley within the same timeframe.

Figure C-6 Per Capita Income (in 2021 dollars), 2017-2021 for San Joaquin Valley APCD and Bay Area AQMD Counties



CARB's *2022 Scoping Plan*[196] identifies costs and cost-savings of building decarbonization, which vary by end use and whether it is undertaken in new construction or in existing buildings. As part of this evaluation, CARB considered appliance and equipment capital costs, energy costs, new construction and retrofit costs, and the implications of such costs on low-income and disadvantaged communities. While CARB found that electric alternatives to gas appliances are becoming increasingly cost-competitive, their overall cost evaluation demonstrated that additional retrofit expenses and higher energy costs will place a disproportionate burden on lower-income households. As stated in the document, due to the higher upfront costs and financial challenges, low-income customers are less likely to adopt electric appliances first. Furthermore, as households begin to transition away from using fossil gas, "*those remaining on the fossil gas system are likely to pay an increasingly larger*

[195] U.S. Census Bureau. *Quick Facts*. Retrieved from: https://www.census.gov/quickfacts/fact/table/US/PST045222
[196] CARB. *2022 Scoping Plan for Achieving Carbon Neutrality*, *Appendix F: Building Decarbonization.* December 15, 2022. Retrieved from: https://ww2.arb.ca.gov/sites/default/files/2022-11/2022-sp-appendix-f-building-decarbonization.pdf

share of system wide costs, which could further widen the affordability gap between households that are able to decarbonize early and those that are not."

Given the potential significant impacts to low-income residents, careful equity considerations must be taken into account as new measures are developed. The District must cautiously consider the specific economic challenges that exist in the Valley that may create significant barriers to adoption of a zero-emission standard for residential water heaters sooner than CARB's proposed measure.

Existing District Commitments

In an effort to identify potential emission reduction opportunities, the District's *2022 Ozone* Plan includes a further study commitment to evaluate current and upcoming work from CARB and other agencies related to reducing emissions from residential and commercial combustion sources, and evaluate the feasibility of implementing zero-emission or low-NOx requirements for these sources in the Valley. Through this effort, the District will also evaluate opportunities to advocate for funding under the Inflation Reduction Act, Bipartisan Infrastructure Law, and other funding sources, which are prioritizing funding opportunities for electrification of appliances to reduce greenhouse gas emissions. The District will continue to closely track regulations being developed by CARB, South Coast AQMD, BAAQMD, and others. Additionally, although the District currently implements the most stringent measures feasible, the District remains committed to pursuing zero-emission opportunities, taking into consideration equitable and feasible strategies.

Evaluation Findings

Rule 4905 provides for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

The District continues to support CARB in the development and implementation of a statewide zero-NOx appliances measure, as it will result in direct air quality and public health benefits for the Valley. Additionally, as part of this Plan, the District commits to further evaluating potential opportunities to reduce NOx emissions from natural gas building appliances in the Valley. As part of this evaluation, the District will consider the implementation of zero-NOx requirements earlier than CARB's statewide measure, to the extent that measures are technologically and economically feasible in the Valley. The District will collaborate with utilities, agencies, and organizations to help leverage funding and coordinate incentives with existing programs.

C.22 REGULATION VIII (FUGITIVE PM10 PROHIBITIONS)

Emissions Inventory

Rule 8021: Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	1.32	1.44	1.54	1.74	1.65	2.84	1.82
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	1.21	1.32	1.42	1.59	1.51	2.60	1.66
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Rule 8031: Bulk Materials

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.03	0.03	0.03	0.03	0.03	0.03	0.03
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	0.03	0.03	0.03	0.03	0.03	0.03	0.03
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Rule 8041: Carryout and Trackout

The emissions from this source category are included in the inventory for Rule 8061 (Paved and Unpaved Roads).

Rule 8051: Open Areas

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.34	0.34	0.34	0.34	0.34	0.34	0.34
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	0.21	0.21	0.21	0.21	0.21	0.21	0.21
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Rule 8061: Paved and Unpaved Roads

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	6.68	6.82	7.00	7.20	7.40	7.50	7.54
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	5.80	5.93	6.10	6.29	6.48	6.58	6.62
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Rule 8071: Unpaved Vehicle/Equipment Traffic Areas

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.59	0.59	0.58	0.58	0.58	0.57	0.57
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	0.60	0.60	0.59	0.59	0.59	0.58	0.58
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Rule 8081: Agricultural Sources

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	1.18	1.17	1.16	1.15	1.14	1.14	1.14
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	0.73	0.72	0.72	0.71	0.71	0.70	0.70
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Rule Descriptions

The District's Regulation VIII series (Fugitive PM10 Prohibitions) was adopted in November 2001, and subsequently amended in 2004. This rule series contains a comprehensive suite of rules designed to reduce fugitive PM10 emissions from a range of sources, as further described below:

Rule 8011: General Requirements

The provisions of Rule 8011 are applicable to specified outdoor fugitive dust sources. The definitions, exemptions, general requirements, administrative requirements, recordkeeping requirements, and test methods set forth in this rule are applicable to all rules under District Regulation VIII. The rules were developed pursuant to EPA guidelines for serious PM10 nonattainment areas. In 2004, the District adopted

amendments to Regulation VIII to upgrade existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas.

Rule 8021: Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities

Rule 8021 applies to construction or demolition related disturbances of soil, including land clearing, grubbing, scraping, excavation, extraction, land leveling, grading, cut and fill operations, travel on the site, travel access roads to and from the site, and demolition activities. The rule also applies to construction of new landfill disposal sites or modifications to existing landfill disposal sites prior to commencement of landfilling activities. In 2004, Rule 8021 was amended to add dust suppression requirements, and to require submittal of Dust Control Plans on residential construction sites 10.0 acres or more in size and on non-residential construction sites 5.0 acres or more in size.

Rule 8031: Bulk Materials

Rule 8031 applies to the outside storage and handling of any unpackaged material, which emits or has the potential to emit dust when stored or handled. Rule 8031 requires bulk handling and storage facilities to restrict dust from material transfer, and reduce emissions from transport material and storage piles that emit dust. Facilities subject to Rule 8031 are required to use control measures to ensure that visible dust emissions (VDE) are limited to 20% opacity or less. These control measures can include application of water or other dust stabilizers, covering of bulk materials, construction of wind barriers, covering of haul trucks, and other measures. In 2004, Rule 8031 was amended to require the construction and maintenance of wind barriers when handling bulk materials.

Rule 8041: Carryout and Trackout

Rule 8041 applies to the prevention and cleanup of mud and dirt whenever it is deposited (carryout and trackout) onto public paved roads from activities subject to the requirements of Rules 8021, 8031, 8061, and 8071. The rule contains requirements for: removing carryout and trackout at the end of each workday; carryout and trackout thresholds for any site with 150 or more daily vehicle trips; addressing carryout and trackout in Dust Control Plans; removing carryout and trackout in urban areas; paved interior roads; and prevention of carryout and trackout. Rule 8041 was amended in 2004 to require a threshold for vehicles with three or more axles to takes actions for carryout and trackout. Amendments included a threshold for projects located in rural areas, a provision requiring actions within half an hour if specified measures are insufficient to prevent carryout and trackout, and specifications for dust collectors, gravel pads, and paved surfaces.

Rule 8051: Open Areas

Rule 8051 applies to any open area 0.5 acres or more within urban areas, or 3.0 acres or more within rural areas that contains at least 1,000 square feet of disturbed surface area. The rule has requirements for limiting VDE to 20% opacity, to comply with the conditions of a stabilized surface, and to install barriers to prevent unauthorized vehicles from accessing the stabilized areas. Rule 8051 was amended in 2004 to add applicability thresholds for rural and urban areas.

Rule 8061: Paved and Unpaved Roads

Rule 8061 establishes standards for the construction of new and modified paved roads in accordance with published guidelines by the American Association of State Highway and Transportation Officials for road construction, and applies to any paved, unpaved, or modified public or private road, street highway, freeway, alley way, access drive, access easement, or driveway. The rule also allows alternative means of achieving the same level of dust reduction. Rule 8061 establishes thresholds that, when exceeded, require roads to be treated to reduce VDE. Rule 8061 was amended in 2004 to replace the existing 75 maximum vehicle daily trip (VDT) threshold with a 26 annual average daily trips (AADT) threshold on unpaved roads, and to require that all new roads within urban areas be paved.

Rule 8071: Unpaved Vehicle/Equipment Traffic Areas

Rule 8071 is applicable to unpaved vehicle and equipment areas, including parking, fueling, service, shipping, receiving, and transfer areas. The rule contains requirements for when vehicle traffic reaches or exceeds specified thresholds, limitations on VDE, compliance requirements with the conditions of a stabilized surface, and lists control techniques, which could be implemented to limit VDE and to comply with the conditions of a stabilized surface. Rule 8071 was amended in 2004 to: remove the 1.0 acre or larger threshold; change the vehicle threshold from 75 VDT to 50 AADT; add a single day peak threshold of 150 VDT or require control for sources that exceed the 150 VDT threshold limit on at least 30 days per year; and add a requirement specific to whenever 25 or more three-axle vehicle trips occur on an unpaved vehicle/equipment traffic area.

Rule 8081: Agricultural Sources

Rule 8081 applies to “off-field” agricultural sources including, but not limited to, unpaved roads, unpaved vehicle and equipment traffic areas, and bulk materials. The rule contains requirements to limit VDE and/or to comply with the conditions of a stabilized surface, and lists control techniques that could be implemented to limit VDE and to comply with the conditions of a stabilized surface. Rule 8081 was amended in 2004 to: add an exemption to the rule for vehicle and equipment traffic areas if they are less than one acre in size and more than one mile from an urban area; expand rule applicability by updating the vehicle threshold from 75 VDT to 50 annual average vehicle trips; and add a requirement specific to whenever 26 or more three-axle vehicle trips will occur on an unpaved vehicle and equipment traffic area.

How does District Regulation VIII compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category. The following federal regulations apply to sources covered under Regulation VIII:

- *Rule 57 FR 13498 – General Preamble for Title I of CAA*

The District evaluated the requirements contained within the General Preamble and found no requirements that were more stringent than those already in Regulation VIII.

- *Fugitive Dust Background Document and Technical Information Document for BACM* (EPA-450/2-92-004 1992/09)

The District evaluated the requirements contained within the Fugitive Dust Background Document and Technical Information Document for BACM and found no requirements that were more stringent than those already in Regulation VIII.

State Regulations

There are no state regulations applicable to this source category.

How does District Regulation VIII compare to rules in other air districts?

Bay Area AQMD does not have an analogous rule for this source category.

SCAQMD

- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities) (*Last amended November 6, 2015*)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found that overall Regulation VIII is as stringent as or more stringent than Rule 1156.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations) (*Last amended September 8, 2006*)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found that overall Regulation VIII is as stringent as or more stringent than Rule 1157.

SMAQMD

- Rule 403 (Fugitive Dust) (*Last amended August 3, 1977*)

The District evaluated the requirements contained within SMAQMD Rule 403 and found that overall Regulation VIII is as stringent as or more stringent than Rule 403.

VCAPCD

- Rule 55 (Fugitive Dust) (*Adopted June 10, 2008*)

The District evaluated the requirements contained within VCAPCD Rule 55 and found that overall Regulation VIII is as stringent as or more stringent than Rule 55.

Clark County Department of Environment and Sustainability (CCDES)

- Section 41 (Fugitive Dust) (*Last amended January 21, 2020*)

The District evaluated the requirements contained within CCDES Section 41 and found that overall Regulation VIII is as stringent as or more stringent than Section 41.

- Section 91 (Fugitive Dust from Unpaved Roads, Unpaved Alleys, and Unpaved Easement Roads) (*Last amended April 15, 2014*)

The District evaluated the requirements contained within CCDES Section 91 and found that overall Regulation VIII is as stringent as or more stringent than Section 91.

- Section 92 (Fugitive Dust from Unpaved Parking Lots and Storage Areas) (*Last amended August 3, 2021*)

The District evaluated the requirements contained within CCDES Section 92 and found that overall Regulation VIII is as stringent as or more stringent than Section 92.

- Section 93 (Fugitive Dust from Paved Roads and Street Sweeping Equipment) (*Last amended January 21, 2020*)

The District evaluated the requirements contained within CCDES Section 93 and found that overall Regulation VIII is as stringent as or more stringent than Section 93.

- Section 94 (Permitting and Dust Control for Construction and Temporary Commercial Activities) (*Last amended August 3, 2021*)

The District evaluated the requirements contained within CCDES Section 94 and found that overall Regulation VIII is as stringent as or more stringent than Section 94.

Great Basin APCD Rule 433 (Control of Particulate Emissions at Owens Lake)

- Section 41 (Fugitive Dust) (*Adopted April 13, 2016*)

The District evaluated the requirements contained within Great Basin APCD Rule 433 and found that overall Regulation VIII is as stringent as or more stringent than Rule 433.

Potential Emission Reduction Opportunities

While District Regulation VIII was critical in the District's attainment of the PM10 standards, a variety of studies have been conducted which indicate that the PM2.5 fraction of the PM emissions from this source category may not be as significant as the PM coarse fraction. A better quantification of the PM2.5 fraction is required to develop a more accurate emissions inventory for the various activities under Rule 8021 and to indicate the level of significance of those PM2.5 emissions. Modeling results show that the geologic fraction of PM2.5 found in the Valley makes a relatively small contribution to overall PM2.5 mass.

As demonstrated above, Regulation VIII currently employs the best dust mitigation techniques. The District did not identify any additional emission reduction opportunities at this time.

Evaluation Findings

The District's Regulation VIII rules provide for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore meets or exceeds BACM and MSM requirements.

C.23 ALMOND HARVESTING AND PROCESSING

Emissions Inventory

	2017	2019	2022	2025	2028	2030	2031
	Annual Average - Tons per day						
PM2.5	0.47	0.47	0.47	0.50	0.52	0.54	0.55
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day						
PM2.5	0.22	0.22	0.22	0.23	0.24	0.25	0.25
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Emissions above represent emissions from processing. Harvesting emissions are captured under the inventory for Rule 4550.

Description and Efforts to Date

The San Joaquin Valley is one of the largest agricultural producing regions in the nation, and the sole producer of 99% of the U.S. almond and walnut supply. In the early 2000s, there was a large transition to farming of nut crops due to market conditions. In 2012, there were a total of approximately 750,000 bearing acres of almond in the Valley, and by 2022, almonds were California's #1 crop by acreage with 7,600 farms containing over 1.3 million bearing acres.

The harvesting of almonds includes three processes: shaking, sweeping (and drying), and picking up the nuts in a harvester that separates the almonds from dirt and debris. In recent years, standard practices within the almond industry have shifted as many almond processing facilities have made the decision to no longer accept materials that contain debris, such as sticks, leaves, and dirt. This excess material requires additional processing, and results in significant wear and tear of equipment at almond processing facilities. Almond growers have had to adapt to this change by investing in equipment specifically designed to remove this debris called conditioners. The almonds that have been swept into rows are picked up by conditioners, which separate and remove debris, and are then laid back down in the row to dry before they are picked up by the harvesting equipment. There are many air quality benefits as a result of the use of conditioners, including reduced dust during harvest, lower mobile source emissions due to less material being transported, and less emissions from the processing of material at hullers. As this practice has only been implemented more recently, the overall impact on total emissions from using conditioners in the harvesting process is unclear and additional research is needed to better understand the emissions profile.

After harvesting, almonds are transported to processing facilities, where they are hulled and shelled, leaving the nut, or meat. Processes for removing the debris and almond hulls and shells are potential sources of air emissions, primarily particulate matter due to dust generation from the movement of trash, hulls, shells, and meats. The quantity of PM emissions varies depending on the type of facility, harvest method, trash content, climate, production rate, and the type and number of controls used by the facility. As

discussed above, almond processing facilities are becoming less inclined to accept material containing debris, and therefore emissions from processing are expected to be lower than in the past.

Emission control systems at almond post-harvest processing facilities include both ventilation systems to capture the dust generated during handling and processing of almonds, shells, and hulls, and an air pollution control device to collect the captured PM. Cyclones formerly served as the principal air pollution control devices for PM emissions from almond post-harvest processing operations, however, fabric filters, or a combination of fabric filters and cyclones, are now installed in the San Joaquin Valley. Practices of combining and controlling specific exhaust streams from various operations vary considerably among facilities. The exhaust stream from a single operation may be split and ducted to two or more control devices. Conversely, exhaust streams from several operations may be combined and ducted to a single control device. Fabric filter baghouses achieve ≥99% control of PM10. Additionally, NOx emissions from units used in almond processing are typically controlled by District rules for specific equipment categories, most commonly boilers subject to Rules 4306 and 4320.

District Efforts to Date

The District continues to take actions to reduce exposure to localized sources of particulate matter. As nut harvesting activities can be the cause of localized air quality impacts due to dust emissions, in 2017, the District Governing Board established the Community-Level Targeted Strategy, which led to the development of the first-in-the-nation Low-Dust Nut Harvester Replacement Program in partnership with Valley Agriculture. Through success in competing for and leveraging local and federal funds, the District has been successful in replacing nut harvesters throughout the Valley with lower-dust alternatives, leading to significant emission reductions from these activities, and reducing dust exposure in nearby communities.

The District Board has long supported efforts to conduct research and evaluate technologies to reduce emissions in the Valley, including dust from nut harvesting operations. In line with this priority, the District, in partnership with other agencies and the agricultural industry, has conducted studies to demonstrate that low-dust harvesting technology can be effective at reducing localized PM emissions associated with harvesting activities, with results showing reductions of localized PM emissions by more than 40%, and in some cases up to nearly 80%. To facilitate the transition to low-dust nut harvesting technology, in April 2024, based on recommendations from the AgTech Committee, the District added Low-Dust Nut Harvesters to the CMP list for Nut Crops as an option that can be selected by growers to comply with District Rule 4550.

The District has also successfully obligated over $16.7 million to replace 202 pieces of nut-harvesting equipment with low-dust nut harvesting equipment through the Low-Dust Nut Harvester Replacement Program, which has resulted in the reduction of more than 11,000 tons of PM10 and 1,400 tons of PM2.5. Most recently in May 2023, the District Governing Board accepted EPA's award under the Targeted Airshed Grant Program which included an additional $10,000,000 in funding to deploy this new equipment, which reflects the District's ongoing commitment and success in working with Valley

agriculture to accelerate the deployment of cleaner technologies through innovative locally-developed programs.

How do District requirements for almond harvesting/processing compare with federal and state rules and regulations?

Federal Regulations

There are no Control Techniques Guidelines, Alternative Control Techniques, or New Source Performance Standards applicable to this source category.

State Regulations

There are no state regulations applicable to this source category.

How do District requirements for almond harvesting/processing compare to rules in other air districts?

Bay Area AQMD, Sacramento Metropolitan AQMD, South Coast AQMD, and Ventura County APCD do not have specific rules for this source category.

Potential Emission Reduction Opportunities

Incentives for Low-Dust Nut Harvesters
To continue progress in reducing emissions from nut harvesting, the District will advocate for additional funding, and evaluate potential enhancements to the program to ensure that this program remains effective, and to ensure that small growers have equitable access to available incentive funding. Additionally, the District will support and evaluate potential research opportunities as technology advances, and evaluate potential opportunities to conduct a Valley-wide survey to further understand the number of harvesters operating in the Valley.

As part of this Plan's attainment strategy, the District is committing to continue efforts towards accelerating the deployment of cleaner technologies for nut harvesting with an additional $25 million in funding for the Low-Dust Nut Harvester Replacement Program. Based on historical program participation, this funding is estimated to facilitate the replacement of approximately 358 units with low-dust nut harvesting equipment.

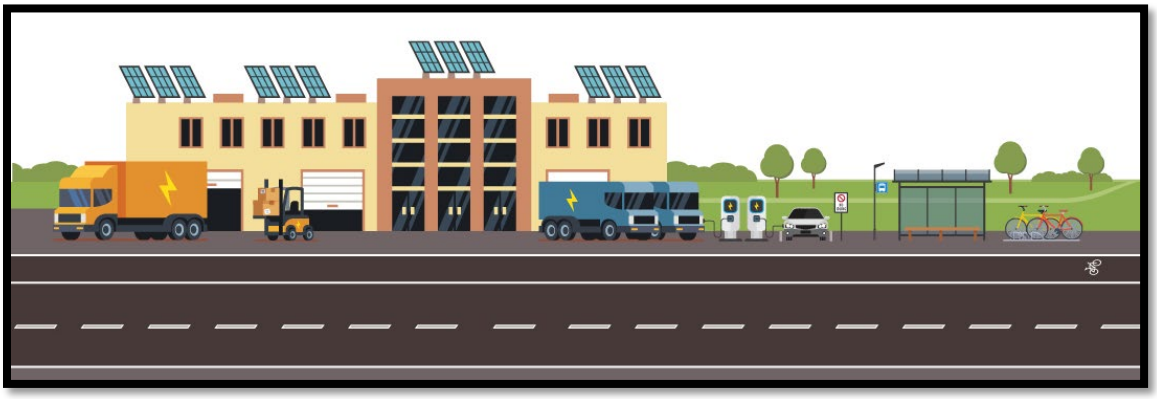
Evaluation Findings

District requirements and additional efforts towards reducing emissions from almond harvesting and processing provide for the maximum degree of emission reduction that has been required or achieved from this source category in any other attainment plans or in practice in any other states that can feasibly be implemented in the Valley, and therefore the District meets or exceeds BACM and MSM requirements for this source category.

C.24 RULE 9510 (INDIRECT SOURCE REVIEW)

The District's Indirect Source Review (ISR) rule was originally adopted in 2005, and later amended in 2017, to reduce the growth in both NOx and PM10 emissions from mobile and area sources associated with construction and operation of new industrial, commercial, residential, transit and other non-residential development projects in the Valley. New development projects create air pollution during construction and operation by prompting more vehicle trips and other pollution-causing activities. To address the rule requirements and achieve emissions reductions at the project site and within local communities, developers incorporate clean air measures into their project designs to reduce emissions impacts at project locations. Some examples include: use of clean, newer model-year off-road construction equipment, zero-emission and or near-zero emission heavy duty on-road trucks and van fleets, zero and or near-zero emission on-site equipment, installation of electric vehicle charging infrastructure, solar power, installation of bike paths and sidewalks, and high-efficiency buildings.

If on-site clean air measures implemented by a developer do not achieve the emission reductions mandated by the ISR rule, the developer must pay an off-site mitigation fee for balance of the emission reductions required for the project. One hundred percent of off-site mitigation fees are used by the District to fund emission reduction projects through its incentive grant programs. Additionally, developers pay an administrative fee equal to four percent (4%) of the required off-site fees. This administrative fee is to cover the District's cost of administering the off-site emission reduction projects through the District's grants and incentives programs.



The rule is the only rule of its kind in the State of California and throughout the nation that applies to new residential and non-residential development projects. The rule is recognized as the benchmark, or best available control, for its longstanding implementation of regulation on these indirect sources of emissions. State and federal laws are prescriptive in establishing the District's authority regulating indirect sources. These complex legal requirements were well documented and litigated as the District spent over five years successfully defending its existing rule through the highest courts at the state and federal levels. The emission control requirements under the District's current rule are stringent and established in adherence with all applicable state and federal regulations and case law.

A significant improvement has occurred in the design of development projects in the Valley through the incorporation of features that result in reduced emissions. The use of clean air project design elements that reduce the vehicle miles travelled associated with a project, operational measures such as the use of clean trucking fleets, and construction measures such as the use of clean construction fleets, have resulted in more than 20,800 tons of NOx and PM10 reductions over the life of the program. In addition, off-site mitigation fees collected under ISR have generated more than 7,000 tons of NOx and PM10 reductions through the investment of approximately $60 million dollars towards local emission reduction projects utilizing the District's incentive programs.

In May 2021, SCAQMD replicated the District's success in the development of their own ISR rule, utilizing the District's experience and regulatory language to help guide their efforts. SCAQMD Rule 2305 applies to both the operators and owners of new and existing warehouses greater than or equal to 100,000 square feet in size, and targets exhaust emission from mobile sources. Implementation of this rule will require warehouses to be phased in over a 3-year period based on their size.

The general approach of the SCAQMD warehouse ISR rule is similar to the District's ISR rule in that it requires clean air project design elements to reduce NOx and particulate emissions, and payment of a mitigation fee, if necessary, to achieve remaining rule requirements. It differs in that it applies to operational mobile source emissions from existing and new warehouses only, whereas, the District's ISR rule applies to both construction and operational mobile and area source emissions from various new residential, commercial, industrial, transportation, and other development projects, including warehouses. The District is currently evaluating the early implementation of the SCAQMD warehouse ISR rule to determine potential opportunities for future enhancements of the District's ISR implementation.

C.25 EMISSION INVENTORY CODE (EIC) TABLE

Control Measure	Emission Inventory Codes
Rule 4103 (Open Burning)	670-660-0262-0000; 670-660-0262-9842; 670-660-0262-9856; 670-660-0262-9862; 670-660-0262-9874; 670-660-0262-9884; 670-660-0262-9888; 670-660-0262-9892; 670-662-0262-0000; 670-662-0262-9866; 670-662-0262-9878; 670-662-0262-9882; 670-668-0200-9858; 670-668-0200-9872; 670-668-0200-9886; 670-995-0240-9848; 670-995-0240-9852; 670-995-0240-9854; 670-995-0240-9868
Rule 4104 (Reduction of Animal Matter)	420-995-6004-0000
Rule 4106 (Prescribed Burning and Hazard Reduction Burning)	670-664-0200-0000; 670-666-0200-0000; 670-668-0200-0000; 670-668-0200-9894; 670-670-0200-0000
Rule 4203 (Particulate Matter Emissions from Incineration of Combustible Refuse)	There is no specific emissions inventory associated with Rule 4203.
Rule 4204 (Cotton Gins)	420-418-6028-0000; 420-420-6028-0000
Rule 4301 (Fuel Burning Equipment)	There is no specific emissions inventory associated with Rule 4301.
Rule 4307 (Boilers, Steam Generators, and Process Heaters - 2.0 to 5.0 MMBtu/hr)	010-005-0110-0000; 010-005-0124-0000; 010-005-0130-0000; 010-005-0300-0000; 010-005-1220-0000; 010-005-1530-0000; 010-010-0110-0000; 020-005-0110-0000; 030-005-0110-0000; 030-005-0122-0000; 030-005-0124-0000; 030-005-0130-0000; 030-005-1220-0000; 030-005-1530-0000; 030-010-0100-0000; 030-010-0110-0000; 030-010-0130-0000; 030-010-1220-0000; 030-010-1500-0000; 030-010-1600-0000; 030-015-0110-0000; 030-015-0130-0000; 030-015-1500-0000; 040-005-0110-0000; 040-005-0124-0000; 040-005-0130-0000; 040-005-1530-0000; 040-010-0100-0000; 040-010-0110-0000; 040-010-0120-0000; 040-010-0130-0000; 040-010-1000-0000; 050-005-0110-0000; 050-005-0122-0000; 050-005-0124-0000; 050-005-0130-0000; 050-005-0300-0000; 050-005-1100-0000; 050-005-1220-0000; 050-005-1510-0000; 050-005-1520-0000; 050-005-1530-0000; 050-005-3220-0000; 050-010-0110-0000; 050-010-0120-0000; 050-010-0130-0000; 050-010-0320-0000; 050-010-1220-0000; 050-010-1224-0000; 052-005-0110-0000; 052-005-0122-0000; 052-005-0124-0000; 052-005-0130-0000; 052-005-0320-0000; 052-005-1100-0000; 052-005-1220-0000; 052-005-1510-0000; 052-005-1520-0000; 052-005-1530-0000; 052-010-0110-0000; 052-010-0120-0000; 052-010-1224-0000; 052-010-1500-0000; 060-005-0110-0000; 060-005-0122-0000; 060-005-0124-0000; 060-005-0130-0000; 060-005-0142-0000; 060-005-0144-0000; 060-005-1220-0000; 060-005-1510-0000; 060-005-1520-0000; 060-005-1530-0000; 060-010-0100-0000; 060-010-0110-0000; 060-010-0120-0000; 060-010-0142-0000; 060-010-1220-0000; 060-010-1500-0000 The EICs are the same for Rules 4306/4320, 4307, and 4308; the three rules share a combined emission inventory.

Control Measure	Emission Inventory Codes
Rule 4308 (Boilers, Steam Generators, and Process Heaters - 0.075 to less than 2.0 MMBtu/hr)	The EICs are the same for Rules 4306/4320, 4307, and 4308; the three rules share a combined emission inventory. See Rule 4307 for the EICs.
Rule 4309 (Dryers, Dehydrators, and Ovens)	050-012-0110-0000; 050-012-0120-0000; 052-012-0110-0000; 060-012-0110-0000; 060-012-0120-0000; 310-333-0100-0000; 430-422-7078-0000; 430-424-7000-0000; 430-424-7006-0000; 430-995-7000-0000; 499-995-0000-0000; 499-995-5630-0000
Rule 4311 (Flares)	110-132-0110-0000; 110-132-0130-0000; 110-132-0136-0000; 110-132-0146-0000; 120-132-0136-0000; 130-132-0110-0000; 130-132-0130-0000; 130-132-0136-0000; 140-130-0010-0000; 310-320-0010-0000; 310-320-0110-0000; 310-320-0120-0000; 310-320-0130-0000; 310-320-0136-0000; 320-320-0010-0000; 320-320-0110-0000; 320-320-0120-0000; 320-320-0130-0000; 330-320-0010-0000
Rule 4313 (Lime Kilns)	Lime kilns are not included in the CARB emissions inventory. There are no lime kilns currently operating in the Valley.
Rule 4306/4320 (Boilers, Steam Generators, and Process Heaters greater than 5.0 MMBtu/hr)	The EICs are the same for Rules 4306/4320, 4307, and 4308; the three rules share a combined emission inventory. See Rule 4307 for the EICs.
Rule 4352 (Solid Fuel Fired Boilers, Steam Generators, and Process Heaters)	010-005-0214-0000; 010-005-0218-0000; 010-005-0220-0000; 010-005-0240-0000; 010-005-0243-0000; 010-005-0254-0000; 020-005-0214-0000; 020-005-0218-0000; 020-005-0220-0000; 020-005-0230-0000; 030-005-0214-0000; 050-005-0214-0000; 050-005-0254-0000; 052-005-0212-0000; 052-005-0240-0000; 052-005-0254-0000; 060-005-0240-0000; 060-005-0243-0000; 060-005-0250-0000; 060-005-0264-0000
Rule 4354 (Glass Melting Furnaces)	410-403-5018-0012; 460-460-7025-0000; 460-460-7037-0000; 460-460-7038-0000; 460-460-7039-0000
Rule 4550 (Conservation Management Practices)	620-614-5400-0000; 620-615-5400-0000; 650-650-5400-0000; 650-651-5400-0000
Rule 4692 (Commercial Charbroiling)	690-680-6000-0000
Rule 4702 (Internal Combustion Engines)	010-040-0110-0000; 010-040-0142-0000; 010-040-1100-0000; 010-040-1200-0000; 020-040-0110-0000; 020-040-1200-0000; 030-040-0110-0000; 030-040-0124-0000; 030-040-0130-0000; 030-040-1100-0000; 030-040-1200-0000; 030-040-1210-0000; 030-040-1600-0000; 040-040-0110-0000; 050-040-0012-0000; 050-040-0110-0000; 050-040-0120-0000; 050-040-0122-0000; 050-040-0124-0000; 050-040-1100-0000; 050-040-1200-0000; 050-040-1210-0000; 050-040-1299-0000; 050-040-3220-0000; 052-040-0110-0000; 052-040-0124-0000; 052-040-0146-0000; 052-040-1100-0000; 052-040-1200-0000; 052-042-0110-0000; 052-042-1200-0000; 052-042-1200-0010; 052-042-1200-0011; 060-040-0012-0000; 060-040-0110-0000; 060-040-0120-0000; 060-040-0122-0000; 060-040-0124-0000; 060-040-0130-0000; 060-040-0142-0000; 060-040-0146-0000; 060-040-1100-0000; 060-040-1200-0000; 060-040-1210-0000; 060-995-1220-0000; 099-040-0136-0000; 099-040-1200-0000
Rule 4703 (Stationary Gas Turbines)	010-045-0110-0000; 010-045-0112-0000; 010-045-1200-0000; 020-045-0110-0000; 020-045-1200-0000; 030-045-0110-0000; 030-045-0130-0000; 030-045-1200-0000; 040-045-0134-0000; 040-045-1412-0000; 050-045-0110-0000; 050-045-1200-0000; 050-045-1299-0000;

Control Measure	Emission Inventory Codes
	052-045-0110-0000; 052-045-0146-0000; 052-045-1200-0000; 060-045-0012-0000; 060-045-0110-0000; 060-045-0146-0000; 060-045-1200-0000; 060-045-1400-0000; 060-045-1412-0000; 060-045-1420-0000; 060-045-1450-0000
Rule 4901 (Wood Burning Fireplaces and Wood Burning Heaters)	610-600-0230-0000; 610-602-0230-0000
Rule 4902 (Residential Water Heaters)	610-608-0110-0000
Rule 4905 (Natural Gas-Fired, Fan-Type Central Furnaces)	060-020-0110-0000; 610-606-0110-0000
Rule 8011 (General Requirements)	There is no specific emissions inventory associated with Rule 8011.
Rule 8021 (Construction, Demolition, Excavation, Extraction, and Other Earthmoving Activities)	430-426-7006-0000; 630-622-5400-0000; 630-624-5400-0000; 630-626-5400-0000; 630-628-5400-0000; 630-634-5400-0000
Rule 8031 (Bulk Materials)	410-436-5800-0000; 430-436-7006-0000; 430-436-7016-0000; 430-436-7018-0000; 430-436-7078-0000; 430-995-7006-0000; 430-995-7012-0000; 430-995-7016-0000; 430-995-7018-0000; 430-995-7050-0000; 430-995-7064-0000; 430-995-7072-0000
Rule 8041 (Carryout and Trackout)	The EICs are included in Rule 8061 (Paved and Unpaved Roads).
Rule 8051 (Open Areas)	650-652-5400-0000
Rule 8061 (Paved and Unpaved Roads)	640-635-5400-0000; 640-637-5400-0000; 640-639-5400-0000; 640-641-5400-0000; 640-643-5400-0000; 645-638-5400-0000; 645-640-5400-0000; 645-644-5400-0000; 645-648-5400-0000
Rule 8071 (Unpaved Vehicle/Equipment Traffic Areas)	645-645-5400-0000; 645-647-5400-0000. The CARB Emissions Inventory database does not contain emissions data on unpaved vehicle and equipment traffic areas.
Rule 8081 (Agricultural Sources)	645-646-5400-0000
Almond Processing	420-418-6003-0000

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