Appendix C

BACM and MSM for Stationary and Area Sources

2015 Plan for the 1997 PM2.5 Standard
SJVUAPCD

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Appendix C: BACM and MSM for Stationary and Area Sources

C.i Introduction

The San Joaquin Valley (Valley) faces significant challenges in meeting National Ambient Air Quality Standards (NAAQS). 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.

Multiple regulatory control measures have been adopted under the District's air quality attainment plans that reduce particulate matter (PM) that is 2.5 microns or less in diameter (PM2.5), including but not limited to commitments made in the *2007 Ozone Plan, 2008 PM2.5 Plan, 2012 PM2.5 Plan,* and *2013 Plan for the Revoked 1-Hour Ozone Standard.* All of these commitments serve as control measures that will reduce emissions under the *2015 Plan for the 1997 PM2.5 Standard (2015 PM2.5 Plan)*. Under the U.S. Environmental Protection Agency (EPA) policy, there is a preference for reliance on control measures that have already been adopted. The *2015 PM2.5 Plan* regulatory control measures that have already been adopted include both stationary and area source control measures, as well as California Air Resources Board (ARB) rules for mobile sources.

Table C-1 below identifies the control measures that the District has already adopted and that are contributing to attainment of the 1997 PM2.5 standard. These adopted District rules are achieving new emissions reductions after 2012, the base year for this plan. Even pre-2012 emissions reductions are contributing, and will continue to contribute, to the Valley's progress toward clean air.

Table C-1 District Regulations Contributing to Attainment of PM2.5 NAAQS

Rule #	Adopted District Rule	Last Adoption/ Amendment Date
4307	Boilers, Steam Generators, and Process Heaters—2.0 MMBtu/hr to 5.0 MMBtu/hr	5/19/11
4308	Boilers, Steam Generators, and Process Heaters—0.075 MMBtu/hr to less than 2.0 MMBtu/hr	11/14/13
4311	Flares	6/18/09
4320	Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater than 5.0 MMBtu/hr	10/16/08
4354	Glass Melting Furnaces	5/19/11
4702	Internal Combustion Engines	8/18/11
4703	Stationary Gas Turbines	9/20/07
4901	Wood Burning Fireplaces and Wood Burning Heaters	9/18/14
4902	Residential Water Heaters	3/19/09
4905	Natural Gas-Fired, Fan-Type Central Furnaces	1/22/15
9310	School Bus Fleets	9/21/06
9410	Employer-based Trip Reduction	12/17/09

One of the requirements for a Serious nonattainment area plan under Subpart 4 is to demonstrate that the plan includes the best available control measures (BACM) that can be feasibly and cost effectively implemented. EPA defines BACM as being more stringent than reasonably available control measures (RACM), but less stringent than the lowest achievable emission rate (LAER), which does not take into consideration the cost effectiveness of implementing a particular control measure.[1]

As a Serious nonattainment area, the Valley would have until December 31, 2015 to attain the 1997 PM2.5 standard. As demonstrated in Chapter 2 and Appendix A, the Valley will not attain the 1997 PM2.5 standard by the attainment date and is therefore requesting an extension of the attainment date. Under Subpart 4, EPA may grant one extension of the attainment date of up to five years for a Serious nonattainment area provided the attainment plan for that area satisfies several federal requirements, including the most stringent measures (MSM) that are included in the implementation plan of any State or are achieved in practice in any State, and can feasibly be implemented in the area. EPA defines MSM as the, "maximum degree of emission reduction that has been required or achieved from a source or source category in other SIPs or in practice in other states and can be feasibly implemented in the area."[2] This appendix demonstrates that the control measures in this *2015 PM2.5 Plan* satisfy both BACM and MSM requirements.

The analysis in this appendix consists of a literature review and evaluation of emission reduction opportunities for a variety of stationary and area source categories. District staff in multiple departments with expertise in these various sectors contributed to this effort. The evaluations in this appendix capture relevant background information, examine potential emission reduction opportunities for technological and economic feasibility, and make recommendations for appropriate District actions moving forward. This appendix reflects the comprehensive evaluation performed by the District to examine the Valley's various emissions sources and identify any potential BACM or MSM for inclusion in this plan.

C.ii BACM/MSM Evaluation Process

As discussed in detail in Chapter 5, the District must demonstrate that its rules meet both BACM and MSM requirements.

The Maricopa County PM10 nonattainment area is the only other area in the nation that has conducted a BACM and MSM analysis. Within the technical support document (TSD) for the Maricopa County Serious Area Nonattainment Plan,[3] EPA defined the process for determining BACM and MSM. EPA noted that MSM follows the same process for determining BACM, but with one additional step to compare the potential MSM against the measures already adopted in the area to determine if the existing

[1] EPA. 1994 Addendum to the General Preamble, p. 10.
[2] EPA. Technical Support Document for Maricopa County PM10 Nonattainment Area. 2001, p. 237.
[3] EPA. Technical Support Document (Notice of Proposed Rulemaking on the Serious Area PM-10 State Implementation Plan for the Maricopa County PM-10 Nonattainment Area Provisions for Attaining the 24-Hour Standard and Contingency Measures). (2001, September 14).

measures are most stringent. Because this is the only EPA guidance available for a Serious Nonattainment area under Subpart 4 (to evaluate BACM and MSM) at the time of the development of this *2015 PM2.5 Plan,* the District will follow this process as summarized below:

1. Develop a detailed emissions inventory of PM2.5 sources and source categories (Appendix B).

2. Model to evaluate the impact of various source categories on PM2.5 concentrations over the NAAQS to determine which sources are significant and which sources are de minimis (less than significant) for the purposes of adopting BACM and MSM[4] (Chapter 5).
    a. ARB relative response factor (RRF) results demonstrate that the significance levels for PM2.5, oxides of nitrogen (NOx), and oxides of sulfur (SOx) are as follows (*see Chapter 5 for the full calculations*):
        i. PM2.5: 1.4 tons per day (tpd) for combustion, 4.0 tpd for dust
        ii. NOx: 13.1 tpd
        iii. SOx: 1.0 tpd
    b. To determine if a particular source category is significant for the purposes of adopting BACM and MSM, the 2012 baseline emissions inventory for each source category was compared to the significance thresholds above.

3. Identify potential BACM and MSM in other implementation plans or used in practice in other states for each significant source category, and for each measure evaluate the technological and economic feasibility for the area, as necessary (Appendix C).

4. Compare potential BACM/MSM for each significant source category against the control measures, if any, already adopted for that source category (Appendix C).

5. Provide for the adoption of any BACM/MSM that is more stringent than existing similar local measures and provide for implementation as expeditiously as practicable or, in lieu of adoption, provide a reasoned justification for rejecting the potential MSM, i.e., why such measures cannot be feasibly implemented in the area (Appendix C).

Using the BACM/MSM process summarized above, emission control requirements for stationary and area source categories are evaluated to determine if they satisfy both BACM and MSM requirements or if there are any potential technologies or practices

[4] EPA stated in the Maricopa County TSD that more source categories should be subject to the MSM analysis than those subject to a BACM analysis by lowering the threshold for what is considered a de minimis source category. What constitutes a de minimis source category for BACM is dependent upon the specific facts of the nonattainment problem under consideration. EPA states that one means of determining an appropriate de minimis level is to determine if applying MSM to the proposed de minimis source categories would meaningfully expedite attainment. If it did, then the established de minimis level is too high, and if it did not, then the de minimis level is appropriate.

that could further reduce PM2.5 and precursor emissions and prove to be technologically and economically feasible for sources in the Valley.

C.iii Appendix C Organization and Evaluation

Each control measure evaluation includes a discussion of the rule applicability and rule adoption/amendment history; an overview of the source category and affected sources; an emissions inventory table for the source category; a regulatory evaluation; a technological feasibility and cost effectiveness analysis of any other potential BACM/MSM; and a summary of the evaluation findings. The sections below elaborate in more detail with respect to the information included within each individual rule evaluation.

Discussion

This section provides an overview of rule applicability, identifies what types of emissions the rule controls, provides the rule adoption/amendment history, and discusses additional pertinent details, as necessary. This section is not included for the source categories where there is no current District prohibitory rule.

Source Category

This section discusses what types of units, industries, or operations are included in the respective source category.

Emissions Inventory

Each emissions inventory table lists the annual average and wintertime average (November through April) PM2.5, NOx, and SOx emissions for the respective source category for the years 2012 through 2020. The data provided in this section is a compilation of the data sources identified in the emission inventory appendix. See Appendix B (Emission Inventory) for additional information.

This section also includes a significance discussion, which compares the emissions from the respective source category to the applicable significance/de minimis thresholds developed by ARB, as shown in Chapter 5 of the plan.

Regulatory Evaluation

As part of the regulatory evaluation, District rules and source categories are compared to federal and state air quality regulations and standards, and the regulations and standards in other air districts. 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)[5]
    - Alternative Control Techniques (ACT)[6]

[5] EPA. Control Techniques Guidelines. Retrieved from http://www.epa.gov/groundlevelozone/SIPToolkit/ctgs.html
[6] EPA. Alternative Control Techniques. Retrieved from http://www.epa.gov/groundlevelozone/SIPToolkit/ctgs.html

- New Source Performance Standards (NSPS)[7]
- National Emission Standards for Hazardous Air Pollutants (NESHAP)[8]
- Maximum Achievable Control Technology (MACT)[9]

- **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 ARB Airborne Toxic Control Measures (ATCM)[10] that apply to stationary and area sources. While most of the rules evaluated in this *2015 PM2.5 Plan* do not have a state regulation associated with their source category, any relevant state guidelines are evaluated within this section.

- **Other Air Districts' Rules –** As agreed to by EPA for the *2009 RACT SIP*, the rules were also compared to analogous regulations adopted by California's most progressive air districts. Control strategies and measures in other air districts and agencies include, but are not limited to the following air districts:

  - South Coast Air Quality Management District (SCAQMD)[11]
  - Bay Area Air Quality Management District (BAAQMD)[12]
  - Sacramento Metropolitan Air Quality Management District (SMAQMD)[13]
  - Ventura County Air Pollution Control District (VCAPCD)[14]

All potential BACM/MSM identified through this regulatory evaluation were then thoroughly evaluated using the following key factors, defined by EPA in the Maricopa County TSD, to determine if potential opportunities qualify as BACM/MSM for the Valley:

- **Technological feasibility**[15] – This analysis determines if the new control can be integrated with the existing controls without reducing or delaying the emission reductions from the existing control. If it cannot, then it would not be considered

[7] 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
[8] EPA. 40 CFR 61 – National Emission Standards for Hazardous Air Pollutants (NESHAPs). Retrieved from http://www.tceq.state.tx.us/permitting/air/rules/federal/61/61hmpg.html
[9] EPA. 40 CFR 63 – Maximum Achievable Control Technology (MACT). Retrieved from http://www.tceq.state.tx.us/permitting/air/rules/federal/63/63hmpg.html
[10] California Air Resources Board (ARB). Airborne Toxic Control Measures (ATCMs). Retrieved from http://www.arb.ca.gov/toxics/atcm/atcm.htm
[11] 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
[12] Bay Area Air Quality Management District (BAAQMD). Rules and Regulations. Retrieved from http://www.baaqmd.gov/Divisions/Planning-and-Research/Rules-and-Regulations.aspx
[13] Sacramento Metropolitan Air Quality Management District (SMAQMD). Rules and Regulations. Retrieved from http://www.airquality.org/rules/
[14] Ventura County Air Pollution Control District (VCAPCD). Rules and Regulation. Retrieved from http://www.vcapcd.org/Rulebook/RuleIndex.htm
[15] EPA. (2001, June 22). *Technical Support Document for Maricopa County PM10 Nonattainment Area,* p. 34. Retrieved from http://www.epa.gov/region9/air/phoenixpm/pdf/tsd.pdf.

to be technologically feasible for the area unless the emission benefit of the new measure is substantially greater than the existing measure.

- **Economic feasibility**[16] – If the potential control is determined to be technologically feasible, it is then evaluated for economic feasibility. The District has evaluated the economic feasibility of various control measures by conducting cost effectiveness analyses within this appendix. 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. EPA cautions that the threshold for economic feasibility should be addressed on a case-by-case basis.

Additional Emission Reduction Opportunities

The District reviewed the following areas to identify any additional potential BACM/MSM, exclusive of potential BACM/MSM evaluated in the Regulatory Evaluation section:

- Any emission reduction opportunities identified/considered in previously adopted District plans that were determined to be beyond reasonably available control technology (RACT) at that time.
- New emission reduction opportunities adopted in California SIPs, SIPs in other states, or achieved in practice in other areas.

All potential BACM/MSM identified were then thoroughly evaluated for technological and economic feasibility, as previously defined. 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 BACM/MSM.

Evaluation Findings

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

[16] EPA. (2001, June 22). *Technical Support Document for Maricopa County PM10 Nonattainment Area,* p. 34. Retrieved from http://www.epa.gov/region9/air/phoenixpm/pdf/tsd.pdf.

C.iv Ammonia Regulations

Under Subpart 4 of the federal Clean Air Act (CAA), regions are required to address ammonia as a precursor in BACM/MSM analyses unless EPA determines that ammonia sources do not contribute significantly to PM concentrations. As demonstrated in Appendix A, ammonia emissions controls are not effective in significantly reducing ambient PM2.5 concentrations and do not contribute to the Valley's PM2.5 attainment. As such, the District is not required to evaluate its ammonia regulations as part of the BACM/MSM analysis for this *2015 PM2.5 Plan.*

Nevertheless, the District has implemented the most stringent controls feasible for local sources of ammonia and the Valley's ammonia emissions have been significantly reduced through stringent District regulations which include the following:

- Rule 4570 (Confined Animal Facilities)
- Rule 4566 (Organic Material Composting)
- Rule 4565 (Biosolids, Animal Manure, and Poultry Litter Operations)

Even though the District is not required to evaluate ammonia as part of this plan, Section C.41 (Ammonia Controls) includes a full analysis for the above sources and demonstrates that existing requirements meet or exceed BACM and MSM levels of control. Therefore, even if ammonia was a significant precursor to PM2.5 concentrations in the Valley (which they are not), there are no current opportunities for additional ammonia emission reductions.

C.1 RULE 4103 OPEN BURNING

Discussion

The provisions of Rule 4103 apply to open burning conducted in the Valley, with the exception of prescribed burning and hazard reduction burning, as defined in Rule 4106 (Prescribed Burning and Hazard Reduction Burning). The purpose of Rule 4103 is to permit, regulate, and coordinate the use of open burning while minimizing smoke impacts on the public.

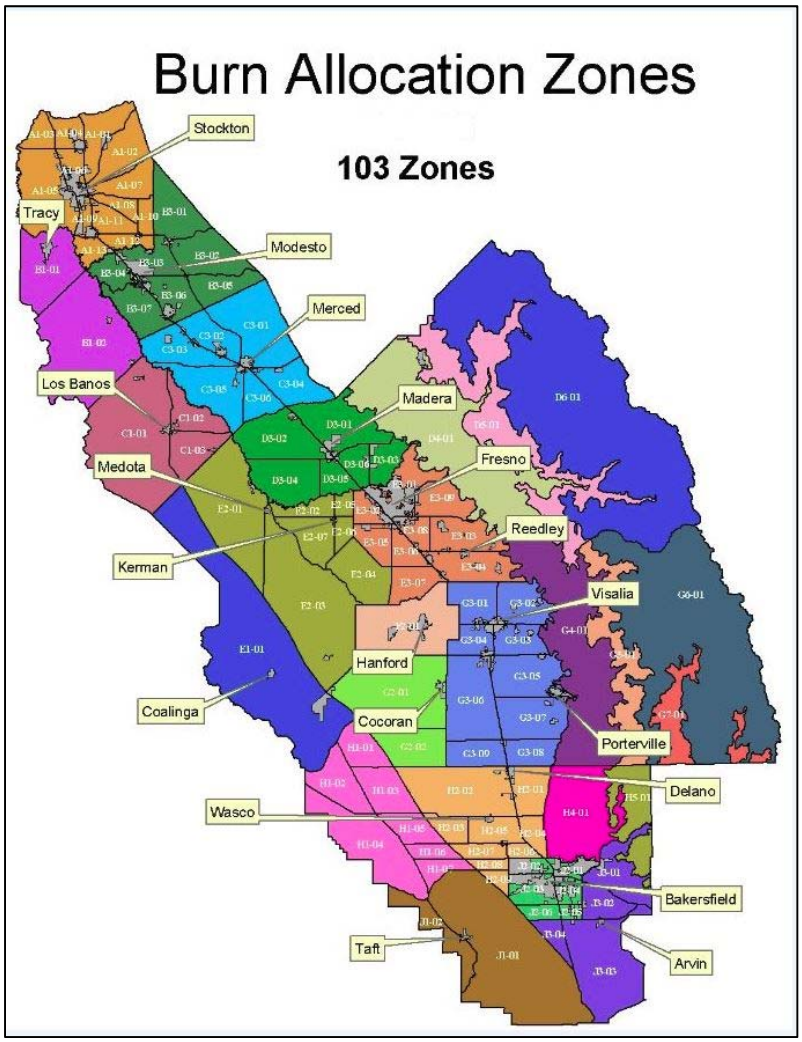
Rule 4103 was originally adopted on June 18, 1992 and it has been amended several times to incorporate state law requirements. In 2003, California Senate Bill (SB) 705 (CH&SC Section (§) 41855.5 and 41855.6) established a schedule for specific types of agricultural material to no longer be openly burned in the field, but provided for a postponement of the phase-out where justified by technical and economic impediments. The air quality impacts from open burning in the Valley are of significant concern for the District and Valley growers; as such, Valley growers have reduced open burning through the use of sustainable agricultural practices. Those practices have contributed to a significant reduction in PM emissions since 1992.

The historical cultural practice for disposing of agricultural materials, such as prunings and orchard removals, is to burn the materials. Burning agricultural materials provided an economically feasible method for the timely disposal of these materials, helped prevent the spread of plant diseases, and controlled weeds and pests. As part of implementing SB 705 and enhancing the effectiveness of the District's burn reduction efforts, in 2004 the District established the Smoke Management System (SMS), a more refined method of authorizing or prohibiting individual burns, based on modeled smoke impacts. Rule 4103 and the District's SMS have reduced the total acreage of agricultural materials burned in the Valley to date by more than 80% since 2002.

Smoke Management System

The District uses the SMS to manage the Valley's remaining open burning of agricultural crops and materials. The District's air quality forecasters incorporate projected meteorological information and air quality statistical modeling to determine the amount and location of agricultural burning that can be allowed without resulting in ambient air pollutant concentrations that exceed federal health-based standards. Through the results of this daily analysis, the SMS allows the District to manage 103 burn zones in the Valley through allocating daily burning allowances in each zone based on local meteorology, the air quality conditions, the atmospheric holding capacity, the amount of burning already approved in a given area, and the potential impacts on downwind populations (see Figure C-1). This approach allows the District to better distribute air pollutant emissions from open burning temporally and spatially, providing flexibility of burn days for growers while minimizing the impact on the public.

Figure C-1 Agricultural Burn Zones Defined in the District SMS



Properly managed burning allocations under the existing District SMS ensures that air quality and health impacts of open burning of agricultural materials, prescribed burning, and hazard reduction burning are minimized to the fullest extent feasible. Under the SMS, emissions within a zone are limited to levels below the exceedance threshold of any applicable federal ambient air quality standard and burns are not allowed in zones on days when exceedances of the federal standards are projected to occur in that zone. Additionally, zones directly adjacent to an area where open burning is restricted are also allocated zero emissions in an effort to reduce pollutant transport into an area with already elevated pollutant concentrations.

During the wood-burning season from November through February, the District implements even tighter open burning restrictions based on the daily residential wood-burning declarations issued for the Check Before You Burn program. With the recent amendment of Rule 4901, residential wood-burning with unregistered devices is no longer allowed when an area's forecasted PM2.5 concentration is expected to be greater than or equal to 20 $\mu g/m^3$. This threshold is now lower compared to past years

when it was set at 30 μg/m^3. To be consistent with the residential wood-burning declaration, an area's burn zones in SMS are allocated zero emissions when residential wood-burning is prohibited in that area. Following similar procedures discussed above, zones directly adjacent to an area where residential wood-burning is restricted are also allocated zero emissions. Under this policy, agricultural burning is placed under tighter control during the winter season and burning is only allowed when air quality is expected to be below 20 μg/m^3, when meteorological conditions are projected to be conducive for pollutant dispersion, which is well below the current federal 24-hour average PM2.5 standard of 35 μg/m^3.

Under the SMS, individuals who need to burn their agricultural waste first submit their permit request to the District, which includes information regarding the material that needs to be burned and the location of the burn project (see attachment for sample burn permit). If there are positive air quality and atmospheric dispersion conditions, the District allocates a certain amount of emissions to the applicable burn allocation zone. The SMS will then automatically call the specified contact's phone number to notify them that burn allocation is available in their zone for their project. Through the phone system, the individual can then either notify SMS that they will proceed with their burn or hold off until another time.

Through this process, SMS is able to automatically manage and notify a large number of stakeholders in the agricultural community on whether they can proceed with their burn project. If there are more requests for burning than there are emissions allocated in the system for a day, those individuals will be placed on a waiting list and given priority when another burn window opens.

As agricultural burning projects are occurring across the Valley, District air quality enforcement staff inspect the region to observe permitted agricultural burns to ensure their practices conform to District regulations. In addition, on days when agricultural burning is not permitted, enforcement staff inspect the region to ensure that un-permitted agricultural burning is not occurring and to issue notices of violation (NOVs), as needed.

The continued issuance of burn permits for certain crop categories is not expected to cause or substantially contribute to a violation of an applicable federal ambient air quality standard because the District follows its SMS procedures.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	2.27	2.27	2.26	2.26	2.25	2.25	2.24	2.24	2.23
NOx	1.61	1.60	1.60	1.59	1.59	1.59	1.58	1.58	1.57
SOx	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Winter Average - Tons per day								
PM2.5	3.47	3.46	3.46	3.45	3.44	3.43	3.43	3.42	3.41
NOx	2.44	2.44	2.43	2.42	2.42	2.41	2.41	2.40	2.39
SOx	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07

As previously stated, the emissions from this source category continue to decline and contribute 5.2% of average winter NOx and 5.6% of average winter PM2.5 emitted from stationary and area sources in the 2014 emission inventory. District regulatory efforts have fostered significant reductions in emissions from this source category.

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 1.4 tons per day (tpd) for PM2.5 combustion emissions, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from open burning are lower than the NOx and SOx BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a NOx and SOx control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for Rule 4103.

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

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

State Regulations

The following state regulation applies to sources covered under Rule 4103:

- CH&SC §41850-41866 (Agricultural Burning)

The District has continued to work closely with the stakeholders to identify economically feasible alternatives to open burning of various agricultural materials and to meet its legal obligation under the CH&SC. To fulfill the state law requirements, the District has implemented the requirements for most crop categories identified in CH&SC §41855.5. In addition to those requirements, the state law authorizes the District to postpone the burn prohibition dates for specific types of agricultural material if the District makes three specific determinations and the Air Resources Board (ARB) concurs. 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 amended Rule 4103 in April 2010 to incorporate CH&SC requirements and committed the District to review its determinations for any postponed crops and materials at least once every five years. In 2010, the District also evaluated each crop category identified in CH&SC §41855.5 to determine any technologically and economically feasible alternatives to open burning. After working extensively with stakeholders to understand viable alternatives to open burning and the associated costs, the District provided recommendations for allowing or prohibiting the open burning of agricultural material categories in the District's *2010 Final Staff Report and Recommendations on Agricultural Burning*. ARB concurred with the District's determinations and recommendations; however, ARB made a one-time request that the District re-visit the 2010 findings after two years to determine if additional reductions in open burning were feasible.

The District revisited its 2010 analysis in 2012 and submitted those findings to ARB. The 2012 Report showed that in the two years since the 2010 Report, there had been no significant changes in the economic feasibility of various alternatives to agricultural burning. The amount of agricultural materials accepted at biomass facilities continued to fluctuate based on market conditions and there were no long-term federal or state funding commitments for the operation of biomass facilities or development of alternatives to burning. EPA finalized approval for Rule 4103 on January 4, 2012 and deemed this rule as at least meeting RACT requirements.[17] The District most recently reevaluated the availability of alternatives to open burning in the *2014 Reasonably Available Control Technology Demonstration for the 8-Hour Ozone State Implementation Plan* (*2014 RACT SIP*). The District is committed to review its determinations for any postponed crops and materials by December of 2015.

Current Status of Biomass Facilities

Biomass power plants in the Valley will generally accept agricultural, forestry, construction, and urban residues. The power plants burn the material in combustors to produce steam and the steam is then used to spin turbines to generate electricity.

Biomass power plants do not universally accept all agricultural material due to concerns that some materials may harm power plant machinery. Several issues have been noted concerning the types of material, such as citrus chips, that can be burned by the biomass power plants and the amount of agricultural materials that is accepted at the plants at any given time.

Using the orchard removal materials for fuel at the biomass power plant is currently the most viable and cost effective alternative to open burning for growers due to available

[17] Revisions to the California State Implementation Plan, San Joaquin Valley Unified Air Pollution Control District, 75 Fed. Reg. 2, pp 214-217 (2012, January 4). (to be codified at 40 CFR Part 52)

tax credits for biomass facilities and required agricultural offsets for some biomass power plants. However, the ability to meet the needs of the agricultural industry in a timely and cost effective fashion is a critical factor in any action taken by the District to address the biomass industry's long-term viability as an alternative to open burning. Farmers need certainty and timely removal of material so that they do not miss planting seasons. In the past, lack of coordination and available storage for biomass fuels has led to uncertainty as to when material would be removed from the field. This has been a major concern of the agriculture industry. If the process is not optimized, it can quickly result in a system that does not meet agriculture's needs.

In addition, the reliance on biomass fuel as a primary alternative to open burning is somewhat uncertain since there are no long-term federal or state funding commitments for biomass facilities in the Valley. In fact, the biomass industry has indicated that given current energy policy in California there is concern that biomass power facilities are in jeopardy. Many biomass plants in the Valley are nearing the end of their long-term contracts with utilities and find themselves in a position where the power that they provide is not the type of power that utilities are seeking (base load vs. intermittent) and that the prices being offered for new contracts are too low to support their operations.

Two biomass power plants serving the Valley have shut down due to their inability to secure contracts with utilities at rates that are sufficient to sustain their operations. Greenleaf Power that operates the Tracy Biomass Plant, located in Tracy, reported that they shut down on October 31, 2014 and the Covanta facility located in Mendota was shut down in January 2015. Initially, another Covanta facility in Delano had indicated that they were likely to shut down, but is now reporting that they were able to secure a one-year extension on their current utility contract at the same rate that enables them to continue to operate.

Staff has convened a number of productive meetings with agricultural stakeholders and representatives of the biomass industry in order to more fully understand the issues faced by the industry and develop a common vision of the future of biomass power amongst the stakeholders in the Valley. The meetings have been helpful in forging a better working relationship between agriculture representatives and biomass power producers and developing consensus on short-term and long-term solutions.

The District and representatives from agriculture and biomass industries are working to develop and pursue specific actions with the legislative branch, utilities, Public Utility Commission, CalRecycle, and other government agencies to help level the playing field and allow the biomass industry to fairly compete.

In June 2014, the District's Governing Board adopted positions on two pieces of legislation that impact the biomass industry. The District adopted a position in support of AB 2363 (Dahle), which was sponsored by the biomass industry, and would make biomass plants more competitive by fully accounting for the costs associated with intermittent sources of renewable power (solar and wind) when comparing them to other sources of power. AB 2363 was signed by the Governor and will begin to help level the renewable energy playing field. The District also took a position in opposition to SB

1139 (Hueso) that would have given preferential treatment to new geothermal power plants by requiring that utilities purchase specified amounts of new geothermal power. Ultimately, AB 1139 was not passed by the legislature.

The District is also working with the stakeholders, including the Federal Department of Energy, California Energy Commission, and other partner agencies, to pursue clean alternatives to biomass power production for agricultural waste disposal.

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

BAAQMD

- Regulation 5 (Open Burning)

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. BAAQMD Regulation 5 was amended on June 19, 2013 to add new fee requirements. The amendments did not implement any requirements more stringent than the current requirements in District Rule 4103.

SMAQMD

- Rule 407 (Open Burning)

The District evaluated the requirements contained within SMAQMD's Rule 407 and found no requirements that were more stringent than those already in Rule 4103.

VCAPCD

- Rule 56 (Open Burning)

The District evaluated the requirements contained within VCAPCD's Rule 56 and found no requirements that were more stringent than those already in Rule 4103.

SCAQMD

- Rule 444 (Open Burning)

The District evaluated the requirements contained within SCAQMD's Rule 444 and found no requirements that were more stringent than those already in Rule 4103. SCAQMD Rule 444 was amended on July 12, 2013 to include beach burning in the rule applicability. The amendments apply to sources that do not exist within District's boundaries. Rule 444 also restricts burning on residential wood combustion curtailment days. As discussed in detail above, this is a practice that has already been implemented within the District. District Rule 4103 is still as stringent as SCAQMD Rule 444.

Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in another area or included in another state implementation plan. As demonstrated above, Rule 4103 currently has in place the most stringent measures

feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. Therefore, there are no recommendations for additional regulatory actions for Rule 4103.

The District carefully manages agricultural burning with its SMS with even tighter open burning restrictions based on the daily residential wood-burning declarations issued within the Check Before You Burn program. With the recent amendment of Rule 4901, residential wood-burning with unregistered devices is no longer allowed when an area's forecasted PM2.5 concentration is expected to be greater than or equal to 20 $\mu g/m^3$. This threshold is now lower compared to past years when it was set at 30 $\mu g/m^3$. Burning is only allowed when air quality is forecasted to be below 20 $\mu g/m^3$, which is well below the current federal 24-hour average PM2.5 standard of 35 $\mu g/m^3$. By restricting open burning to this level, impacts to ambient air quality are significantly minimized and are not expected to contribute to a violation of the federal PM2.5 standards. Furthermore, the District continues to consider the economic feasibility of burning alternatives on a case-by-case basis and in accordance with the five year evaluation period outlined in Rule 4103 with the next evaluation scheduled for 2015.

Further progress and complete phase-out of agricultural burning requires economically feasible alternatives that do not currently exist. Subsidies or preferential utility rates for power produced from biomass can serve as measures to enhance the economic feasibility of this alternative. Additional research is also needed to identify other technologically and economically feasible alternatives. A comprehensive strategy to promote these alternatives will also help in meeting renewable power goals and standards. As the District continues to develop new attainment plans that address increasingly stringent federal air quality standards, the District will continue to evaluate potential opportunities to reduce emissions from open burning in the Valley.

Figure C-2 Sample Agricultural Burn Permit (Front Page)

San Joaquin Valley Air Pollution Control District
1990 East Gettysburg Avenue, Fresno, CA 93726
Smoke Management Program (559) 227-7143 or 1 (800) 665-BURN (2876)
www.valleyair.org

PERMIT FOR AGRICULTURAL BURNING

SJVAPCD
DISTRICT_T SMS-TESTING
1990 EAST GETYSBURG
FRESNO, CA 93726

Permit #: **140111**
Security Code: 5252
Expiration Date: 3 February 2017

Location and Crop List

Location Number	LocationDescription (Cross Streets)	Acres	County	Crop Code	Material allowed to be burned
1	1990 EAST GETTYSBURG WEB TEST(A1-01)	30	FRESNO	140	* ALMOND PRUNING <20
				151	* ALMOND ATTRITION

* Indicates a restriction exists for this crop. Refer to Crop Restrictions for details.

Crop Restrictions

140: ALMOND PRUNING <20 ACRES - Pruning do not include suckers, dead or broken branches and trees, or orchard removals. This crop code is limited to a total of 20 land acres across all agricultural operational sites per year.

151: ALMOND ATTRITION - Attrition materials include suckers and dead or broken branches and trees, but do not include annual prunings or orchard removals. When requesting to burn attrition materials using the automated system, report each ton of material as one acre.

GENERAL BURN PERMIT CONDITIONS

1. **Please read and follow all permit conditions.** All burning shall conform to general conditions 1-14, any site-specific conditions of this permit, and any applicable local and state regulations.
2. **Igniting an open burn without first receiving a burn authorization with a confirmation number is a violation subject to penalties.** Prior to ignition, you must contact the District to obtain burn authorization by calling **(559) 227-7143** or **1 (800) 665-BURN (2876)**, or accessing the District's web site via the Internet at **www.valleyair.org**. A confirmation number will be provided to you once the burn has been approved.

Please refer to the backside of this permit for additional conditions.

(Back Page)

GENERAL BURN PERMIT CONDITIONS – Continued

3. **All ignition and burning shall comply with any special conditions given at the time of authorization.** Daily authorizations are required in cases where burning continues for more than one day. Materials and/or piles burning for more than one day may not be moved or actively tended to promote burning without a daily authorization.

4. **The permit holder is responsible for monitoring and managing the smoke created by the burn.** Burning shall cease immediately if the smoke impacts sensitive receptor areas. Active burns may be extinguished at the owner's expense if it becomes necessary for public health and safety or if the burn creates a nuisance as determined by the District or any public officer. Creating a nuisance will result in the issuance of a Notice of Violation to the permit holder.

5. **This permit is valid only for the materials listed on the permit.** The burning of any other types of materials, such as petroleum wastes; demolition or construction debris; garbage and residential rubbish; non-agricultural vegetation; tires; tar; wood waste; chemically treated, painted, or stained wood; or other combustible or flammable solid, liquid, or gaseous wastes is prohibited.

6. **Orchard or vineyard removals must be specifically listed on the permit and additional burn restrictions may apply.**

7. **Minimum material drying times are required.** In cold or wet seasons or for certain crop residue it will be necessary to extend these minimum drying times in order to facilitate burning with the least amount of smoke.

Spread rice straw	3 days	Prunings and small branches	3 weeks
Rowed rice straw	10 days	Large branches and trees	6 weeks

8. **Materials shall be properly dried and loosely stacked to facilitate efficient combustion.** Piles shall be free of dirt, soil, and visible surface moisture in order to avoid smoldering or excessive smoke. Smoldering produces twice the smoke and is a rule violation.

9. **Burns are to be ignited by the use of approved ignition devices that will ignite the burn without the production of black smoke.** Approved ignition devices include: matches, paper, and flame producing devices (i.e. propane or gas burners). The spraying or dousing of materials with any accelerant such as gasoline or diesel fuel or using other types of flammable materials (e.g. motor oil or tires) to ignite an open burn is prohibited.

10. **Open burning is limited to materials produced in commercial agricultural operations.** Regardless of where they are produced, waste materials from landscaping, family orchards, or private garden crops cannot be burned. Such waste materials should be disposed of by other legal methods such as recycling, chipping, mulching, composting, or re-incorporation into the soil.

11. **Materials may not be transported from one location to another for burning.** Materials may only be burned at the location where they were produced.

12. **Paper pesticide, fertilizer, and seed sacks shall only be burned in the field where they are emptied.** The burning of plastic sacks or jugs, cardboard boxes, and packing materials is prohibited. These must be disposed of by recycling or proper waste disposal. Commercial applicators are not eligible to obtain agricultural burn permits for burning these and other materials under any circumstances.

13. **The burn area or materials shall not be left unattended until the burn is extinguished and dead out.** The law requires the application of common sense and reasoning by persons using fire so the fire does not escape control and do damage to others. Burning shall be attended by a sufficient number of able-bodied adults with adequate tools and equipment to control the fire at all times. The burn shall be confined by cleared firebreaks or barriers adequate to prevent it from escaping control.

14. **This permit may be revoked or suspended for violations of any burn permit condition, rule requirement, or if necessary for the protection of public health and safety.** Any person who violates any provision of the District's Rules and Regulations can be subject to significant penalties plus the costs associated with extinguishing the fire.

The issuance of this permit shall not be construed as imposing on the issuing agency, any official, or any employee thereof any responsibility whatsoever for damages incurred by the use of the permit.

Our air quality standards are health-based standards. Please keep in mind that they exist for everyone's benefit.

For burn authorization, please call (559) 227-7143 or 1 (800) 665-BURN (2876), or access the District's web site via the Internet at www.valleyair.org.

Reference Authority: SJVAPCD Open Burning Rule 4103, Nuisance Rule 4102, the California Health and Safety Code § 41852 and § 41853 of California Code of Regulations Title 17.

C.2 RULE 4104 REDUCTION OF ANIMAL MATTER

Discussion

Rule 4104 is applicable to any source operation used for the reduction of animal matter. Adopted on May 21, 1992, primarily to control pathogens, this rule was amended for District rule number reorganization on December 17, 1992. Rule 4104 requires 100% VOC capture and a high level of destruction (1,200 degrees for 0.3 seconds). EPA finalized approval for Rule 4104 on March 9, 2010 and deemed this rule as being at least as stringent, if not more stringent than, RACT requirements.

Source Category

The reduction of animal matter includes rendering, cooking, drying, dehydration, digesting, evaporating, and protein concentration processes. The emission control equipment for these processes generally includes a condenser for VOC control and a venturi scrubber or cyclone, followed by either a packed bed scrubber or a thermal oxidizer. Blood drying facilities have additional processes controlled by cyclones and a baghouse.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.03	0.03	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	0.00	0.00
SOx	0.00	0.00	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	0.03	0.03
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

These facilities generally use steam from a boiler (indirect-fired) or a rotary dryer (direct-fired) for their operations, which generates NOx emissions from these combustion units. Combustion units are regulated by other District rules; as such, those emissions are controlled by and accounted for as a part of other District rules.

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from this source category are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for the reduction of animal matter.

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

Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for 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?

SCAQMD
- Rule 472 (Reduction of Animal Matter)

The District evaluated the requirements contained within SCAQMD's Rule 472 and found no requirements that were more stringent than those already in Rule 4104.

BAAQMD
- Regulation 12 Rule 2 (Rendering Plants)

The District evaluated the requirements contained within BAAQMD's Regulation 12 Rule 2 and found no requirements that were more stringent than those already in Rule 4104.

SMAQMD
- Rule 410 (Reduction of Animal Matter)

The District evaluated the requirements contained within SMAQMD's Rule 410 and found no requirements that were more stringent than those already in Rule 4104.

VCAPCD
- Rule 58 (Reduction of Animal Matter)

The District evaluated the requirements contained within VCAPCD's Rule 58 and found no requirements that were more stringent than those already in Rule 4104.

Additional Emission Reduction Opportunities

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, determining the scrubber medium may take some experimenting on the part of the facility to ensure it does not cause an increase in emissions or violate other District rules. It would also need to be replaced periodically, adding to the cost of upkeep. Thermal oxidizers do

not present similar issues. Also, 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. The current requirements are as stringent as possible for these types of facilities.

Regenerative Thermal Oxidizers

The District also evaluated the potential opportunity to reduce emissions from facilities by replacing thermal oxidizers with regenerative thermal oxidizers (RTOs) with heat recovery, which is a current practice at some facilities in the Valley. RTO devices use less supplementary fuel. While using less fuel may reduce NOx emissions, this is not necessarily the case. The PM control efficiency is nearly the same for both thermal oxidizers and RTOs, and the total NOx emissions from this category are relatively small given that there are only a few units subject to this rule that are not already subject to other combustion rules limiting NOx emissions. Any new units would be evaluated through the District's Best Available Control Technology New Source Review requirements.

Evaluation Findings

Even though the reduction of animal matter is not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4104 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from this source category in the Valley.

C.3 RULE 4106 PRESCRIBED BURNING AND HAZARD REDUCTION BURNING

Discussion

Adopted in June 2001 and approved by EPA as a SIP amendment in February 2002, [18] Rule 4106 is applicable to all prescribed burning and to hazard reduction burning in the wildland/urban interface within the Valley. Rule 4106 incorporated provisions made necessary by the March 23, 2000 amendment of Title 17 of the California Code of Regulations. 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 is only allowed when air quality and dispersion conditions are favorable, thus lessening the health impacts on Valley citizens and on air quality in the Valley.

Source Category

This rule is applicable to range improvement burning, forest management burning, wildland vegetation management burning, and hazard reduction burning. Agricultural burning, which is subject to Rule 4103, is generally done by farmers to dispose of tree prunings, crop residue, and other agricultural materials; disease and pest control; and orchard removal. In contrast, prescribed burning generally includes forest waste, fire hazard reduction, rangeland management, wildlife habitat improvement, and ecosystem (forest health) burning.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77
NOx	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
SOx	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	Winter Average - Tons per day								
PM2.5	0.88	0.88	0.88	0.88	0.89	0.89	0.89	0.90	0.90
NOx	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11
SOx	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from prescribed burning and hazard reduction burning are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does

[18] 67 Federal Register 39, pp. 8894-8897 (to be codified at 40 CFR Part 52). (2002, February 27). *Revisions to the California State Implementation Plan, San Joaquin Valley Unified Air Pollution Control District*. 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.

not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for prescribed burning and hazard reduction burning.

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

Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

State Regulations
There are no state regulations applicable to this source category.

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

SCAQMD
- Rule 444 (Open Burning)

The District evaluated the requirements contained within SCAQMD's Rule 444 and found no requirements that were more stringent than those already in Rule 4106.

BAAQMD
- Regulation 5 (Open Burning)

The District evaluated the requirements contained within BAAQMD's Regulation 5 and found no requirements that were more stringent than those already in Rule 4106.

SMAQMD
- Rule 501 (Agricultural Burning)

The District evaluated the requirements contained within SMAQMD's Rule 501 and found no requirements that were more stringent than those already in Rule 4106.

VCAPCD
- Rule 56 (Open Burning)

The District evaluated the requirements contained within VCAPCD's Rule 56 and found no requirements that were more stringent than those already in Rule 4106.

Placer County APCD (PCAPCD)
- PCAPCD Rule 301 (Nonagricultural Burning Smoke Management)

The District evaluated the requirements contained within PCAPCD Rule 301 and found no requirements that were more stringent than those already in Rule 4106.

- PCAPCD Rule 303 (Prescribed Burning Smoke Management)

The District evaluated the requirements contained within PCAPCD Rule 303 and found no requirements that were more stringent than those already in Rule 4106.

Additional Emission Reduction Opportunities

Prescribed Burning Emission Reduction Opportunities

Land Management Agencies (LMAs) are the agencies that regularly conduct prescribed burning operations. Since the adoption of Rule 4106, the District has developed cooperative relationships with the LMAs. Through this cooperation, the District advises the LMAs on which days would be the most conducive for igniting a burn project, based on air quality and meteorological conditions. The District continues to work with LMAs to identify favorable burning conditions with the goal of completing a maximum number of prescribed burning projects while minimizing air quality impacts. This collaborative effort ensures that the ignition of burn projects occurs when air quality and dispersion conditions are favorable, thus lessening the impacts on air quality in the Valley. Potential opportunities to reduce emissions from prescribed burning include the mechanical removal of the materials, firebox air curtain burners, and management of wild fires.

Mechanical Removal of Materials

One potential option to reduce burning materials would be to physically remove material from a project site. As these locations are not near roadways, it is often not practical or possible to bring mechanical equipment to remote and dense forest lands to collect and remove the material. Additionally, mechanical removal is much more expensive for the LMAs, who are already subject to budgeting restrictions, to reduce the fuels in an area as compared to burning. Mechanical removal of materials from forest areas is not technologically or economically feasible.

Firebox Air Curtain Burners

Assuming that a LMA could mechanically remove all of the material from a project burn site and that the material was placed in piles and prepared for burning, an alternative to open burning would be to use a firebox air curtain burner. A firebox air curtain burner is a device that circulates large volumes of air over a burning fire in an open topped fire proof metal box. When compared to open burning, firebox air curtain burners have been shown to greatly reduce PM and carbon dioxide emissions; however, the potential NOx emissions compared to open burning have not been fully evaluated yet. Because the Valley is a NOx-limited area, more research on the technology is needed to verify that there would be potential NOx emission reductions by switching from open burning practices to the use of firebox air curtain burners.

Wildfires

Often, primarily during the warm summer months, wildfires are naturally ignited through lightning strikes from passing storms. These wildfires have the potential to produce significant emissions and heavily impact residents within the Valley. When these wildfires occur, the District works with the responsible LMA in managing the fire as the

dispersion and air quality conditions fluctuate. This cooperation allows the LMA to be more aggressive with the fire when meteorological conditions are favorable and more defensive when the conditions are poor. The District will continue to use the tools available to guide the activities of LMAs when wildfires occur, and is continuously seeking opportunities to work with LMAs to improve the management of these fires in order to reduce emissions and impacts to Valley residents.

Hazard Reduction Burning Emission Reduction Opportunities

Hazard reduction burning is used exclusively by landowners in the wildland/urban interface within the foothill and mountain regions in the State Responsibility Areas, which comprise about 20% of the total land area in the Valley. Section 4291 of the California Public Resources Code (CPRC) states that structures must maintain a defensible perimeter of 100 feet in all directions; this defensible perimeter is commonly created through the clearing of vegetation. Although Section 4291 does not require it, most of this vegetation is burned because it is less expensive, faster, and more convenient than other options. Potential opportunities evaluated below include the reorganization of hazard reduction zones and alternatives to burning the vegetation.

Reorganization of Hazard Reduction Zones

Under Rule 4106, hazard reduction burning is only allowed when the District forecasts favorable air quality and dispersion conditions. Currently this forecast is based on a county-by-county basis, with appropriate elevation breaks. As an improvement to this zone system, and similar to agricultural burning, the Valley could be separated into smaller hazard reduction zones to provide more effective smoke management. Managing the allowance of hazard reduction burning under this type of scheme also has the potential to limit smoke impacts on residents. Establishing this type of management system would not cause an increase in costs for landowners, making this a cost effective opportunity. However, emissions reduced, if any, would be minimal, since the burning would still occur, just on different days when conditions are favorable.

Alternatives to Burning

As an alternative to the open burning of the vegetation, the District could encourage alternative methods like chipping or burn boxes through grant programs targeted at communities that regularly conduct hazard reduction burning.

1. Chipping

One potential alternative to the open burning of material is to use a chipper to break down the material into small pieces suitable for landscaping, dust control cover, or biomass burning. Evaluation of this alternative option revealed that chippers are not a viable alternative. The requirement by the CPRC to maintain a defensible perimeter of 100 feet is enforced annually; therefore, the organic materials to be cleared and disposed of consist of leaves, pine needles, weeds, and some small brush, all of which are not acceptable materials for wood chippers.

2. Firebox Air Curtain Burners

Another potential opportunity examined is the feasibility of usage of a firebox air curtain burner, which was described earlier. Again, this is not a feasible option for the Valley because the potential NOx emission reductions have not been verified.

3. Biomass Removal Program

A potential opportunity to reduce emissions from hazard reduction burning would be by removing the biomass from the area and sending it for combustion at a biomass plant, similar to a pilot program implemented by the PCAPCD in 2007. The pilot program in Placer County was evaluated below to determine feasibility for implementation in the Valley.

PCAPCD Program

PCAPCD implemented a "Biomass Box" program beginning in the spring of 2007 to collect and utilize biomass that would traditionally be collected and burned as a part of hazard reduction efforts, for use as fuel for producing energy. The program, funded with a grant from PCAPCD, collected the biomass by distributing 20 to 40 foot industrial containers throughout participating communities in the county. When full, the containers were transported to another location where the materials were grinded into useable fuel that biomass energy companies could accept. The chipped biomass was then loaded onto larger trucks and hauled to one of two biomass facilities.

Figure C-3 Image of a Typical 40' Biomass Box Used in Placer County in 2007

The final report by PCAPCD that evaluated this pilot program documented that from an emissions reductions standpoint the project was a success, with net air pollution reductions at 88.6%, including 24.7 tons of particulates and 4.0 tons of NOx reduced at a cost of $80,000. Based on the perceived success of this study, the District

evaluated this pilot program for potential emissions reductions and feasibility of implementation in the Valley.

Hazard reduction in Placer County is overseen by the Placer County Biomass Program with help from local fire departments and land managers. The Placer County Biomass Program and PCAPCD confirmed that the community biomass bins are no longer prominently used. The program was initially designed to change the culture of hazard reduction burning by providing an alternative to burning. However, the bin program proved to have many complications that rendered it an ineffective program. One issue was that residents were disposing of items other than biomass into the bins. This caused problems for the chippers and produced less than ideal fuel for biomass plants. Additionally, PCAPCD determined that the transport of biomass bins any further than 30 miles round trip was cost prohibitive.[19]

A few biomass bins were still in use as of 2013, but only in communities that explicitly requested them following the 2007 pilot project. PCAPCD determined that there are more cost effective options for removing residential biomass then using community biomass bins, such as using mobile chippers to provide residents with a low cost "curb side" chipping service. The chipped biomass is blown back onto the property for use as mulch or as a dust suppressant. The program is supported in part by grants from Placer County Resource Conservation District, Placer County Sheriff's Department, PCAPCD, and Calfire. As stated above, chipping is not a feasible option to implement in the Valley.

Evaluation Findings

Even though prescribed burning and hazard reduction burning are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4106 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from prescribed burning and hazard reduction burning in the Valley.

[19] Storey, B., Biomass Program Manager, Placer County Executive Office, Personal Communication.

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

Discussion

Rule 4203 is applicable to any person, operation, facility, incinerator, or equipment used to dispose or process combustion refuse. The rule limits the concentration of particulate matter emissions based on process weight rates, and prohibits the discharge of visible emissions. Rule 4203 was adopted on May 21, 1992 and subsequently amended for District rule number reorganization on December 17, 1992.

Source Category

There are currently 3 facilities in the Valley subject to Rule 4203. Units subject to this rule already meet BACT level requirements, which require the mitigation of air pollution to the maximum degree achievable using control technologies like baghouses and lime scrubbers.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.00	0.00	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	0.00	0.00
SOx	0.00	0.00	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	0.00	0.00
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 1.4 tons per day (tpd) for PM2.5 combustion. As identified in the above table, emissions from the incineration of combustible refuse are lower than the BACM/MSM PM2.5 significance threshold. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for the incineration of combustible refuse.

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

Federal Regulations

There are no specific federal guidelines for particulate matter concentration in terms of EPA CTG, ACT, NSPS, NESHAP, or MACT requirements. EPA BACT standards require the use of a fabric filter or baghouse. District BACT standards are as stringent and require existing facilities to use a natural gas supplemental fuel with a baghouse.

State Regulations
There are no state regulations applicable to this source category.

How does District Rule 4203 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

SCAQMD
- Rule 473 (Disposal of Solid and Liquid Wastes)

The District evaluated the requirements contained within SCAQMD's Rule 473 and found no requirements that were more stringent than those already in Rule 4203.

SMAQMD
- Rule 407 (Open Burn)

The District evaluated the requirements contained within SMAQMD's Rule 407 and found no requirements that were more stringent than those already in Rule 4203.

VCAPCD
- Rule 57 (Incinerators)

The District evaluated the requirements contained within VCAPCD's Rule 57 and found no requirements that were more stringent than those already in Rule 4203.

Evaluation Findings
Even though particulate matter emissions from the incineration of combustible refuse are not a significant source of PM2.5 in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4203 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from the incineration of combustible refuse in the Valley.

C.5 RULE 4204 COTTON GINS

Discussion

Adopted on February 17, 2005, Rule 4204 is intended to reduce particulate emissions from cotton ginning facilities operating within the Valley. The implementation of this rule has achieved 0.79 tpd of PM10 reductions from this source category. EPA finalized approval of Rule 4204 on November 9, 2006 and deemed this rule as meeting established RACT standards.

The *2003 PM10 Plan* identified cotton gins as a significant source of PM10 emissions in the Valley. The federal CAA requires air districts designated as Serious nonattainment for PM10 to implement BACM, including BACT, on significant stationary and area sources of PM10 and PM10 precursors. Although many gins in the Valley were already retrofitted with 1D3D high-efficiency cyclones, considered BACT, the District developed Rule 4204 to assure that all cotton gins met BACT requirements at the earliest practicable date.

Source Category

There are two types of cotton gins: saw and roller. A saw gin is commonly used for short fiber cotton where the cotton is pulled across knifed edges to remove seeds and trash. A roller gin is instead used for long fiber cotton and the cylinders or rollers carry the cotton across screens or perforated metal where the trash is removed. Throughput for saw gins can be higher than that of a roller gin, but a roller gin produces a higher quality end-product.

Modern ginning uses pneumatic conveyance, in the form of fans blowing air, which moves the cotton gin material. Particulate matter emissions are the unwanted by-products of this otherwise very efficient means of transferring massive quantities of cotton gin material from one process to the next process, such as from unloading to drying and cleaning. PM emissions from cotton ginning facilities occur mostly during a three-month period from October to December, the time of year during which the Valley's ambient PM concentrations are highest.

Cotton ginning, the process of separating the lint from the seed, has evolved from a labor-intensive process capable of producing small quantities of cotton to a highly efficient industry producing millions of bales. With this increase in production came the problem of how to handle the debris made up of plant and soil material that comes from machine harvesting the cotton. Since cotton gins use large quantities of air for conveying, the use of cyclones for air pollution abatement was a logical choice.

Cotton gins are regulated through a combination of permit conditions and other prohibitory rules aside from Rule 4204. Permit conditions cite Rules 1070, 2201, 4101, 4102, 4201, and 4202 as the regulatory basis for cotton gins:

- **Rule 1070** requires the keeping of daily records, which are available for District inspection upon request.
- **Rule 2201** covers the following areas:

a. Type of cyclones or other control devices for specific exhaust points.
b. Allowable PM10 emission rate for the cotton gins as an integrated system and allowable PM10 emission rate for specific exhaust points.
c. Bale throughput in bales/day or bales/season.

- **Rule 4101** prohibits the discharge into the atmosphere of air contaminants for a period or periods aggregating more than three minutes in any one hour, which is as dark as or darker than Ringelmann 1 or 20% opacity.
- **Rule 4102** prohibits the release of air contaminants that causes a public nuisance.
- **Rule 4201** limits particulate matter emissions concentration to 0.1 grains/dscf or less.
- **Rule 4202** limits particulate matter emissions by establishing allowable emission rates based on process weights.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.22	0.22	0.23	0.22	0.22	0.23	0.23	0.24	0.24
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day								
PM2.5	0.34	0.35	0.35	0.35	0.35	0.36	0.36	0.37	0.37
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from cotton gins are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for cotton gins.

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

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

State Regulations

There are no state regulations applicable to this source category.

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

There are no analogous rules for this source category in SCAQMD, BAAQMD, SMAQMD, or VCAPCD.

Other Analogous Rules

- New Mexico Administrative Code 20.2.66.1 (Cotton Gins)

The District evaluated the requirements contained within New Mexico Administrative Code 20.2.66.1 and found no requirements that were more stringent than those already in Rule 4204.

- Louisiana Department of Environmental Quality, Title 33 (Environmental Regulatory Code), Part III (Air)

The District evaluated the requirements contained within Louisiana Department of Environmental Quality, Title 33 and found no requirements that were more stringent than those already in Rule 4204.

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

The District evaluated the requirements contained within North Carolina Administrative Code Title 15A, Subchapter 2D, Section .0542 and found no requirements that were more stringent than those already in Rule 4204.

- South Carolina Air Pollution Control Regulations and Standards, Regulation 61-62.5, Standard No. 4, Section V (Cotton Gins)

The District evaluated the requirements contained within South Carolina Regulation 61-62.5, Standard No. 4, Section V and found no requirements that were more stringent than those already in Rule 4204.

- Oklahoma Department of Environmental Quality, Air Pollution Control, 252:100-23 (Cotton Gins)

The District evaluated the requirements contained within South Carolina Regulation 61-62.5, Standard No. 4, Section V and found no requirements that were more stringent than those already in Rule 4204.

- Texas Commission on Environmental Quality, Air Quality Standard Permit for Cotton Gin Facilities and Cotton Burr Tub Grinders

The District evaluated the requirements contained within the above rules and found no requirements that were more stringent than those already in Rule 4204.

Additional Emission Reduction Opportunities

Research and PM2.5 Fraction

Research was completed in 2013 by the United States Department of Agriculture Agricultural Research Service (USDA-ARS), in partnership with cotton associations, EPA, ARB, and the District to measure actual PM10 and PM2.5 emissions from stack sources and fugitive emissions in and around several ginning facilities. This research provided emission factors for comparison to previous estimations that are included in emission inventories and provided data for both types of cotton gins currently in use in California. This project was designed to measure emissions from facilities with current emissions control technologies in place and to improve emissions estimations by measurement with the highest quality methods and instruments. The project was not designed to evaluate new technologies or measures to further reduce emissions. Results for the seven gins that were sampled for the project indicate the estimated ratio of PM2.5 to PM10 is approximately 16%.[20] This fraction of PM2.5 to PM10 is lower than indicated in the emissions inventory currently being used. Future research will include particle size analysis of EPA Method 17 samples, and modeling to compare model output and ambient sampling data and develop suggested modeling corrections.

1D3D Cyclones with Expansion Chamber

Currently, all cotton gins in the Valley are required to operate using a 1D3D cyclone. 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 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.[21] However, there is no completed research indicating the fraction of PM2.5 emitted or the effectiveness of reducing PM2.5 by installing an expanded chamber. Since 1D3D cyclones are already required by the current rule, and there is no definitive data to verify the effectiveness in reducing PM2.5 emissions with an expansion chamber, this is not a feasible opportunity to reduce emissions.

Loadout

Rule 4204 currently requires wind screens for loadout. Two potential opportunities to reduce emissions through control options to capture PM10 emissions from the truck loading operation were identified as follows: 1) venting the loadout area to pre-cleaning cyclones and a baghouse; and 2) venting the receiving pit to a 1D-3D cyclone. While it is technologically feasible to enclose the loadout area and receiving pits and vent to the respective control devices, the District's BACT Guideline 5.1.8 has found those options to not be cost effective. This analysis was calculated according to PM10 emission factors and again, the PM2.5 fraction is unknown at this time.

[20] United States Department of Agriculture, Agricultural Research Service. (2013). *Characterization of Cotton Gin Particulate Matter Emissions.* Obtained from http://buser.okstate.edu/air-quality/cotton-gin/national-study/.
[21] 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.

Mechanical Conveyance

Mechanical conveyance for the main trash handling system could be a potential opportunity to reduce emissions, but it has only been demonstrated as feasible for newly constructed or rebuilt cotton gins. Mechanical conveyance almost entirely eliminates emissions from cotton gin trash handling exhaust streams, which were previously 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 they are able to design the cotton gin around the equipment and space 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 industry representatives and equipment manufacturers, it is not technologically feasible to retrofit existing cotton gins with mechanical conveyance systems to replace existing trash handling equipment. Additionally, any new facilities would trigger New Source Review requirements and would be required to implement BACT level controls.

Plenum Chambers

Plenum chambers are in use at a number of cotton gins in the Valley. Plenum chambers are placed upstream of selected cyclones to remove large trash. Studies have been inconclusive in demonstrating an increase in PM control efficiency with the utilization of a plenum chamber. Most cotton ginning facilities that have installed plenum chambers are using those devices to reduce wear and tear on the cyclones, thus prolonging the life of the cyclones, and not for increased PM controls.

Evaluation Findings

Even though cotton gins are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4204 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from cotton gins in the Valley.

C.6 RULE 4301 FUEL BURNING EQUIPMENT

Discussion
Rule 4301 was last amended in 1992 and 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 and deemed this rule as being at least as stringent as established RACT requirements.

Source Category
Rule 4301 has a very broad applicability, as it applies to all types of fuel burning equipment. Since its early adoption in 1992, it has largely been superseded by several District rules with more stringent NOx requirements for specific types of fuel burning equipment. See the control measure evaluations for Rules 4306, 4307, 4308, 4309, 4352, and 4703 for more specific information about the individual fuel burning equipment source categories.

Emissions Inventory
There is no emissions inventory specific to Rule 4301; see Rules 4306, 4307, 4308, 4309, 4352, and 4703 for the individual emissions inventories.

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, such as CTG, ACT, NSPS, NESHAP, and MACT. However, as previously mentioned, several District rules have superseded Rule 4301 with more stringent requirements. Comparisons of those District rules to the applicable federal and state rules are discussed within those control measure evaluations.

How does District Rule 4301 compare to rules in other air districts?
There are no analogous rules in BAAQMD, SMAQMD, and VCAPCD.

SCAQMD
- Rule 474 (Fuel Burning Equipment—Oxides of Nitrogen)

The District evaluated the requirements contained within SCAQMD's Rule 474 and found no requirements that were more stringent than those already in Rule 4301.

Evaluation Findings
District Rule 4301 alone cannot be considered to fulfill BACM/MSM requirements for this source category. The NOx requirements of this rule have been superseded by the requirements of other District rules that satisfy BACM/MSM for fuel burning equipment since all units subject to Rule 4301 are subject to a more specific NOx rule discussed elsewhere in this appendix. See the control measure evaluations for Rules 4306, 4307, 4308, 4309, 4352, and 4703.

C.7 RULE 4306 AND RULE 4320 ADVANCED EMISSION REDUCTION OPTIONS FOR BOILERS, STEAM GENERATORS, AND PROCESS HEATERS GREATER THAN 5.0 MMBTU/HR

Discussion

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 NOx and carbon monoxide (CO) emissions from boilers, steam generators, and process heaters of this size range.

Rule 4320 is the third generation rule for this source category. The first District rule for this source category, Rule 4305 (Boilers, Steam Generators, and Process Heaters), was adopted on December 16, 1993. Rule 4305 was superseded by Rule 4306 (Boilers, Steam Generators, and Process Heaters – Phase 3) on September 18, 2003 to implement a NOx control measure from the District's ozone and PM10 attainment plans, lowering the NOx emissions limits in Rule 4305. Since adoption, Rule 4306 has been amended twice.

The amendment of Rule 4306 in October 2008 was initially proposed to lower the NOx emission limit from 9 ppmv to 6 ppmv for units greater than 20 MMBtu/hr. It was determined that the proposed NOx limits could be accomplished by using selective catalytic reduction (SCR) or a combination of SCR and ultra-low NOx burners (ULNBs), thus making the lower limits technologically feasible. However, through the public workshop process and additional research it was also determined that most of the units subject to Rule 4306 have undergone several generations of NOx controls, and consequently, certain applications of SCR may not be cost effective and/or technological infeasible because of physical limitations. Therefore, the lower NOx limits were included in new Rule 4320 and an option was provided in the rule that allows for the payment of an annual emissions fee based on total actual emissions, rather than installation of additional NOx controls. These fees are used by the District to achieve cost effective NOx reductions through District incentive programs, the District's Technology Advancement Program, and other routes. The previous versions of Rule 4305 and 4306 combined with the implementation of Rule 4320 achieve approximately 96% control of NOx emissions from this source category.

The implementation of Rule 4320 does not substitute the requirements of Rule 4306, but enforces requirements supplementary to Rule 4306. As such, this evaluation is applicable to both Rule 4306 and Rule 4320.

Source Category

Facilities with units subject to this rule 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.

To recognize the operational and technical differences between different types of equipment subject to Rules 4306 and 4320, the different equipment types were separated into several major categories, with different requirements, including the following:

- Units with a total rated heat input greater than 5.0 MMBtu/hr to 20.0 MMBtu/hr
- Units with a total rated heat input greater than 20.0 MMBtu/hr
- Oilfield steam generators of all ratings and fuel types
- Refinery units of all ratings and fuel types
- Low-use units limited by a Permit to Operate to an annual heat input greater than 1.8 billion Btu/year but less than or equal to 30 billion Btu/year
- Units at a wastewater treatment facility using less than 50% PUC quality fuel
- Small specialty units operated by a small producer

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	1.27	1.25	1.23	1.21	1.19	1.17	1.14	1.13	1.10
NOx	1.93	1.83	1.72	1.61	1.56	1.51	1.46	1.41	1.36
SOx	0.60	0.59	0.24	0.24	0.23	0.23	0.23	0.22	0.22
	Winter Average - Tons per day								
PM2.5	1.25	1.24	1.21	1.19	1.17	1.15	1.13	1.11	1.09
NOx	1.88	1.78	1.68	1.57	1.51	1.47	1.42	1.38	1.32
SOx	0.58	0.57	0.24	0.23	0.23	0.23	0.22	0.21	0.21

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion emissions, 13.1 tons per day (tpd) for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from boilers, steam generators, and process heaters greater than 5.0 MMBtu/hr are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for this source category.

How does District Rule 4306/4320 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG requirements for this source category.

ACT

- EPA-453/R-93-034 (Alternative Control Techniques Document – NOx emissions from Process Heaters)

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.

- EPA-453/R-93-022 (Alternative Control Techniques Document – NOx Emissions from Industrial/Commercial/Institutional Boilers)

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.

- EPA-453/R-93-023 (Alternative Control Techniques Document – NOx Emissions from Utility Boilers)

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.

NSPS

- 40 CFR 60 Subpart D (Standards of Performance for Fossil-Fuel Fired Steam Generators for Which Construction Is Commenced After August 17, 1971)

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)

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)

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.

NESHAP/ MACT

- 40 CFR 63 Subpart DDDDD (NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters)

40 CFR 63 Subpart DDDDD was amended on January 31, 2013 to include new emission limits for PM, CO, and total selective metals (TSM), replace numeric dioxin

emission limits with work practice standards, add new subcategories of facilities, and add alternative monitoring approaches for compliance with the PM limit. The PM limit in District Rule 4320 is more stringent for liquid fuels because it only allows liquid fuels to be burned during PUC quality natural gas curtailment periods. It is equivalent to DDDDD for all gasses burned except for gasses exceeding 40 $\mu g/m^3$ of mercury.

The District evaluated the requirements contained within the above NESHAP 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 does District Rule 4306/4320 compare to rules in other air districts?

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

SCAQMD Rule 1146 was amended on November 1, 2013 to include rule language clarifications and revisions to address SIP creditability issues. None of the amendments affected emissions reductions.

The District evaluated the requirements contained within SCAQMD's Rule 1146 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

BAAQMD
- Regulation 9 Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional and Commercial Boilers, Steam Generators and Process Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 7 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

- Regulation 9 Rule 10 (Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators and Process Heaters in Petroleum Refineries)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 10 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

SMAQMD
- Rule 411 (NOx from Boilers, Process Heaters and Steam Generators)

The District evaluated the requirements contained within SMAQMD's Rule 411 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

VCAPCD

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

The District evaluated the requirements contained within VCAPCD's Rule 74.15 and found no requirements that were more stringent than those already in Rules 4306 and 4320.

Additional Emission Reduction Opportunities

Over the years, the District has adopted numerous generations of rules and rule amendments for boilers greater than 5 MMBtu/hr that have significantly reduced NOx and PM emissions from this source category. The emissions inventory for NOx from these boilers has dropped from 40.2 tpd in 1993 to 1.61 tpd in 2015. As part of these regulatory efforts, hundreds of boilers in the Valley have been equipped with the best available NOx and PM control technologies. Given the significant effort already made to reduce emissions from this source category, there are little remaining opportunities for obtaining additional emissions reductions.

Low Temperature Oxidation

The District researched emerging technologies that may have the potential to reduce emissions. A Low Temperature Oxidation (LTO) System was installed at a dairy in the SCAQMD and was able to reach NOx limits between 1.0- 3.2 ppmv for loads 4.1-13 MMBtu/hr. The LTO system utilizes ozone to oxidize and control various pollutants, including NOx. According to the SCAQMD BACT database information, capital and installation costs ranged from $360,000 - $400,000 for the LTO system when it was installed in 1997.[22] Installation within the South Coast region was heavily subsidized with government funding and the installation costs appear cost prohibitive for an installation that is not subsidized. In addition, the LTO system is classified as "Other Technologies" in the SCAQMD BACT guidelines, which means that the technology has not met the achieved in practice (AIP) criteria of six months of continuous operation at a minimum of 50% operating capacity and does not qualify as the lowest achievable emission rate (LAER). Since the technology has not been achieved in practice and cost prohibitive without significant subsidies, this is not a feasible opportunity at this time.

EMx

The District researched the potential for emissions reductions through EMx, the second generation of the SCONOx technology that is a post-combustion control that reduces NOx, SOx, CO, and volatile organic compound (VOC) emissions. This technology has not been AIP in the District and there is no available data that indicates that SCONOx or EMx has been installed on boilers even though the manufacturer's website states that the technology is transferrable to industrial boilers. Based on research of the best available controls from EPA and other air districts, the SCONOx and EMx systems have only been utilized by power plants for control of turbine emissions. In fact, cost effectiveness analyses conducted by the District for the installation of SCONOx/EMx

[22] South Coast Air Quality Management District. (2012). *SCAQMD Best Available Control Technology (BACT) Database*.

units on large power plant turbine installations within the Valley have been found to not be 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.

PM2.5 Limits for Alternative Fuels

The majority of boilers (>5 MMBtu/hr) in the Valley combust Public Utilities Commission (PUC) quality natural gas, which contains a very low sulfur content and inherently has low emissions. Few boilers in the Valley use alternative fuels for their combustion processes. Alternative fuels 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. Current rule language requires that liquid fuel shall be used only during a PUC-quality natural gas curtailment period provided it contains no more than 15 ppm sulfur. While the use of liquid fuel is strictly limited, the feasibility of reducing PM emissions through adding PM2.5 limits for units using liquid fuel was explored as part of the District's comprehensive control measure evaluation.

There are 83 units that are permitted to utilize liquid fuel in the Valley (>5 MMBtu/hr) during a natural gas curtailment with an average combined emissions inventory of approximately 0.034 tons per year of total PM. The low emissions inventory is attributed to the fact that these units either utilize liquid fuel as a backup if there is a natural gas curtailment. The following three technologies were researched as potential opportunities to reduce PM emissions: baghouses, electrostatic precipitators (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%.[23] Currently, there are a few crude oil-fired or field gas-fired steam generators operating in crude oil production facilities that are required by their permits to operate SOx scrubbers and ESPs. However, baghouses are typically not used with liquid-fired boilers due to the potential clogging of the baghouse[24] and are therefore not a recommended technology due to infeasibility and safety issues.

[23] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVlXQ&bvm=bv.86956481,d.cWc.

[24] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVlXQ&bvm=bv.86956481,d.cWc.

PM Potential Emissions Reductions for an ESP and Scrubber

For the purposes of these calculations, the following assumptions were made:

1. For simplicity, the analysis will evaluate the cost effectiveness of these technologies for total PM reductions from liquid fuel fired units.
2. The PM control efficiency of an ESP is 99%.
3. The PM control efficiency of a scrubber is 99%.

Potential Emissions Reductions $_{(ESP)}$ = (Total PM Emissions) x (Control Efficiency)
Potential Emissions Reduction $_{(ESP)}$ = 0.034 tons/year X 0.99
Potential Emissions Reduction $_{(ESP)}$ = 0.0337 tons/ year (tpy)

Potential Emissions Reductions $_{(scrubber)}$ = (Total PM Emissions) x (Control Efficiency)
Potential Emissions Reduction $_{(scrubber)}$ = 0.034 tons/year X 0.99
Potential Emissions Reduction $_{(scrubber)}$ = 0.0337 tons/ year (tpy)

Annualized Cost of an ESP and Wet Scrubber

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 is $1,000-$2,000.[25] 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.[26] The District used the following assumptions in the cost effectiveness calculations:

1. The capital cost of an ESP for a 5 MMBtu/hr boiler is assumed to be $100,000.
2. The annual maintenance cost of an ESP for a 5 MMBtu/hr boiler is assumed to be $2,000.
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.

Annual Cost$_{(ESP)}$ = (Total Capital Cost) x (0.1627) + (Annual Maintenance Cost x 83)
Annual Cost$_{(ESP)}$ = ($100,000 x 83) x (0.1627) + ($2,000 x 83)
Annual Cost$_{(ESP)}$ = $1,516,410/year

[25] 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.
[26] EPA. (2002). *Air Pollution Control Technology Fact Sheet: Spray-Chamber/Spray-Tower Wet Scrubber.* Retrieved from http://www.epa.gov/ttncatc1/dir1/fsprytwr.pdf.

Annual $Cost_{(scrubber)}$ = (Annualized Cost of 1 unit) x (Number of Units) x (Avg. Flow Rate)
Annual $Cost_{(scrubber)}$ = ($53,650/ sm^3/sec) x (83) x (23.85 sm^3/sec)
Annual $Cost_{(scrubber)}$ = $106,202,858/ year

Cost Effectiveness of an ESP and Wet Scrubber
Cost Effectiveness = Annual Cost / Annual Emissions Reductions

Cost $Effectiveness_{(ESP)}$ = ($1,516,410/year) / (0. 0337 tons/ year)
Cost $Effectiveness_{(ESP)}$= $44,997,329/ton of PM

Cost $Effectiveness_{(scrubber)}$= ($106,202,858/year) / (0. 0337 tons/ year)
Cost $Effectiveness_{(scrubber)}$ = $3,151,420,104/ton of PM

As illustrated above, neither PM control technology is a cost effective option for this source category. The cost of the ESP technology does not include costs of retrofitting equipment and/or the facility or compliance monitoring costs, which would drive the cost effectiveness up even more.

Evaluation Findings

Even though boilers, steam generators, and process heaters greater than 5.0 MMBtu/hr are not a significant source of NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4306 and 4320 currently have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from this source category in the Valley.

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

Discussion

This rule applies to any gaseous fuel or liquid fuel fired boiler, steam generator, or process heater with a total rated heat input of 2.0 million British thermal units per hour (MMBtu/hr) up to and including 5.0 MMBtu/hr. The purpose of this rule is to limit emissions of NOx, carbon monoxide (CO), sulfur dioxide (SO2), and particulates from units subject to this rule.

Rule 4307 was adopted on December 15, 2005 to establish emissions limits and control requirements for these units which were previously exempt because of their smaller size. Since its adoption, the rule has been amended three times. The October 2008 amendments strengthened the rule by removing some exemptions, imposing NOx limits of 9 or 12 ppmv for new and replacement units, and adding a menu-approach for particulate matter control that also encompasses SOx controls. The rule was amended again in 2011 to specifically incorporate tree nut pasteurizers as a separate type of unit. EPA published a direct final approval of the 2011 amendments to Rule 4307 on February 12, 2015 and deemed this rule as being at least as stringent as established RACT requirements. NOx emissions have been controlled by over 84% for units in this source category.

Source Category

Based on District permits information, there are currently 540 permitted and Permit-Exempt Equipment Registration (PEER) units subject to Rule 4307 requirements. Facilities with units subject to this rule represent a wide range of industries, including but not limited to, medical facilities, educational institutions, office buildings, prisons, military facilities, hotels, and industrial facilities.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.32	0.32	0.31	0.30	0.30	0.29	0.29	0.28	0.28
NOx	0.49	0.46	0.43	0.41	0.39	0.38	0.37	0.36	0.34
SOx	0.15	0.15	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Winter Average - Tons per day								
PM2.5	0.32	0.31	0.31	0.30	0.30	0.29	0.28	0.28	0.27
NOx	0.47	0.45	0.42	0.40	0.38	0.37	0.36	0.35	0.33
SOx	0.15	0.14	0.06	0.06	0.06	0.06	0.06	0.05	0.05

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from boilers, steam generators, and process heaters 2.0 to 5.0 MMBtu/hr are lower than the BACM/MSM significance thresholds. Therefore, the

Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for this source category.

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

Federal Regulations
There are no EPA CTG or NSPS requirements for this source category.

ACT

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

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.

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

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.

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

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.

NESHAP/ MACT

- 40 CFR 63 Subpart DDDDD (NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters)

40 CFR 63 Subpart DDDDD was amended on January 31, 2013 to include new emission limits for PM, CO, and total selective metals (TSM), replace numeric dioxin emission limits with work practice standards, add new subcategories of facilities, and add alternative monitoring approaches for compliance with the PM limit. The PM limits in 40 CFR 63 Subpart DDDDD would not apply to Rule 4307 sources. Subpart DDDDD contains alternative requirements for units less than 10 MMBtu/hr and requires tuning every 2-5 years.

The District evaluated the requirements contained within 40 CFR 63 Subpart DDDDD and found no requirements that were more stringent than those already in Rule 4307.

State Regulations
There are no state regulations applicable to this source category.

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

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

The District evaluated the requirements contained within SCAQMD's Rule 1146.1 and found no requirements that were more stringent than those already in Rule 4307.

BAAQMD
- Regulation 9 Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 7 and found no requirements that were more stringent than those already in Rule 4307.

- Regulation 9 Rule 10 (Nitrogen Oxides and Carbon Monoxide from Boilers, Steam Generators and Process Heaters in Petroleum Refineries)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 10 and found no requirements that were more stringent than those already in Rule 4307.

SMAQMD
- Rule 411 (NOx from Boilers, Process Heaters and Steam Generators)

The District evaluated the requirements contained within SMAQMD's Rule 411 and found no requirements that were more stringent than those already in Rule 4307.

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

The District evaluated the requirements contained within VCAPCD's Rule 74.15.1 and found no requirements that were more stringent than those already in Rule 4307.

Additional Emission Reduction Opportunities
The District has adopted numerous rule amendments over the years for boilers that have significantly reduced emissions from units subject to Rule 4307. Most units subject to Rule 4307 are fired on Public Utilities Commission (PUC) quality natural gas, and are inherently low-emitters of SOx and PM2.5 emissions. The NOx limits implemented through Rule 4307 and its amendments will reduce emissions from over 1,000 small (2-5 MMBtu/hr) boilers in the Valley when fully implemented, including from units that were previously exempt. As a result of these regulatory efforts, the emissions inventory for NOx from these boilers has dropped from 3.81 tpd in 2005 to 0.41 tpd in

2015. Additional emissions reductions are forthcoming with existing Rule 4307 as additional compliance dates are approaching in 2016. Given the significant efforts and investments already made to reduce emissions from this source category, there are little remaining opportunities for obtaining additional emissions reductions.

EMx as Potential Control

The District researched post-combustion controls such as EMx, the second generation of the SCONOx technology that reduces NOx, SOx, CO, and volatile organic compound (VOC) emissions. This technology has not been achieved in practice (AIP) in the District and there is no available data that indicates that SCONOx or EMx has been installed on boilers, particularly in this size range, even though the manufacturer's website states that the technology is transferrable to industrial boilers. Based on research of the best available controls from EPA and other air districts, the SCONOx and EMx systems have only been utilized by power plants for the control of turbine emissions. 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.

PM2.5 Limits for Alternative Fuels

The majority of boilers (2-5 MMBtu/hr) in the Valley combust PUC-quality natural gas; PUC 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. Alternative fuels 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. Current rule language requires that on and after July 1, 2015 liquid fuel shall be used only during a PUC quality natural gas curtailment period provided it contains no more than 15 ppm sulfur. While the currently limited use of liquid fuel will become even more strictly limited by July 2015, the feasibility of reducing PM emissions through adding PM2.5 limits for units using liquid fuel was explored as part of the District's comprehensive control measure evaluation.

There are 24 liquid fuel fired units in the Valley (2-5 MMBtu/hr) with an average combined emissions inventory of approximately 0.00077 tons per year of total PM. The low emissions inventory is attributed to the fact that these units either utilize liquid fuel as a backup if there is a natural gas curtailment or are minimally operated units. The following three technologies were evaluated as potential control options for reducing PM emissions: baghouses, electrostatic precipitators (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%.[27] However, baghouses are

[27] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from

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.[28]

PM Potential Emissions Reductions for an ESP and Scrubber

For the purposes of these calculations, the following assumptions were made:

1. For simplicity, the analysis will evaluate the cost effectiveness of these technologies for total PM reductions from liquid fuel fired units.
2. The PM control efficiency of an ESP is 99%.
3. The PM control efficiency of a scrubber is 99%.

Potential Emissions Reductions $_{(ESP)}$ = (Total PM Emissions) x (Control Efficiency)
Potential Emissions Reductions $_{(ESP)}$ = 0.00077 tons/year X 0.99
Potential Emissions Reductions $_{(ESP)}$ = 0.00076 tons/ year (tpy)

Potential Emissions Reductions $_{(scrubber)}$ = (Total PM Emissions) x (Control Efficiency)
Potential Emissions Reductions $_{(scrubber)}$ = 0. 00077 tons/year X 0.99
Potential Emissions Reductions $_{(scrubber)}$ = 0.00076 tons/ year (tpy)

Annualized Cost of an ESP and Wet Scrubber

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 is $1,000-$2,000.[29] 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.[30] The following assumptions were made for this cost effectiveness 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).

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http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVlXQ&bvm=bv.86956481,d.cWc.

[28] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVlXQ&bvm=bv.86956481,d.cWc.

[29] 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.

[30] EPA. (2002). *Air Pollution Control Technology Fact Sheet: Spray-Chamber/Spray-Tower Wet Scrubber.* Retrieved from http://www.epa.gov/ttncatc1/dir1/fsprytwr.pdf.

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.

Annual Cost $_{(ESP)}$ = (Total Capital Cost) x (0.1627) + (Annual Maintenance Cost)
Annual Cost $_{(ESP)}$ = ($95,000 x 24) x (0.1627) + ($1,500 x 24)
Annual Cost $_{(ESP)}$ = $406,956/year

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 (24) x (23.85 sm^3/sec)
Annual Cost $_{(scrubber)}$ = $30,709,260/ year

Cost Effectiveness of an ESP and Wet Scrubber

Cost Effectiveness = Annual Cost / Annual Emissions Reductions

Cost Effectiveness $_{(ESP)}$ = ($406,956/year) / (0.00076 tons/ year)
Cost Effectiveness $_{(ESP)}$ = $535,468,421/ton of PM

Cost Effectiveness $_{(scrubber)}$ = ($30,709,260/year) / (0.00076 tons/ year)
Cost Effectiveness $_{(scrubber)}$ = $40,406,921,053/ton of PM

As illustrated above, neither PM control technology is a cost effective option for this source category. The cost of the ESP technology does not include costs of retrofitting equipment and/or the facility or compliance monitoring costs, which would drive the cost effectiveness up even more.

Evaluation Findings

Even though boilers, steam generators, and process heaters 2.0 to 5.0 MMBtu/hr are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4307 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from this source category in the Valley.

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

Discussion

This rule applies to any person who supplies, sells, offers for sale, installs, or solicits the installation of any boiler, steam generator, process heater or water heater with a rated heat input capacity greater than or equal to 0.075 MMBtu/hr and less than 2.0 MMBtu/hr. The purpose of this rule is to limit NOx and carbon monoxide (CO) emissions from units within this source category. As a point of sale rule, Rule 4308 achieves emissions reductions as units subject to the rule are replaced over time. This rule has resulted in more than 93% control of emissions from this source category.

Rule 4308 was adopted on October 20, 2005 to establish NOx emissions limits for these units which 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. In 2013, the District determined that a 20 ppmv limit was now technologically feasible and cost effective for instantaneous water heaters 0.075 MMBtu/hr to 0.4 MMBtu/hr; as such, that emission limit was lowered during the November 2013 amendment of Rule 4308. EPA published a direct final approval the 2013 amendments to Rule 4308 on February 12, 2015.

Source Category

Units subject to Rule 4308 are used in settings including, but not limited to, apartment buildings, large homes, small businesses, commercial buildings, manufacturing facilities, government facilities, restaurants, hotels, hospitals, educational institutions, and religious organizations. Affected persons include water heater manufacturers, plumbing wholesalers, supply stores, plumbers, contractors, and end-users. 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.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.61	0.60	0.59	0.58	0.57	0.56	0.55	0.54	0.53
NOx	0.92	0.87	0.82	0.77	0.74	0.72	0.70	0.67	0.65
SOx	0.28	0.28	0.12	0.11	0.11	0.11	0.11	0.10	0.10
	Winter Average - Tons per day								
PM2.5	0.59	0.58	0.57	0.56	0.55	0.54	0.53	0.52	0.51
NOx	0.89	0.84	0.79	0.74	0.72	0.69	0.67	0.65	0.63
SOx	0.28	0.27	0.11	0.11	0.11	0.11	0.10	0.10	0.10

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from these units are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for boilers, steam generators, and process heaters 0.075 to 2.0 MMBtu/hr.

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

Federal Regulations

There are no EPA CTG, NSPS, NESHAP, or MACT requirements for boilers, steam generators, and process heaters of this size.

ACT

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

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 4308.

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

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 4308.

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

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 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?

SCAQMD

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

The District evaluated the requirements contained within SCAQMD's Rule 1146.2 and found no requirements that were more stringent than those already in Rule 4308.

BAAQMD

- Regulation 9 Rule 6 (Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 6 and found no requirements that were more stringent than those already in Rule 4308.

- Regulation 9 Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 7 and found no requirements that were more stringent than those already in Rule 4308.

SMAQMD

- Rule 411 (NOx from Boilers, Process Heaters and Steam Generators)

The District evaluated the requirements contained within SMAQMD's Rule 411 and found no requirements that were more stringent than those already in Rule 4308.

- Rule 414 (Water Heaters, Boilers and Process Heaters Rated Less Than 1,000,000 Btu Per Hour)

The District evaluated the requirements contained within SMAQMD's Rule 414 and found no requirements that were more stringent than those already in Rule 4308.

VCAPCD

- Rule 74.11.1 (Large Water Heaters and Small Boilers)

VCAPCD Rule 74.11.1 was amended on September 11, 2012 to implement a 20 ppmv NOx emission limit for all natural gas fired units with a rated heat input of 0.075-1.0 MMBtu/hr, with the exception of pool heaters. All District units 0.075-1.0 MMBtu/hr (with the exception of pool heaters 0.075-0.4 MMBtu/hr) are currently subject to a 20 ppmv NOx emission limit. As such, there are no requirements in VCAPCD Rule 74.11.1 that are more stringent than those already in Rule 4308.

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

VCAPCD Rule 74.15.1 was also amended on September 11, 2012. The amendments incorporated a 20 ppmv NOx emission limit for natural gas fired units 1-2 MMBtu/hr and other administrative recordkeeping requirements. Rule 4308 contains a 20 ppmv NOx emission limit for all natural gas fired units 1-2 MMBtu/hr so the amendments did not implement any requirements more stringent than the requirements in District Rule 4308. Therefore, there are no requirements in VCAPCD Rule 74.15.1 that are more stringent

than those already in Rule 4308.

Placer County APCD (PCAPCD)

- Rule 247 (Natural Gas-Fired Water Heaters, Small Boilers and Process Heaters)

PCAPCD Rule 247 was amended on February 13, 2014; however, the amendments incorporated the same emission limits contained within District Rule 4308. Therefore, there are no requirements in PCAPCD Rule 247 that are more stringent than those already in Rule 4308.

Additional Emission Reduction Opportunities

Mobile Home Exemption

The District evaluated the possibility of removing the exemption for water heaters used in mobile homes because multiple air districts do not exempt these sources in their analogous rules. However, because those air districts have different rule structures with regards to the size of devices regulated, District Rule 4308 requirements are as stringent as the other districts' rules.

For example, SCAQMD Rule 1146.2 does not regulate mobile home water heaters, per the definition for type 1 units, because they are subject to Rule 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters). SCAQMD Rule 1121 regulates units less than 0.075 MMBtu/hr, which is out of the size range of District Rule 4308. Similarly, in SMAQMD Rule 414, mobile home units are regulated in the size range of units less than 0.075 MMBtu/hr. District Rule 4902 (Residential Water Heaters) applies to units less than 0.075 MMBtu/hr and currently regulates mobile home water heaters with the same emission limit contained in SCAQMD and SMAQMD rules. BAAQMD Rule Regulation 9 Rule 6 regulates all units less than 2 MMBtu/hr, essentially combining the requirements of District Rules 4308 and 4902.

In addition, after researching the size of mobile home water heaters, it was found that mobile home water heaters are not available in the 0.075-2.0 MMBtu/hr size range. Four mobile home retailers and three mobile home manufacturers were contacted to inquire about the size of mobile home water heaters. All seven contacts stated that the average size of a mobile home water heater is 30-40 gallons, whereas a 0.075 MMBtu/hr water heater is approximately 80 gallons. One manufacturer and one retailer stated that 50 gallon mobile home water heaters are available but rarely used. If the exemption for mobile home water heaters in Rule 4308 were to be removed, it would not result in any additional emissions reductions since units do not exist in this size range.

Recreational Vehicle Exemption

The District evaluated the potential opportunity to remove the exemption for recreational vehicles (RVs). Stakeholder input indicates that there are very few units in RVs that fall under the size category subject to this rule. Most units in RVs are 12 gallons, which is

significantly smaller than the 80 gallon size of a typical 0.075 MMBtu/hr unit.[31] Also, RV units are typically not used on a frequent basis and thus are small contributors to the NOx emissions of this source category. Other air districts, such as SCAQMD and BAAQMD, include this exemption in their rules. Removing this exemption would result in little to no emissions reductions because of the lack of units within this size range and the intermittent use of units in RVs.

Evaluation Findings

Even though boilers, steam generators, and process heaters 0.075 to 2.0 MMBtu/hr are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4308 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from this source category in the Valley.

[31] SJVAPCD. (2009). *Final Staff Report for Amendments to Rule 4308 (Boilers, Steam Generators, and Process Heaters—0.075 MMBtu/hr to less than 2.0 MMBtu/hr)*.

C.10 RULE 4309 DRYERS, DEHYDRATORS, AND OVENS

Discussion

Rule 4309 is applicable to 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 5.0 million British thermal units per hour (5.0 MMBtu/hr) or greater. The purpose of this rule is to limit NOx and carbon monoxide (CO) emissions from these units, which result from the combustion of fuel in the burners. The rule enforces NOx emission limits between 3.5-12 ppmv for four categories of equipment, achieving approximately 34% control of total NOx emissions.

Rule 4309 was adopted on December 15, 2005 and has not been amended. EPA finalized approval of Rule 4309 on May 30, 2007 and deemed this rule as being at least as stringent as established RACT requirements.

Source Category

Dryers, dehydrators, and ovens are utilized in a broad range of industries. Analyses performed for the rule adoption separated the unit types into four broad industry groups: dehydrators; asphalt/concrete; milk, cheese, and other dairy processing; and other. Dryers, dehydrators, and ovens currently operate either seasonally or year-round depending on the industry and the unit's purpose within the process. There are 126 units subject to this rule, ranging in size from 5.0 MMBtu/hr to 200 MMBtu/hr.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.85	0.88	0.90	0.92	0.95	0.98	1.00	1.02	1.04
NOx	0.20	0.20	0.21	0.22	0.22	0.23	0.24	0.24	0.25
SOx	0.47	0.48	0.49	0.50	0.52	0.53	0.55	0.56	0.57
	Winter Average - Tons per day								
PM2.5	0.80	0.82	0.85	0.87	0.89	0.92	0.95	0.96	0.98
NOx	0.18	0.18	0.19	0.19	0.20	0.20	0.21	0.21	0.22
SOx	0.38	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.46

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from dryers, dehydrators, and ovens are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for dryers, dehydrators, and ovens.

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

Federal Regulations

There are no EPA CTG, NSPS, NESHAP, or MACT requirements for this source category.

Alternative Control Techniques (ACT)

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

The District evaluated the requirements contained within the ACT for NOx Emissions from Cement Manufacturing and found no requirements that were 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?

There are no analogous rules for this source category in BAAQMD, SMAQMD, or VCAPCD.

SCAQMD

- SCAQMD Rule 1147 (NOx Reductions from Miscellaneous Sources)

The District evaluated the requirements contained within SCAQMD's Rule 1147 and found no requirements that were more stringent than those already in Rule 4309.

Additional Emission Reduction Opportunities

The adoption of Rule 4309 has considerably reduced NOx and PM emissions from this source category. The emissions inventory for NOx from dryers, dehydrators, and ovens has dropped from 1.93 tpd in 2005 to 0.20 tpd in 2012. Although this source category had a relatively small emissions inventory prior to the adoption of Rule 4309, stakeholders have installed control equipment and modified their operations considerably to reduce emissions to ultra-low levels. Given the significant effort already made to reduce emissions from this source category, there are little remaining opportunities for obtaining additional emissions reductions.

Asphalt Plants

PUC-quality natural gas fuel is part of the BACT requirements for asphalt plants for the District, BAAQMD, and SCAQMD. There are currently nine asphalt plants in the Valley that do not utilize PUC-quality natural gas because some facilities are physically too far removed from natural gas lines to use natural gas. Six of these asphalt plants use LPG fuel or propane to comply with the same gaseous fuel fired limit as PUC-quality natural gas-fired facilities. The other three facilities utilize diesel gas; however, none of the facilities operate full time and their combined NOx emissions are less than 7 tons per

year. Therefore, requiring natural gas for all asphalt facilities is not a feasible opportunity that would generate significant emission reduction benefits.

The District evaluated the potential opportunity to lower the NOx emissions limits for asphalt plants from the current limits of 4.3 ppmv (gaseous fuel) and 12 ppmv (liquid fuel) to make them closer or equivalent to the BAAQMD BACT limit of 3.9 ppmv @ 19% O2. To meet this limit, operators would need to install low-NOx burners or modify existing burners to comply with lower limits; however, all of the asphalt plants have already installed new low-NOx burners or modified their units to meet the 4.3 ppmv @ 19% O2 and 12 ppmv @ 19% O2 emissions limits in Rule 4309.

Based on District permit records, a good portion of the asphalt units fired on gaseous fuel would be in compliance with a 3.9 ppmv @ 19% O2 NOx limit. However, reducing the limit to 3.9 ppmv @ 19% O2 would reduce the margin of compliance the facility has, and would make it more difficult for the facility to show continued compliance. In addition, reducing the limit from 4.3 ppmv to 3.9 ppmv would be an administrative change in nature, since it would not require any additional control equipment or changes in operating techniques or practices to comply, and it would not generate additional emissions reductions from these units.

A higher NOx limit is required for the liquid fuel fired facilities due to the characteristics of liquid fuels. In BAAQMD's BACT guideline for hot mix asphalt facilities, there is a clause that states, *"For remote locations where natural gas is not available, liquefied petroleum gas may be permitted up to 38 ppmvd NOx @ 15% O2 and fuel oil < 0.05 wt. % sulfur may be permitted up to 55 ppmvd NOx @ 15% O2."* This equates to 12.24 ppmv @ 19% O2 for liquefied petroleum gas and 17.73 ppmv @ 19% O2 for fuel oil. The District's Permits department enforces a limit of 4.3 ppmv @ 19% O2 for liquefied petroleum gas and 12 ppmv for other liquid fuels. Therefore, the District's requirements are more stringent than both limits in the BAAQMD BACT guideline.

Dehydrators

Rule 4309 requires dehydrators be fired on PUC-quality natural gas. The District evaluated the potential opportunity to further reduce emissions by requiring the use of low-NOx burners; however, this option is infeasible due to the potential negative effects on product quality. Additionally, enforcing the emissions limits is potentially infeasible because monitoring and source testing of dehydrators is difficult to perform, if not impossible.

Dryers

The District considered the potential opportunity to add a requirement for the use of dust collection devices, such as baghouses. Through the District's New Source Review Rule (Rule 2201), dust collection devices are already in place in the permit requirements for units that create PM emissions from handling the products they are drying. These facilities install baghouses or cyclones because they do not want to blow their product

out of their stack. While baghouses can foster PM2.5 reductions, cyclones are generally not as effective in removing fine particulate matter. [32]

The District researched the potential installation of baghouses on dryers. However, it is technologically infeasible to install a baghouse for some of the dryers subject to Rule 4309. The purpose of a dryer is to remove moisture from a product, which means that the exhaust from dryers have a high humidity. Baghouses can have problems with high humidity exhaust streams because the bags become caked. The air stream would have to be dried somehow before entering the baghouse. As a result, this is not a feasible opportunity at this time.

The District also evaluated the possibility of removing the exemption for column dryers and dryers with no stack and one or more sides open to the atmosphere. However, compliance with the proposed limits would be difficult to determine reliably given the design of these units. Column dryers have large fans to move the warm air through the material and air escapes through screens that cover the side of the dryer. Similarly, dryers with no stack and at least one side open deal with air escape, which makes monitoring and testing emissions difficult, if not impossible. Since source testing of these types of dryers is difficult due to the fact that there is not a stack where all emissions are exhausted, this is not a technologically feasible opportunity at this time.

Evaluation Findings

Even though dryers, dehydrators, and ovens are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4309 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from dryers, dehydrators, and ovens in the Valley.

[32] Northeast States for Coordinated Air Use Management. (November 2008) *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Retrieved from http://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CB8QFjAA&url=http%3A%2F%2Fwww.nescaum.org%2Fdocuments%2Fici-boilers-20081118-final.pdf%2F&ei=7nfvVIivFai1sAT07IHIAg&usg=AFQjCNFBdQn7MVAibSTZIbHV7-ojXkVIXQ&bvm=bv.86956481,d.cWc.

C.11 RULE 4311 FLARES

The purpose of Rule 4311 is to limit volatile organic compounds (VOC), NOx, and SOx emissions from any operation involving the use of flares, with the exception of a limited list of sources identified in the rule. Any unreasonable restrictions on flaring could potentially result in catastrophic consequences which may lead to explosions resulting in loss of property, injury, and potentially loss of human life.

Flaring is a high temperature oxidation process used to burn combustible components, primarily hydrocarbons, of waste gases from industrial operations, primarily for the purpose of controlling emissions and as a safety device. The majority of waste gases flared are natural gas, propane, ethylene, propylene, butadiene and butane. During combustion, gaseous hydrocarbons react with atmospheric oxygen to form carbon dioxide (CO_2) and water. In some waste gases, carbon monoxide (CO) is the major combustible component. In addition to serving as safety devices, the combustion of industrial gas streams in flares is also recognized as a means of reducing greenhouse gases (GHG), in line with California's AB32 GHG reduction goals and emerging federal GHG reduction goals.

Combustion efficiency depends on flame temperature, residence time in the combustion zone, vent gas flammability, auto ignition temperature, heating value, and turbulent mixing. When operated at an optimal combination of these factors, flares have a destruction efficiency of 98 percent or greater. Complete combustion converts all VOCs to CO_2 and water; however incomplete combustion generates air pollutants such as NOx, sulfur dioxide, carbon monoxide, and particulate matter. Additionally, there is a possibility of release of hydrocarbons if they have not been completely combusted. To prevent the creation of smoke or soot, which is influenced by fuel characteristics and the amount and distribution of oxygen in the combustion zone, most industrial flares are steam-assisted or air-assisted. In some cases, another fuel must be added to flare gas to achieve the minimum heating value of 200-250 Btu/ft^3 required for complete combustion.

There are two general types of flares: open and enclosed flares. Flares are further categorized by the height of the flare tip, and by the method of enhancing combustion by mixing at the flare tip (i.e., steam-assisted, air-assisted, pressure assisted, or non-assisted).

Flaring in the San Joaquin Valley

Flares serve two basic functions: as a safety device during unforeseeable and unpreventable emergency situations/standby situations and less commonly as a primary emissions control device for VOC emissions. As safety devices, flares are necessary to prevent catastrophic consequences such as the release of toxic gases and explosions, which could result in loss of property, injury, and loss of human life. In the Valley, the vast majority of flares are employed as emergency/standby control devices, which is in direct contrast with other regions, such as North Dakota, where flares are used for primary disposal of waste gas from oil and natural gas production. Also, while regions like North Dakota utilize flares to combust associated gas during the initial extraction

phase of the production process (i.e., directly from the well), Valley flares are typically used further down the process chain, primarily as a safety device associated with gas collection systems, resulting in far lower quantities of flared gas.

Valley operators have generally evaluated all feasible and cost effective options for handling and disposing of the associated/waste gases generated by their facilities and installing a flare as the primary method of disposal would be the last resort. In addition to Rule 4311 requirements to evaluate and implement all feasible measures to reduce flaring activities, other associated rules also implement stringent capture and control of these gases. Therefore, most facilities have made significant investments to capture and utilize these process gases in a variety of methods and this ability has allowed facilities to maximize income generation. Some capture and treat these gases and sell them to natural gas/utility providers (generates monetary income), while others utilize these gases on-site to fuel equipment that generates electricity and/or provides process heating (saves fuel costs). In fact, most Valley facilities regard flaring events as a significant monetary cost, through directly lost profit or increased fuel costs.

In the District's evaluation of Valley flaring activity,[33] nearly all of the flaring events were either one-time events due to new control equipment installation or maintenance of existing equipment, and therefore not repeated, or in response to emergency situations or process upsets. For example, one Valley facility (light oil production facility) experienced abnormally high flaring because the sales transmission pipeline was offline for repairs, an event beyond their control. Another facility (wastewater treatment plant) normally uses the fuel onsite to produce electricity and process heating, but could not do so because additional air pollution control devices were being installed.

Flares in the Valley subject to the requirements in Rule 4311 are employed by a diverse group of industries for a wide variety of applications, as illustrated by the below list. In contrast, other air districts' flare rules generally limit the applicability of their rules to petroleum production facilities or refineries.

- Gas plants
- Heavy oil production/ thermally enhanced oil recovery
- Light oil production
- Refinery operations
- Wastewater treatment plants
- Cheese production
- Wine
- Dairy operations
- Flat glass production
- Correctional facility

[33] SJVAPCD. (2014). *Rule 4311 (Flares) Further Study*. Retrieved February 3, 2015 from: http://valleyair.org/Air_Quality_Plans/docs/R4311.pdf.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17
NOx	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54
SOx	0.33	0.33	0.33	0.33	0.32	0.32	0.33	0.32	0.32
	Winter Average - Tons per day								
PM2.5	0.16	0.16	0.16	0.16	0.16	0.16	0.17	0.17	0.17
NOx	0.56	0.56	0.56	0.55	0.55	0.54	0.54	0.54	0.54
SOx	0.33	0.33	0.33	0.33	0.32	0.32	0.33	0.32	0.32

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from flares are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for Rule 4311.

Valley Flaring Activity Compared to Other Regions

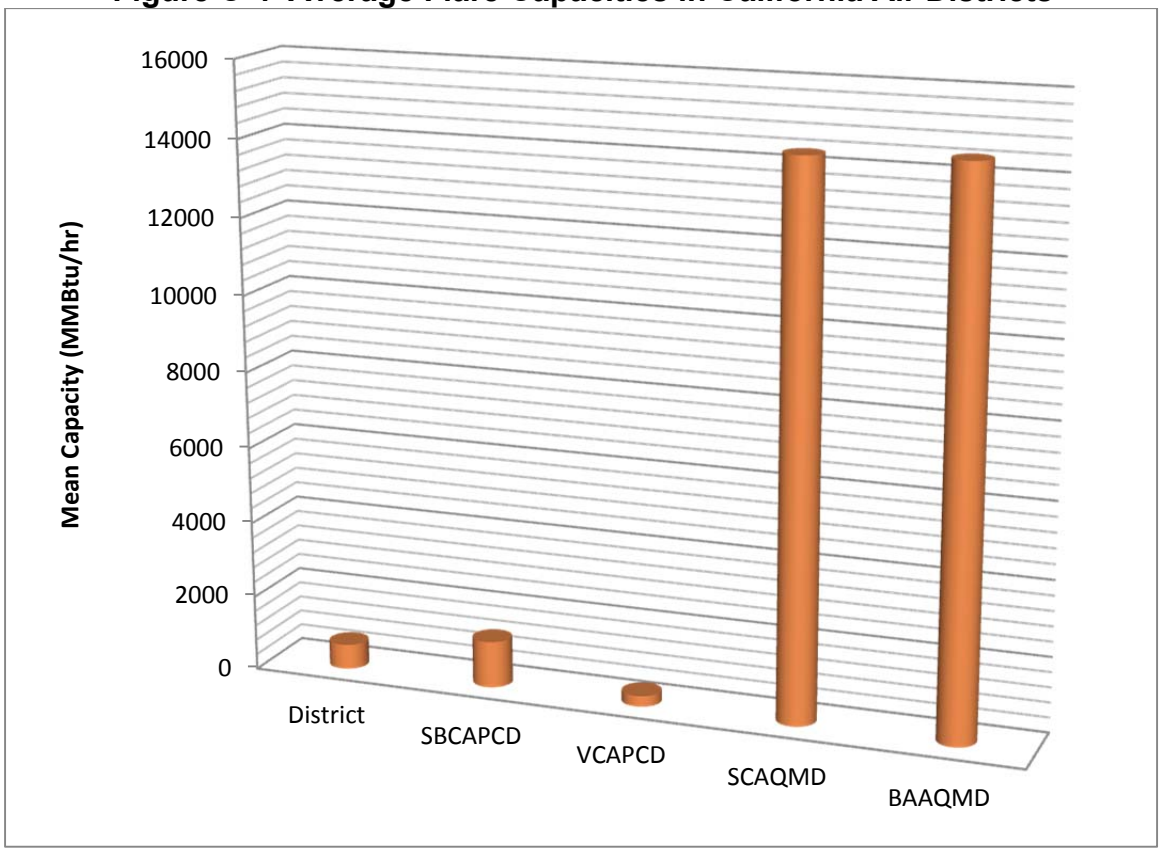
Flares in the Valley and other air districts are primarily engineered for emergency operation during process upsets and emergency situations. Given this use, any unreasonable restrictions on flaring could potentially result in catastrophic consequences which may lead to explosions resulting in loss of property, injury and potentially loss of human life. While flares can be used during maintenance, new equipment installations, and startup/shut-down, the main concern is safety. In this regard, Valley flares are similar to those in other districts, the difference being that facilities in SCAQMD, BAAQMD, and SBCAPCD are much larger. The facilities in those districts are mostly operated at massive oil and gas refineries, with significantly higher throughputs than those in the Valley. Temperatures and pressures are higher, cracking occurs regularly, and the flares must be engineered to control emergencies and process upsets on a larger scale. Flare gas is typically sent to a flare header, where it is distributed to multiple large flares. The flares at these facilities are much larger in physical size, as well as capacity, as shown in the table below.

Table C-2 Comparison of Flaring Capacity for Flares in California Air Districts

Air District	Total Flares	Median (MMBtu/hr)	Mean (MMBtu/hr)	Largest (MMBtu/hr)
SJVAPCD	235	33	663	40,000
SCAQMD	29	10,234	14,328	72,751
BAAQMD	23	108	14,442	246,612
VCAPCD	55	34	284	7,100
SBCAPCD	75	17	1,242	18,200

Flaring capacities of the flares in the SCAQMD, BAAQMD, and SBCAPCD are all significantly higher than the flaring capacities of flares in the Valley, while those in VCAPCD are similar size to Valley flares. Flares in BAAQMD have a wide range of capacities, while those in SCAQMD are all greater than 1,000 MMBtu/hr. The figure below shows the average capacity of flares in the District, SCAQMD, BAAQMD, VCAPCD, and SBCAPCD.

Figure C-4 Average Flare Capacities in California Air Districts



With roughly ten times the number of flares, the Valley has total NOx emissions from flares that are less than BAAQMD and less than half of SCAQMD, as illustrated in the emission inventory tables below. The flaring data in the tables below is compiled from all flaring activities in each air district's jurisdiction and is provided in the ARB-maintained 2012 CEPAM: NORCAL 2012 PM2.5 SIP Baseline Emission Projection Tool.

Table C-3 NOx Emissions Inventories for Flares in California Air Districts (tpd)

Air District	2012	2013	2014	2015	2016	2017	2018	2019
SJVAPCD	0.57	0.57	0.57	0.56	0.56	0.55	0.55	0.55
SCAQMD	1.19	1.20	1.20	1.21	1.22	1.22	1.23	1.23
BAAQMD	0.64	0.64	0.64	0.64	0.64	0.64	0.64	0.65
VCAPCD	0.12	0.12	0.12	0.12	0.12	0.13	0.13	0.13
SBCAPCD	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08

Table C-4 VOC Emissions Inventories for Flares in California Air Districts (tpd)

Air District	2012	2013	2014	2015	2016	2017	2018	2019
SJVAPCD	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.25
SCAQMD	0.40	0.41	0.41	0.41	0.41	0.41	0.41	0.41
BAAQMD	1.32	1.33	1.33	1.33	1.33	1.33	1.33	1.33
VCAPCD	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
SBCAPCD	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05

Table C-5 SOx Emissions Inventories for Flares in California Air Districts (tpd)

Air District	2012	2013	2014	2015	2016	2017	2018	2019
SJVAPCD	0.34	0.34	0.34	0.34	0.33	0.33	0.33	0.33
SCAQMD	3.27	3.27	3.27	3.27	3.28	3.28	3.28	3.28
BAAQMD	0.58	0.58	0.58	0.58	0.58	0.58	0.58	0.58
VCAPCD	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
SBCAPCD	0.18	0.17	0.17	0.17	0.16	0.16	0.16	0.15

In summary:

- Emissions in SCAQMD, BAAQMD, and SBCAPCD are much higher per flare than in the Valley;
- Valley facilities flare a far lower volume;
- Each facility contributes only a small fraction of emissions;
- Emissions are effectively controlled at these facilities; and
- Flaring is necessary for safety.

To supplement the discussion found later in this chapter comparing North Dakota Century Code 38-08-06.4 to District Rule 4311, the District examined flaring in North Dakota. Research indicates that North Dakota has become the second largest producer of oil in the United States, behind Texas. The recent boom in oil production has led to far greater production, without the infrastructure and regulation to support emissions control. Oil production facilities in North Dakota have focused on expanding oil production by opening new wells, and as a consequence have not invested in the installation of onsite cogeneration equipment or sales transmission pipelines. The result

has been the flaring off of approximately 29% of all natural gas produced in North Dakota[34], compared to approximately 3.8% in the Valley (as shown in the table below).

Rule 4311 Regulatory Background

Rule 4311 was adopted in June 2002 to establish flaring requirements and reduce emissions from flares. Amendments were adopted on June 15, 2006 and June 18, 2009. The September 2009 amendment incorporated requirements for flare minimization plans and increased the stringency of existing requirements for sulfur emissions. EPA finalized approval of the 2009 amendments to Rule 4311 on November 3, 2011 and deemed this rule as being at least as stringent as established RACT requirements.[35] On January 10, 2012 EPA finalized a partial approval/partial disapproval of the *2009 RACT SIP* and deemed this rule as still being at least as stringent as established RACT requirements.[36]

Rule 4311 Components

Rule 4311 applies to all operations involving the use of flares. Exemptions include flares operated in municipal solid waste landfills subject to the requirements of Rule 4642, flares subject to the requirements of 40 CFR 60 Subpart WWW (Standards of Performance for Municipal Waste Landfills) or Subpart Cc (Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills), and except for recordkeeping requirements, any stationary source that does not have the potential to emit at least ten tons per year of VOC and NOx (non-major sources).

Of the 235 flares operating in the Valley, 126 are exempt from Rule 4311 requirements other than basic recordkeeping due to one of the following reasons:

- The flare is not part of a major source - 60 flares
- The flare is subject to other rules regulating landfills – 27 flares
- The flare is not stationary (i.e. transportable units) – 39 flares

Of the flares exempt from Rule 4311 requirements (other than record keeping), over 90% flaring activity is associated with landfills that utilize flares as part of their federally mandated gas collection systems. These flares are already required to meet strict local and federal requirements through 40 CFR 60 Subpart WWW (Standards of Performance for Municipal Solid Waste Landfills), or Subpart Cc (Emission Guidelines and Compliance Times for Municipal Solid Waste Landfills) and District Rule 4642 (Solid Waste Disposal Sites). Rule 4642 applies to any solid waste disposal sites which have a gas collection system and/or control device in operation or undergoing maintenance or repair. Major requirements include:

[34] Scientific American. (2013, September 12). *North Dakota flared off $1 billion worth of natural gas last year*. Retrieved February 14, 2015 from http://blogs.scientificamerican.com/plugged-in/2013/09/12/north-dakota-flared-off-1-billion-worth-of-natural-gas-last-year/.
[35] EPA. (2011, November 3). 76 FR 68106. Retrieved April 4, 2014 from http://www.gpo.gov/fdsys/pkg/FR-2011-11-03/pdf/2011-28391.pdf
[36] EPA. (2012, January 10). 77 FR 1417. Retrieved April 4, 2014 from http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf

- For gas collection system: operate so that TOC concentrations do not exceed 1000 ppmv at any point on the surface of the solid waste disposal site or along the gas transfer path of the gas collection system; install sampling ports on each well head; operate in a manner which maximizes the amount of landfill gas extracted while preventing overdraw that can cause fires or damage the gas collection system; control by a control device that meet the control device requirements.
- For a control device: achieve a VOC destruction efficiency of at least 98% by weight, or reduce the VOC concentration to 20 ppmv or less; for those that have an Authority to Construct (ATC) permit issued prior to July 20, 1995, achieve a destruction efficiency of at least 90% by weight or reduce the VOC concentration to 20 ppmv; operate enclosed flares in accordance with 40 CFR 60.756(b) and 40 CFR 60.18 and open flares in accordance with 40 CFR 60.756(c) and 40 CFR 60.18.
- During maintenance, notify the APCO 24 hours in advance, minimize the emissions during shutdown, and prevent shut down for more than 144 cumulative hours in any calendar year.
- Other requirements not applicable to flares.

In addition to Rule 4311 requirements, any new flares are subject to New Source Review (NSR) requirements (District Rule 2201) including Best Available Control Technology (BACT) requirements, meaning they may be required to implement even more stringent controls regardless of whether they are subject to Rule 4311. All sources must obtain an ATC permit before they are operated.

Rule 4311 includes the following major requirements (described in more detail in the following sections):

- Operation requirements that ensure the flare is achieving maximum destruction efficiency
- Operation of measurement and monitoring devices to ensure all requirements are being met
- VOC and NOx emission limits for ground-level enclosed flares
- Flare minimization plans
- Petroleum refinery SO2 performance targets
- Extensive recordkeeping requirements including annual monitoring reports and reportable flaring event reports

Operation Requirements

General requirements for flare operation include:

- Maintain a flame at all times when combustible gases are vented through the flare
- Equip the outlet with an automatic ignition system, or operate with a pilot flame present at all times when combustible gases are vented through the flare, except during purge periods for automatic-ignition equipment flares
- Except for flares equipped with a flow-sensing ignition system, install and operate a heat sensing device such as a thermocouple, ultraviolet beam sensor, infrared

sensor, or an alternative equivalent device, capable of continuously detecting at least one pilot flame or the flare
- Use purge gas for purging flares that use flow-sensing automatic ignition systems and that do not use a continuous flame pilot
- For open flares (air-assisted, steam-assisted, or non-assisted) in which the flare gas pressure is less than 5 psig, operate the flare pursuant to 40 CFR 60.18

Emission Limits
Emission reductions are obtained directly by requiring ground-level enclosed flares to meet the following emission standards for VOC and NOx:

Table C-6 Rule 4311 Emission Limits for Ground-level Enclosed Flares

Type of Flare and Heat Release Rate in MMBtu/hr	VOC (lb/MMBtu)	NOx (lb/MMBtu)
Without Steam-assist		
<10 MMBtu	0.0051	0.0952
10-100 MMBtu	0.0027	0.1330
>100 MMBtu	0.0013	0.5240
With Steam-assist		
All	0.14 as TOG	0.068

Flare Minimization Plans
Rule 4311 requires a Flare Minimization Plan (FMP) to be submitted to and approved by the District for any petroleum refinery with a flare or any flare with a flaring capacity greater than or equal to 5.0 MMBtu/hr. The rule prohibits facilities subject to FMP requirements from flaring unless it is consistent with a District-approved FMP and all commitments in that FMP have been met. FMPs must include all necessary information to satisfy the underlying regulatory requirements, and must be submitted to the District for approval. In addition to their initial submittal, FMPs must be modified prior to making any modifications to related equipment or processes, and at least every five years. FMPs are required to include the following:
- Description and technical specifications for each flare and associated knock-out pots, surge drums, water seals, and flare gas recovery systems
- Process flow diagrams of upstream equipment and process units venting to each flare (with identification of type and location of control equipment)
- Description of equipment, processes, or procedures the operator plans to install or implement to eliminate or minimize flaring, and planned date of installation or implementation
- Evaluation of prevention measures to reduce flaring that has occurred or may be expected to occur during planned major maintenance activities, including startup and shutdown

- Evaluation of preventative measures to reduce flaring that may be expected to occur due to issues of gas quantity and quality. This includes an audit of vent gas recovery capacity of each flare system, storage capacity for excess vent gas, and scrubbing capacity available for vent gas for use as a fuel; and shall determine the feasibility of reducing flaring through the recovery, treatment, and use of the gas
- Evaluation of preventative measures to reduce flaring caused by the recurrent failure of air pollution control equipment, process equipment, or a process to operate in a normal or usual manner. Evaluation shall determine adequacy of existing maintenance schedules and protocols for such equipment. A failure is recurrent if it occurs more than twice during any five year period as a result of the same cause.

Of the 109 facilities subject to Rule 4311 requirements, 14 do not have a flaring capacity of at least 5.0 MMBtu/hr and are not operated at a petroleum refinery and are therefore not subject to FMP requirements. The remaining 95 are subject to FMP requirements. FMP submittals by facility type are summarized in the below table.

Table C-7 Submitted FMPs Summarized by Industry

Industry Summary	Qty
Cheese production	1
Wine	2
Correctional Facility	1
Oil and natural gas production, processing, and transmission	76
Petroleum refinery	7
Dairy	1
Flat glass	1
Wastewater	6
Total	95

Actions identified in the FMPs are typically dependent on the facility and operation type, as well as the quality of gas being flared. Similarly, the feasibility of potential control options is highly dependent on the same factors. The following table is a sample of measures committed to in FMPs submitted to the District:

Table C-8 Sample FMP Measures by Facility Type

Facility Category	Actions Identified in FMP to Minimize Flaring*
Oil and Gas Production and Transmission	Include permit limit on gas flared daily and annually Streamline startup, shutdown, and maintenance procedures to minimize equipment downtime, thereby minimizing flaring Hydrogen sulfide scrubbing of flare gases to condition for sale Inject flare gas in DOGGR-approved wells Use other combustion devices (and offset the need for other natural gas fuel sources) such as glycol re-boiler/thermal oxidizer
Wastewater Treatment/ Reclamation	Install new equipment to combust digester gas in internal combustion engines, fuel cells, and process heaters Install equipment to allow digester gas storage and conditioning for greater use in turbines (additional storage is minimal and only capable of handling excess gas during minor process upsets)
Wine Production	Burn flare gas in steam generation boilers; coordinate plant operations that generate the flare gas with production operations requiring steam
Cheese Production	Modify boiler to combust a natural gas/digester gas blend
Flat Glass Manufacturing	Reduce idle time during calibration and purge test to reduce necessary flaring
Dairy Farming	Install additional gensets (electricity generation equipment located near the end user) to combust more produced biogas

Many of the above measures are not feasible for all facilities. For oil and gas production, the flare gas produced is often in excess of what could be used onsite to power equipment. For these facilities, flares are generally used only under abnormal conditions, as the flare gas is usually high enough quality to sell for use at other facilities.

For facilities other than oil and gas production, the gas produced is usually a much lower heating value and requires conditioning if combusted for electrical generation or process heating. Expensive modifications or new equipment is often required to allow said combustion activities and the flare gas is sometimes of too low quality or quantity to make these installations cost effective. Additionally, emissions from other combustion devices would likely be higher because flares are inherently low emitting and serve as combustion control devices.

Of the 95 flares required to submit FMPs, 92 are standby flares or emergency flares that are only utilized when needed such as during maintenance or to dispose of excess flare gas or during emergencies. Only the remaining 3 flares in the Valley are permitted to

be used as primary disposal devices. Two of the three flares are used at an oil and natural gas production facility as strictly an emissions control device for vapors displaced from trucks only during load-out operations pursuant to requirements in District Rule 2201 (New and Modified Stationary Source Review Rule). The third flare is used at a cheese making facility as an emissions control device for gases generated at the wastewater anaerobic digester at the facility. As a component of their submitted FMP, this cheese making facility has committed to modify an on-site boiler to combust a natural gas/digester gas as a means of reducing current flaring activity.

Petroleum Refinery SO2 Performance Targets

Operators of petroleum refineries are required to minimize SO2 emissions to less than 1.5 tons per million barrels of crude processing capacity. Starting January 1, 2017, operators of petroleum refineries will be required to lower this target to 0.5 tons SO2 per million barrels of crude processing capacity.

Annual Monitoring Reports

Rule 4311 also requires the operator of any petroleum refinery flare or any flare with a flaring capacity equal to or greater than 50 MMBtu/hr to submit an Annual Monitoring Report (AMR) to the District no later than July 31st of each calendar year, containing the following information:

- Total volumetric flow of vent gas
- Hydrogen sulfide content, methane content, and hydrocarbon content of vent gas
- If vent gas composition is monitored by a continuous analyzer: average total hydrocarbon content by volume, average methane content by volume, and depending upon the analytical method used, total reduced sulfur content by volume or hydrogen sulfide content by volume of vent gas flared for each hour of the month
- If the flow monitor measures molecular weight, the average molecular weight for each hour of each month
- For any pilot and purge gas used, the type of gas used, the volumetric flow for each day and for each month, and the means used to determine flow
- Flare monitoring system downtime periods, including dates and times
- For each day and each month provide calculated sulfur dioxide emissions
- A flow verification report for each flare

Of the facilities subject to FMP requirements, 40 are not required to submit annual monitoring reports. Some of these facilities are too small or do not utilize their flares, but the majority have accepted specific limiting conditions on their permits to operate that limit the amount of flaring the facility can conduct to less than the threshold for reportable flaring events. The remaining 55 facilities are therefore subject to AMR requirements. Of these 55 flares, only one is used as a primary disposal device, one is dormant, and eleven are designated for emergency use only. The remaining flares are standby flares.

Information from the AMRs has allowed the District to evaluate the total amount of vent gases combusted and their compositions and increased understanding of flaring

activities in the Valley. This information in turn allows the District to calculate the amounts of emissions from reported flaring and compare those values to verify the accuracy of the emissions inventory for flares.

Reportable Flaring Events

Rule 4311 requires annual reports to be submitted each year summarizing all reportable flaring events. A flaring event is considered a reportable flaring event if more than 500,000 standard cubic feet (scf) of vent gas is flared per calendar day, or where sulfur oxide emissions are greater than 500 pounds per calendar day. Assuming an estimated heating value for flare gas of 1,000 Btu/scf, a flare must have a capacity greater than or equal to 20.8 MMBtu/hr to achieve a reportable flaring event, although most flares commonly operate at a small fraction of maximum capacity. Additionally, some low quality waste gases can have heating values of 200-300 Btu/scf, which would lower the minimum capacity for reportable flaring events. Reportable flaring event requirements are applicable to the operator of a flare subject to FMP requirements with the exception of flares that the operator can verify are not capable of producing reportable flaring events.

The reports are required to include at least the following:

- The results of an investigation to determine the primary cause and contributing factors of the flaring event
- Any prevention measures considered or implemented to prevent recurrence together with a justification for rejecting any measures that were considered but not implemented
- If appropriate, an explanation of why the flaring was an emergency and necessary to prevent accident, hazard or release of vent gas to the atmosphere, or where, due to a regulatory mandate to vent a flare, it cannot be recovered, treated, and used as a fuel at the facility
- The date, time, and duration of the flaring event

The majority of reportable flaring events are planned—thereby allowing for greater preparation and control—for repair, maintenance, or new equipment installations, including new air pollution control devices. Most of the events are one-time events. Of the gas flared, less than 20% is salable quality, lending support to the fact that facilities sell flare gas when feasible.

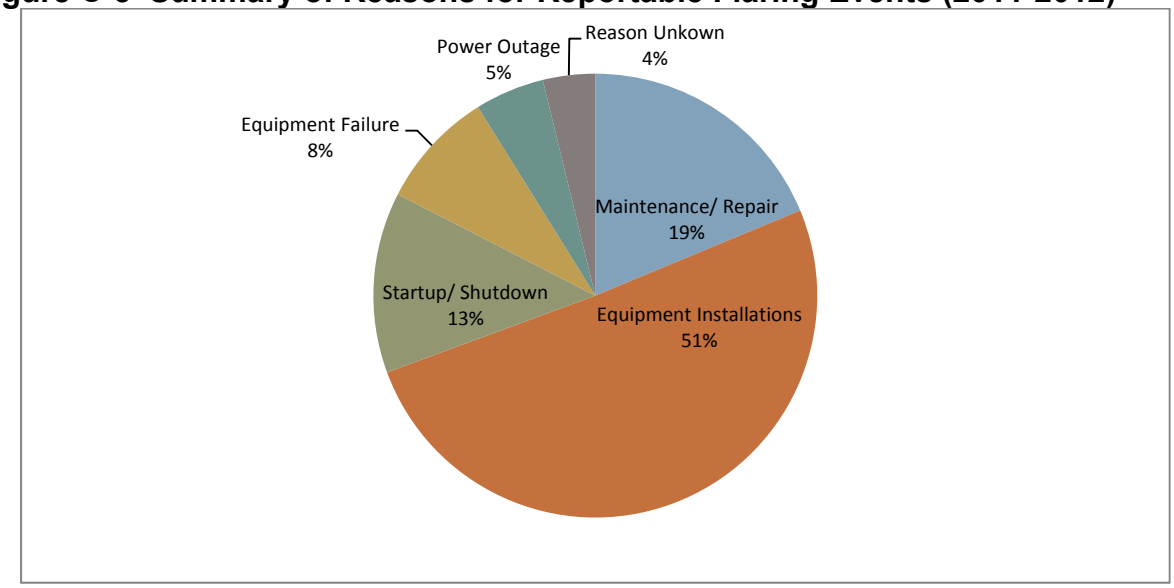
Of the 109 flares subject to Rule 4311, 21 flares generated 395 reportable flaring events during the 2011-2012 period. This period is a conservative reflection of potential reporting flaring event activity in the Valley given the unusually high number of events reported by a single facility (described in more detail below). The table below summarizes these events by facility type.

Table C-9 Summary of Total Reportable Flaring Events from 2011-2012 Period

Industry Summary	Qty of Flares	Reportable Flare Events – Total (MMscf)
Crude Oil and natural gas production	3	27.8
Gas plant	2	12.0
Light oil production	3	7.7
Natural gas processing and production	5	42.8
Oil and natural gas production	4	52.5
Petroleum and NG production	1	20.9
Petroleum refining	2	59.4
Wastewater reclamation facility	1	124.2
Total	21	347.4

The following graph illustrates the fact that the majority of flaring events are for equipment installations, maintenance, and repair.

Figure C-5 Summary of Reasons for Reportable Flaring Events (2011-2012)

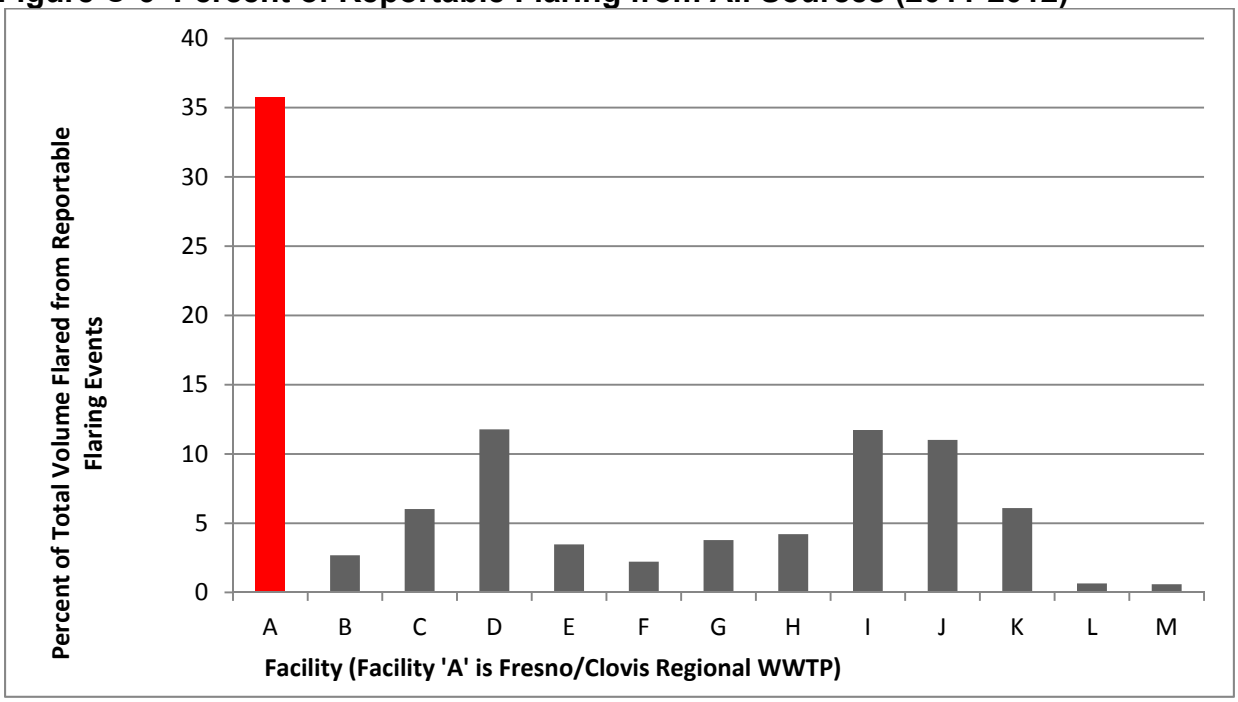


During this period, the largest percent of all gas flared during reportable flaring events was by a single wastewater treatment plant. According to the District-approved FMP for this facility, digester gas is utilized to create electricity and provide heat for the digesters (and offset the combustion of pipeline natural gas). The WWTP uses two 3.4 MW turbine engines and one 16.7 MMBtu/hr process boiler that are almost completely fueled by digester gas. Because there is no significant gas storage capacity, any excess digester gas or gas produced during interruptions to the turbines or boiler must be flared to avoid direct emissions to the atmosphere or potential gas build-up leading to explosions at the plant. To fulfill commitments in the FMP, the facility installed a small digester gas storage tank, installed additional digester gas conditioning, and increased the allowable digester gas fuel for the turbines from 50% to 100%. The

storage tank is capable of holding gas for small periods, such as during switchover between turbines, and the gas conditioning allows the use of selective catalytic reduction (SCR) on the turbines. The addition of this equipment has resulted in a 71% reduction in the volume of gas flared by the WWTP; however, during the 2011-2012 reporting period the facility experienced abnormally high flaring activity. During this period, the turbines were out of service to allow installation of SCR control devices for reducing over 90% of NOx emissions from the turbines pursuant to District Rule 4703 (Stationary Gas Turbines) and permitted emission limits. As a result, a large portion of the digester gas was flared. Out of the 395 total reportable flaring events in the Valley during the 2011-2012 reporting period, 164 occurred at the WWTP. Those events accounted for 36% of the total volume of gas flared during reportable events, more than three times the next highest volume at any facility. By contrast, the 2012-2013 reporting period showed only 46 reportable flaring events at this facility, all of which were for regular activities except one due to failure of a turbine. Because the majority of flaring events during the 2011-2012 reporting period were due to installations and are therefore one-time events, they are not part of normal facility operations.

The following graph illustrates the percentages of gas flared from all sources during reportable flaring events for the 2011-2012 period.

Figure C-6 Percent of Reportable Flaring from All Sources (2011-2012)



Comparison of Rule 4311 to State, Federal, and Local Regulations

Comparison of Rule 4311 to Federal Regulations

There are no EPA CTG or ACT requirements for this source category.

The following federal regulations apply to Rule 4311 sources:

- NESHAP/MACT:
  - 40 CFR 63 Subpart SS (National Emission Standards for Closed Vent Systems, Control Devices, Recovery Devices and Routing to a Fuel Gas System or a Process)
- NSPS:
  - 40 CFR 60.18 (General Control Device and Work Practice Requirements)
  - 40 CFR 65.147 (Flares)
  - 40 CFR 60 Subpart OOOO (Standards of Performance for Crude Oil and Natural Gas Production, Transmission and Distribution)
  - 40 CFR 60 Subpart Ja (Standards of Performance for Petroleum Refineries for Which Construction, Reconstruction, or Modification Commenced After May 14, 2007)

Rule 4311 is as stringent as or more stringent than the above NSPS and NESHAP requirements. The most recently amended NSPS (40 CFR 60 Subpart OOOO and 40 CFR 60 Subpart Ja) are discussed below.

40 CFR 60 Subpart OOOO is a new NSPS requirement that was finalized by EPA on August 16, 2012. This NSPS may indirectly affect some Valley flares since there is a possibility that a flare is exempt from the majority of Rule 4311 and is used as a control device for a vapor controlled tank that is subject to Subpart OOOO.

Affected facilities under this subpart that may use flares as an approved control device include centrifugal compressors, storage vessels, and onshore natural gas processing plants. If the facility chooses to meet the control requirements, then the flare must be designed and operated in accordance with §60.18(b) and must conduct the compliance determination using Method 22 at 40 CFR part 60, appendix A-7, to determine visible emissions. §60.18(b) was last amended on December 22, 2008, which is before the last amendment for District Rule 4311 (June 18, 2009). The requirements of the 2008 amendments were closely evaluated during the District's 2009 Rule amendment. EPA deemed Rule 4311 as being at least as stringent as established RACT requirements on January 10, 2012.[37] Since Subpart OOOO has no new requirements for flares after the 2012 EPA RACT approval, Rule 4311 continues to be at least as stringent as these requirements.

40 CFR 60 Subpart Ja was amended by EPA on September 12, 2012. Amendments clarified existing requirements and applicability, including what constitutes a flare modification, clarification of secondary flares, and clarification of the records that must be maintained by the operator. EPA also added new requirements to Subpart Ja as part of these amendments, including flare related unit and process descriptions, assessments, and evaluations; analyses of causes and corrective actions for reportable flaring events; and sulfur limits for petroleum refineries.

[37] EPA. (2012, January 10). 77 FR 1417. Retrieved 2/11/15 from http://www.gpo.gov/fdsys/pkg/FR-2012-01-10/pdf/2012-139.pdf.

Subpart Ja did not implement more stringent requirements than District Rule 4311. Subpart Ja has one new exemption for continuous monitoring, which allows for fewer requirements than previously required in the NSPS, and therefore, is not more stringent than current rule language. While there may be some minor differences in terminology or requirements making direct comparisons not possible, the same level of controls and emission reductions are achieved through District regulations as through this NSPS. Additionally, the District's Permit Services Department continuously evaluates NSPS on a case-by-case basis to ensure the relevant flares comply with all federal requirements as they are promulgated. Rule 4311 is as stringent as, if not more stringent than, this NSPS.

As demonstrated by the discussion above, Rule 4311 is as stringent as or more stringent than the applicable federal regulations.

Comparison to State Regulations
There are no state rules or regulations that apply to this source category.

Comparison to Regulations in other Air Districts
As previously stated, EPA analysis of Rule 4311 resulted in the 2012 determination that Rule 4311 is as stringent as requirements in other air districts in California (76 FR 68106); however, in keeping with the methodology of this plan, the District conducted a thorough examination of rules in other air districts, including the following:

- SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)
- BAAQMD:
    - Regulation 12 Rule 11 (Flare Monitoring at Petroleum Refineries)
    - Regulation 12 Rule 12 (Flares at Petroleum Refineries)
- SMAQMD and VCAPCD do not have an analogous rule for this source category.

The District also conducted an exhaustive search for rules in all other air districts, including those outside of California, to identify any that might contain more stringent requirements. While Rule 4311 is as stringent as or more stringent than any rules in the nation, the District prepared comparisons to Santa Barbara County Air Pollution Control District (SBCAPCD) Rule 359 and North Dakota Century Code 38-08-06.4. The North Dakota rule is not included in the comparison table below because it does not contain most of the core requirements of California air district flare regulations. The following table compares major elements of Rule 4311 with those in other California air districts.

Table C-10 Summary of Rule Requirement Comparisons

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
DATES OF ADOPTION/ AMENDMENT					
Adopted Jun 20, 2002; Amended Jun 15, 2006; Jun 18, 2009	Adopted Feb 13, 1998; Amended Nov 4, 2005	Adopted Jun 4, 2003	Adopted Jul 20, 2005	Adopted Jul, 1968; Revised Oct 1968; Jun 1969; May	Adopted Jun 28, 1994

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
				1972; Jul 1983; Jun 1994	
APPLICABILITY					
All flares	Flares used at: • Petroleum (petro.) refineries • Sulfur recovery plants • Hydrogen production plants	Flares used at petro. refineries	Flares used at petro. refineries	Any person who discharges sulfur compounds from any source	Flares and thermal oxidizers used at: • Oil and gas production • Petro. refinery • Natural gas services and transportation • Wholesale trade in petro./petro. products
EXEMPTIONS					
• Municipal solid waste landfill flares subject to Rule 4642 • Flares subject to 40 CFR 60 WWW or Cc • Stationary sources w/ potential to emit <10 tons VOC and <10 tons NOx per year (Not exempt from recordkeeping)	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; Sulfur dioxide (SO_2) emissions (emissions) 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)	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	Same as Rule 11 (except last exemption on list)	Sulfur emission limit and avg. concentration limit don't apply to: Unplanned flaring for emergency or safety if: • Not result of intentional or negligent act, omission, improper maintenance or setting of shut-in sensors • Results from operational problems (emergency blowdowns, process upsets, power outages, equipment breakdown) • Records of event kept • corrective measures immediately taken • Event lasts <24 hr. • Notify <4 hr. after	Burning of sulfur, hydrogen sulfide, acid sludge, or other sulfur compounds in manufacturing of sulfur or sulfur compounds For oil and gas sources that recover sulfur as by-product of gas treating/sweetening, manufacturing exemption applies only to those specific processes (Except technology-based std.) Burning gas w/ net heating value <300 Btu/scf if fuel used to incinerate gas has sulfur compounds: • <15 grain/100 ft3 in Southern Zone • <50 grain/100 ft3 in Northern Zone Flare and thermal oxidizer units rated $\leq$1.7 MMBtu/hr., unless total cumulative rating of all such units at a source is $\geq$5 MMBtu/hr. (Not exempt from sulfur

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
		are routed to flare header) Monitoring and reporting total hydrocarbon (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		detection and submit report if event >1 hr. Planned flaring if: • Notice submitted >72 hr. in advance, justifying work (reasons and steps to minimize sulfur emissions) • Notice can be submitted <72 hr. if hazardous situation, economic harm, or excess emissions • Submit planned flaring mgmt. plan • Records kept 2 yrs. • District notified when work complete • Sulfur emissions are minimized • Excess emissions fee paid to District each year ($5.00/lb. SO2 emitted)	content std., technology std., monitoring, recordkeeping, and recording.) Flares and thermal oxidizers exempt from FMP: • Rated at <15 MMBtu/hr, unless cumulative rating >50 MMBtu/hr. • Operations of only planned, continuous flaring due to non-availability of a produced gas pipeline outlet
FLARE MINIMIZATION PLAN (FMP) REQUIREMENTS					
FMP requirements don't apply if flaring caused by emergency and necessary to prevent accident, hazard or release of vent gas directly to the	Owner/operator of petro. refinery exceeding performance targets submit FMP: • <90 days from end of year w/ emissions	None	FMP required for flares subject to rule and 3-month status reports required until FMP completed: • Technical	Each operator submits a planned flaring management plan: • Measures to decrease FG volume and reduce sulfur	Sources subject to rule and flares and thermal oxidizers rated at ≥15 MMBtu/hr submit FMP: • Planned flaring: targeted max monthly FG volume

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
atmosphere FMP required for petro. refinery flare or any flare w/ capacity ≥5.0 MMBtu/hr.: • Technical specs for each flare, knock-out pots, surge drum, water seal, and flare gas (FG) recovery system • Process flow diagrams of upstream equipment and process units venting to each flare • Equipment, processes, or procedures planned to install or implement to minimize flaring and planned date • Evaluations of preventative measures to reduce flaring expected due to planned major maintenance activities, gas quantity and quality issues, and recurrent failure of equipment or processes • Submit updated FMP every 5 years and for new or modified equipment prior to installing	exceeding target • Plan is pursuant to Rule 221 and fees pursuant to Rule 306 • List all actions to be taken to meet targets: o Technical specs for flares, knock-out pots, surge drums, water seals and FG recovery systems o Process flow diagrams of upstream equipment and process units venting to flares o Policies, procedures, and equipment improvements to minimize flaring and flare emissions o FG recovery equipment and treatment systems to be installed • FMPs available for 60-day public review prior to approval • 45 days allowed to correct deficiencies • Facility in violation if FMP denied • Revised FMP submitted 90 days after end of year if performance		information for each flare • Upstream equipment and processes (Same as SJVAPCD and SCAQMD) • Equipment, processes, and procedures implemented in last 5 years to reduce flaring and those planned to be installed or implemented • Prevention measures, including schedule for implementation for flaring: o That has or will occur during planned major maintenance o Expected to occur due to issues of gas quantity and quality (include audits of capacities), or caused by recurrent failure of equipment or processes	emissions • Description of planned operational or maintenance procedures that may cause flaring • Description of each flare system including design features • Description of any sulfur reduction system • Measures to be implemented to reduce the number of planned flaring events	o <5% avg. monthly gas handled/ produced/ treated at source based on 3 years o Higher limit may be granted by APCO if demonstrated to be infeasible • Submit emissions mitigation plan if: o Volume limit >10% of avg. monthly gas o Sulfur content of flared gas >239 ppmv/ >796 ppmv in Southern/ Northern Zone • The emissions mitigation plan must achieve 50% reduction of greater of actual or proposed avg. monthly FG volume limit • Owner/operator reimburses for review and approval of plans FMP includes: • Measures to decrease volume of FG and planned flaring events • Measures to prevent emergency flaring and unplanned flaring • Flare system • FG monitoring system • Design and operation features of pilot and purge gas system • Design features of flare to handle nominal and peak gas flows and range of compositions

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
	targets exceeded				• Plans to reduce planned flaring emissions • Schedules to reduce planned shutdowns • Proposed study of different settings to minimize emissions • Summary of scheduled/typical planned flaring • Review FMP every 5 years
ANNUAL MONITORING REPORTS					
For refinery flare or flare w/ flaring capacity ≥50 MMBtu/hr: Operator submit annual report ≤30 days after end of each 12 month period including: • Total volumetric flow of vent gas (scf) for each day • Contents of vent gas composition: o Hydrogen sulfide o Methane o HC • If vent gas composition monitored by continuous analyzer or analyzers: the following for each hour of the month: o Avg. total HC content by volume o Avg. methane content by volume o Total reduced sulfur content by volume or hydrogen sulfide content by volume • Avg. molecular	Submit quarterly report ≤30 days after end of each quarter including: • Information required to be monitored: o Table of nine operating parameters, based on flare type (clean service, emergency service, general service) o Alternative flare vent gas sampling information necessary to calculate flare emissions o Flare monitoring system data o Images of visible emissions o Presence of pilot flame o Pilot gas and purge gas flow to each flare • Total daily and quarterly emissions of criteria	Monthly report: • Total volumetric flow each day and month • If gas composition monitored w/ sampling, content by volume for each sample of total HC, methane, and H_2S • If composition monitored w/ continuous analyzer, avg. content by volume of: total HC; methane; total reduced sulfur; H_2S • Avg. molecular weight for each hour of the month (if measured) • For pilot & purge gas o Type of gas o Volumetric flow for each day and month o Means used to	None	None	Submitted annually, by March 1 of the following calendar year, including: • Monthly volumes of gas flared per planned continuous and planned intermittent flaring categories • Summary of total gas volume released during emergencies and weighted-average H2S content for the entire volume • Monthly reporting on any exceedance of the allowable monthly volume of gases planned for flaring

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
weight for each hour of each month (if measured) • For pilot and purge gas: o Type of gas used o Volumetric flow for each day and each month o Means used to determine flow • Flare monitoring system downtime • SO_2 emissions for each day and each month • Flow verification report for each flare	pollutants from each flare and each flare event along with information used to calculate emissions • Description of cause and category of each flare event • Records of annual acoustical or temperature leak survey • Flare monitoring system downtime periods • Copy of written notices for all reportable air releases related to any flare event	determine flow • For any 24-hr period when 1 million scf flared, description: o Cause o Time and duration o Source o Measures to reduce or eliminate flaring • Monitoring system downtime periods • Images recorded for the month • Methane, non-methane, and SO_2 emissions for each day and for the month Semi-annual flow verification report, comparing flow measured by monitoring system and flow verification for same period of time			
REPORTABLE FLARING EVENT REPORTS					
• Definition: o Flaring event where >500,000 scf gas flared/day or o SO2 emissions >500 lb/day o Ends when water seal integrity demonstrated or	Requirements: • Notify by telephone ≤1 hr. of unplanned flare event w/ emissions >100 lb. VOC, >500 lb. SO2, or >500,000 scf gas • Submit Specific Cause Analysis	For any 24-hour period during which >1 million scf of vent gas was flared: • Cause • Time of occurrence and duration • Source or equipment of origin	Notify if volume flared >500,000 scf per day: • Results of cause investigation • Measures to prevent recurrence • Justification for rejecting measures • Explanation	For unplanned flaring >1 hr. in duration: • Notify <4hr. after detection • Submit report: o Date, time, duration, volume of gas flared o Reasons for flaring	Exceedance not a violation if emergency: • Inform <4 hr. after start of next business day • Document event occurrence and causes • Submit <7days after end of event: o Description of event and

District Rule 4311 (Flares)	SCAQMD Rule 1118 (Control of Emissions from Refinery Flares)	BAAQMD Reg. 12 Rule 11 (Flare Monitoring at Petroleum Refineries)	BAAQMD Reg. 12 Rule 12 (Flares at Petroleum Refineries)	VCAPCD Rule 54 (Sulfur Compounds)	SBCAPCD Rule 359 (Flares and Thermal Oxidizers)
o For flares w/o water seal, ends when flow <0.12 ft/s • Submit annual report summarizing all reportable flaring events: o Results of cause investigation o Mitigation/ corrective actions to prevent recurrence o Justification for rejecting measures o Explanation of why emergency and cannot be recovered o Date, time, duration	w/in 30 days – cause, duration, mitigation/ corrective actions	• Measures taken to reduce or eliminate flaring	why consistent with FMP • Explanation of why emergency and cannot be recovered • Volume flared • Methane, non-methane, HC, and SO_2 emissions	o Settings pressure relief valves and max/min allowed safety settings o Corrective measures and actions to prevent recurrence o Sulfur emissions o Equipment or controls that failed For planned flaring: • Notice submitted >72 hr. prior: o Work that requires o Date and time o Expected gas volume and sulfur emissions o Steps or equipment to minimize sulfur emissions	mitigating and corrective actions implemented o Demonstration reasonable steps taken to minimize excess emissions o Demonstration that emergency not caused by improperly designed equipment; lack of preventative maintenance; careless or improper operation; operator error; willful misconduct o Document that source was properly operated at time event occurred

As demonstrated above, Rule 4311 is as stringent as or more stringent than analogous rules in other California air districts.

SBCAPCD Rule 359 (Flares and Thermal Oxidizers)[38]

SBCAPCD Rule 359 was adopted on June 28, 1994. Provisions of this rule apply to the use of flares and thermal oxidizers at oil and gas production sources, petroleum refinery and related sources, and natural gas services. Rule 359 sets specific requirements for the sulfur content in gaseous fuels, technology based standards, flare minimization plans, emergency events, and emission and operational limits.

[38] Santa Barbara County Air Pollution Control District. (1994, June 28). *Rule 359 Flares and Thermal Oxidizers. Retrieved February 13, 2015 from http://www.ourair.org/wp-content/uploads/rule359.pdf.*

Section D.3 of Rule 359 requires a FMP be submitted by any source subject to this rule that operates a flare rated at 15 MMBtu/hour or greater. For planned flaring, the FMP for all sources subject to this rule shall list a targeted maximum monthly flared gas volume, which shall not exceed 5% of the average monthly gas handled/produced/treated at the source unless the operator demonstrates such a maximum volume to be infeasible based on safety, engineering or cost constraints and proposes a different percentage. Any flaring that causes an exceedance of the emission limits or standards of Rule 359 is also not considered to be in violation if the operator demonstrates that the exceedance resulted from an emergency event.

Unlike District Rule 4311, SBCAPCD Rule 359 does not apply to the burning of sulfur compounds in the manufacturing of sulfur compounds. Additionally, under SBCAPCD Rule 359, flares for which flaring operations solely consist of planned, continuous flaring due to the non-availability of a produced gas pipeline are exempt from FMP requirements.

Although FMPs in SBCAPCD Rule 359 are required to list a targeted maximum monthly flared gas volume of five percent (5%) of the average monthly gas handled/produced/treated, the operator can obtain approval of a higher percentage by demonstrating that the maximum flare volume limit is infeasible based on safety, engineering, or cost constraints, which leaves the rule open to allow a higher amount of flaring. The District evaluated the percentage of gas flared in the Valley and found that the average percentage of gas flared between 2009 and 2013 was well below SBCAPCD's 5% theoretical level at 3.8% as shown in the table below.

Table C-11 Percent of Gas Flared at Valley Facilities

Year Of Data	Gas Produced (MCF)	5% Flared (if meeting SBCAPCD target) (Mscf)	Actual Flared (Mscf)	Percent of gas flared
2009	223,220,118	11,161,006	7,134,977	3.2
2010	241,676,822	12,083,841	7,884,879	3.3
2011	240,000,594	12,000,030	8,324,237	3.5
2012	216,232,509	10,811,625	10,147,080	4.7
2013	238,058,188	11,902,909	10,581,415	4.4
			Total Average Percent of Gas Flared in Valley	**3.8%**

In addition, unlike SBCAPCD rule 359, Rule 4311 does not allow an exceedance of any emissions limits or the requirement to minimize flaring activity, regardless of the cause. Allowing such a measure in the Valley would result in a serious relaxation of rule requirements and a potential increase in emissions. Under the District's rule, any exceedance or excess flaring not allowed under Rule 4311, regardless of the cause, would result in a violation and be subject to enforcement action. Flares subject to SBCAPCD Rule 359 whose flaring operations solely consist of planned, continuous flaring due to the non-availability of a produced gas pipeline outlet are also exempt from

FMP requirements while such flares subject to Rule 4311 are not exempt from FMP requirements and are still required to identify and implement actions that reduce flaring.

Based on the discussion above, District Rule 4311 is clearly more stringent than SBCAPCD Rule 359 for the following reasons:

- Rule 4311 applies to a broader range of sources than SBCAPCD Rule 359
- SBCAPCD Rule 359 includes a performance standard for the volume of gas flared (5%), but also includes APCO discretion for allowing unlimited flaring activity
- SBCAPCD Rule 359 contains several exemptions not allowed in Rule 4311, including the allowance for exceedance of emission limits
- EPA analysis resulted in the 2012 determination that Rule 4311 is as stringent as requirements in SBCAPCD Rule 359 in terms of core RACT requirements
- Overall, Rule 4311 results in significantly less flared gas relative to flaring capacity in the District as compared the allowable levels of flaring under SBCAPCD

State of North Dakota

- **Century Code 38-08-06.4**[39]
- **Industrial Commission Order**[40]

North Dakota Century Code 38-08-06.4 applies to flaring of gas produced with crude oil from an oil well. The North Dakota rule allows for the uncontrolled flaring of all gases during the first year after opening a new crude oil production well, after which flaring of the entire volume of gas must cease and the well must be:

- Capped;
- Connected to a gas gathering line;
- Equipped with an electrical generator that consumes at least seventy-five percent (75%) of the gas from the well;
- Equipped with a system that intakes at least seventy-five percent (75%) of the gas and natural gas liquids volume from the well for beneficial consumption by means of compression to liquid for use as fuel, transport to a processing facility, production of petrochemicals or fertilizer, conversion to liquid fuels, separating and collecting over fifty percent (50%) of the propane and heavier hydrocarbons; ***or***
- Equipped with other value-added processes as approved by the industrial commission, which reduce the volume or intensity of the flare by more than sixty percent (60%).

[39] North Dakota Legislative Branch. (2013, August). *Century Code 38-08-06.4 Flaring of Gas Restricted – Imposition of Tax – Payment of Royalties – Industrial Commission Authority. Retrieved February 13, 2015 from* http://www.legis.nd.gov/cencode/t38c08.pdf?20150213153521.

[40] North Dakota Industrial Commission. (2014, July 1). *Order of the Commission*. Obtained February 3, 2015 from https://www.dmr.nd.gov/oilgas/or24665.pdf.

Because of excessive flaring in North Dakota, the North Dakota Industrial Commission acted on a motion of the commission to consider amending the current oil production rule to reduce the amount of flared gas by issuing an order in July 2014 to increase gas capture from oil wells. The order requires 74% of gas capture (instead of flaring) by October 2014, 77% by January 2015, 85% by 2016, and 90% by 2020. If such gas capture percentage is not attained at a maximum efficient oil production rate, the well may still continue to produce 200 barrels of oil per day if at least 60% of the monthly volume of associated gas produced from the well is captured. If the 60% gas capture target is not met, the well may continue to produce 100 barrels of oil per day. This Order of the Commission is not an actual rule amendment and, because it did not pass through the entire public process, could be defeated in court or simply expire January 2016.[41]

Many of the sources subject to Rule 4311 design and operate their equipment and processes in a manner that inherently results in minimal flaring activity. Flare gas is typically flared further along in the process, rather than directly from production wells, resulting in less flaring activity. In contrast, sources in North Dakota flare large portions of the gas generated at oil production wells. This is a rudimentary oil production method that is often seen in regions with little to no history of emission regulations. Flaring in North Dakota has increased more than 50% in the past two years to levels previously unknown in the United States and comparable to those of Russia and Nigeria.[42] According to North Dakota's Department of Mineral Resources, 29 percent (29%) of the natural gas now extracted in North Dakota is flared off, which accounts for almost 28% of all flaring in the United States and one percent (1%) of all flaring worldwide.[43] In April, 2014 alone, North Dakota wells burned off 10.3 billion scf of natural gas, worth almost $50 million on the spot market. The annual value of flared gas is reportedly worth as much as $1 billion.[44] This excessive flaring is due in part to the addition of 1,100 to 2,700 wells per year, with tens of thousands of wells still lacking access to a gas transmission pipeline.[45,46]

Even with the recent order from the North Dakota Industrial Commission to increase gas capture to 74% by October 2014, 77% by January 2015, 85% by 2016, and 90% by 2020, the District already requires a minimum of 95% gas capture and achieves over 96%. In addition, because the North Dakota rule contains no requirements to control

[41] The Bismarck Tribune. (2015, January 19). *Helm says tax revenue at risk if flaring, oil conditioning orders voided*. Retrieved February 13, 2015 from http://bismarcktribune.com/news/state-and-regional/helms-says-tax-revenue-at-risk-if-flaring-oil-conditioning/article_e615f72d-d2ff-50a6-a151-4875945792c5.html

[42] King & Spalding. (2014, June). *Dispute Resolution, Oil & Gas Litigation*. Retrieved February 13, 2015 from http://www.kslaw.com/library/newsletters/EnergyNewsletter/2014/June/article2.html.

[43] North Dakota Pipeline Authority. *Natural Gas Facts*. Retrieved February 13, 2015 from http://northdakotapipelines.com/natgasfacts/.

[44] General Electric. (2014, September 10). *Taming North Dakota's Gas Flares*. Retrieved February 13, 2015 from http://www.gereports.com/post/97136504480/taming-north-dakotas-gas-flares.

[45] Oil & Gas Monitor. (2014, August 11). *Can a Flaring Problem Become Natural Gas Industry Advantage in North Dakota?* Retrieved February 13, 2015 from http://www.oilgasmonitor.com/can-flaring-problem-become-natural-gas-industry-advantage-north-dakota/7617/.

[46] North Dakota Department of Mineral Resources. Retrieved February 13, 2015 from http://www.ndoil.org/image/cache/NDPCAnnual092111_2.pdf.

the fraction of gas not addressed by one of the required options, a producer would be able to vent up to 40% of produced gas directly to the atmosphere and still have the ability to flare the full captured amount. For the first year of operation, operators of new oil production wells are permitted to flare 100% of produced gas. Additionally, the optional equipment used to control the captured gas, such as uncontrolled internal combustion engines, could easily increase emissions because flaring in itself is a highly effective control technology. Finally, a producer may obtain an exemption by demonstrating to the industrial commission that connection of the well to a natural gas gathering line is economically infeasible or that a market for the gas is not available and equipping the well with an electrical generator to produce electricity from gas or employing a collection system is economically infeasible. North Dakota regulators granted ninety-five percent (95%) of extension requests over the last two years.[47]

In the Valley, operators do not have the flexibility to capture only 60% of associated gas or to obtain extensions or exemptions from rule requirements as allowed in the North Dakota rule. New steam enhanced wells (the vast majority of wells in the District are heavy oil steam enhanced wells) require an ATC permit before they are operated. As part of receiving an ATC, these wells are subject to the District's New Source Review rule (District Rule 2201), which requires the installation of Best Available Control Technology (BACT) consisting of a system that collects and controls well vapors and must comply with a multitude of additional requirements (i.e, offsets, public noticing, health risk assessment, etc.).

The District has two rules specific to the operation of crude oil wells. Rule 4401 (Steam-Enhanced Crude Oil Production Wells) and Rule 4409 (Components at Light Crude Oil Production Facilities, Natural gas Production Facilities, and Natural Gas Processing Plants). These rules contain control requirements including a minimum 95% capture and control, periodic leak detection, and repair requirements for steam enhanced wells and light oil wells. These rules also require the development of an Operator Management Plan (OMP) that describes how a facility will comply. The OMP must be updated annually to reflect any changes to the OMP, including changes to address newly installed wells. These prohibitory rules are applicable to both existing and new wells.

Regions such as North Dakota have only recently begun controlling emissions from flares and, as such, must make significant progress before matching the District in capture and control technology and stringency of regulations. After extensive analysis of the North Dakota rule requirements and comparison to those in the District, it is clear that Rule 4311 is significantly more stringent than North Dakota Century Code 38-08-06.4 for at least the following reasons:

- Rule 4311 applies to a broader range of sources than the North Dakota rule

[47] Scientific American. (2013, September 12). *North Dakota flared off $1 billion worth of natural gas last year*. Retrieved February 14, 2015 from http://blogs.scientificamerican.com/plugged-in/2013/09/12/north-dakota-flared-off-1-billion-worth-of-natural-gas-last-year/.

- Rule 4311 requires 95% capture and treatment of produced gas, whereas the North Dakota rule only requires 60% capture and allows one year of unlimited flaring
- The North Dakota rule does not contain any requirements that address the remaining 40% of produced gas
- 95% of facilities that requested extensions to the requirements of the North Dakota rule were approved

Evaluation Findings

Even though flares are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4311 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category.

As described in the section detailing FMP requirements, operators of flares in the Valley are already implementing all feasible measures to reduce flaring activity. Even for those devices that have been committed to in FMPs, alternative methods of disposal do not necessarily decrease emissions, and could even increase emissions compared to the baseline from flares; however, combusting gas onsite or transmitting it for use at other sources could prevent the additional combustion of other fuel, thereby reducing overall emissions in the Valley, if not actually reducing emissions from the combustion of the flare gas.

In other air districts, the addition of transmission pipelines is the only major viable possible measure to reduce emissions. In the Valley, most producers of associated gas have access to transmission pipelines and are already selling as much gas as possible. The addition of pipelines would most likely not be performed by the facilities operating flares, but would instead be installed by utility companies such as PG&E. Requiring oil and gas producers that do not have access to transmission pipelines to construct them would be cost prohibitive and is beyond the scope of what is required by any other air district.

Although Rule 4311 already meets BACM and MSM requirements, the District is committing to further evaluate Rule 4311 beginning in 2015. See Chapter 8 (Commitment to Leave No Stone Unturned to Evaluate Additional Opportunities) for more information.

C.12 RULE 4313 LIME KILNS

Discussion

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. EPA finalized approval of the 2003 adoption of Rule 4313 on September 4, 2003 and deemed this rule as being at least as stringent as established RACT requirements.

Source Category

There are currently no lime kilns operating in the Valley. At the time of rule adoption, there were a total of three lime kilns in the Valley, used at two sugar processing plants; however, these plants have been non-operational since 2008. Any lime kilns beginning operation in the Valley in the future would be required to meet District BACT requirements, per District Rules 2201 (New and Modified Stationary Source Review Rule) and 4001 (New Source Performance Standards).

Emissions Inventory

There is no emissions inventory associated with lime kilns because there are no lime kilns operating in the Valley; no lime kilns are in the preliminary permitting process to become operational in the Valley, nor are any lime kilns expected to be operated in the Valley in the future.

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

Federal Regulations

There are no EPA CTG or ACT requirements for this source category.

NSPS

- 40 CFR 60 Subpart HH (Standards of Performance for Lime Manufacturing Plants)

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.

NESHAP/ MACT

- 40 CFR 63 Subpart AAAAA (National Emission Standards for Hazardous Air Pollutants for Lime Manufacturing Plants)

The District evaluated the requirements contained within 40 CFR 63 Subpart AAAAA 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?

There are no analogous rules for this source category in SCAQMD, BAAQMD, SMAQMD, and VCAPCD.

Evaluation Findings

There are no lime kilns operating in the Valley and thus no emissions or emission reduction opportunities for this source category. As previously mentioned, any lime kilns beginning operation in the future would be required to meet District BACT requirements. As such, Rule 4313 meets or exceeds both BACM and MSM requirements for this source category.

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

Discussion

The purpose of Rule 4352 is to limit NOx and carbon monoxide (CO) emissions from any boiler, steam generator or process heater fired on solid fuel. Prior to September 14, 1994 solid fuel fired units were exempt from the requirements of District Rule 4305. The adoption of Rule 4352 established NOx limits of 200 parts per million volume (ppmv) for municipal solid waste facilities (MSW), 0.35 pounds per million British thermal units per hour (lb/MMBtu) for biomass facilities, and 0.20 lb/MMBtu for all other solid fuel fired units. Since its adoption, the rule has been amended three times. The December 2011 amendments strengthened the rule by lowering NOx emissions limits for all three source categories. However, no emissions reductions were quantified because the rule amendments were meant to satisfy EPA RACT requirements and all units were determined to be operating at the new emission limits. EPA finalized approval of Rule 4352 on November 6, 2012 and deemed this rule as being at least as stringent as established RACT requirements.

While previous rule-amending projects for Rule 4352 have not quantified specific emissions reductions, the use of biomass facilities in the Valley has fostered emissions reductions. As an energy source, biomass can either be used directly or converted into other energy products such as biofuel. Biomass facilities in the Valley reduce the amount of pollutants created by open burning practices and the landfilling of potential biofuels such as agricultural materials, and urban and forest wood waste products by utilizing these materials. The District has reduced the total acreage of agricultural materials burned in the Valley to date by more than 80%.

Source Category

Boilers, steam generators, and process heaters are used in a broad range of industrial, commercial, and institutional settings. Units subject to this rule fire on a variety of solid fuels: coal, petroleum coke, biomass, tire-derived fuel, and MSW. Although the output from units subject to the rule could be utilized in many settings, all of the operators within the Valley use the units' output to generate electricity. There are 17 units subject to this rule located at 15 facilities.

The two primary methods of controlling NOx emissions from boilers, steam generators, and process heaters are either to change the combustion parameters to reduce NOx formation (i.e., combustion modification) or to treat the NOx formed in the process before the NOx is emitted into the atmosphere (i.e., post-combustion control or flue gas treatment).

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.62	0.65	0.67	0.72	0.76	0.79	0.82	0.84	0.87
NOx	2.69	2.77	2.85	2.99	3.14	3.21	3.30	3.36	3.47
SOx	0.56	0.57	0.59	0.61	0.64	0.66	0.68	0.69	0.71
	Winter Average - Tons per day								
PM2.5	0.61	0.64	0.66	0.71	0.75	0.77	0.81	0.83	0.86
NOx	2.40	2.49	2.56	2.71	2.85	2.91	3.01	3.07	3.18
SOx	0.54	0.56	0.57	0.59	0.62	0.64	0.66	0.68	0.69

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from solid fuel fired boilers, steam generators, and process heaters are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for solid fuel fired boilers, steam generators, and process heaters.

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

Federal Regulations

There are no EPA CTG requirements for this source category.

ACT

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

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 4352.

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

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 4352.

NSPS

- 40 CFR 60 Subpart Cb (Emission Guidelines and Compliance Times for Municipal Waste Combustors that are Constructed on or before December 19, 1995)

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 for which Construction is Commenced after August 17, 1971)

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 Db (Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units)

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

NESHAP/ MACT

- 40 CFR 63 Subpart DDDDD (NESHAP for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters)

40 CFR 63 Subpart DDDDD was amended on January 31, 2013 to include new emission limits for PM, CO, and total selective metals (TSM), replace numeric dioxin emission limits with work practice standards, add new subcategories of facilities, and add alternative monitoring approaches. The District evaluated the requirements contained within this NESHAP 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?

There are no analogous rules for this source category in VCAPCD.

SCAQMD

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

The District evaluated the requirements contained within SCAQMD's Rule 1146 and found no requirements that were more stringent than those already in Rule 4352.

BAAQMD

- Regulation 9 Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 7 and found no requirements that were more stringent than those already in Rule 4352.

- Regulation 9 Rule 11 (Nitrogen Oxides and Carbon Monoxide from Electric Power Generating Steam Boilers)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 11 and found no requirements that were more stringent than those already in Rule 4352.

SMAQMD

- Rule 411 (NOx from Boilers, Process Heaters, and Steam Generators)

The District evaluated the requirements contained within SMAQMD's Rule 411 and found no requirements that were more stringent than those already in Rule 4352.

Additional Emission Reduction Opportunities

Biomass Facilities

The presence of biomass facilities in the Valley, from either new facilities or other solid fuel fired boilers that have converted to biomass, continues to significantly reduce NOx and PM emissions from open burning practices. However, the biomass industry has indicated that given current energy policy in California there is concern that biomass power facilities are in jeopardy. Many biomass plants in the Valley are nearing the end of their long-term contracts with utilities and find themselves in a position where the power that they provide is not the type of power that utilities are seeking (base load vs. intermittent) and that the prices being offered for new contracts are too low to support their operations.

The District has learned that two biomass power plants have shut down due to their inability to secure contracts with utilities at rates that are sufficient to sustain their operations. Greenleaf Power that operates the Tracy Biomass Plant, located in Tracy, reported that they shut down on October 31, 2014 and the Covanta facility located in Mendota was shut down in January 2015. Initially, another Covanta facility in Delano had indicated that they were likely to shut down but is now reporting that they were able to secure a one-year extension on their current utility contract at the same rate that enables them to continue to operate. With additional biomass facilities on the brink of closure, it has become even more infeasible to require citrus orchard removals to be sent for use in biomass.

The District has convened a number of productive meetings with agricultural stakeholders and representatives of the biomass industry in order to more fully understand the issues faced by the industry and develop a common vision of the future of biomass power amongst the stakeholders in the Valley. The meetings have been helpful in forging a better working relationship between agriculture representatives and biomass power producers and developing consensus on long-term solutions. The group has also discussed potential short term solutions.

In June 2014, the District's Governing Board adopted positions on two pieces of legislation that impact the biomass industry. The District adopted a position in support

of AB 2363 (Dahle), which was sponsored by the biomass industry, and would make biomass plants more competitive by fully accounting for the costs associated with intermittent sources of renewable power (solar and wind) when comparing them to other sources of power. AB 2363 was signed by the Governor and will begin to help level the renewable energy playing field. The District also took a position in opposition to SB 1139 (Hueso) that would have given preferential treatment to new geothermal power plants by requiring that utilities purchase specified amounts of new geothermal power. Ultimately, AB 1139 was not passed by the legislature.

Long-Term Solutions for Biomass

There is consensus that biomass power producers currently are not on a level playing field in competing with other renewable sources of power for utility contracts. They are also not receiving any preferential treatment for the societal benefits for providing a cleaner alternative to the open burning of agricultural waste and assisting with meeting landfill diversion goals.

Contracts between power producers and utilities are confidential, but the current market rate that the biomass plants can garner is approximately 6 cents/KWH. This is the rate that the utilities obtain through contracts with solar power providers. This low cost is made possible largely due to government subsidies provided for solar power production. Biomass power producers have indicated that it takes approximately 9-10 cents/KWH for the plants to cover their operating costs.

The District and representatives from agriculture and biomass industries are working to develop and pursue specific actions with the legislative branch, utilities, Public Utility Commission, CalRecycle, and other government agencies to help level the playing field and allow the biomass industry to fairly compete.

The District will also work with the stakeholders including the Federal Department of Energy, California Energy Commission, and other partner agencies to pursue clean alternatives to biomass power production for agricultural waste disposal.

Selective Catalytic Reduction

When comparing Rule 4352 to EPA and other air districts' BACT requirements, it was noted that SCR systems are considered BACT. A SCR system reduces NOx emissions by converting the emissions to water and elemental nitrogen. In the analyses below, the District evaluated the cost effectiveness of requiring SCR for all three categories of solid fuel fired boilers: MSW, biomass, and other fuels.

Cost Effectiveness of SCR for MSW Units

Currently, facilities are generally equipped with Selective Non-Catalytic Reduction (SNCR) and utilize this technology to meet emission limits ranging between 165 ppmv to 210 ppmv. Although it appears that facilities can achieve a lower NOx limit beyond the current rule requirements, an additional NOx control technology such as Selective Catalytic Reduction (SCR) would be needed. In fact, the installations that are achieving lower NOx emissions were installed as new installations equipped with the SCR

technology. The District could not find an example of an SCR installation as a retrofit on an existing MSW facility.

Though a retrofit installation has not been demonstrated in practice, the District conducted a cost effectiveness analysis to determine if installing SCR as a retrofit would be reasonable. The District used the following methodology and assumptions for this cost effectiveness analysis:

Assumptions

- Baseline emission factor is 0.286 lb-NOx/MMBtu (equivalent to 165 ppmv @ 12% CO2)
- SCR provides control to 50 ppmv at 7% O2 (47 ppmv @ 12% CO2)
- Capital cost annualized at 10% interest for 10 years

Cost data was obtained from a preconstruction approval by the Florida Department of Environmental Protection (FDEP) issued on December 23, 2010. The approval was issued for an MSW-fired combustor equipped with SCR for NOx control. The control equipment costs from the FDEP application include uncontrolled NOx emissions of 250 ppmv and controlled NOx emissions of 50 ppmv which represents an 80% reduction in NOx from the SCR. However, 80% reduction from 165 ppmv @ 12% CO2 would yield controlled emissions of 33 ppmv, which is well below BACT. Therefore, controlled emissions are evaluated at the BACT limit of 47 ppmv @ 12% CO2.

The SCR installation is sized for a unit rated at approximately 460 MMBtu/hr used to produce superheated steam for an electrical generator. The District reviewed the expected exhaust parameters and found them comparable to the parameters for solid fuel-fired boilers in the Valley. Therefore, it is believed that this cost estimate provides a valid basis for estimating costs for installing SCR on boilers in the Valley.

To maximize the emission reductions and economies of scale in estimating the retrofit costs, it is assumed that a 350 MMBtu/hr unit operating at full fire at 100% capacity factor year round for the MSW facility. The purpose of these assumptions is to err on the conservative side throughout the analysis.

Emissions are calculated in the following table:

Table C-12 Emissions from a MSW Unit

Fuel	Rating (MMBtu/hr)	Time (hr/yr)	EF (lb/MMBtu)	Emissions (lb/yr)	Emissions (tons/yr)
MSW (baseline)	350	8,760	0.286	876,000	438
MSW (controlled)	350	8,760	0.081	248,346	124

The capital and operational costs are sized to the facility size using the six-tenths rule, where:

- CA is a known cost of equipment of size A
- CB is the estimated cost of equipment of size B

- SB is the size of equipment B
- SA is the size of equipment A

$$C_B = C_A \times (S_B \div S_A)^{0.6}$$

It is standard District policy for Best Available Control Technology (BACT) analyses to use a 10 year life and 10% interest rate unless information indicates otherwise; therefore the capital recovery factor (CRF) of 0.1627 will be used to annualize the capital costs.

It is noted that the FDEP cost analysis is for a new unit with an adequately-sized induced draft (ID) fan. However, for a new unit the ductwork can be laid out in a way that minimizes pressure losses, allowing for a smaller ID fan than may be required for a retrofit. Affected sources have provided some estimates for additional electrical costs associated with the larger ID fan required for a retrofit, so these have been incorporated into the analysis. In addition, the FDEP analysis is for a new unit so it does not include the loss of revenue from taking a unit off-line to retrofit the new technology. For each unit it is estimated that the retrofit would require at least six months of downtime at $118/MW-hr; this will be added to the capital cost. Finally, the FDEP analysis specifically ignored sales tax on capital equipment on the grounds it is exempt from sales tax in Florida. This would not be the case in California, so 8% sales tax has been included.

The cost effectiveness analysis for installing SCR on a MSW unit is as follows:

Table C-13 Cost Effectiveness for Installing SCR on a MSW Unit

Description of Cost	Cost Factor	Cost	Source
Direct Capital Costs (DC):			
Purchase Equipment Costs (PE):			
(A) Basic Equipment:			
1) SCR System (Quote from Babcock Power)		6,790,099	FDEP[48]
2) Additional Ductwork (220 ft)	$1,800/ft	336,110	FDEP
3) Increased ID fan size		7,384	FDEP
Subtotal of Basic Equipment	A	7,133,593	FDEP
(B) Instrumentation and controls: (1% of A)	0.01 A	71,336	FDEP
(C) Freight: (5% of A)	0.05 A	356,680	FDEP
(D) Taxes	0.08 (A+B+C)	604,929	OAQPS
PE Total:		8,166,538	
Direct Installation Costs (DI): Assume Modular SCR w/ simple installation			
Foundation and Supports:	0.16 PE	1,306,646	FDEP
Handling and Erection:	0.40 PE	3,266,615	FDEP
Electrical: (quote from CH2M Hill)	0.10 PE	816,654	Industry
Piping: (quote from CH2M Hill)	0.20 PE	1,633,308	Industry
Insulation:	0.01 PE	81,665	OAQPS
Painting:	0.01 PE	81,665	OAQPS

[48] All costs from FDEP size-adjusted using six-tenths rule from 460 MMBtu/hr to 350 MMBtu/hr.

Description of Cost	Cost Factor	Cost	Source
Costs for Expansion of APC Building for SCR Components (quote Malcolm Pirnie)		366,665	FDEP
DI Total:		7,553,218	
Retrofit (Deconstruct existing building/structures, estimated equal to DI total)		7,553,218	District
Natural gas pipeline (replace fuel oil #2)		3,000,000	Industry
Site Preparation and Buildings			
DC Total = PE + DI + retrofit + pipeline:		26,272,974	
Indirect Costs (IC):			
Engineering:	0.10 PE	816,654	OAQPS
Construction and Field Expenses:	0.05 PE	408,327	OAQPS
Contractor Fees:	0.10 PE	816,654	OAQPS
Contingencies:	0.15 PE	1,224,981	FDEP
Start-up:	0.02 PE	163,331	OAQPS
Performance Testing:	0.01 PE	81,665	OAQPS
Retrofit Downtime (6 months minimum, electricity sales and tipping fees)		11,000,000	Industry
IC Total:		14,511,612	
Total Capital Investments (TCI = DC + IC):		40,794,586	
Direct Annual Costs (DAC): Assume SCR requires 0.5 hrs/shift			
Operating Costs (O): (≈ 1,095 shifts/year @ 3 shifts/day)			
Operator: 1.0 hr/shift	$50/hr	54,750	FDEP
Supervisor:	15% operator	8,213	OAQPS
Maintenance Costs (M):			
Labor: 1.0 hr/shift	$50/hr	54,750	FDEP
Material:	100% labor	54,750	FDEP
Utility Costs (U):			
Performance loss:	$0.08848/kW-hr	386,495	FDEP
Electricity Cost: (additional 818 kW[49])	$0.08848/kWhr	634,019	Industry
Catalyst Replace:		123,071	FDEP
Total DAC:		1,316,048	
Indirect Annual Costs (IAC):			
Overhead:	60% O & M	87,828	OAQPS
Insurance:	0.01 TCI	407,946	OAQPS
Property Tax:	0.01 TCI	407,946	OAQPS
Administrative:	0.02 TCI	815,892	OAQPS
Annualized Total Capital Investment: interest rate (%) 10			
Period (years): 10	0.1627 TCI	6,637,279	District Policy
Total IAC:		9,672,939	
Total Annual Cost (DAC + IAC):		**9,672,939**	

[49] Resized from industry estimate of 2 trains, 628 kW/train, for a 715 MMBtu/hr facility, resized to 350 MMBtu/hr

Table C-14 Summary of Cost Effectiveness for Installing SCR on a MSW Unit

Fuel Type	Baseline Emissions (tons/yr)	Controlled Emissions (tons/yr)	Emissions Reduced (tons/yr)	Adjusted Annualized Cost ($/yr)	Cost Effectiveness ($/ton)
MSW	438	124	314	9,672,939	$30,806/ton

The cost effectiveness for installing SCR on a MSW fired boiler is $30,806 per ton of NOx reduced. It is important to note that this calculation is based off of a new installation of SCR, not a retrofit as would be required by Valley facilities. While some retrofit expenses have been included, operators would potentially incur additional costs when retrofitting to incorporate SCR including expenses for additional ductwork, installation of a new natural gas pipeline to replace the existing fuel oil supply, and labor; therefore, District staff assumes the cost effectiveness is even higher than presented in this analysis.

Cost Effectiveness of SCR for Biomass Units

Currently, facilities are generally equipped with SNCR and although it appears that facilities could possibly achieve a lower NOx limit beyond the revised proposed rule amendments, additional NOx control technology such as SCR would be needed. In fact, the installations that are achieving lower NOx emissions are typically installed as new installations equipped with the SCR technology, with one exception. One facility in the Valley has installed SCR on a smaller existing boiler under an experimental research exemption approved in February 2008. In March 2009, the District approved the facility's application to replace the existing SNCR (which had become inoperable) with the SCR installed under the experimental research exemption. This modification did not result in any reduction in permitted emissions as the SCR-equipped boiler is only required to comply with the same emission limit the SNCR-equipped boiler was. This modification was incorporated into the Title V permit in September 2010. While this example may indicate that SCR is technologically feasible as a retrofit for smaller sized biomass-fired boilers, there are many other considerations unique to each facility that may inhibit the retrofit of a SCR system. Based on the following analysis, SCR is not cost effective at this time. It is important to note that this cost effectiveness analysis does not take into consideration the current economic struggles of the biomass industry, as previously described.

The District used the following methodology and assumptions for this cost effectiveness analysis:

Assumptions

- Baseline emission factor is 0.11 lb-NOx/MMBtu for Biomass(equivalent to 85ppmv @ 3% O2)
- SCR provides 80% control efficiency (from the provided cost estimates)
- Capital cost annualized at 10% interest for 10 years

Cost data was obtained from a preconstruction approval by the FDEP issued on December 23, 2010 as described above in the MSW section.

To maximize the emission reductions and economies of scale in estimating the retrofit costs, it is assumed that a 700 MMBtu/hr unit is operating at full fire at 100% capacity factor year round is representative for the Valley biomass facilities. The purpose of these assumptions is to err on the conservative side throughout the analysis.

Emissions are calculated in the following table:

Table C-15 Emissions Calculations for a Biomass Unit

Fuel Type	Rating (MMBtu/hr)	Time (hr/yr)	EF (lb/MMBtu)	Emissions (tons/yr)	Control Efficiency	Emissions Reduced (tons/yr)
Biomass	700	8,760	0.11	337.26	80%	269.8

The capital and operational costs are sized to the facility size using the six-tenths rule, as described in the MSW section above.

$$C_B = C_A \times (S_B \div S_A)^{0.6}$$

Therefore;

C_B = \$9,672,939/year x (700 MMBtu/hr ÷ 350 MMBtu/hr)$^{0.6}$

= \$14,661,434/year

It is standard District policy to use a 10 year life and 10% interest rate; therefore the capital recovery factor (CRF) of 0.1627 will be used to annualize the capital costs.

Table C-16 Cost Effectiveness for Installing SCR on a Biomass Unit

Fuel Type	Adjusted Annualized Cost ($/yr)	Emissions Reduced (tons/yr)	Cost Effectiveness ($/ton)
Biomass	14,661,434	269.8	\$54,342/ton

It is estimated based on the above data and assumptions that requiring the installation of SCR would provide a cost effectiveness of \$54,342/ton for a biomass-fired boiler. The cost effectiveness was evaluated without taking into account additional potential costs involved in a retrofit of the facility. It should also be noted that the District's cost effective analysis is very conservative since the installation of the SCR technology with an 80% control efficiency assumes a NOx emission level of approximately 17 ppmv @ 3% O2. This level is lower than established BACT levels and well beyond RACT thresholds. Therefore, even with these conservative assumptions, the installation of SCR is not cost effective for these types of installations.

Furthermore, the emission factors used above are short-term emission limits on a block 24-hour average basis and in all probability will not be representative of actual annual emission rates. Indeed, the post-SCR emission factors for biomass is 0.022 lb/MMBtu,

which is well below the short-term emission limits for recently issued biomass-fired boiler ATCs. If, as appears possible, the post-SCR emission rates are higher than assumed above, then the quantity of emission reductions will be lower and the cost of emission reductions greater. Finally, it is vital to remember that the 700 MMBtu/hr boiler assumed for biomass boilers above is an idealized hypothetical chosen to maximize the economies of scale in using the six-tenths rule to scale the cost estimate. For any actual plant within the population of solid fuel-fired boilers in the Valley, the boiler rating will be lower (as small as 171.2 MMBtu/hr) and the cost of emission reductions will be correspondingly higher.

Cost Effectiveness of SCR for Units Using Other Fuels

Currently, facilities are equipped with SNCR and although facilities may be able to achieve a lower NOx limit beyond the revised proposed rule amendments, additional NOx control technologies such as SCR would be needed. District staff conducted a cost effectiveness analysis to determine if installing SCR as a retrofit would be reasonable.

District staff used the following methodology and assumptions for this cost effectiveness analysis:

Assumptions

- Baseline emission factor is 0.10 lb-NOx/MMBtu (equivalent to 73 ppmv @ 3% O2)
- SCR provides 80% control efficiency (from the provided cost estimates)
- Capital cost annualized at 10% interest for 10 years

Cost data to install the SCR technology was obtained from a preconstruction approval the FDEP issued on December 23, 2010 as described above in the MSW section.

To maximize the emission reductions and economies of scale in estimating the retrofit costs, it is assumed that a 700 MMBtu/hr unit operating at full fire at 100% capacity factor year round is representative for boilers firing on “other” fuels. The purpose of these assumptions is to err on the conservative side throughout the analysis.

Emissions are calculated in the following table:

Table C-17 Emissions Calculations for Other Units

Fuel Type	Rating (MMBtu/hr)	Time (hr/yr)	EF (lb/MMBtu)	Emissions (tons/yr)	Control Efficiency	Emissions Reduced (tons/yr)
Other	700	8,760	0.10	306.6	80%	245.3

The capital and operational costs are sized to the facility size using the six-tenths rule, as described in the MSW section above.

$$C_B = C_A \times (S_B \div S_A)^{0.6}$$

Therefore;

$$C_B = \$9{,}672{,}939/\text{year} \times (700\ \text{MMBtu/hr} \div 350\ \text{MMBtu/hr})^{0.6}$$
$$= \$14{,}661{,}434/\text{year}$$

It is standard District policy to use a 10 year life and 10% interest rate; therefore the capital recovery factor (CRF) of 0.163 will be used to annualize the capital costs.

Table C-18 Cost Effectiveness for Installing SCR Other Unit

Fuel Type	Adjusted Annualized Cost ($/yr)	Emissions Reduced (tons/yr)	Cost Effectiveness ($/ton)
Other	14,661,434	245.3	$59,769/ton

It is estimated based on the above data and assumptions that requiring the installation of SCR would result in a cost effectiveness of $59,769/ton for an Other Fuel-fired boiler. The cost effectiveness was evaluated without taking into account additional potential costs involved in a retrofit of the facility. The District has determined that is not economically feasibility to require SCR based on this cost effectiveness analysis and did not further evaluate additional costs associated with a retrofit. It should also be noted that the District's cost effective analysis is very conservative since the installation of the SCR technology with an 80% control efficiency assumes a NOx emission level of approximately 15 ppmv @ 3% O2. This level is lower than established BACT levels and well beyond RACT thresholds. Therefore, even with these conservative assumptions, the installation of SCR is not cost effective.

Furthermore, the emission factors used above are short-term emission limits on a block 24-hour average basis and in all probability will not be representative of actual annual emission rates. Indeed, the post-SCR emission factors for "other" fuels is 0.020 lb/MMBtu, which is well below the short-term emission limits for recently issued ATCs. If, as appears possible, the post-SCR emission rates are higher than assumed above, then the quantity of emission reductions will be lower and the cost of emission reductions greater. Finally, it is vital to remember that the 700 MMBtu/hr boiler assumed for "other" fuels above is an idealized hypothetical chosen to maximize the economies of scale in using the six-tenths rule to scale the cost estimate. For any actual plant within the pollution of solid fuel-fired boilers in SJVAPCD, the boiler rating will be lower (as small as 171.2 MMBtu/hr) and the cost of emission reductions will be correspondingly higher. Based off of this information, it would not be cost effective to require Valley facilities to retrofit with additional NOx reduction technology beyond what is currently being used.

Controls for Direct PM2.5 Emissions

The District researched the potential opportunity of specifying required controls for direct PM2.5 emissions. Three technologies were recognized as being able to potentially reduce direct PM2.5 emissions: electrostatic precipitators (ESPs), baghouses, and cyclones.

An ESP is a particulate collection device that removes particles from a flowing gas using the force of an electrostatic charge with a 90- 99.9% control efficiency of PM2.5 for solid fuel fired boilers within the 100-500 MMBtu/hr size range of District units.[50] A baghouse, on the other hand, is a technology in which particulates are removed from a stream of exhaust gases as the stream passes through a large cloth bag. Baghouses have a PM2.5 removal effectiveness of 90-99.9% for solid fuel fired boilers in the size range of District units.[51] Coal and coke-fired units generally use baghouses, but biomass boilers usually use ESPs because of the health and safety risk of the burning embers causing a fire in the baghouse. However, when cyclones are combined with the use of a baghouse, the burning embers are extinguished and allow for the use of a baghouse in a biomass facility[52]. This also reduces acid gases and some PM2.5 compared to the use of a baghouse alone.

All of the facilities subject to Rule 4352 have installed either a baghouse or ESP particulate matter removal system due to permitting requirements. Since the control efficiency ranges for both technologies are equivalent, there are currently no other PM controls more effective than current practices.

Controls for SOx Emissions

Potential opportunities to reduce SOx emissions from this source category were also researched. Most facilities subject to Rule 4352 currently inject limestone into the combustion chamber to react with fuel sulfur and produce various sulfate compounds, which can then be removed by the ESP or baghouse. This control technology typically achieves around 50% control of SOx emissions[53]; however, the emissions reduced are less for a low sulfuric fuel due to the lower concentration of sulfur dioxide (SO2) initially in the combustion products.

Scrubbers are an add-on control technology that can achieve 70-95% control of SOx emissions for solid fuel fired boilers[54]. The only MSW facility in the Valley currently utilizes a semi-dry scrubber system to control SOx emissions. Therefore, the District calculated the average cost effectiveness of a scrubber system for biomass and coal/coke facilities.

The District conducted a SOx BACT evaluation for a local power generation facility that was installing a biomass boiler and determined the capital costs for a wet scrubber

[50] Senior, C., Afonso, R. (January 2009). *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Northeast States for Coordinated Air Use Management.
[51] Senior, C., Afonso, R. (January 2009). *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Northeast States for Coordinated Air Use Management.
[52] Roberts, C. (2009). *Information on Air Pollution Control Technology for Woody Biomass Boilers.* Northeast States for Coordinated Air Use Management and the EPA Office of Air Quality Planning and Standards.
[53] Alberta Research Council Inc. (2001). *Technical Advice on Air Pollution Control Technologies for Coal-fired Power Plants*.
[54] Senior, C., Afonso, R. (January 2009). *Applicability and Feasibility of NOx, SO2, and PM Emissions Control Technologies for Industrial, Commercial, and Institutional (ICI) Boilers.* Northeast States for Coordinated Air Use Management.

system are approximately $5.8 million. The annualized capital equipment cost is calculated by multiplying the installed equipment cost by the capital recovery factor of 0.1627.

Annual Capital Costs ($AC_{capital}$)

$AC_{capital}$= $5,800,000 X 0.1627
$AC_{capital}$= $943,660/year

In addition, this system has additional costs for the sodium hydroxide reagent used in the scrubber which are estimated to be an additional $642,000 per year. Thus, the total annual cost would be:

Total Annual Costs (AC_{total})

AC_{total} = Capital Costs + Reagent Costs = ($943,660/year) + ($642,000/year)
AC_{total} = $1,585,660/year

Cost effectiveness is calculated by dividing the annual cost by the annual emissions reductions from District standard emissions. One cost effectiveness analysis was conducted for the biomass and coal/coke fired units in the Valley because the four coal/coke fired units are fired on biomass part of the time.

The average SOx emissions limit of these units, based on District Permits SOx emissions limits, is 0.044 lb/MMBtu and the average heat input is 341 MMBtu/hr. An emissions factor of 0.27 lb/MMbtu at 24 hours per year is assumed to reflect the time needed for the startup and shutdown period, when the exhaust temperature is not high enough for controls to be fully effective. Therefore, those numbers were utilized to calculate annual standard emissions as follows:

Annual Standard Emissions ($AE_{standard}$)

$AE_{standard}$ = [(0.044 lb/MMBtu) x (341 MMBtu/hour) x (8,760 hour/year)] + [(0.27 lb/MMBtu) x (24 hour/year) x (341 MMBtu/hr)]
$AE_{standard}$ = 133,644.7 lb/year

Potential emissions, using the technologically feasible emission limit of 0.012 lb/MMBtu that is achieved by the use of a wet scrubber system, can be calculated as follows:

Annual Emissions with Wet Scrubber System ($AE_{scrubber}$)

$AE_{scrubber}$ = [(0.012 lb/MMBtu) x (341 MMBtu/hour) x (8,760 hour/year)] + [(0.27 lb/MMBtu) x (24 hour/year) x (341 MMBtu/hour)]
$AE_{scrubber}$ = 38,055.6 lb/year

Therefore, the cost effectiveness would be:

Cost Effectiveness (CE)

CE= ($1,585,660/year) ÷ [(133,644.7 lb/year – 38,055.6 lb/year) x (1 ton/2,000 lb)]
CE = $33,177/ton

It is important to note that the cost effectiveness analysis above does not reflect the costs of additional electricity consumption, additional labor costs, additional solid waste disposal, and other operational changes or additions that would be required to comply with the lower limit. The option of scrubbers is not a cost effective option, and therefore, is not feasible.

There are no additional technologies available to reduce SOx emissions from solid fuel fired units.

Start-up Periods

The possibility of reducing the allowed start-up period of solid fuel fired boilers was considered, since facilities are exempt from emissions limits during this period. Facilities subject to Rule 4352 are currently subject to a start-up limit of 96 hours. Operators currently limit their start-up and shut-down times as much as possible since down time results in reduced productivity and profits. However, facilities periodically perform “cold repairs” on their solid fuel fired boilers for maintenance or trouble-shooting purposes. This requires operators to completely shut down the boilers, which in turn requires a longer start-up period to return to correct operating temperature. When the solid fuel fired boilers are starting up, the units are not operating with a full load which reduces emissions. Therefore, this is not a technologically feasible option for solid fuel fired facilities given the needs of current work practices.

Evaluation Findings

Even though solid fuel fired boilers, steam generators, and process heaters are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4352 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from solid fuel fired boilers, steam generators, and process heaters in the Valley.

C.14 RULE 4354 GLASS MELTING FURNACES

Discussion

The provisions of Rule 4354 are applicable to glass melting furnaces in the Valley. The purpose of this rule is to limit NOx, SOx, volatile organic compounds (VOC), carbon monoxide (CO), and PM emissions from glass melting furnaces.

Rule 4354 was adopted on September 14, 1994 and has been subsequently amended six times. Rule 4354 was amended September 16, 2010 to strengthen the NOx emission limits in the rule; EPA finalized approval for these amendments on August 29, 2011. Rule 4354 was subsequently amended again in May 19, 2011 to implement updated start-up requirements; EPA finalized approval of the 2011 amendments to Rule 4354 on January 31, 2013 and deemed this rule as being as stringent as, if not more stringent than, established RACT requirements. As a result of this stringent prohibitory rule and continuing efforts on behalf of this industry to reduce emissions, the Valley is home to glass-making facilities with glass melting furnaces that utilize the most advanced low-NOx firing technology.

Source Category

Industrial glass making is a continuous process with raw materials supplied to the furnace at the front end, and product taken off the line at the back end of the process. The raw materials for making glass are silica sand and soda ash. Melting these basic materials and forming them into the desired product geometry creates the final glass product. The different end products vary widely in raw material additives, processing equipment and conditions, and product quality requirements. The emission limits of Rule 4354 depend on the type of glass produced, furnace firing technology and the emission-averaging period.

Rule 4354 is among the most stringent rules in the nation for glass melting furnaces. The NOx emission limits contained within Rule 4354 require the installation of the best available NOx technology (i.e. oxy-fuel firing or SCR systems).

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.33	0.34	0.35	0.36	0.38	0.39	0.39	0.40	0.40
NOx	6.04	6.21	3.99	4.08	4.17	4.27	4.31	4.35	4.38
SOx	1.96	2.00	1.83	1.87	1.90	1.93	1.95	1.96	1.98
	Winter Average - Tons per day								
PM2.5	0.33	0.34	0.35	0.36	0.38	0.39	0.39	0.40	0.40
NOx	6.04	6.21	3.98	4.08	4.17	4.27	4.31	4.34	4.38
SOx	1.96	2.00	1.83	1.87	1.90	1.93	1.95	1.96	1.98

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per

day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, PM2.5 and NOx emissions from glass melting furnaces are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements for PM2.5 and NOx; however, the District has still conducted a full control measure evaluation for glass melting furnaces.

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

Federal Regulations

There are no EPA CTG requirements for this source category.

ACT

- EPA-435/R-94-037 (Alternative Control Techniques Document—NOx Emissions from Glass Manufacturing)

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

NSPS

- 40 CFR 60 Subpart CC (Standards of Performance for Glass Manufacturing Plants)

The District evaluated the requirements contained within 40 CFR 60 Subpart CC and found no requirements that were more stringent than those already in Rule 4354.

- 40 CFR 60 Subpart PPP (Standards of Performance for Wool Fiberglass Insulation Manufacturing Plants)

The District evaluated the requirements contained within 40 CFR 60 Subpart PPP and found no requirements that were more stringent than those already in Rule 4354.

NESHAP/ MACT

- 40 CFR 61 Subpart N (National Emission Standard for Inorganic Arsenic Emissions from Glass Manufacturing Plants)

40 CFR 61 Subpart N was last amended February 27, 2014; however, this NESHAP only regulates inorganic arsenic emissions and therefore does not apply to this control measure evaluation.

- 40 CFR 63 Subpart NNN (National Emission Standards for Hazardous Air Pollutants for Wool Fiberglass Manufacturing Plants)

The District evaluated the requirements contained within 40 CFR 63 Subpart NNN and found no requirements that were more stringent than those already in Rule 4354.

- 40 CFR 63 Subpart SSSSSS (National Emission Standards for Hazardous Air Pollutants for Glass Manufacturing Area Sources)

The District evaluated the requirements contained within 40 CFR 63 Subpart SSSSSS 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?

There are no analogous rules for this source category in VCAPCD and SMAQMD.

SCAQMD

- Rule 1117 (Emissions of Oxides of Nitrogen from Glass Melting Furnaces)

The District evaluated the requirements contained within SCAQMD's Rule 1117 and found no requirements that were more stringent than those already in Rule 4354.

BAAQMD

- BAAQMD Regulation 9 Rule 12 (Nitrogen Oxide Emissions from Glass Melting Furnaces)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 12 and found no requirements that were more stringent than those already in Rule 4354.

Additional Emission Reduction Opportunities

SOx Limits for Container Plants
The District evaluated the possibility of lowering the existing SOx limits for container plants from the current limits of 0.9 and 1.1 lbs of SOx per ton of glass, depending on cullet content, to the District BACT limit of 0.8 lbs/ton. The analysis below indicates that it is not technologically feasible to lower the SOx limits.

The glass container industry is mandated by the State of California to use a minimum quantity of recycled glass (cullet) as part of the production process. The quantity of clear glass cullet available to glass manufacturers is very limited; therefore, cullet with a large portion of colored glass is included in each batch. The continued use of mixed color cullet is critically important to meeting California's recycling goals. Due to the variable quality of mixed color cullet, SOx emissions produced by the melting of recycled cullet are also variable.

Container glass manufacturers control multiple furnaces as a single unit, meaning that the exhaust from multiple furnaces are ducted together and the total emissions are averaged over the total amount of glass pulled from all furnaces. Because emissions are averaged across furnaces, EPA requires that there be a 10% air quality benefit, meaning that the overall limit for multiple furnaces be 10% less than the limit for a single

furnace. This imposes the lowest SOx emission limit on container glass furnaces, but allows operators to install one control device per facility rather than one add-on control device per furnace. SOx emissions limits for container glass were adopted at 1.1 pounds per ton of glass produced if the operator uses at least 25% by weight of mixed color cullet and a limit of 0.9 pounds per ton of glass produced for all other container glass manufacturing. If the District were to lower the limits in the rule to 0.8 lbs/ton, then the 10% required air quality benefit for multiple furnaces extend beyond BACT, which is not feasible. The 0.8 lbs/ton BACT limit is equivalent to the 0.9 lbs/ton limit with the additional EPA required 10% air quality benefit.

Evaluation Findings

Even though glass melting furnaces are not a significant source of PM2.5 or NOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4354 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from glass melting furnaces in the Valley.

C.15 RULE 4550 CONSERVATION MANAGEMENT PRACTICES

Discussion

Rule 4550 is the District's Conservation Management Practices (CMP) rule. Rule 4550 was the first rule of its kind in the nation to reduce fugitive particulate emissions from agricultural operations through the reduction of passes of agricultural equipment and implementation of other conservation practices. Rule 4550 is unique because it is based upon a menu approach of control techniques to accommodate the variability of agricultural industries. The selected CMPs are listed on application forms that are submitted to the District for approval as a CMP Plan. Agricultural operations are required to maintain detailed records verifying use of the approved Conservation Management Practices. Approved CMP plans are enforced through onsite inspections and operators are required to submit applications and modify their plans when changing their conservation management practices. Through this rule, PM10 emissions have been reduced by 35.3 tons per day[55], which is approximately a 24% reduction for this source category.

The District worked extensively with stakeholders, growers, and the Agricultural Technical Committee for the San Joaquin Valley-wide Air Pollution Study Agency (AgTech) for two years prior to developing the Conservation Management Practices (CMP) Rule. Rule 4550 was adopted on August 19, 2004 to help bring the Valley into attainment of federal PM10 standards. Rule 4550 has served as a model for other regions seeking to reduce fugitive particulate emissions from agricultural sources.

Upon adoption of Rule 4550, the District embarked on an ambitious implementation strategy, working extensively with agricultural stakeholders to ensure that affected sources were assisted as much as possible in complying with the requirements, and consequently ensuring that the CMP Program was successful. To this end, the District created special CMP application forms, which were designed to allow growers to select approved practices from simplified checklists. A special web page was created that contains answers to frequently asked questions, application forms, and other forms of assistance for agricultural operations. The District hired additional staff, including additional Small Business Assistance (SBA) staff, and took part in over 40 workshops throughout the Valley to assist sources in completing and submitting the required CMP application forms. The workshops were coordinated with agricultural stakeholders, and tremendous outreach was performed to ensure that as many affected sources as possible would attend and receive assistance at the workshops. As a result of these efforts, the District's CMP Program realized the following notable achievements:

- Approximately 4,000 workshop participants, with many of the participants submitting CMP Plan applications during the workshops.
- The District received and processed over 6,000 CMP Plan applications during 2005.

[55] SJVAPCD. *Conservation Management Practices Program Report for 2005.* (2006, January 19). Retrieved from http://www.valleyair.org/farmpermits/updates/cmp_program_report_for_2005.pdf

- The practices used by valley agricultural sources encompass 3.2 million acres of farmland, and over 30,000 miles of unpaved roads.
- The PM10 reductions are quantifiable and enforceable through approved CMP plans and inspections.
- The collaborative effort responsible for the CMP program received US EPA Region IX's "2005 Environmental Award for Outstanding Achievement."

The District also conducted an additional 60 workshops throughout the Valley over the last 10 years for the purpose of assisting sources comply with the CMP and other ag-related rules.

EPA finalized approval of Rule 4550 on February 14, 2006 and determined that the rule met BACM requirements.[56] 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 Rule 4550 meets BACM requirements.[57,58]

Source Category

This rule is applicable to on-field farming and agricultural operation sites located within the Valley. 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. 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. 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. 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. PM10 emissions 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,

[56] 71 Federal Register 30, 7683-7688. (2006, February 14). *Revisions to the California State Implementation Plan; San Joaquin Valley Unified Air Pollution Control District*. Retrieved from http://www.gpo.gov/fdsys/pkg/FR-2006-02-14/pdf/06-1311.pdf

[57] 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

[58] SJVAPCD. *Court rules in favor of Air District ag rule. Second decision this week affirms PM progress.* Retrieved from https://www.valleyair.org/recent_news/Media_releases/2009/PR%20Court%20decision%20favors%20District%20ag%20rule.pdf

resulting in the entrainment of soil or plant materials into the air. Wind blowing across exposed agricultural land also causes the entrainment of PM10 into the air. In addition, PM10 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 PM10; and
- Application of water or dust suppressants on unpaved roads and other travel areas to reduce emissions entrained by moving vehicles and equipment.

Emissions Inventory

There are no NOx or SOx emissions attributable to the sources subject to CMP requirements. The following emissions inventory table represents PM2.5 emissions only.

Source	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
Tilling Dust	5.17	5.14	5.12	5.09	5.07	5.04	5.02	5.00	4.97
Harvest Operations – Dust	7.28	7.25	7.23	7.20	7.18	7.15	7.12	7.10	7.07
Dust from Agricultural Lands (non-pasture)	6.15	6.12	6.08	6.05	6.02	5.99	5.96	5.93	5.90
Dust from Pasture Lands	1.09	1.09	1.08	1.08	1.08	1.07	1.07	1.06	1.06
	Winter Average - Tons per day								
Tilling Dust	7.37	7.33	7.29	7.25	7.21	7.18	7.14	7.10	7.06
Harvest Operations – Dust	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.29
Dust from Agricultural Lands (non-pasture)	4.36	4.33	4.30	4.28	4.25	4.23	4.20	4.17	4.15
Dust from Pasture Lands	0.23	0.23	0.23	0.23	0.23	0.23	0.22	0.22	0.22

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 4.0 tons per day (tpd) for PM2.5 dust emissions. As identified in the above table, annual average emissions from pasture lands are lower than the BACM/MSM significance threshold. Therefore, the Clean Air Act does not require a control measure evaluation for that source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for CMPs for all emission categories.

Contribution of PM2.5 to PM10 Emissions from Agricultural Operations

While Rule 4550 has been successful in reducing both PM10 and PM2.5 emissions, recent studies have indicated that the PM2.5 fraction of emissions makes up a small portion of the total particulate emissions from agricultural operations. Additionally, particulate emissions from agricultural operations are geologic in nature. These geologic particulate emissions make up a relatively small portion of the overall PM2.5

concentrations during the winter season and have relatively low toxicity relative to the organic carbon fraction of PM2.5 and to re-suspended road dust.[59]

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 is primarily a PM10 reduction strategy. For example, 2004-2006 speciation analyses of PM2.5 from the Speciated Trends Network in Fresno and Bakersfield found that the annual average geologic fraction was 4% and 6%, respectively.[60] Given that PM2.5 emissions from agricultural field operations are generally subject to deposition near their source, the predominant source of this geologic PM2.5 would be urban re-suspended road dust with relatively little contribution from agricultural activities.

PM2.5 emissions from agricultural field operations have been generally over-estimated in absolute terms due to species differences between the fine and coarse fractions of geologic emissions. Using Valley ambient measurements of trace elements, the PM2.5/PM10 ratios for the predominant trace elements found in fugitive dust have been estimated.[61] 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%). This ratio estimate is substantially lower that the ratio of 0.20 reported previously for agricultural crops nationwide by MRI in 1996 based on limited supporting data and broad assumptions.[62] Further review of Valley research on PM2.5/PM10 ratios shows a consistent mid-point estimate of 0.10.[63] To summarize, PM2.5 comprises a small fraction of total PM10 emissions from field operations, approximately 10% in the Valley.

Historically, both grid models and PM2.5 monitors used in field studies have significantly over-estimated overall PM2.5 emissions from agricultural field operations as well as their contribution to ambient PM2.5 concentrations. In respect to grid modeling biases, there is an expert consensus regarding the sources of grid model overestimation: (1) faulty emission factor algorithms, (2) imprecise or difficult to obtain activity data to apply these algorithms (including inability to account for the effect of actual meteorological conditions on emissions), (3) the multiplier used to infer PM2.5 from PM10 emissions, and (4) modeling transport over-estimation (especially in the treatment of particles near their point of emissions).[64]

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[59] Rogge, W. F., Hildemann, L. M., Mazurek, M. A., Cass, G. R. and Simoneit, B. R. T. *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. 1993.

[60] SJVAPCD. (2012). *2012 PM2.5 Plan*. Retrieved from http://www.valleyair.org/Workshops/postings/2012/12-20-12PM25/FinalVersion/04%20Chapter%204%20Sci%20Foundation%20and%20Modeling.pdf

[61] Countess, R. *Reconciling Fugitive Dust Emission Inventories with Ambient Measurements.* 12th Annual EPA EI Mtg, San Diego, CA. April 29-May 1, 2003.

[62] Cowherd, C., and W. Kuykendal. (1996, June). *Paper No. WP96.04, Proceedings of the Annual Meeting of the Air and Waste Management Association*

[63] Pace, T.G, EPA. (2005, April). *Examination of the Multiplier Used to Estimate PM2.5 Fugitive Dust Emissions from PM10.* Retrieved from http://www.epa.gov/ttn/chief/conference/ei14/session5/pace.pdf.

[64] Pace, T.G, EPA. (2005). *Methodology to Estimate the Transportable Fraction (TF) of Fugitive Dust Emissions for Regional and Urban Scale Air Quality Analyses*.

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.[65,66,67] 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 over-estimation of PM10 and PM2.5, grid models ignore 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.

Wind-blown Dust in the Valley

The Valley experiences wind-blown dust events from time to time typically during the spring and fall seasons when weather disturbances are most common. These events are less likely to occur during the long stagnation periods of the summer and winter. When soil conditions are dry, strong wind events often entrain coarse particulate matter into the atmosphere, carrying the pollution long distances across the Valley. This phenomenon has the potential to create higher concentrations of PM10 in its path of impact.

Although these events primarily cause higher PM10 concentrations, there are rare instances where PM2.5 concentrations become elevated. In addition to the rarity of elevated PM2.5 concentrations, 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. As a result, the wind events experienced in the Valley are not a significant contributor to the PM2.5 attainment challenges for the region, and placing further controls on this source would not make a substantial difference in the District's PM2.5 design values.

Continuous Evaluation of Potential CMPs

The District evaluates the effectiveness of CMPs on a regular basis, as illustrated on the District's web page under *Requirements for Agricultural Operations*.[68] Rule 4550 was adopted in August 2004, and during that same year the *Ag CMP Handbook*, the *Poultry CMP Handbook*, and a list of conservation management practices were posted to the same District site. In 2006, the District prepared and published a CMP Program Report

[65] Watson, J. G., J. Chow and contributors (2000, May). *Reconciling Urban Fugitive Dust Emissions Inventory and Ambient Source Contribution Estimates*. Desert Research Institute Report 6110.4F. Prepared for U.S. EPA. Retreieved from http://www.epa.gov/ttn/chief/efdocs/fugitivedust.pdf

[66] Slinn, W. "Predictions for Particle Depositions to Vegetative Canopies", Atmospheric Environment, 16: 1785-1794, 1982.

[67] Etyemezian, V. et al., Desert Research Institute (2003, January) *Field Testing and Evaluation of Dust Deposition and Removal Mechanisms – Final Report*. Retrieved from http://www.westar.org/Docs/Dust/Transportable_Dust_Final_Report_DRI_WESTAR.pdf

[68] SJVAPCD. *Requirements for Agricultural Operations.* http://www.valleyair.org/farmpermits/

for 2005,[69] in which the District provided an explanation of the key components of the CMP program and a detailed summary of the process of identifying and quantifying the emission reductions achieved through December 31, 2005.

The District also posted a guidance document entitled, *San Joaquin Valley Air Pollution Control District Approval of New Conservation Management Practices (CMPs),*[70] to the District web page in 2010. This document outlines procedures for the approval of new CMPs proposed by owners/operators to be used for compliance with the requirements of Rule 4550 conservation management practices. In addition, District Rule 4550 is brought up for discussion frequently in the AgTech Committee, which consists of various regulatory agencies, agricultural industry representatives, and university professors. The AgTech Committee has evaluated proposed CMPs for inclusion as part of the approved CMP list, including the promotion of conservation tillage at Valley farms, misting to reduce PM10 generated by disking, and almond harvesting techniques to reduce emissions.

- **Conservation Tillage/Combined Operations**
  Conservation tillage includes types of tillage that reduce loss of soil and water in comparison to conventional tillage. Benefits include the reduction of passes and soil disturbance and soil improvements because it retains plant residue and increases organic matter. Examples of conservation tillage include converting to no or low till operations, implementing reduced till activities, adding soil/water amendments to improve resources, and reducing tillage needs.

  In the spring of 2008, EPA and USDA Agricultural Research Service (ARS) in collaboration with the District, NRCS, and other agencies/stakeholders performed a study of conservation tillage/combined operations and demonstrated significant PM emission reductions from this practice. EPA completed the final report in June 2013. This report, including the merits of conservation tillage/combined operations were discussed in great detail in the AgTech meetings and amongst industry stakeholders. It was determined that the conservation tillage/combined operations management practice is already included in nine out of the eleven crop categories with the other two crop categories consisting of a "non-tillage/chemical tillage" option. Non-tillage requires no disturbance of soil and can achieve even more reductions than conservation tillage. In addition, Rule 4550 already allows the option to select an "other" mitigation measure, which needs to be approved on a case by case basis. Since "conservation tillage" is already an approved conservation management practice, if an operator chose this for the "other" mitigation measure it would likely be approved.

[69] SJVAPCD. (2006, January 19). *Conservation Management Practices Program Report for 2005.* Retrieved 2/2/2015 from http://www.valleyair.org/farmpermits/updates/cmp_program_report_for_2005.pdf.
[70] SJVAPCD. (2010, December 14). *San Joaquin Valley Air Pollution Control District Approval of New Conservation Management Practices (CMPs)*. Retrieved 2/2/2015 from http://www.valleyair.org/policies_per/Policies/SSP_3010.pdf.

- **CSUF Foundation Report: MISTING: A Conservation Management Practice for Reducing PM10 Generated by Disking**
  A study was performed between March 2008 and September 2011 to test if the addition of a Misting System Duct Control Unit manufactured by Diamond E. Manufacturing would reduce emissions from disking. The final report was published in December 2011. In January 2013, Diamond E. Manufacturing requested that the Diamond E. Manufacturing Dust Control Unit be added to the official CMP list. A District review of the report indicated that it did not provide sufficient information to demonstrate the minimum 10% reduction in PM10 emissions and therefore, was not added to the official CMP list. If sufficient information demonstrating that the dust control unit achieves the minimum PM10 reductions is provided in the future, this measure would be allowed to be selected under the existing CMP category: Cropland – Land Preparation/Cultivation, Equipment changes/Technological Improvements.

- **Harvesting Equipment to Reduce PM Emissions from Almond Harvest Operations**
  A study was performed in 2010 and 2011 by Texas A&M to evaluate a variety of improved almond harvesters and their ability to reduce PM emissions. A final report was published in January 2013, demonstrating that the newer harvesters achieved significant PM emissions compared to their predecessors. This specific measure was not added to the list of conservation practices because it was determined that using newer almond harvesters to reduce PM emissions would be allowed under the existing CMP Category: Cropland-Harvest, Equipment Changes/Technological Improvements.

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

Federal requirements such as NSPS, NESHAP, MACT, CTGs, and ACTs and state regulations are not applicable to this source category.

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

The 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. BAAQMD and VCAPCD do not have rules that are analogous to Rule 4550.

SMAQMD

- Rule 215 (Agricultural Permit Requirements and New Agricultural Permit Review): District Rule 4550 is at least as stringent as if not more stringent than the analogous rule in SMAQMD.

SCAQMD

- SCAQMD has adopted agricultural best management practices (BMP) programs, which were approved by EPA as Best Available Control Measures (BACMs); however, the District's CMP rule exceeds these standards.

Imperial County Air Pollution Control District (ICAPCD)

- Rule 806 (Conservation Management Practices)

Imperial County APCD (Imperial) first adopted their Regulation VIII rules in 2005 to implement requirements designed to reduce the amount of PM10 entrained in the ambient air as a result of emissions generated from anthropogenic fugitive dust sources. Rule 806 (Conservation Management Practices) is a part of this set of rules. EPA did not approve the Regulation VIII rules as amendments to the state implementation plan (SIP) in July 2010. After a public process and mediation between Imperial and EPA, on October 16, 2012, a revised rule was adopted with rule requirements effective on and after January 1, 2013.

Imperial Rule 806 requires one conservation practice from each of three categories (land preparation and cultivation, harvesting, and cropland-other), but the rule also specifies that if the owner or operator of an Agricultural operation site chooses to implement conservation tillage as a conservation practice, then that owner/operator does not need to select any additional conservation practices.

As stated earlier, the District's CMP rule includes conservation tillage as a conservation management practice for nine out of the eleven crop categories, listed as an option under Land Preparation/Cultivation and/or under the Harvest section. The option to select conservation tillage is also available to all crops by program design because each of the three sections includes an "Other (approved on a case-by-case basis)," thus allowing conservation tillage to be chosen as a conservation practice by any owner/operator. District Rule 4550 is more stringent than Imperial Rule 806 where a Valley operator selects "conservation tillage" in one category, but still has to select two additional measures, resulting in even more emission reductions. Therefore, requirements in Rule 4550 are equivalent, if not more stringent than Imperial Rule 806.

Arizona Department of Environmental Quality

- The Arizona Department of Environmental Quality adopted agricultural BMP programs.

The Arizona Agricultural Best Management Practices Committee was established in 1998 by Arizona Revised Statutes (A.R.S) §49-457 to research and adopt BMPs for agricultural operations that generate dust. The BMPs are designed to reduce emissions of PM10 in the Maricopa County Serious PM10 nonattainment area. In 2006, the Committee reconvened the Technical Workgroup to review the current use of BMPs in Maricopa County.

The Arizona rule is not applicable to dairies, cattle feedlots, turkey ranches, chicken ranches, or chicken egg ranches. District Rule 4550 is more stringent than the Arizona rule for these categories. With regards to measures specific to agricultural crops, the measures offered as conservation practices in Arizona are similar to the conservation practices offered within District Rule 4550 and would likely yield similar amounts of emission reductions.

Evaluation Findings

EPA's approval of Rule 4550 as BACM and the District's review of similar rules in other regions demonstrate that the District has adopted the most stringent rule of its kind. Rule 4550 is more stringent than the Imperial rule and the Arizona rule, as both rules are not applicable to dairies, cattle feedlots, turkey ranches, broiler ranches, or layer hen ranches. With regards to measures specific to agricultural crops, the measures allowed as conservation practices in Imperial County and Arizona are similar to the conservation practices allowed under Rule 4550 and yield similar amounts of emission reductions.

Given the relatively low contribution that emissions from this category make to the Valley's PM2.5 concentrations and current stringent requirements under Rule 4550, the District has not identified any additional rule amendment opportunities for further emission reductions from source categories subject to CMP requirements to include in this plan. As demonstrated above, Rule 4550 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category.

Although Rule 4550 already meets BACM and MSM requirements, the District is committing to further evaluate Rule 4550 for additional opportunities. See Chapter 8 (Commitment to Leave No Stone Unturned to Evaluate Additional Opportunities) for more information.

C.16 RULE 4692 COMMERCIAL CHARBROILING

Discussion

Rule 4692 applies to chain-driven charbroilers used to cook meat. The purpose of the rule is to limit volatile organic compound (VOC) and PM10 emissions from commercial charbroiling. The rule also specifies administrative, recordkeeping requirements, and test methods.

The original rule, adopted in March 2002, reduced PM2.5 emissions from chain-driven charbroilers by 84%. The September 2009 rule amendment expanded rule applicability to more chain-driven charbroilers, reducing 25% of the remaining PM2.5 chain-driven charbroiler emissions. EPA finalized approval for Rule 4692 on November 3, 2011. The District evaluated Rule 4692 in its *2009 Reasonably Available Control Technology Demonstration for Ozone State Implementation Plans (2009 RACT SIP)*; however, EPA noted in its Technical Support Document (TSD) for the approval of Rule 4692 that the rule is not subject to RACT because it is not subject to CTG requirements and it does not regulate major sources.

Source Category

There are two types of commercial charbroilers: chain-driven and under-fired. A chain-driven charbroiler is a semi-enclosed broiler that moves food mechanically through the device on a grated grill to cook the food for a specific amount of time. An under-fired charbroiler has a metal "grid," a heavy-duty grill like that of a home barbecue, with gas burners, electric heating elements, or wood under the grid to cook the food. The smoke and vapors generated by cooking on either type of charbroiler contain water, VOCs, and PM. Larger particles and grease are typically captured by the grease filter of the ventilation hood over the charbroiler. The remaining VOCs and PM2.5 are exhausted outside the restaurant, unless a secondary control is installed.

Currently, District Rule 4692 reduces emissions by requiring catalytic oxidizers for chain-driven charbroilers that meet rule applicability thresholds. Charbroiler exhaust is directed 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 is transferred to a heat recovery system, so no additional fuel is needed for the unit. Controlling emissions from under-fired charbroilers has proven to be far more challenging. To date, no cost effective technologies have been demonstrated.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	2.84	2.87	2.92	2.97	3.04	3.11	3.18	3.24	3.31
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day								
PM2.5	2.84	2.87	2.92	2.97	3.04	3.11	3.18	3.24	3.31
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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

Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

State Regulations
There are no state regulations applicable to this source category.

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

There are no analogous rules for this source category in SMAQMD.

SCAQMD

- Rule 1138 (Control of Emissions from Restaurant Operations)

The District evaluated the requirements contained within SCAQMD's Rule 1138 and found no requirements that were more stringent than those already in Rule 4692.

BAAQMD

- Regulation 6 Rule 2 (Commercial Cooking Equipment)

BAAQMD Regulation 6 Rule 2 regulates both chain-driven and under-fired units. Newly installed under-fired units with more than 10 square feet of cooking area are required to limit emissions to 1 lb of PM10 per 1,000 lbs of cooked beef. Effective January 2013, the same emissions requirements also apply to pre-existing units. However, as the BAAQMD rule is implemented, a significant portion of under-fired charbroilers are below the applicability thresholds for grill size or amount of food cooked, and are thus exempt from rule requirements. In addition, BAAQMD has been unable to enforce this rule because no control technologies have been certified.

The applicability thresholds for grill size in District Rule 4692 are lower than those in BAAQMD Regulation 6 Rule 2. Therefore, because BAAQMD Regulation 6 Rule 2 is not currently being enforced for under-fired charbroilers, District Rule 4692 is effectively more stringent. Additionally, the District committed in the *2012 PM2.5 Plan* to amend

Rule 4692 in 2016 to expand applicability to include under-fired charbroilers. During the rule development process for this amendment, the District will examine all potential opportunities for further emission reductions.

VCAPCD

- Rule 74.25 (Restaurant Cooking Operations)

The District evaluated the requirements contained within VCAPCD's Rule 74.25 and found no requirements that were more stringent than those already in Rule 4692.

Additional Emission Reduction Opportunities

Chain-Driven Charbroilers

Rule 4692 requires emission controls for chain-driven charbroilers that cook 400 pounds of meat or more per week. In 2009, the amended rule was estimated to apply to about 280 of the 427 chain-driven identified charbroilers of the Valley. This rule thus applies to about 65% of the units and a much greater percentage of the total emissions from chain-driven charbroilers since they are higher use. The applicability threshold for chain-driven charbroilers under Rule 4692 could be lowered to make smaller facilities subject to the rule. However, these currently-exempt chain-driven units are a very small portion of the total inventory for this category. Emissions reductions would be minimal and costly through this approach. Furthermore, the District's applicability threshold is already lower than that of other air districts.

Under-Fired Charbroilers

Rule 4692 does not currently require emissions controls for under-fired charbroilers. Catalytic oxidizers are not effective for reducing emissions from under-fired charbroilers because the exhaust from these devices loses too much heat as it is directed to the control device, and the reactions at the catalyst cannot take place under this lower temperature. The following control strategies are more effective for under-fired charbroilers:

- **High efficiency particulate-arresting (HEPA) filtration systems:** This system adds a HEPA filter to the appliance's existing grease filters to effectively eliminate particulates down to about 0.3 microns in diameter. System maintenance is relatively easy to perform, but filters need to be regularly changed (perhaps weekly, depending on the amount of food cooked).

- **Electrostatic precipitators (ESPs):** Exhaust particles become electrically charged as they pass through an electrically charged screen. These ionized particles are then collected by one of two oppositely-charged plates. ESP systems need filtration prior to the ESP itself to remove grease and larger particles from kitchen exhaust. These devices are cleaned daily with a clean-in-place system, and more thorough cleaning is required once or twice a year. Routine maintenance often requires hiring an outside company, since the ESP plates can weigh as much as 75 pounds.

- **Wet scrubbers:** A fine stream of water and detergent "washes" the particulates from the kitchen exhaust. The particulate/water/detergent mix is then filtered; the filtered water/detergent mix is recycled through to clean more exhaust, and the particulate-laden wash water is discharged to the sewer system. In addition to the cost of the system itself, associated water/sewer usage costs and detergent costs can be high, although recent improvements in design are improving system efficiencies.

These controls for under-fired charbroilers were unproven and extremely costly during the District's 2009 amendment of Rule 4692. The costs of these under-fired charbroiler controls, as analyzed in 2009, ranged from $37,500 to $104,000, with a cost effectiveness of up to $58,200 per ton of PM2.5 reduced. However, the control technology for under-fired units has continued to develop over the past few years, in part through the District, SCAQMD, and EPA technology demonstration efforts. Since under-fired charbroilers are a larger part of the total commercial charbroiling inventory, and since these units are currently unregulated in the Valley, there is potential to achieve emissions reductions from under-fired charbroilers.

In parallel with this plan, SCAQMD has also included a draft commitment in Chapter 4 of their *Draft 2012 AQMP* to achieve a 1 tpd PM2.5 reduction from under-fired charbroilers, though the details of their approach are yet to be determined.[71] SCAQMD would submit their approach into the SIP once technically feasible and cost effective options are confirmed.

The District created and implemented a pilot program in 2009, the Charbroiler Incentive Program (ChIP), to provide grant funding to cover a significant portion of the cost of installing particulate control devices on under-fired charbroilers. However, there was no stakeholder interest in this program and no projects were funded under ChIP. The District released a Request for Qualifications (RFQ) for its Restaurant Charbroiler Technology Partnership (RCTP) in 2014 and received several applications that were approved to move forward with the contracting process. Multiple projects are still in the contracting phase and the District expects to begin demonstration of some of the above described control technologies by mid-2015.

The District has also been tracking and involved with technology demonstration projects for under-fired charbroilers at other agencies, including testing of control technologies for under-fired charbroilers at University of California at Riverside's Center for Environmental Research and Technology (CE-CERT). This program began in early 2012 and several tests were completed in early 2014. Additional tests are ongoing.

According to estimates submitted by manufacturers for RCTP, the initial capital costs of feasible control technologies will range from $40,000 to over $100,000, and monthly operation and maintenance costs will range from a few thousand dollars to tens of thousands of dollars. As such, it is yet to be seen whether any cost effective and

[71] SCAQMD. (2012). *Draft 2012 AQMP*. Retrieved from http://aqmd.gov/aqmp/2012aqmp/draft/Chapters/Ch4.pdf

technologically feasible control technologies will be identified and demonstrated in the next few years. However, as part of the 2016 rule amendment process, the District will examine all potential opportunities for further emissions reductions.

Evaluation Findings

The District has evaluated all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4692 currently has in place the most stringent measures feasible to implement in the Valley at this time and therefore meets or exceeds both BACM and MSM requirements for this source category.

Rule 4692 achieves significant emissions reductions from chain-driven charbroilers; however, the rule does not require emissions controls for under-fired charbroilers. Analyses indicate that extending the applicability of the rule to include under-fired units could further reduce PM2.5 emissions by as much as 20% (0.4 tpd PM2.5) from the baseline inventory for under-fired charbroilers upon implementation in 2017, thus providing significant health benefits Valley-wide per the District's Health Risk Reduction Strategy. Research and demonstration projects are underway to evaluate emission control technologies for under-fired charbroilers in support of this measure. As included in the *2012 PM2.5 Plan*, the District will amend Rule 4692 in 2016 to add requirements for under-fired charbroilers, with an anticipated compliance date of 2017. The District will also consider development of a new incentive program to assist in the deployment of new technologies upon their development and commercial availability.

C.17 RULE 4702 INTERNAL COMBUSTION ENGINES

Discussion

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, carbon monoxide (CO), volatile organic compounds (VOC), and SOx emissions from units subject to this rule.

The District's original IC engine rule, Rule 4701 (Internal Combustion Engines – Phase 1), was adopted on May 21, 1992, superseded by Rule 4702, adopted on August 21, 2003, and subsequently amended five times. The rule originally established NOx limits between 25-50 ppmv achieving 90-96% control for non-agricultural operations rich-burn engines and 65-75 ppmv achieving 85-90% control for non-agricultural operations lean-burn engines. In its continuous effort to improve air quality in the Valley, the District has adopted numerous amendments to Rule 4702 that have resulted in significant reductions of NOx and PM emissions.

Substantial emission reductions from agricultural IC engines have also been achieved through a combination of regulatory efforts and incentive actions. Rule 4702 has effectively reduced emissions from agricultural engines by 84% since the 2005 amendments to the rule, with substantial investments being made by the affected sources to comply with the rule. The rule was further strengthened in August 2011 when rule amendments implemented more stringent NOx limits as low as 11 ppmv for non-agricultural operations spark-ignited engines. Additional emission reductions are forthcoming under Rule 4702 as compliance dates for emission control requirements continue to approach over the coming years.

Source Category

An internal combustion engine is any engine that operates by burning its fuel inside the engine. Engines generate power by the combustion of an air/fuel mixture. The main types of engines are spark-ignited engines and compression-ignited (or diesel) engines. In the case of spark-ignited engines, a spark plug ignites the air/fuel mixture. Spark-ignited engines come in several designs such as: two-stroke and four-stroke, rich-burn and lean-burn, turbocharged and naturally aspirated. Spark-ignited engines may use one or more fuels, such as natural gas, propane, butane, liquefied petroleum gas, oil field gas, digester gas, landfill gas, methanol, ethanol, and gasoline.

Compression-ignited engines rely on heating of the inducted air during the compression stroke to ignite the injected diesel fuel. In addition to being classified into compression-ignited and spark-ignited, IC engines can be further divided into two-stroke and four-stroke engines. Most diesel engines are four-stroke, while larger diesel engines often are two-stroke. Natural gas fired spark-ignited engines are usually four-stroke, but some operators prefer two-stroke engines for their applications.

Engines are used by a variety of private businesses and public agencies throughout the Valley for a number of purposes, primarily for powering pumps, compressors, or electrical generators. Examples of businesses and industries that use engines include schools and universities, agriculture, oil and gas production and pipelines, petroleum

refining, manufacturing facilities, food processing, electrical power generation, landfill and waste water treatment facilities, and water districts. Many engines are limited or low use in nature, such as emergency standby engines that provide backup power when electric service is interrupted.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.49	0.49	0.48	0.40	0.31	0.30	0.29	0.28	0.27
NOx	13.06	12.85	12.50	9.21	7.22	6.82	6.57	6.37	6.09
SOx	0.12	0.12	0.12	0.09	0.08	0.08	0.08	0.08	0.08
	Winter Average - Tons per day								
PM2.5	0.36	0.36	0.35	0.30	0.24	0.23	0.23	0.22	0.21
NOx	9.44	9.29	9.03	6.82	5.51	5.24	5.07	4.93	4.72
SOx	0.10	0.10	0.09	0.08	0.07	0.07	0.07	0.07	0.07

As detailed in Chapter 5, the significance threshold for source categories for the purpose of evaluating the application of BACM and MSM requirements is 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from IC engines are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for IC engines.

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

Federal Regulations

There are no EPA Control Technique Guidelines (CTG) requirements for this source category. Rule 4702 is at least as stringent as the following applicable federal regulations:

ACT

- EPA – 453/R-93-032 (Alternative Control Techniques Document – NOx Emissions from Stationary Reciprocating Internal Combustion Engines)

The District evaluated the requirements contained within the EPA – 453/R-93-032 ACT document and found no requirements that were more stringent than those already in Rule 4702.

NSPS

- 40 CFR 60 Subpart IIII (Standards of Performance for Stationary Compression Ignition Internal Combustion Engines)

The District evaluated the requirements contained within 40 CFR 60 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)

The District evaluated the requirements contained within 40 CFR 60 Subpart JJJJ and found no requirements that were more stringent than those already in Rule 4702.

NESHAP/ MACT

- 40 CFR 63 Subpart ZZZZ (NESHAP for Stationary Reciprocating Internal Combustion Engines)

The District evaluated the requirements contained within 40 CFR 63 Subpart ZZZZ NESHAP and found no requirements that were more stringent than those already in Rule 4702.

State Regulations

The following state regulations apply to sources covered under Rule 4702:

- 17 CCR 93114 (ATCM to Reduce Particulate Emissions from Diesel-Fueled Engines—Standards for Nonvehicular Diesel Fuel)
- 17 CCR 93115 (ATCM for Stationary Compression Ignition Engines)

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

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

BAAQMD

- Regulation 9 Rule 8 (Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 8 and found no requirements that were more stringent than those already in Rule 4702.

SMAQMD

- Rule 412 (Stationary Internal Combustion Engines Located at Major Stationary Sources of NOx)

The District evaluated the requirements contained within SMAQMD's Rule 412 and found no requirements that were more stringent than those already in Rule 4702.

VCAPCD

- Rule 74.9 (Stationary Internal Combustion Engines)

The District evaluated the requirements contained within VCAPCD's Rule 74.9 and found no requirements that were more stringent than those already in Rule 4702.

SCAQMD

- Rule 1110.2 (Emissions from Gaseous- and Liquid-Fueled Engines)
- Rules 2000 – 2020 (RECLAIM program)

South Coast Air Quality Management District (SCAQMD) regulates the emissions from IC engines through a combination of control measures. SCAQMD 1110.2 is directly applicable to IC engines and includes emissions limitations for various applications. SCAQMD's RECLAIM program (Rules 2000 – 2020) allows most operators to purchase credits in lieu of instituting engine emissions controls otherwise required under SCAQMD 1110.2. Given these overlapping sets of requirements, Rule 4702 must be compared in context of both regulations. Additionally, many of the engine applications found in the San Joaquin Valley vary substantially from engine applications in SCAQMD; for example, engines used for agricultural irrigation pumping that exist in the Valley and are no longer found in SCAQMD. While not directly comparable, the following tables compare the emission limits between SCAQMD Rule 1110.2 and District Rule 4702.

Table C-19 Comparison of District and SCAQMD NOx Emission Limits for Non-Agricultural Operations (Non-AO) Spark-Ignited Waste Gas Engines Rated at >50 bhp (corrected to 15% oxygen on a dry basis)

Engine Type	District NOx Limit (ppmv)	SCAQMD NOx Limit (ppmv)
Waste Gas Fueled (Rich-Burn)	50	*Until 01-01-16* bhp ≥ 500: 36 x ECF[72] bhp < 500: 45 x ECF[1] *On and after 01-01-16* 11 ppmv
Waste Gas Fueled (Lean-Burn)	65 ppmv or 90% reduction	*Until 01-01-16* bhp ≥ 500: 36 x ECF[1] bhp <500: 45 x ECF[1] *On and after 01-01-16* 11 ppmv

[72] The efficiency correction factor (ECF) is 1.0 unless: 1) The engine operator has measured the engine's net specific energy consumption, in compliance with ASME Performance Test Code PTC 17 -1973, at the average load of the engine; and 2) the ECF-corrected emission limit is made a condition of the engine's permit to operate. The ECF is never less than 1.0 so in some cases the SCAQMD limits could potentially be less stringent than the District's NOx limits.

Table C-20 Comparison of District and SCAQMD NOx Emission Limits for Non-AO Spark-Ignited Engines Rated >50 bhp (corrected to 15% oxygen on a dry basis)

Engine Type	District NOx Limit (ppmv)	SCAQMD NOx Limit (ppmv)
1. Rich-Burn		
Rich-Burn Engine (except for below special applications)	11	11
Cyclic Loaded, Field Gas Fueled	50	11
Limited Use	25	11[73]
2. Lean-Burn Engines		
Lean-Burn Engine (except for below special applications)	11	11
Two-Stroke, Gaseous Fueled, >50 bhp and < 100 bhp	75	11
Limited Use	65	11[2]
Lean-Burn Engine used for gas compression	65 ppmv or 93% reduction	11

Table C-21 Comparison of District and SCAQMD NOx Emission Limits for Agricultural Operations (AO) Spark-Ignited Engines Rated >50 bhp (corrected to 15% oxygen on a dry basis)

Engine Type	District NOx Limit	SCAQMD NOx Limit
1. Rich-Burn	90 ppmv or 80% reduction	11
2. Lean-Burn	150 ppmv or 70% reduction	11
3. Certified and installed on or before June 16, 2005	Meet a Certified Spark-Ignited Engine Standard of HC + NOx < 0.6 g/bhp-hr	11

Medium and large operators in the South Coast Air Basin are most likely part of the South Coast RECLAIM program and are subsequently not required to meet the engine emission limitations included in Rule 1110.2. All facilities that emit over a certain threshold are required to participate in the RECLAIM program. As part of the RECLAIM program certain companies receive emission allocations every year and each allocation is good for 12 months. The portion of the allocation not needed to offset the operator's own emissions can be sold to other companies. If the operator does not receive an emission allocation, they must buy emission credits from operators with unused emission allocations. In this way, the RECLAIM program is similar to a cap-and-trade program. The District does not have a RECLAIM-type program for this source category and all operators are required to meet the stringent emission limitations included in Rule 4702.

[73] SCAQMD exempt units that operate less than 500 hours from this limit; District defines "limited use" units as those operating less than 4,000 hours and only exempts engines operating less than 200 hours.

Although the SCAQMD emission level of 11 ppm has not yet been proven as technologically feasible in agricultural settings and it is unclear what percentage of facilities are complying with the current SCAQMD NOx limits for non-ag categories, the District evaluated the cost-effectiveness and feasibility of implementing an 11 ppmv NOx emission limit for the following categories of IC engines:

- Non-Agricultural Operations (Non-AO) Waste Gas Engines
- Non-AO Spark-Ignited Engines
  - Cyclic Loaded, Field Gas Fueled
  - Limited Use Engines
    - Lean-Burn Engines
    - Rich-Burn Engines
  - Two-Stroke, Gaseous Fueled Engines 50-100 bhp
  - Lean-Burn Engines Used for Gas Compression
- Agricultural Operations (AO) Spark-Ignited Engines

The District also evaluated the cost-effectiveness and feasibility of implementing intermediate NOx emission limits for AO spark-ignited engines that more closely match the current NOx emission limits for non-AO limited use rich-burn and lean-burn engines. The following analyses were conducted:

- 25 ppmv NOx emission limit for AO Rich-Burn Spark-Ignited Engines
- 65 ppmv NOx emission limit for AO Lean-Burn Spark-Ignited Engines

To determine potential emissions reductions, the District used the following equations:

NOx = (BHP x HR x EF x LF) / (CF)

Where:

NOx = Current annual NOx emissions or potential annual NOx emissions in ton/year
BHP = engine power
HR = annual hours of operation
EF = NOx emission factor
LF = engine load factor
CF = conversion factor from grams to pounds

The estimated annual NOx emissions reduction was calculated using the following equation:

Potential Emissions Reduction = current annual NOx emissions – potential NOx annual NOx emissions

NOx Emission Limitation for Non-Agricultural Operations (Non-AO) Waste Gas Engines:

The District analyzed the technological feasibility of lowering the NOx emission limit for waste gas engines and determined that due to the variability of waste gas, additional levels of NOx control on existing waste gas engines can pose significant technical and feasibility challenges. Waste gas includes landfill gas, which is generated at landfills, and digester gas, which is generated from anaerobic digestion. Both landfill and digester gas result from the decomposition of organic matter by microorganisms in the absence of oxygen. Unlike pipeline natural gas, the composition of waste gas is not consistent or guaranteed. The heating value and composition of the gas (e.g. methane and oxygen contents) will vary with the type of materials that enter the landfill or digester and can also fluctuate seasonally or even daily. Both landfill and digester gases contain impurities, such as siloxanes, sulfur compounds, and halides. Landfill gas also contains entrained particulate matter, and both landfill and digester gas may contain particulate that results from combustion of the impurities in the gas. The contaminants in waste gas can coat and/or poison catalysts, rendering them ineffective. Because of its variable composition and contaminants, untreated waste gas is not interchangeable with pipeline-quality natural gas and extensive and costly cleanup would be necessary to allow the use of catalytic emission controls needed to achieve 11 ppmv. This is not a practical option for most existing waste gas-fired engines, which were not designed to include the required gas systems and catalytic controls.

In addition to the District's efforts to identify additional potential technology options for this category, SCAQMD has also been evaluating this issue. In February 2008, SCAQMD amended Rule 1110.2 to include an 11 ppmv limit for waste gas engines rated at >50 bhp. The original compliance date for this emissions limit was July 1, 2012, with the assumption that SCAQMD would complete a Technology Assessment to verify the feasibility of available control technologies for waste gas engines. However, SCAQMD had to amend Rule 1110.2 in September 2012 to extend the compliance deadline for waste gas engines from 2012 to 2016 in order to allow for more time to complete their Final Technology Assessment, which is currently still incomplete and has yet to identify feasible technology options. Additionally, these sources may also be in a position to avoid installing additional NOx control technologies through their participation in SCAQMD's RECLAIM program.

District Rule 4702 contains the most stringent limits feasible for existing waste gas-fueled engines based on the use of combustion processes that minimize emissions without the use of post-combustion catalytic controls. Therefore, Rule 4702 meets or exceeds BACM and MSM for non-AO waste gas fueled spark-ignited engines. Additionally, the District continues to investigate potential NOx and SOx control technologies for waste gas engines through its Technology Advancement Program, with projects currently approved for funding that will continue to demonstrate new technologies in this sector.

NOx Emission Limitation for Non-AO Spark-Ignited Engines:

Cyclic Loaded, Field Gas Fueled

Cyclic-loaded, field gas fueled engines can achieve some level of control, but not the stringent level of control that can be imposed on engines that operate in a narrow and more stable range of loads. The exhaust gas temperature of cyclic loaded engines varies as a function of the engine load; however, catalyst chemistry is dependent on a minimum temperature to be effective in reducing emissions. When the cyclic load engine is operating in a particular engine load range, the exhaust gas temperature can reach the catalyst's effective range and allow for emissions to be well-controlled; however, as the engine cycles out of this load range, the exhaust gas temperature becomes too low for effective emissions control. Since the exhaust temperature fluctuates frequently for this category of units, it is technologically infeasible to require a lower NOx limit for cyclic loaded field-gas fueled engines. The current emission limit for this category of engines meets or exceeds BACM and MSM for these sources.

Limited Use Engines

During the 2011 amendments to Rule 4702, the District created this category of engines based on the high costs and cost effectiveness associated with the installation of additional controls for these engines (> 4,000 hours of operation). As discussed in the staff report, the NOx emission reductions foregone from not lowering the existing NOx limits to 11 ppmv for limited use engines was insignificant (about 0.004 tons per day in 2011).[74]

However, since the evaluation was conducted in 2011, the District re-evaluated the cost effectiveness of lowering the NOx emission limits to 11 ppmv for limited use non-AO rich-burn and lean-burn engines. The costs in the analyses below were gathered from information in the District's Permits database, IC engine manufacturers, and operators.

Limited Use Lean-Burn Engines

When evaluating the ability to lower NOx emissions to 11 ppmv, an operator can either retrofit the existing lean-burn IC engine with a selective catalytic reduction (SCR) system or install a new lean-burn engine with an SCR system. In many cases, retrofitting an existing IC engine is technologically infeasible or may require substantial additional unanticipated costs (such as the incompatibility of an older engine with less sophisticated operating controls with additional control technology, additional labor/maintenance costs, etc.). However, for the purpose of evaluating all potential controls, the District has included both options in the below analysis.

[74] SJVAPCD. (2011, August 18). *Adopt Revised Proposed Amendments to Rule 4702 (Internal Combustion Engines).* Retrieved from http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2011/August/Agenda_Item_10_Aug_18_2011.pdf

Table C-22 Annual Costs for Retrofitting an Existing Limited Use Lean-Burn Engine and Installing a New Limited Use Lean-Burn Engine with SCR

Item	Assumptions/Methodology	Cost
Average Engine Power Rating	1100 brake horsepower (bhp)	n/a
Annual Operation	2500 hours (hr)	n/a
Capital Costs		
New Engine Cost (without SCR)	Includes: engine, freight, installation, start-up, additional equipment (belt guards, fuel connection, etc.), and tax	$110,656
Annualized Engine Capital Costs (10 years, 10%)	0.163 x New Engine Cost	**$18,037**
SCR Equipment Costs		
SCR System	$73,000 per engine	$73,000
550 gallon double wall plastic urea tank and accessories	$5,270 per tank	$5,270
3 hp rotary screw air compressor with dryer and receiver tank	$5,875 per compressor package	$5,875
Total SCR Equipment Costs	Equipment costs x 20% profit/mark-up	$100,974
SCR Installation Costs		
Start-up and Commissioning Rate	$1,500/day; assume 1 day for each system	$1,500
Electrical upgrade to power compressor	n/a	$0
Total SCR Installation Costs		$1,500
Total SCR Capital Costs	SCR Equipment Costs + SCR Installation Costs	$102,474
Annualized SCR Capital Costs (10 years, 10%)	0.163 x Total SCR Capital Costs	**$16,703**
Annual Operating and Maintenance Costs		
Annual Reagent (urea) Cost	$3 per gallon; 1 gallon/hr Cost = $3 x 2500 hr	$7,500
Annual Increase in Fuel Cost (due to drop in fuel efficiency with SCR)	Fuel usage = 9,322.5 standard cubic feet per hour (scf/hr) Fuel cost (per 1,000 scf) = $7.36 Fuel cost (per hour) = (9,322.5 x $7.36) / 1000 Fuel cost (per year) = hourly cost x 2500 hr 2.5% drop in fuel efficiency Added Fuel Cost = Annual fuel cost x 2.5%	$4,288
Annual Electricity Cost (for compressor)	3 hp compressor = 2.24 kW power rating Electricity rate for industrial operations = $0.132/kW-hr Hourly electricity cost = 2.24 kW x $0.132/kW-hr Daily meter charge = $49.281 Annual electricity cost = hourly cost x 2500 hr Annual meter charge = daily meter charge x 365 days Total utility cost = Annual electricity cost + Annual meter charge	$18,728

Item	Assumptions/Methodology	Cost
Annual Catalyst Cost	Life of catalyst = 5 years Cost per catalyst = $5,000 Catalyst costs for 10 years = $5,000 x 2 Annualized cost = $10,000 x 0.163	$1,630
Annual Maintenance Cost	Maintenance = $0.02 per bhp per hour of operation Annual cost = $0.02 x 1,100 bhp x 2500 hr	$55,000
Annual Operating & Maintenance (O&M) Costs	Annual O&M = Annual Reagent Cost+ Annual Increase in Fuel Cost + Annual Electricity Cost + Annual Catalyst Cost + Annual Maintenance Cost	**$87,147**
Annual Cost for Retrofit of LB Engine with SCR	Annualized SCR Capital Cost + Annual O&M Cost	**$103,850**
Annual Cost for New LB Engine with SCR	Annualized Engine Capital Cost + Annualized SCR Capital Cost + Annual O&M Cost	**$121,887**

The emissions reductions are calculated below:

BHP = 1,100 bhp
HR = 2,500 hours/year (hr/yr)
EF1 = 0.78 g-NOx/bhp-hr (equivalent to 65 ppmvd NOx at 15% O2; assuming 35% thermal efficiency)
EF2 = 0.132 g-NOx/bhp-hr (equivalent to 11 ppmvd NOx at 15% O2; assuming 35% thermal efficiency)
LF = 0.8
CF = 453.6 grams/pound (g/lb)

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (1,100 bhp x 2500 hr/yr x 0.78 g-NOx/bhp-hr x 0.8) / (453.6 g/lb)
= 3,783 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (1,100 bhp x 2500 hr/yr x 0.132 g-NOx/bhp-hr x 0.8) / (453.6 g/lb)
= 640 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (3,783-640 lb) x (1 ton / 2,000 lb)
Potential Emissions Reduction = 1.57 tons/year

Cost Effectiveness

The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of retrofitting or replacing current limited use lean-burn spark-ignited engines is as follows:

- Retrofitted limited use lean-burn engine with SCR: $66,086/ton of NOx reduced
- New limited use lean-burn engine with SCR: $77,564/ton of NOx reduced

As demonstrated in the analysis and summary above, it is not cost effective to require the retrofit or replacement of limited use lean-burn engines to achieve 11 ppmv.

Limited Use Rich-Burn Engines

When evaluating the ability to lower NOx emissions to 11 ppmv, an operator will generally retrofit the existing rich-burn IC engine with a nonselective catalytic reduction (NSCR) system. In many cases, retrofitting an existing IC engine is technologically infeasible or may require substantial additional unanticipated costs (such as the incompatibility of an older engine with less sophisticated operating controls with additional control technology, additional labor/maintenance costs, etc.). However, for the purpose of evaluating potential controls in this category, the District has included the less costly, potentially feasible scenario of retrofitting an existing rich-burn engine with NSCR in the below analysis.

Table C-23 Annual Costs for Retrofitting an Existing Limited Use Rich-Burn Engine

Item	Assumptions/Methodology	Cost
Average Engine Power Rating	500 bhp	n/a
Annual Operation	2500 hours (hr)	n/a
Capital Costs		
New Catalyst System	Includes: catalyst, air-to fuel ratio controller, ignition system, and installation	$75,000
Annualized Catalyst Capital Cost (10 years, 10%)	0.163 x New Catalyst System	**$12,225**
Annual Cost for Retrofit of RB Engine with New Catalyst	Annualized Catalyst Capital Cost	**$12,225**

The emissions reductions are calculated below:

BHP = 500 bhp
HR = 2,500 hours/year (hr/yr)
EF1 = 0.30 g-NOx/bhp-hr (equivalent to 25 ppmvd NOx at 15% O2; assuming 35% thermal efficiency)
EF2 = 0.132 g-NOx/bhp-hr (equivalent to 11 ppmvd NOx at 15% O2; assuming 35% thermal efficiency)
LF = 0.8
CF = 453.6 grams/pound (g/lb)

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (500 bhp x 2500 hr/yr x 0.30 g-NOx/bhp-hr x 0.8) / (453.6 g/lb)
= 661 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (500 bhp x 2500 hr/yr x 0.132 g-NOx/bhp-hr x 0.8) / (453.6 g/lb)

= 291 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (661 - 291 lb) x (1 ton / 2,000 lb)
Potential Emissions Reduction = 0.19 tons/year

Cost Effectiveness

The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of retrofitting or replacing current limited use rich-burn spark-ignited engines is as follows:

- Retrofitted limited use rich-burn non-AO engine with new catalyst: $66,015/ton of NOx reduced

As demonstrated in the analysis and summary above, it is not cost effective to require the retrofit or replacement of limited use rich-burn engines to achieve 11 ppmv, even without including additional substantial costs, such as annual operating and maintenance costs.

Two-Stroke, Gaseous Fueled Engines 50-100 bhp

There is no control technology compatible with two-stroke, gaseous fueled engines, including SCR, which will allow these units to achieve a NOx emission limit below 75 ppmv. An 11 ppmv NOx emission limit is not technologically feasible for these engines; the current limit implements BACM and MSM for two-stroke, gaseous fueled engines less than 100 bhp.

Lean-Burn Engines Used in Gas Compression

Similar to the "Limited Use" engine category, during the 2011 amendments to Rule 4702, the District created this category of engines based on the technological infeasibility to control these types of engines. Lean-burn engines used in gas compression in the Valley are used in natural gas distribution and storage service, and these engines frequently experience changing load conditions. As noted in EPA's Stationary IC Engine Technical Support Document[75], SCR use is problematic for these engines due to the fluctuations over a broad range of conditions. For this reason, EPA states that there is an insufficient basis to conclude that SCR is an appropriate technology for large lean-burn engines used for gas compression. The current emission limit is achievable through low-NOx combustion technology, which includes changes to the engine's timing, enhanced control of the air-fuel ratio, and other changes that lower NOx emissions. Due to the technological complexities associated with lean-burn engines used in gas compression, the current emissions limit implements BACM and MSM for these units.

[75] EPA. (2003, October). *Stationary Reciprocating Internal Combustion Engines Technical Support Document for NOx SIP Call*.

NOx Emission Limitation for AO Spark-Ignited Engines:

Potential methods for reducing NOx emissions from Agriculture Operation (AO) spark-ignited engines include retrofitting them with emission control technologies or replacing them. As the below analysis demonstrates, given the high costs and limited seasonal nature of operation of AO spark-ignited engines, requiring additional controls beyond the existing stringent requirements is not cost-effective and often technologically infeasible. Despite the technological feasibility issues associated with retrofitting or replacing existing AO spark-ignited engines, the District evaluated the cost effectiveness and feasibility of achieving an 11 ppmv NOx emission limit for the following scenarios:

- Installing a new IC lean-burn engine with SCR as a replacement for an existing unit
- Retrofitting an existing lean-burn IC engine with SCR
- Installing a new rich-burn engine with a three-way catalyst system as a replacement for an existing unit

The District also evaluated the cost effectiveness and feasibility of achieving intermediate NOx emission limits of 25 ppmv for AO rich-burn spark-ignited engines and a 65 ppmv for lean-burn spark-ignited engines, similar to the corresponding limited use engine limits for non-AO engines. The scenarios evaluated include:

- Installing a new IC lean-burn engine as a replacement for an existing unit to meet 65 ppmv
- Installing a new rich-burn engine with a three-way catalyst system as a replacement for an existing unit to meet 25 ppmv

The costs in the analyses below were gathered from information in the District's Permits database, IC engine manufacturers, and agricultural industry representatives.

AO Lean-Burn Engines (11 ppmv)

When evaluating the ability to lower NOx emissions to 11 ppmv, an agricultural operator can either retrofit the existing lean-burn IC engine with a selective catalytic reduction (SCR) system or install a new lean-burn engine with an SCR system.

Table C-24 Annual Costs for Retrofitting an Existing AO Lean-Burn Engine with SCR and Installing a New AO Lean-Burn Engine with SCR

Item	Assumptions/Methodology	Cost
Average Engine Power Rating	241 brake horsepower (bhp)	n/a
Annual Operation	2500 hours (hr)	n/a
Capital Costs (Engine)		
New Engine Cost (without SCR)	Includes: engine, freight, installation, start-up, additional equipment (belt guards, fuel connection, etc.), and tax	$109,480
Annualized Engine Capital Costs (10 years, 10%)	0.163 x New Engine Cost	**$17,845**
SCR Equipment Costs		
SCR System	$73,000 per engine	$73,000
550 gallon double wall plastic urea tank and accessories	$5,270 per tank	$5,270
3 hp rotary screw air compressor with dryer and receiver tank	$5,875 per compressor package	$5,875
Total SCR Equipment Costs	Equipment costs x 20% profit/mark-up	$100,974
SCR Installation Costs		
Start-up and Commissioning Rate	$1,500/day; assume 1 day for each system	$1,500
Electrical upgrade to power compressor	$43.22/foot; avg. 1,020 feet to extend electrical line	$44,084
Total SCR Installation Costs		$45,584
Total SCR Capital Costs	SCR Equipment Costs + SCR Installation Costs	$146,558
Annualized SCR Capital Costs (10 years, 10%)	0.163 x Total SCR Capital Costs	**$23,889**
Annual Operating and Maintenance Costs (SCR)		
Annual Reagent (urea) Cost	$3 per gallon; 1 gallon/hr Cost = $3 x 2500 hr	$7,500
Annual Increase in Fuel Cost (due to drop in fuel efficiency with SCR)	Fuel usage = 1750.7 standard cubic feet per hour (scf/hr) Fuel cost (per 1,000 scf) = $7.36 Fuel cost (per hour) = (1,750.7 x $7.36) / 1000 Fuel cost (per year) = hourly cost x 2500 hr 2.5% drop in fuel efficiency Added Fuel Cost = Annual fuel cost x 2.5%	$805
Annual Electricity Cost (for compressor)	3 hp compressor = 2.24 kW power rating Electricity rate for AO = $0.136/kW-hr Hourly electricity cost = 2.24 kW x $0.136/kW-hr Annual electricity cost = hourly cost x 2500 hr	$761
Annual Catalyst Cost	Life of catalyst = 5 years Cost per catalyst = $5,000 Catalyst costs for 10 years = $5,000 x 2 Annualized cost = $10,000 x 0.163	$1,630
Annual Maintenance Cost	Maintenance = $0.02 per bhp per hour of operation Annual cost = $0.02 x 241 bhp x 2500 hr	$12,050

Item	Assumptions/Methodology	Cost
Annual Operating & Maintenance (O&M) Costs	Annual O&M = Annual Reagent Cost+ Annual Increased Fuel Cost + Annual Electricity Cost + Annual Catalyst Cost + Annual Maintenance Cost	**$22,746**
Annual Cost for Retrofit of LB Engine with SCR	Annualized SCR Capital Cost + Annual O&M Cost	**$46,635**
Annual Cost for New LB Engine with SCR	Annualized Engine Capital Cost + Annualized SCR Capital Cost + Annual O&M Cost	**$64,480**

*The values within this table are rounded.

The emissions reductions are calculated below:

BHP = 241 bhp
HR = 2,500 hours/year (hr/yr)
EF1 = 2.092 g-NOx/bhp-hr (equivalent to 150 ppmv)
EF2 = 0.132 g-NOx/bhp-hr (equivalent to 11 ppmv)
LF = 0.65
CF = 453.6 grams/pound (g/lb)

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (241 bhp x 2500 hr/yr x 2.092 g-NOx/bhp-hr x 0.65) / (453.6 g/lb)
= 1,806 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (241 bhp x 2500 hr/yr x 0.132 g-NOx/bhp-hr x 0.65) / 453.6
= 114 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (1806-114 lb) x (1 ton / 2,000 lb)
Potential Emissions Reduction = 0.85 tons/year

Cost Effectiveness (AO Lean-Burn, 11 ppmv)

The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of retrofitting or replacing current AO lean-burn spark-ignited engines is as follows:

- Retrofitted lean-burn engine with SCR: $55,118/ton of NOx reduced
- New lean-burn engine with SCR: $76,209/ton of NOx reduced

In addition to the unique feasibility issues that AOs face with regards to the installation and maintenance of IC engines (see below), the cost effectiveness values above demonstrate that it is not cost effective to retrofit or replace existing AO lean-burn engines with new more controlled engines.

AO Lean-Burn Engines (65 ppmv)

When evaluating the ability to lower NOx emissions to 65 ppmv, an agricultural operator would have to replace the existing lean-burn IC engine with a new lean-burn engine certified to meet 65 ppmv.

Table C-25 Annual Costs for Installing a New AO Lean-Burn Engine

Item	Assumptions/Methodology	Cost
Average Engine Power Rating	241 brake horsepower (bhp)	n/a
Annual Operation	2500 hours (hr)	n/a
Capital Costs (Engine)		
New Engine Cost (without SCR)	Includes: engine, freight, installation, start-up, additional equipment (belt guards, fuel connection, etc.), and tax	$109,480
Annualized Engine Capital Costs (10 years, 10%)	0.163 x New Engine Cost	**$17,845**
Annual Operating and Maintenance Costs		
Annual Maintenance Cost	Maintenance = $0.01 per bhp per hour of operation Annual cost = $0.01 x 241 bhp x 2500 hr	**$6,025**
Annual Cost for New LB Engine	Annualized Engine Capital Cost + Annual O&M Cost	**$23,870**

*The values within this table are rounded.

The emissions reductions are calculated below:

BHP = 241 bhp
HR = 2,500 hours/year (hr/yr)
EF1 = 2.092 g-NOx/bhp-hr (equivalent to 150 ppmv)
EF2 = 0.78 g-NOx/bhp-hr (equivalent to 65 ppmv)
LF = 0.65
CF = 453.6 grams/pound (g/lb)

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (241 bhp x 2500 hr/yr x 2.092 g-NOx/bhp-hr x 0.65) / (453.6 g/lb)
= 1,806 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (241 bhp x 2500 hr/yr x 0.78 g-NOx/bhp-hr x 0.65) / 453.6
= 673 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (1806-673 lb) x (1 ton / 2,000 lb)
Potential Emissions Reduction = 0.57 tons/year

Cost Effectiveness (AO Lean-Burn, 65 ppmv)

The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of replacing current AO lean-burn spark-ignited engines is as follows:

- New lean-burn engine: $42,146/ton of NOx reduced

In addition to the unique feasibility issues that AOs face with regards to the installation and maintenance of IC engines (see below), the cost effectiveness value above demonstrates that it is not cost effective to replace existing AO lean-burn engines with newer less polluting engines.

AO Rich-Burn Engines (11 ppmv)

When evaluating the ability to lower NOx emissions to 11 ppmv, an agricultural operator can install a new rich-burn engine with 3-way catalyst.

Table C-26 Annual Cost for Installing a New AO Rich-Burn Engine with a 3-way Catalyst

Item	Assumptions/Methodology	Cost
Average Engine Power Rating	256 bhp	n/a
Annual Operation	2500 hr	n/a
Total Capital Costs		
New Engine Cost	Includes: engine with 3-way catalyst, freight, installation, and tax	$95,000
Annualized Engine Capital Costs (10 years, 10%)	0.163 x New Engine Cost	**$15,485**
Annual Operating and Maintenance Costs (SCR)		
Annual Added Fuel Cost (due to drop in fuel efficiency with catalyst)	Fuel usage = 1,859.7 scf/hr Fuel cost (per 1,000 scf) = $7.36 Fuel cost (per hour) = (1,859.7 x $7.36) / 1000 Fuel cost (per year) = hourly cost x 2500 hr Assume 2.5% drop in fuel efficiency Added Fuel cost = Annual fuel cost x 2.5%	$855
Annual Catalyst Cost	Life of catalyst = 5 years Cost per catalyst = $5,000 Catalyst costs for 10 years = $5,000 x 2 Annualized Catalyst Cost = $10,000 x 0.163	$1,630
Annual Maintenance Cost	Maintenance = $0.02 per bhp per hour of operation Annual Maintenance Cost = $0.02 x 256 bhp x 2500 hr	$12,800
Annual Operating & Maintenance (O&M) Costs	Annual O&M = Annual Added Fuel Cost + Annual Catalyst Cost + Annual Maintenance Cost	**$15,285**
Annual Cost for New RB Engine with 3-way	Annualized Engine Capital Cost + Annual O&M Cost	**$30,770**

*The values within the above table are rounded.

The emissions reductions are calculated below:

BHP = 256 bhp
HR = 2,500 hours/year
EF1 = 1.255 g-NOx/bhp-hr (equivalent to 90 ppmv)
EF2 = 0.132 g-NOx/bhp-hr (equivalent to 11 ppmv)
LF = 0.65
CF = 453.6 grams/pound

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (256 bhp x 2500 hr/yr x 1.255 g-NOx/bhp-hr x 0.65) / 453.6
= 1,151 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (256 bhp x 2500 hr/yr x 0.132 g-NOx/bhp-hr x 0.65) / 453.6
= 121 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (1,151-121 lb) x (1 ton / 2,000 lb)
Potential Emissions Reduction = 0.52 tons/year

Cost Effectiveness (AO Rich-Burn, 11 ppmv)
The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of replacing current AO rich-burn engines is as follows:

- New rich-burn engine with a 3-way catalyst to meet 11 ppmv: $59,754/ton of NOx reduced

In addition to the unique feasibility issues that AOs face with regards to the installation and maintenance of IC engines (see below), the cost effectiveness value above demonstrates that it is not cost effective to replace existing AO spark-ignited engines with new controlled engines.

AO Rich-Burn Engines (25 ppmv)
In order to meet a 25 ppmv, an agricultural operator would have to install a new rich-burn engine with a slightly less expensive catalyst compared to the catalyst needed to meet 11 ppmv.

Table C-27 Annual Cost for Installing a New AO Rich-Burn Engine with a 3-way Catalyst

Item	Assumptions/Methodology	Cost
Average Engine Power Rating	256 bhp	n/a
Annual Operation	2500 hr	n/a
Total Capital Costs		
New Engine Cost	Includes: engine with 3-way catalyst, freight, installation, and tax	$95,000
Annualized Engine Capital Costs (10 years, 10%)	0.163 x New Engine Cost	**$15,485**
Annual Operating and Maintenance Costs (SCR)		
Annual Added Fuel Cost (due to drop in fuel efficiency with catalyst)	Fuel usage = 1,859.7 scf/hr Fuel cost (per 1,000 scf) = $7.36 Fuel cost (per hour) = (1,859.7 x $7.36) / 1000 Fuel cost (per year) = hourly cost x 2500 hr Assume 2.5% drop in fuel efficiency Added Fuel cost = Annual fuel cost x 2.5%	$855
Annual Catalyst Cost	Life of catalyst = 5 years Cost per catalyst = $4,000 Catalyst costs for 10 years = $4,000 x 2 Annualized Catalyst Cost = $8,000 x 0.163	$1,304
Annual Maintenance Cost	Maintenance = $0.02 per bhp per hour of operation Annual Maintenance Cost = $0.02 x 256 bhp x 2500 hr	$12,800
Annual Operating & Maintenance (O&M) Costs	Annual O&M = Annual Added Fuel Cost + Annual Catalyst Cost + Annual Maintenance Cost	**$14,959**
Annual Cost for New RB Engine with 3-way	Annualized Engine Capital Cost + Annual O&M Cost	**$30,444**

*The values within the above table are rounded.

The emissions reductions are calculated below:

BHP = 256 bhp
HR = 2,500 hours/year
EF1 = 1.255 g-NOx/bhp-hr (equivalent to 90 ppmv)
EF2 = 0.30 g-NOx/bhp-hr (equivalent to 25 ppmv)
LF = 0.65
CF = 453.6 grams/pound

Current NOx = (BHP x HR x EF1 x LF) / (CF)
= (256 bhp x 2500 hr/yr x 1.255 g-NOx/bhp-hr x 0.65) / 453.6
= 1,151 lb-NOx/year

Potential NOx = (BHP x HR x EF2 x LF) / (CF)
= (256 bhp x 2500 hr/yr x 0.30 g-NOx/bhp-hr x 0.65) / 453.6

= 275 lb-NOx/year

Potential Emissions Reduction = Current NOx – Potential NOx
Potential Emissions Reduction = (1,151-275 lb) x (1 ton / 2,000 lb)
Potential Emissions Reduction = 0.44 tons/year

Cost Effectiveness (AO Rich-Burn, 25 ppmv)

The cost effectiveness is the added cost, in dollars per year, of the control technology, divided by the emissions reductions achieved, in tons per year. Based on the calculations above, the cost effectiveness of replacing current AO rich-burn engines is as follows:

- New rich-burn engine with a 3-way catalyst to meet 25 ppmv: $69,521/ton of NOx reduced

In addition to the unique feasibility issues that AOs face with regards to the installation and maintenance of IC engines (see below), the cost effectiveness values above demonstrate that it is not cost effective to replace existing AO spark-ignited engines with new controlled engines.

Other Feasibility Considerations AO Spark-Ignited Engines

In addition to the high cost-effectiveness and potential infeasibility associated with retrofitting or replacing existing AO spark-ignited engines currently regulated under Rule 4702, requiring additional costly controls on AO engines is economically challenging and potentially infeasible. Unlike most other industries, AOs cannot pass increased production costs on to consumers, thereby forcing AOs to absorb the compliance costs associated with costly additional retrofits and replacements. Over the past decade, AOs have invested significant capital to retrofit and replace thousands of irrigation pump and other engines reducing emissions by over 80% in this category, and continue to do so as emission limitations and associated compliance deadlines materialize under Rule 4702.

Additionally, AO spark-ignited engines are generally located in rural, hard to access areas with minimal oversight due to limited resources and staffing. With seasonal labor and minimal year-round staffing, it is difficult for AOs to provide the frequent and complex maintenance required for retrofitted or new engines equipped with advanced emission controls. The oil production industry is the only other major industry in the Valley that has IC engines located in remote locations; however, with the highly technical nature of oil production and refining as compared to agricultural production and additional economic resources, it is feasible for the oil and gas production industry to hire qualified staff dedicated to maintaining and operating IC engines and other equipment on-site.

Additional Emission Reduction Opportunities

SOx and PM limitations

Rule 4702 contains stringent requirements requiring the combustion of Public Utilities Commission (PUC) quality natural gas, or other equivalent ultra-low sulfur fuels, and diesel engines subject to Rule 4702 are required to be EPA Tier 3 or Tier 4 certified, depending on the size of the engine and the annual operating hours. EPA Tier 3 and 4 certifications require the units to meet low PM limits and Tier 4 engines are required to meet even lower PM emissions through the use of particulate filters. Given the low PM2.5 and SOx emissions from IC engines and existing rule requirements, the District determined that no further requirements were needed to address PM2.5 and SOx emissions.

Emission limitation exemptions for emergency standby engines and low-use engines

The existing requirements are consistent with Air Resources Board (ARB) RACT/BARCT Determination for Spark-Ignited Engines and ARB Airborne Toxics Control Measures (ATCM). Since these units are used only for emergencies or in very limited capacities, emissions from these units are relatively minor, and requiring additional emissions controls would likely not be cost effective.

Non-Regulatory Actions

The District implements a stationary agricultural irrigation pump engine program as a component of the *Heavy-Duty Engine Program*. This program provides incentives for both the conversion of Tier 1 and Tier 2 engines to lower NOx and PM-emitting Tier 4 engines and for the electrification of diesel engines, as the District highly prioritizes electrification efforts to achieve zero and near-zero emissions from engines. The District's legislative platform[76] includes support for incentive funding through the Carl Moyer Program. Continued support of this funding stream will continue to provide incentives for accelerated reductions from IC engines.

Meeting air quality standards requires transformative measures and technologies to achieve near zero emissions. In order to further develop technology to close the gap in required emissions reductions, the District operates a Technology Advancement Program (TAP). Along with its own resources, the District seeks state and federal assistance through its legislative platform to advance technologies to reduce emissions in the Valley. District TAP projects seek innovations in several areas of technology including IC engines. While no technologies to reduce emissions from IC engines have been achieved in practice yet, these projects may provide the basis for future feasible, SIP-creditable emission reductions.

[76] SJVAPCD. (January 2015). *Legislative Platform 2015.* http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2015/January/final/10.pdf

Evaluation Findings

Even though IC engines are not a significant source of PM2.5 or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4702 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce NOx emissions from IC engines in the Valley.

C.18 RULE 4703 STATIONARY GAS TURBINES

Discussion

The provisions of this rule are applicable to all stationary gas turbine systems, which are subject to District permitting requirements, and with electrical generation ratings equal to or greater than 0.3 megawatt (MW) or a maximum heat input rating of more than 3 million British Thermal Units per hour (MMBtu/hr), and that are used for the generation of electrical power. The purpose of this rule is to limit NOx emissions from these stationary gas turbines.

Rule 4703 was adopted on August 18, 1994. Since its adoption, the rule has been amended six times. The latest rule amendment in September 2007 strengthened the rule by establishing more stringent NOx limits for existing stationary gas turbines. EPA finalized approval for Rule 4703 on October 21, 2009 and deemed this rule as being at least as stringent as established RACT requirements. NOx emissions have been controlled by over 86% for this source category.

Source Category

The requirements of Rule 4703 affect owners and operators of stationary gas turbine systems used to pump, compress, generate electricity, or perform other tasks. The four major industry groups are oil and gas production, utilities, manufacturing, and government.

In complying with the rule, all affected entities are required to control NOx and CO emissions by installing approved emissions control devices. Early in the rule development process, the District identified five different emissions control technologies that could be used to achieve proposed limits for stationary gas turbines. Of the five options, four mainly control NOx emissions, while the other one controls CO emissions. The four NOx control technologies are:

- Dilutant (water or steam) injection systems,
- Dry, low-NOx,
- Selective catalytic reduction, and
- SCONOx

Costs associated with different compliance options vary a great deal depending on technologies and available products. Depending on the size of the existing turbine systems, engine model and make, type of existing emissions control equipment, and many other factors, owners and operators of stationary gas turbine systems face different compliance costs. The impacts of Rule 4703 have been concentrated in the oil and gas production sector and utilities sector of the Valley, as they own and operate the vast majority of stationary gas turbines subject to the rule.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	1.22	1.28	1.14	1.09	1.11	1.14	1.14	1.14	1.10
NOx	3.09	3.23	2.89	2.77	2.83	2.89	2.90	2.92	2.81
SOx	0.22	0.23	0.20	0.19	0.19	0.20	0.20	0.20	0.19
	Winter Average - Tons per day								
PM2.5	1.21	1.27	1.13	1.08	1.10	1.13	1.13	1.14	1.09
NOx	3.00	3.14	2.82	2.70	2.76	2.82	2.83	2.84	2.74
SOx	0.21	0.23	0.20	0.19	0.19	0.20	0.20	0.20	0.19

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from stationary gas turbines are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for stationary gas turbines.

How does District Rule 4703 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG requirements for this source category.

ACT

- EPA–435/R-93-007 (Alternative Control Techniques Document—NOx Emissions from Stationary Gas Turbines)

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.

NSPS

- 40 CFR 60 Subpart GG (Standards of Performance for Stationary Gas Turbines)

The District evaluated the requirements contained within 40 CFR 60 Subpart GG and found no 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 above NSPS and found no requirements that were more stringent than those already in Rule 4703.

NESHAP/ MACT

- 40 CFR 63 Subpart YYYY (NESHAP for Stationary Combustion Turbines)

The District evaluated the requirements contained within 40 CFR 63 Subpart YYYY and found no 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?

SCAQMD

- Rule 1134 (Emissions of Oxides of Nitrogen from Stationary Gas Turbines)

The District evaluated the requirements contained within SCAQMD's Rule 1134 and found no requirements that were more stringent than those already in Rule 4703.

BAAQMD

- Regulation 9 Rule 9 (Nitrogen Oxides from Stationary Gas Turbines)

The District evaluated the requirements contained within BAAQMD's Regulation 9 Rule 9 and found no requirements that were more stringent than those already in Rule 4703.

SMAQMD

- Rule 413 (Stationary Gas Turbines)

The District evaluated the requirements contained within SMAQMD's Rule 413 and found no requirements that were more stringent than those already in Rule 4703.

VCAPCD

- Rule 74.23 (Stationary Gas Turbines)

The District evaluated the requirements contained within VCAPCD's Rule 74.23 and found no requirements that were more stringent than those already in Rule 4703.

Additional Emission Reduction Opportunities

The District has adopted numerous rule amendments to the turbine rule that have successfully and significantly reduced emissions from this source category. The emissions inventory for NOx from turbines has been reduced from 31.9 tpd in 1994 to 2.77 tpd in 2015. Significant emission reductions have been achieved through the implementation of the most stringent regulations in the nation for this source category and significant investments by stakeholders to implement effective and innovative emission control technologies. Given the significant efforts and investments already made to reduce emissions from this source category, there are little remaining feasible opportunities for obtaining additional emissions reductions.

BACT Comparisons

Comparisons of this rule with the District, BAAQMD, and SCAQMD BACT requirements showed that some BACT emissions limits are more stringent than Rule 4703 limits. For units greater than 3 MW, some of the District's NOx limits ranged from 3-5 ppmv, whereas the BACT limits ranged from 2-3 ppmv. For units less than 3 MW, the District's NOx limit was 9 ppmv, whereas the BACT limit was 5 ppmv. The BACT guidelines list SCR and SCONOx as the emissions control technologies used to achieve emission limits in the range of 2-5 ppmv. Although lower emission limits are potentially achievable for this source category, BACT requirements are imposed on new or modified turbine installations where ultra-low NOx controls can be installed and the equipment and the facility can be designed to function with this new technology. Rule 4703 is a prohibitory rule that has undergone several generations of NOx limits for existing units in the Valley; facilities comply with these limits by retrofitting their existing equipment. Requiring the installation of entirely new turbine systems is extremely expensive and not cost effective, and therefore not required of facilities.

Selective Catalytic Reduction

Many of the larger units (> 3MW) have already employed SCR to achieve the 5 ppmv limits in place. Therefore, the District evaluated the potential opportunity to employ SCR for units less than 3 MW.

A SCR system reduces NOx emissions by converting the emissions to water and elemental nitrogen. Ammonia is generally injected into the exhaust stream and reacts with the nitrogen. Due to the high cost of SCR systems, they are typically used for controlling emissions from larger units, greater than 3 MW that generally create more emissions. The cost effectiveness of an SCR system for a 1 MW unit was calculated based on the cost effectiveness methodologies in the 2007 Staff Report for Rule 4703 and some of the newer methodologies used to calculate the cost effectiveness of SCR in the August 2011 Staff Report for Rule 4702. The tables below present the total annual costs for a new SCR system and a retrofit system.

Table C-28 SCR Annual Costs for a New Installation on a 1 MW Turbine

Item		Source	Cost
Turbine Rating	1 MW		
SCR Cost/KW	$125/KW	Mid-point between high and low estimate from R4703 analysis	
Operating Hours	7884 hrs/year		
Direct Capital Costs			
Total Purchased Equip Cost	$125/KW x 1000 KW		$125,000
Freight	5% Purchased Equip. Cost (PEC)	Rule 4702	$6,250
Sales Tax	8.25% PEC	Rule 4702	$10,313
Direct Installation Costs	25% PEC	Rule 4702	$31,250
Total Direct Capital Costs			**$172,813**
Indirect Capital Costs			
Facilities	5% PEC	Rule 4702	$6,250
Engineering	10% PEC	Rule 4702	$12,500
Process Contingency	5% PEC	Rule 4702	$6,250
Total Indirect Capital Costs			**$25,000**
Project Contingency	20% PEC	Rule 4702	$25,000
Total Capital Costs (TCC)	Direct Capital + Indirect Capital + Project Contingency	Rule 4702	$222,813
Annualized Capital Costs (10 years @ 10%)	0.1627*TCC	Rule 4702	**$36,252**
Direct Annual Costs			
Operating Costs			
Operator	0.5 hr/shift, $25/hr	OAQPS	$13,688
Supervisor	15% of operator	OAQPS	$2,053
Maintenance Costs			
Labor	0.5 hr/shift, $25/hr	OAQPS	$13,688
Material	100% of labor cost	OAQPS	$13,688
Utility Costs			
Electricity Costs		Variable	$5,747
Cat. Replacement		MHIA	$5,621
Cat. Disposal		OAQPS	$211
Ammonia		Variable	$1,008
NH3 Inject Skid		MHIA	$2,916
Total Direct Annual Costs			**$58,620**
Indirect Annual Costs			
Overhead	60% of Operating and Maintenance	OAQPS	$25,870
Administrative	0.02 x PEC	OAQPS	$2,500
Insurance	0.01 x PEC	OAQPS	$1,250
Property Tax	0.01 x PEC	OAQPS	$1,250
Capital Recovery	0.13 x PEC (10% int. rate, 15 yr period)	OAQPS	$16,250
Total Indirect Annual Costs			$47,120
Total Annual Costs	Annualized capital + Direct Annual + Indirect Annual		**$141,992**

Table C-29 SCR Annual Costs for a Retrofit on a 1 MW Turbine

Item		Source	Cost
Turbine Rating	1 MW		
SCR Cost/KW	$325/KW	Middle point between high and low estimate from R4703 analysis	
Operating Hours	7884 hrs/year		
Direct Capital Costs			
Total Purchased Equip Cost	$325/KW x 1000 KW		$325,000
Freight	5% Purchased Equip. Cost (PEC)	Rule 4702	$16,250
Sales Tax	8.25% PEC	Rule 4702	$26,813
Direct Installation Costs	25% PEC	Rule 4702	$81,250
Total Direct Capital Costs			**$449,313**
Indirect Capital Costs			
Facilities	5% PEC	Rule 4702	$16,250
Engineering	10% PEC	Rule 4702	$32,500
Process Contingency	5% PEC	Rule 4702	$16,250
Total Indirect Capital Costs			**$65,000**
Project Contingency	20% PEC	Rule 4702	$65,000
Total Capital Costs (TCC)	Direct Capital + Indirect Capital + Project Contingency	Rule 4702	$579,313
Annualized Capital Costs (10 years @ 10%)	0.1627*TCC	Rule 4702	**$94,254**
Direct Annual Costs			
Operating Costs			
Operator	0.5 hr/shift, $25/hr	OAQPS	$13,688
Supervisor	15% of operator	OAQPS	$2,053
Maintenance Costs			
Labor	0.5 hr/shift, $25/hr	OAQPS	$13,688
Material	100% of labor cost	OAQPS	$13,688
Utility Costs			
Electricity Costs		Variable	$5,747
Cat. Replacement		MHIA	$5,621
Cat. Disposal		OAQPS	$211
Ammonia		Variable	$1,008
NH3 Inject Skid		MHIA	$2,916
Total Direct Annual Costs			**$58,620**
Indirect Annual Costs			
Overhead	60% of Operating and Maintenance	OAQPS	$25,870
Administrative	0.02 x PEC	OAQPS	$6,500
Insurance	0.01 x PEC	OAQPS	$3,250
Property Tax	0.01 x PEC	OAQPS	$3,250
Capital Recovery	0.13 x PEC (10% int. rate, 15 yr period)	OAQPS	$42,250
Total Indirect Annual Costs			$81,120
Total Annual Costs	Annualized capital + Direct Annual + Indirect Annual		**$233,994**

Potential Emissions Reduction Methodology

The estimated current annual NOx emissions and the estimated potential annual NOx emissions were calculated using the following equation:

NOx = LF x MMBtu/hr x HR x EF/ 2,000 lb/ton

Where:
NOx = Current annual NOx emissions or potential annual NOx emissions (tpy)
LF = turbine load factor
MMBtu/HR= heat input rating
HR = annual hours of operation
EF = NOx emission factor in pounds per MMBtu

Where:
EF = NOx emission factor in ppmv x 0.00366
ppmv = NOx emissions in parts per million corrected to 15% oxygen
0.00366 = Conversion factor used: 0.00366 lb/MMBtu per ppmv NOx

The estimated annual NOx emissions reduction was calculated using the following equation:

NOx Emissions Reduction = Current NOx emissions - Potential NOx emissions

Potential Emissions Reduction Calculation

The emissions reduction calculations below utilized the following information:

Loading factor = 0.75
Heat input rating for a 1 MW unit = 15 MMBtu/hr
Annual Hours of Operation = 7884 hours
Current Emission Factor in Rule 4703 = 9 ppmv
Potential Emissions Factor through the use of SCR = 5 ppmv

Current NOx = LF x MMBtu/hr x HR x EF / 2,000 lb/ton
= 0.75 x 15 x 7884 x (9 x 0.00366) / 2000
= 1.46 tons/year

Potential NOx = LF x MMBtu/hr x HR x EF / 2,000 lb/ton
= 0.75 x 15 x 7884 x (5 x 0.00366) / 2000
= 0.81 tons/year

Emissions Reductions = Current NOx emissions - Potential NOx emissions
= 0.65 tons/year

Table C-30 SCR Cost Effectiveness

Type of Installation	MW	MMBtu/hr	Current NOx Emission Factor (EF), ppmv	Potential NOx EF, ppmv	NOx Reduction (Tons/Year)	Total Annual Cost ($)	Cost Effectiveness ($/ton)
New	1	15	9	5	0.65	$141,992	$218,449
Retrofit	1	15	9	5	0.65	$233,994	$359,991

As demonstrated above, SCR is not a cost effective option as a retrofit or replacement for units less than 3 MW.

EMx

Certain BACT limits for simple cycle plants were achieved through the use of SCONOx. This multifaceted technology reduces NOx, SOx, carbon monoxide (CO), and volatile organic compound (VOC) emissions and is stated as achieving NOx levels less than 1.5 ppmv by its manufacturer. One issue with the use of SCONOx is that it requires steam to operate and simple cycle plants do not generate steam. Therefore, a simple cycle facility would have to add a boiler to their facility to generate steam for the SCONOx system, making the addition of this technology more costly. The District is not aware of any SCONOx applications on simple cycle plants.[77] While SCONOx is better suited for combined cycle turbines, this technology has not been achieved in practice (AIP) yet in the District.

BAAQMD evaluated SCONOx, now known as the EMx system, for turbines in a recent Final Determination of Compliance (FDOC) for the Oakley Generating Station. The FDOC states that EMx could potentially be an improvement over SCR as an add-on control device for achieving NOx reductions – assuming it can achieve the same level of NOx control – because it does not use ammonia. Ammonia has the potential, under certain atmospheric conditions, to react with nitric acid in the atmosphere to form ammonium nitrate, which can be a form of PM2.5. However, based on the implementation of EMx at a facility in Shasta County, BAAQMD voiced some concerns for its use.

EMx has never been used on a large utility-scale turbine and so there is no data on which to make a direct evaluation of how well the technology would work on larger turbines. EMx has been used on a smaller aeroderivitive turbine at the Redding Power Plant Unit No. 5, a 45-MW combined-cycle facility in Shasta County, CA. The Shasta County Air Quality Management District evaluated EMx at the Redding facility under a demonstration NOx limit of 2.0 ppm, which SCR can consistently achieve. After three years of operation, the Shasta County AQMD evaluated whether the facility was meeting this demonstration limit with EMx, and concluded that "*Redding Power is not*

[77] Brian K. Lusher, Bay Area Air Quality Management District. (June 2010). *Final Determination of Compliance: Marsh Landing Generating Station.*

able to reliably and continuously operate while maintaining the NOx demonstration limit of 2.0 ppmvd @ 15% O2."[78]

The FDOC states that although the EMx manufacturer maintains that such problems have been overcome, concerns remain about how consistently the technology would be able to perform. Communications between BAAQMD and Shasta County Air District confirmed that the earlier conclusions about the achievability of a lower limit remain valid.[79] In addition, monthly reports of Continuous Emissions Monitoring System (CEMS) data submitted by Redding Power Plant to Shasta County Air District during 2007 and 2008 indicated that emissions have often been substantially higher.[80] Furthermore, the data from Redding is from a smaller aeroderivitive turbine, and there is no guarantee that if it were scaled up for uses on utility-size turbines that it would even be able to achieve the performance required from larger turbines. For these reasons, BAAQMD concluded that EMx is not as developed as SCR and cannot achieve the same level of emissions performance that SCR is capable of.

SCAQMD is funding a research project that will study and demonstrate the feasibility of control technologies to reduce PM2.5 and ultrafine particulate emissions from natural gas-fired turbine power plants. EMx is one of the two technologies that were selected for demonstration. The findings of this report could potentially be beneficial for evaluating the feasibility of EMx applications for turbines in the future.

SOx

The District considered implementing sulfur dioxide (SO2) limits at least as stringent as the requirements in 40 CFR 60 Subpart KKKK (Standards of Performance for Stationary Combustion Turbines). Fuel treatment sulfur removal systems were recognized as being able to reduce SOx emissions from turbines, other than those fired on Public Utilities Commission (PUC) quality natural gas. One Valley facility installed SCR onto their digester gas-fired turbine to meet the Rule 4703 limit. To do this, they installed a fuel pretreatment system that removes H2S and siloxanes, as they can damage the SCR catalyst if not removed. Other landfill and digester-gas turbines outside the District are also using these systems.

There are only seven units at six facilities in the Valley that utilize a fuel other than natural gas. Four units are fired on diesel gas, while the other three units utilize digester gas. However, the facilities with diesel-fired units utilize natural gas the majority of the time and utilize diesel fuel only during emergencies. Due to California Diesel Fuel requirements, the diesel facilities in the Valley are limited to a sulfur content of 0.0016 lb-SO2/MMBtu. PUC-quality natural gas typically has a sulfur content of 0.00285 lb-SO2/MMBtu and digester turbines are limited to 0.016 lb-SO2/MMBtu per

[78] Letter from R. Bell, Air Quality District Manager, Shasta County Air Quality Management District, to R. Bennett, Safety & Environmental Coordinator, Redding Electric Utility, June 23, 2005.
[79] Kathleen Truesdell, Bay Area Air Quality Management District. (January 2011). *Final Determination of Compliance: Oakley Generating Station.*
[80] Kathleen Truesdell, Bay Area Air Quality Management District. (January 2011). *Final Determination of Compliance: Oakley Generating Station.*

District permits' requirements. By comparison, the Subpart KKKK limit is much higher at 0.060 lb-SO2/MMBtu and all of the units in the Valley are achieving much lower SO2 limits. Adding a SO2 limit similar to Subpart KKKK to the rule will not foster additional emissions reductions for Valley facilities.

PM2.5

PM2.5 reduction technologies for turbines were also researched. Post-combustion controls, including baghouses, electrostatic precipitators, and scrubbers were examined since these technologies can be used to remove PM2.5 emissions from exhaust gas streams.

As previously mentioned, every unit in the Valley subject to Rule 4703 operates on strictly natural gas, with the exception of seven facilities that operated on an alternate fuel part-time or during emergencies. Based on District Permits records and information in the BAAQMD FDOC for the Oakley Generating Station, electrostatic precipitators, baghouses, and scrubbers have not been achieved-in-practice for natural gas-fired turbines. These devices are normally used on solid fuel fired sources or others with high PM emissions, and are not used in natural gas-fired applications, which have inherently low PM emissions. The District is not aware of any gas turbine that has ever been required to use add-on controls such as these. BAAQMD reviewed the EPA BACT/LAER Clearinghouse and confirmed that EPA has no record of any post-combustion particulate controls that have been required for natural gas-fired gas turbines.[81]

Furthermore, these devices would not be technologically feasible to implement for certain facilities. As noted in the BAAQMD FDOC, if add-on control equipment were installed, it would create significant backpressure that would significantly reduce the efficiency of a power plant and would cause more emissions per unit power produced. Moreover, these devices are designed to be applied to emissions streams with far higher particulate emissions, and they would have very little effect on the low-PM emissions streams from natural gas-fired facilities in further reducing PM emissions.[82] It takes an emissions stream with a much higher grain loading for these types of abatement devices to operate efficiently. This low level of abatement efficiency (if any) also means that these types of control devices would not be cost effective, even if they could feasibly be applied to this type of source. For these reasons, post-combustion particulate control equipment is not technologically feasible for units subject to Rule 4703.

As previously mentioned, SCAQMD is funding a research project that will study and demonstrate the feasibility of control technologies to reduce PM2.5 and ultrafine particulate emissions from natural gas-fired turbine power plants. Sulfur removal and the EMx multi-pollutant control system are the two technologies which were selected for

[81] Kathleen Truesdell, Bay Area Air Quality Management District. (January 2011). *Final Determination of Compliance: Oakley Generating Station.*

[82] Kathleen Truesdell, Bay Area Air Quality Management District. (January 2011). *Final Determination of Compliance: Oakley Generating Station.*

demonstration. The findings of this report could potentially be beneficial for evaluating the cost effectiveness and feasibility of applying these emerging technologies to turbines in the future.

Evaluation Findings

Even though stationary gas turbines are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4703 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from stationary gas turbines in the Valley.

C.19 RULE 4802 SULFURIC ACID MIST

Discussion

The purpose of Rule 4802 is to limit sulfuric acid emissions from any sulfuric acid production unit that was constructed or modified before August 17, 1971. The rule was adopted on May 21, 1992 to limit sulfuric acid mist to 0.30 pounds per short ton of acid produced and only applies to one facility in the Valley. EPA approved Rule 4802 into the SIP on June 8, 1999.

Source Category

A sulfuric acid production unit is any facility producing sulfuric acid by the contact process by burning elemental sulfur, alkylation acid, hydrogen sulfide, organic sulfides, or acid sludge. It does not include acid plants used as sulfur dioxide (SO2) control systems, chamber process plants, acid concentrators, or petroleum storage and transfer facilities.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.00	0.00	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	0.00	0.00
SOx	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.83	0.85
	Winter Average - Tons per day								
PM2.5	0.00	0.00	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	0.00	0.00
SOx	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.83	0.85

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from sulfuric acid mist are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for sulfuric acid mist.

How does District Rule 4802 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NESHAP, or MACT requirements for this source category.

NSPS

- 40 CFR 60 Subpart Cd (Emissions Guidelines and Compliance Times for Sulfuric Acid Production Units)

The District evaluated the requirements contained within 40 CFR 60 Subpart Cd and found no requirements that were more stringent than those already in Rule 4802.

- 40 CFR 60 Subpart H (Standards of Performance for Sulfuric Acid Plants)—last amended on February 27, 2014, but the revisions only included corrections for source testing procedures.

The District evaluated the requirements contained within 40 CFR 60 Subpart H and found no requirements that were more stringent than those already in Rule 4802.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4802 compare to rules in other air districts?

There are no analogous rules for this source category in SMAQMD or VCAPCD.

SCAQMD

- Rule 469 (Sulfuric Acid Units)

The District evaluated the requirements contained within SCAQMD Rule 469 and found no requirements that were more stringent than those already in Rule 4802.

BAAQMD

- Regulation 9, Rule 1 (Sulfur Dioxide)

The District evaluated the requirements contained within BAAQMD Regulation 9 Rule 1 and found no requirements that were more stringent than those already in Rule 4802.

- Regulation 12, Rule 6 (Acid Mist from Sulfuric Acid Plants)

The District evaluated the requirements contained within BAAQMD Regulation 12 Rule 6 and found no requirements that were more stringent than those already in Rule 4802.

Additional Emission Reduction Opportunities

Only one facility in the Valley—a sulfuric acid plant—is subject to Rule 4802 (Sulfuric Acid Mist). This facility was in operation before 1971 and is limited by this rule to 0.30 pounds of acid mist per ton of acid produced. The facility uses a mist eliminator to remove fine particles from the acid gas stream, which has been determined to meet BACT requirements. By definition of Rule 4802, no new facility within the Valley will be subject to this rule. Instead, all new facilities would be subject to Rule 2201 (New and Modified Stationary Source Review Rule) and would be required to implement BACT level controls.

The District evaluated the potential opportunity to reduce emissions from this source category by lowering the limit for sulfur emissions from 0.30 pounds per ton produced to 0.1 pound per ton produced, consistent with EPA's BACT determination. Source tests conducted in 2010 and 2011 at the single facility permitted under Rule 4802, showed an actual sulfuric acid mist emission rate of 0.09 pound per ton using existing technology. Hence, the facility is meeting the current national BACT standard with the most advanced technology currently available and enforced through existing permit requirements, despite the fact that their current permit and Rule 4802 do not set that requirement. Therefore, the District has determined that there are no potential opportunities to further reduce emissions from this source category.

Evaluation Findings

Even though sulfuric acid mist is not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4802 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from sulfuric acid mist in the Valley.

C.20 RULE 4901 WOOD BURNING FIREPLACES AND WOOD BURNING HEATERS

Discussion

Rule 4901 limits emissions from wood burning fireplaces, wood burning heaters, and outdoor wood burning devices through wood burning curtailments in areas with natural gas service. Rule 4901 also restricts the sale and transfers of non-compliant wood burning devices, and limits the installation of wood burning devices in new residential developments.

Through the Check Before You Burn program, which is based on Rule 4901, the District has declared and enforced episodic wood burning curtailments, also called "No Burn" days, since 2003. Check Before You Burn 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 PM dispersion.

Rule 4901 was first adopted in 1993 and has been subsequently amended three 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.

The 2003 rule amendments added episodic wood burning curtailments when air quality was forecast to be at 150 or higher on the air quality index (AQI), which is equivalent to a PM2.5 concentration of 65 µg/m³, and added restrictions on the installation of wood burning devices in new residential developments, based on housing density. The 2008 rule amendments lowered the mandatory curtailment level to a PM2.5 concentration of 30 µg/m³, and added a contingency measure to lower the wood burning curtailment level to 20 µg/m³ in the event that EPA finds that the Valley does not attain the 1997 PM2.5 air quality standard in 2014.

The 2014 amendments to Rule 4901 lowered the No Burn threshold for high polluting wood burning heaters and fireplaces from 30 µg/m^3 to 20 µg/m^3. The amendments doubled the number of No Burn days for high polluting units that are the source of over 95% of the wintertime residential wood smoke emissions. By contrast, under the newly amended rule, clean certified units are subject to a minimal number of No Burn days ranging from zero to six days depending on the location in the Valley during the winter season because the No Burn thresholds for these units were raised to 65 µg/m^3.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	4.48	4.38	4.28	4.28	4.28	4.28	4.28	4.28	4.28
NOx	0.50	0.49	0.48	0.48	0.48	0.48	0.48	0.48	0.48
SOx	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
	Winter Average - Tons per day								
PM2.5	8.73	8.54	8.35	8.35	8.35	8.35	8.35	8.35	8.35
NOx	0.98	0.96	0.94	0.94	0.94	0.94	0.94	0.94	0.94
SOx	0.16	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from wood burning fireplaces and wood burning heaters are lower than the BACM/MSM significance thresholds for NOx and SOx. Therefore, the Clean Air Act does not require a NOx and SOx control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for wood burning fireplaces and wood burning heaters.

How does District Rule 4901 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTGs, ACTs, NESHAPs, or MACT guidelines for this source category.

NSPS

- 40 CFR Part 60 Subpart AAA (Standards of Performance for New Residential Wood Heaters)

On February 3, 2014, EPA published proposed amendments to 40 CFR Part 60 Subpart AAA.[83] The proposed rule was finalized by EPA on February 3, 2015. District Rule 4901 points to the NSPS for emission limits and is therefore as stringent as the newly promulgated NSPS.

1988 NSPS

Under the 1988 NSPS, only those wood or pellet-burning units meeting the following criteria require certification and all other units are not required to obtain certification and are therefore considered exempt:

[83] 40 CFR Part 60 Subpart AAA, *Standards of Performance for New Residential Wood Heaters* (FR 79 6330–6416)

1. Units that have an air-to-fuel ratio averaging less than 35-to-1;
2. Units with a usable firebox volume less than 20 cubic feet;
3. Units with a minimum burn rate less than 5 kilograms per hour (11 pounds per hour); and
4. Units that weigh 1,760 pounds or less.

For wood heaters meeting these requirements, the current certification emissions limits are 4.1 grams per hour (g/hr) of PM for units equipped with a catalytic combustor and 7.5 g/hr for units without a catalytic combustor. Units certified to these emission limits are said to be *Phase-II Certified* and will maintain that certification until the certification expires, which is up to 5 years from the issuance date.

Under the current NSPS, pellet stoves are not explicitly exempt from required certification; however, most models currently sold fall outside the regulation because they operate on an air-to-fuel ratio greater than 35-to-1. Single burn rate wood heaters are also not explicitly exempt from the current NSPS, but are not regulated by it because they operate below the burn rate criteria of 5 kilograms per hour.

2015 NSPS

The 2015 NSPS significantly lowers the certification emission limits for wood-burning heaters that are currently required to be certified and sets certification limits for a broader range of wood-burning heaters by removing the existing certification criteria (1 through 4 above). New standards will apply not only to adjustable burn rate wood heaters (the focus of the original regulation), but also to single burn rate wood heaters/stoves, pellet heaters/stoves, and any other affected appliance as defined in revised Subpart AAA as a “room heater.”

Although they do not require EPA certification under the 1988 NSPS, 96% of pellet heaters meet the proposed Step 1 PM emissions limit of 4.5 grams per hour. Single burn rate wood heaters are incapable of operating at the lowest burn rates, and it is the lower burn rates that result in the highest level of PM emissions; therefore, most single burn rate wood heaters will also meet the proposed Step 1 PM emissions limit. Manufacturers of such units will not initially be required to modify their design if they already meet the emissions standard and will automatically be deemed as certified to meet the Step 1 emission limits.

EPA promulgated a two-step compliance approach that applies to all new adjustable burn rate wood heaters, single burn rate wood heaters and pellet heaters/stoves. Under this approach, Step 1 emission limits for these sources will apply to each source manufactured on or after the effective date of the final rule or sold at retail on or after December 31, 2015. Step 2 emission limits for these sources will apply to each heater manufactured or sold at retail on or after the date five years after the effective date of the final rule. EPA is allowing an alternative compliance option for manufacturers who choose to certify using cord wood (rather than crib wood) to meet the Step 2 limits.

Table C-31 Subpart AAA PM Emissions Limits

2-Step, 5-Year Phase-In		
Step	**PM limit**	**Compliance deadline**
1	4.5 g/hr	Upon the effective date of the final rule
2	2.0 g/hr	5 years after effective date of final rule
	2.5 g/hr (Cord wood alternative compliance option)	

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4901 compare to rules in other air districts?

There are no analogous rules for this source category in VCAPCD.

SCAQMD

- Rule 445 (Wood Burning Devices)

Rule 445 was last amended on May 3, 2013 to lower the curtailment threshold from 35 to 30 µg/m3. District Rule 4901 is more stringent than Rule 445, as the District lowered the No Burn threshold for high polluting wood burning heaters and fireplaces from the 30 µg/m^3 to 20 µg/m^3 in 2014. The District evaluated the requirements contained within SCAQMD Rule 445 and found no requirements that were more stringent than those already in Rule 4901.

BAAQMD

- Regulation 6 Rule 3 (Wood-Burning Devices)

The District evaluated the requirements contained within BAAQMD Regulation 6 Rule 3 and found no requirements that were more stringent than those already in Rule 4901.

SMAQMD

- Rule 417 (Wood Burning Appliances)

The District evaluated the requirements contained within SMAQMD Rule 417 and found no requirements that were more stringent than those already in Rule 4901.

- Rule 421 (Mandatory Episodic Curtailment of Wood and other Solid Fuel Burning)

The District evaluated the requirements contained within SMAQMD Rule 421 and found no requirements that were more stringent than those already in Rule 4901.

Other Analogous Rules

- Washington State's Department of Ecology Regulation Chapter 173-433 WAC (Solid Fuel Burning Devices)

The District evaluated the requirements contained within the above regulation and found no requirements that were more stringent than those already in Rule 4901.

- Colorado Air Quality Control Commissions Regulation No. 4

The District evaluated the requirements contained within Colorado's rule and found no requirements that were more stringent than those already in Rule 4901.

- Spokane Regional Clean Air Agency Regulation I Article VIII

The District evaluated the requirements contained within the Spokane rule and found no requirements that were more stringent than those already in Rule 4901.

- Oregon Department of Environmental Quality Division 262 (Heat Smart Program for Residential Woodstoves and Other Solid Fuel Heating Devices)

The District evaluated the requirements contained within Oregon's rule and found no requirements that were more stringent than those already in Rule 4901.

- Yolo-Solano AQMD Rule 2.40 (Wood Burning Appliances)

The District evaluated the requirements contained within Rule 2.40 and found no requirements that were more stringent than those already in Rule 4901.

Additional Emission Reduction Opportunities

2014 Amendments to the District's Residential Wood Burning Program

The District takes a multidimensional and proactive approach to reducing emissions in the Valley. This philosophy is especially true for reducing emissions from residential wood burning with a combination of regulatory controls through Rule 4901, public outreach and education, and the District's Burn Cleaner Wood Stove Change-out Program (Burn Cleaner Program). The District's approach to reducing emissions from residential wood burning empowers Valley residents to play a major role in reducing emissions at almost no cost, and, in many cases, with savings in heating-related energy costs. Valley residents are encouraged to transition from older more polluting wood burning heaters and wood burning fireplaces (also commonly called open hearth fireplaces) to cleaner alternatives, by decreasing the number of allowable burn days for high polluting wood burning heaters and fireplaces while at the same time increasing the number of burn days allowed for registered clean wood burning heaters through a tiered episodic wood burning curtailment program. Emissions reduced through the 2014 amendments to the program are significantly greater than those achieved by reducing the curtailment threshold alone.

Curtailment Level

A potential opportunity for further emissions reductions was to lower the curtailment level, which would reduce emissions by increasing the number of "No Burn" days. Lowering the curtailment level below the 30 $\mu g/m^3$ level has reduced the build-up of emissions during the long stagnation periods experienced in the Valley during the 2014-15 winter season, and helped avoid exceedances of the PM2.5 standard.

During the September 2014 rule amendment project, the District estimated the average number of additional No Burn days likely to occur in future years as a result of lowering the curtailment level from the previous threshold level of 30 µg/m³ to the threshold level of 20 µg/m³. The average increase in No Burn days in future years in each county was calculated by averaging the historical data from the past five wood burning seasons of the number of days P M2.5 concentrations were forecasted to be equal to or exceed 30 µg/m³ versus 20 µg/m³. This analysis is summarized in the table below. The estimated average increase in No Burn days in future years was determined to be 34 days per county (an average of the last column in the table below) per wood burning season. However, the estimation of 34 additional No Burn days per wood burning season in the future will vary. No Burn days are called based on the air quality forecast for each day and are dependent on several variables. As a result of this analysis, the District amended Rule 4901 to lower the curtailment threshold to 20 µg/m^3 in September 2014.

Table C-32 Average Number of Days Forecast Above Curtailment Thresholds*

County	Previous Threshold (≥30 µg/m³)	2014 Adopted Threshold (≥20 µg/m³)	Additional No Burn days
San Joaquin	24	53	29
Stanislaus	36	72	36
Merced	19	55	36
Madera	29	67	38
Fresno	49	85	36
Kings	39	70	31
Tulare	36	69	33
Kern	44	79	35

*Based on Forecast values from the 2009-10, 2010-11, 2011-12, 2012-13, 2013-14 wood-burning seasons

Although a No Burn day can potentially increase a resident's natural gas costs from using a central heating system in lieu of a wood burning heater, this potential cost is offset by the central heating system since a central heating system more efficiently heats the whole home, resulting in less money being spent on firewood based on the increase in No Burn days. Compared to other District rules, curtailing residential wood burning under Rule 4901 is the most cost effective rule for reducing directly emitted PM2.5 emissions.

Wood Burning Season

During the 2014 amendment, the District evaluated the potential opportunity for further reducing emissions from the residential wood burning source category by extending the wood burning curtailment season. The current wood-burning season runs from the beginning of November until the end of February. Expanding the wood-burning season to include October and/or March could have potentially increased the number of No Burn days in each wood-burning season.

Measured Valley concentrations of levoglucosan, a primary indicator for wood burning, are not nearly as high in October or March as found to be during the current wood

burning season of November through February. Additionally, a six-year average was calculated for the number of No Burn days in each county from 2008 through 2013 for the months of October and March as illustrated in the following table. The resulting estimated number of increased No Burn days based on historical data is in the range of less than one day up to six days. Extending the wood burning season would not significantly benefit air quality in the Valley due to the combination of less extensive burning activity and the minute number of additional No Burn days.

Table C-33 Days with PM2.5 ≥ 30µg/m^3

County	Month	2008	2009	2010	2011	2012	2013	Average
Fresno	March	3	0	0	0	0	0	0.5
Kern	March	2	0	0	1	0	2	0.8
Kings	March	1	0	1	0	0	4	1
Madera	March	NA	NA	NA	0	0	0	0
Merced	March	0	0	0	0	0	0	0
San Joaquin	March	0	0	0	0	0	0	0
Stanislaus	March	0	0	0	0	0	0	0
Tulare	March	2	0	0	0	0	3	0.8
Fresno	October	6	2	2	7	1	1	3.2
Kern	October	6	6	3	3	2	NA	4
Kings	October	10	9	7	10	2	1	6.5
Madera	October	NA	NA	NA	3	0	0	1
Merced	October	3	0	2	0	0	0	0.8
San Joaquin	October	2	0	0	0	0	0	0.3
Stanislaus	October	5	1	2	5	0	0	2.2
Tulare	October	4	5	1	6	0	3	3.2

New Residential Developments

The District also considered further limiting the installation of wood burning fireplaces and heaters in new residential developments by strengthening Section 5.3 of Rule 4901, which sets limits for the quantity of wood burning fireplaces or wood burning heaters that can be installed in new residential developments. South Coast Rule 445 prohibits the installation of wood burning devices in any development that has natural gas service. However, since most of the Valley's new developments are already subject to restrictions based on their housing densities, the emissions reduction potential is minimal.

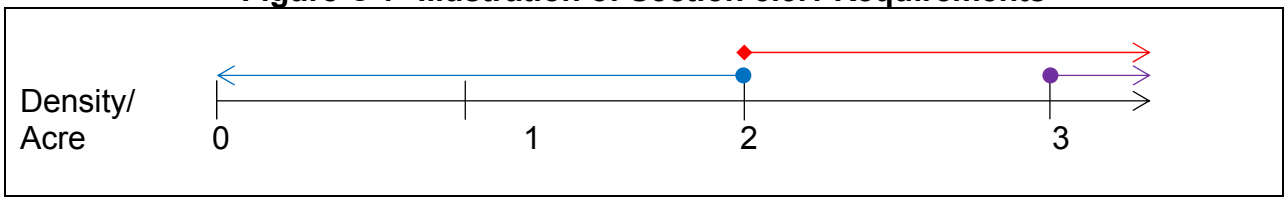
As a part of the 2014 amendments to Rule 4901, the District amended Section 5.3. Previous rule language was not completely clear as to the number of heaters allowed to be installed if that number falls between two whole numbers. The rule language was strengthened by clarifying the number of heaters allowed for installation in a given area, in addition to the language being clarified with regards to the applicability of the density requirements by the removal of the term "new" from rule language.

Section 5.3.1 (Effective until December 31, 2014)

Previous language provided for:

- 5.3.1.1: >2 dwellings/acre: no wood burning fireplaces
- 5.3.1.2: ≥3 dwellings/acre: max of two certified units
- 5.3.1.3: ≤2 dwellings/acre: max of one wood burning fireplace or wood burning heater per dwelling

Figure C-7 Illustration of Section 5.3.1 Requirements

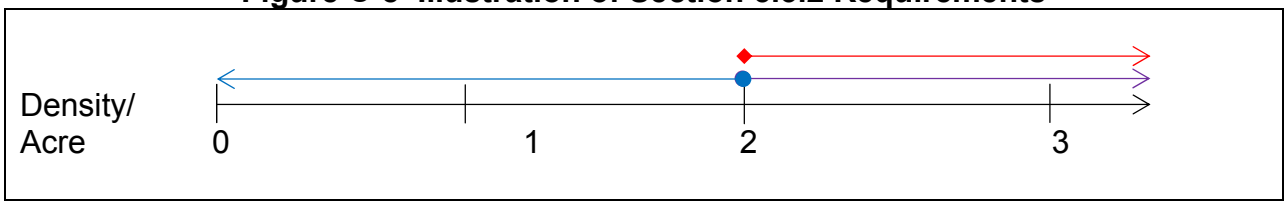


Section 5.3.2 (Effective on and after January 1, 2015)

Amended language provides for:

- 5.3.2.1: >2 dwellings/acre: no wood burning fireplaces
- 5.3.2.2: >2 dwellings/acre: max of two certified units
- 5.3.2.3: ≤2 dwellings/acre: max of one wood burning fireplace or certified wood burning heater per dwelling

Figure C-8 Illustration of Section 5.3.2 Requirements



Section 5.3.2.1 prohibits the installation of a wood burning fireplace in a residential development with a density greater than two dwelling units per acre. While this could be misinterpreted as being less stringent than a similar requirement in SCAQMD Rule 445, in reality it is more stringent because Rule 4901 does not afford the same flexibilities as the SCAQMD rule does. While SCAQMD Rule 445 has language prohibiting the installation of a permanently installed wood burning device into any new development, this requirement is not applicable 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. District Rule 4901 is more stringent in that for the extremely limited cases where wood burning devices are allowed to be installed, the number of units allowed is limited to no more than two per acre. Additionally, Rule 4901 does not exempt any homes from any aspect of rule requirements based on elevation.

Encouraging the Transition to Clean Burning Heaters through Non-Regulatory Measures

Upgrading a home's wood burning device reduces air pollutant emissions on days when wood burning is allowed. By operating more efficiently, these devices can also lower

the overall home heating cost. District Rule 4901 neither prohibits nor requires wood burning device upgrades. However, the District encourages such upgrades through its public outreach and through its Burn Cleaner Program, which provides funding to Valley residents to upgrade their current wood-burning devices and open fireplaces to natural gas or propane gas devices, to certified wood stoves or inserts, or to pellet devices. The District's webpage[84] has more information on program eligibility and qualified devices.

There are several types of wood burning devices and device inserts available. Wood stoves, especially newer models, are generally safe and efficient devices for home heating. There are two types of wood stoves: catalytic and non-catalytic. EPA's Phase II certified wood stoves produce only 2 to 7 grams of smoke per hour, compared to 15 to 30 grams of smoke per hour from older, uncertified devices, and in future years the EPA certified devices will emit even less.

Pellet stoves are similar in appearance to wood stoves, but burn compressed pellets made of ground, dried wood and other biomass wastes. Pellet stoves are generally more expensive than wood stoves and require electricity for operation; however, they are typically more efficient than wood stoves due to the better fuel-to-air ratio in the combustion chamber.

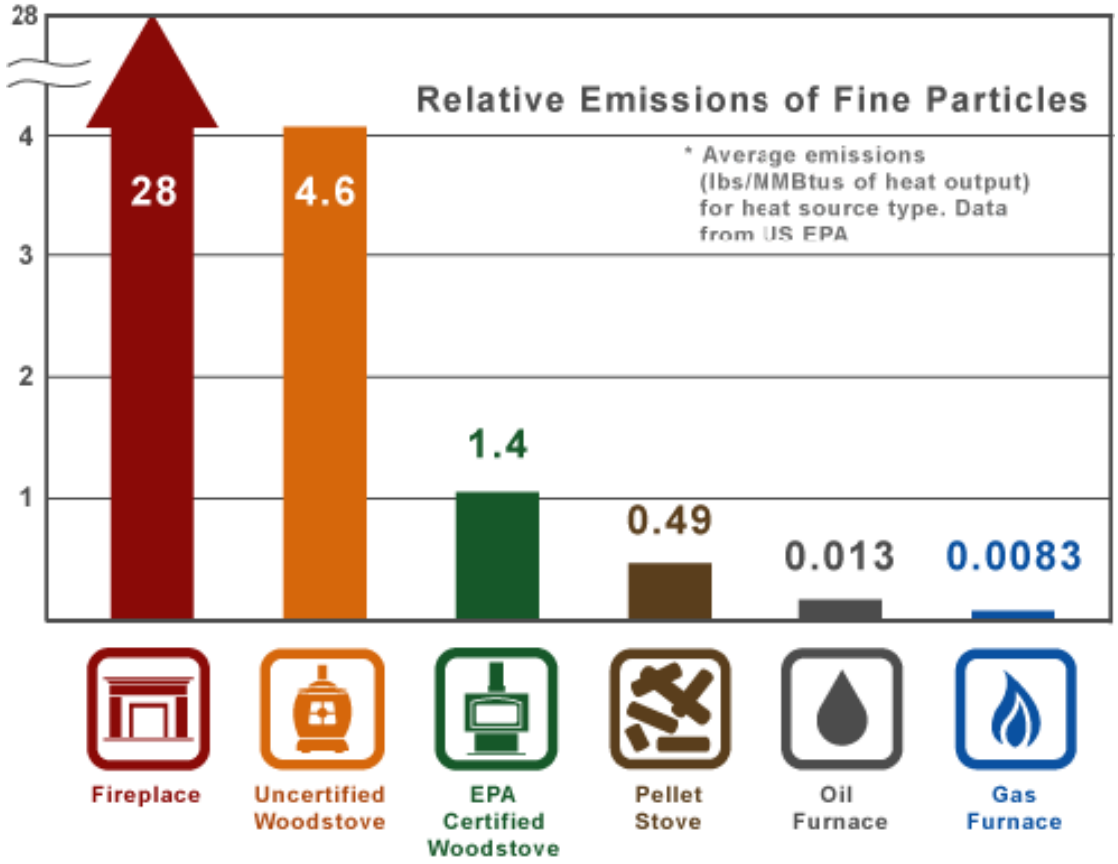
Wood burning fireplaces include traditional masonry fireplaces built into brick or stone, constructed in the home, and "low mass" fireplaces that are pre-fabricated prior to installation. Most fireplaces are not used as a primary source of heat, but serve as a secondary heating source or for ambiance. Fireplaces generate much more emissions than wood stoves or pellet stoves, but fireplace inserts are available to reduce emissions. EPA does not certify fireplaces or fireplace inserts, but does have a voluntary program for devices that meet qualifications to be considered cleaner burning than typical fireplaces and fireplace inserts. While these devices reduce emissions relative to uncontrolled fireplaces, their emissions are still relatively higher than certified wood stoves and pellet stoves.

Gas stoves and gas fireplaces burn natural gas or propane, emit very little air pollution, and require little maintenance. Gas devices are not subject to the requirements of Rule 4901, so they can be used on "No Burn" days. For more information about the various types of wood burning devices available, see EPA's Burn Wise program webpages[85].

The following figure illustrates the average PM2.5 emissions based on various heat sources.

[84] www.valleyair.org/Grant_Programs/GrantPrograms.htm#WoodStoveChangeOut
[85] www.epa.gov/burnwise

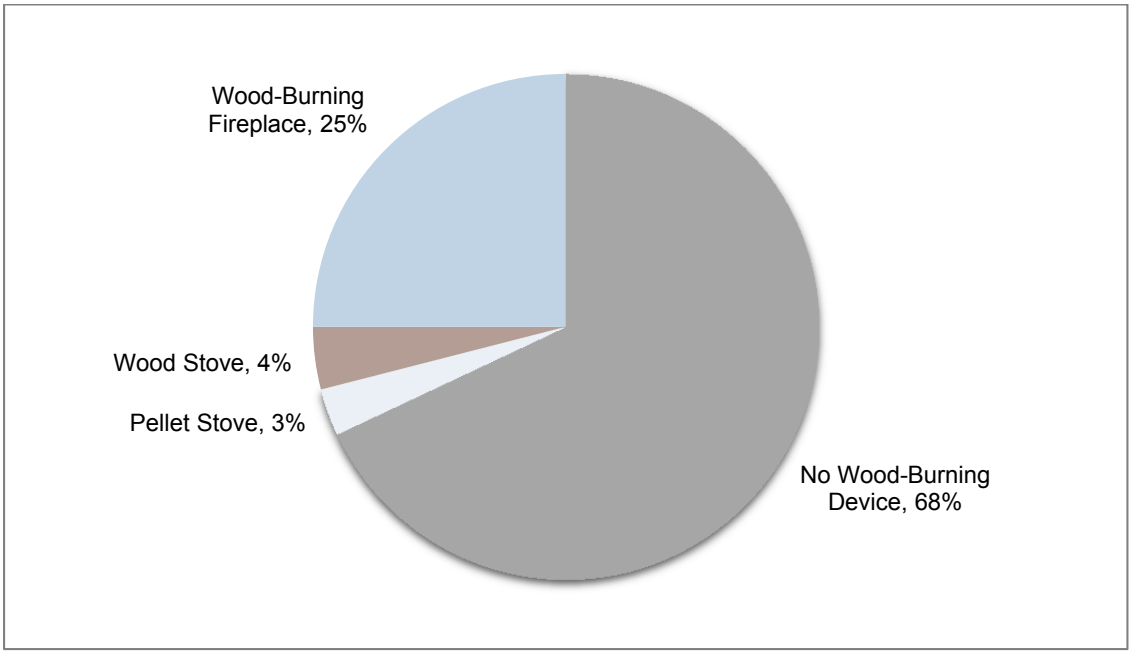
Figure C-9 Average PM2.5 Emissions Based on Wood Burning Heater Type[86]



A third party survey of Valley residents (see Appendix E) revealed that the majority of Valley residents do not have wood burning heaters or wood burning fireplaces. However, of those that do have wood burning heaters and wood burning fireplaces, the majority have wood burning fireplaces, refer to Figure C-10 (Proportion of Residents with a Wood-Burning Fireplace, Wood Stove or Pellet Stove) for a graphical representation of the proportion of Valley residents with wood burning heaters, pellet-fueled wood burning heaters, and wood burning fireplaces.

[86]EPA. (2012, November 14). *Consumers – Energy Efficiency and Wood-Burning Stoves and Fireplaces*. Retrieved from http://www.epa.gov/burnwise/energyefficiency.html.

Figure C-10 Proportion of Residents with a Wood-Burning Fireplace, Wood Stove or Pellet Stove



EPA reports that 75% of wood stoves (also called wood burning heaters) in the United States are non EPA-certified stoves. EPA certified wood burning heaters produce 70% less particle pollution then their older dirtier counterparts.

Survey results indicate the most effective ways to encourage transition to clean burning heaters is to allow more wood burning days for less polluting wood burning heaters and update the District's Burn Cleaner Program to increase incentive amounts. By encouraging Valley residents to transition to clean wood burning heaters, emissions will not only be reduced on No Burn days but also on days when burning is allowed. This health and air quality benefit will occur because cleaner alternatives such as EPA Phase II Certified wood burning heaters and pellet-fueled wood burning heaters, and gaseous-fueled heaters will be in use instead of the older more polluting wood burning heaters and wood burning fireplaces.

Many Valley residents have upgraded their homes with these newer devices, including through programs such as the *District's Burn Cleaner Program* and federal tax incentives. Given their much lower relative emissions, allowed use of these devices during a lower curtailment level still achieves the goal of significantly reducing the overall emissions that ultimately lead to violations of the standard. Enforcing this added flexibility is difficult given the challenge in distinguishing wood smoke emissions from various wood burning devices, and the District explored various options during the rule development process for ensuring that this issue is addressed. Along with this allowance, the District will continue to provide incentives to encourage the replacement of existing older devices with newer clean devices.

Burn Cleaner Incentive Program

The District's Burn Cleaner Wood Stove Change-out Program (Burn Cleaner Program) plays a key role in the success of the transition from older more polluting wood burning heaters and fireplaces to cleaner wood burning heaters. Since 2006, the Burn Cleaner Program has been helping residents overcome some of the financial obstacles in purchasing cleaner alternatives. There are currently more than 30 hearth retailers in the Valley that have partnered with the District to successfully implement the Burn Cleaner Program.

The Burn Cleaner Program offers multiple levels of incentive funding, increased as of the 2014-2015 wood burning season:

- Up to $1,000 to replace a qualifying unit with a certified wood insert/freestanding stove, certified pellet insert/freestanding stove, or natural gas insert/freestanding stove
- Up to $2,500 of any eligible device if the applicant is eligible for Low-Income
- Up to $500 as an additional incentive towards gas devices (for both standard and low-income)

The District continuously reevaluates the Burn Cleaner Program and implements enhancements to the program. In addition to increased incentive amounts, the District has also recently implemented the following enhancements:

- Reducing a substantial portion of the upfront, out-of-pocket cost of a new qualifying unit for low-income qualified applicants. The District has partnered with contracted hearth retailers to allow low-income qualified applicants to make the purchase at a reduced price by deducting the incentive amount from the invoice at the point of purchase. Allowing the incentive funding to be directly applied when purchase is made makes it more feasible for additional low-income applicants to take advantage of the program.
- Refining the low-income eligibility form to streamline the determination process and identifying the hearth retailers that provide the reduced upfront cost option.
- Program documents are now available in Spanish to further extend the outreach efforts to the local community.
- Updates to program documents to make them more user-friendly and to improve the process during the application, installation, and claim for payment request phases.
- The document submittal process has been updated to allow applications and claim for payment requests to now be emailed to the District for faster processing. Also, supplemental forms have been developed further streamline the review process and help keep the retailers and applicants informed on the status of projects.

The upgrades to processing, applications, and incentive amounts, combined with effective and proactive public outreach and education campaign and the assistance of District retail partners, the initial funding for the Burn Cleaner Program was quickly

exhausted. At the November 13, 2014 Governing Board meeting, the District Governing Board approved an additional $2 million in funding to meet the increased demand for this highly successful program. Immediately after the November Board meeting, District staff worked expeditiously to ensure that the additional funding was allocated quickly and efficiently to the residents in the Valley. Given this program's critical role in supporting the District's efforts to reduce the impact of residential wood burning and continued high demand in the program the District went back to the Governing Board at the December 18, 2014 public hearing to request additional funding and other amendments to the program, and an additional $3.6 million in funding was allocated along with programmatic changes proposed by staff including lowering the voucher incentive amount for non-low income applicants from the then $1,500 to $1,000, limiting the number of vouchers per household, and directing funding based upon demand for any surplus remaining in each county.

Collaboration with participating hearth retailers

The District has renewed its contracts with the hearth retailers and hosted informational meetings to discuss program changes in order to ensure a smooth roll out of the enhancements. As part of the District's initiative to increase the effectiveness of the program, District staff has worked closely with the participating hearth retailers on outreach efforts and provided them with promotional tools, such as flyers and quick screens with information about the Burn Cleaner Program.

Public Outreach and Education

The District has an extremely successful outreach and education program with regards to residential wood burning and educating Valley residents about air quality, the effects of air pollution on the population's health, and on options they can take to reduce emissions. In the 2013-14 wood-burning season the District took part in 51 media interviews about extreme weather and wood burning.

The District's informational *Check Before You Burn* program minimizes elevated PM2.5 concentrations throughout the winter. The PM2.5 air quality improvements that the Valley has experienced since the adoption of Rule 4901 have been assisted by strong multimedia outreach by the District and a resultant increase in public awareness and participation in winter District programs.

During the wood-burning season of 2013-14, the District Outreach staff received hundreds of public calls and emails specific to residential wood burning. An interesting new trend has surfaced regarding public opinion, an increased number of the phone calls were in support of an outright ban on residential wood burning year-round (with the exception of residents for whom wood burning is the sole source of heat). This is attributed to heightened awareness among the general population of the deleterious effects of wood burning on public health.

Since the inception of *Check Before You Burn*, the District's complementary tools, such as the Real-time Air Advisory Network (RAAN) and the "Valley Air" smart phone app, have continued to gain in popularity. Annual public call and website "hit" statistics, plus growth in the District's Facebook page activity, also illustrate continued growth in wood-

burning awareness. Survey results also showed an increased public awareness with eight out of ten respondents being aware of the District's *Check Before You Burn* program, 78% of whom confirmed reduced wood-burning activities as a direct result of the program.

The District also incorporates wood-burning messaging into other public outreach products, including Healthy Air Living Schools materials, "Blue Sky, Brown Sky … It's Up to You!" elementary curriculum and other materials.

Multimedia Advertising Campaign

The District's seasonal public outreach advertising campaign is retooled each year to include timely and relevant messaging. In the past few seasons, this messaging has been delivered by the District's Governing Board members, with billboards in English and Spanish strategically placed throughout the Valley, radio and TV spots, and value-added messaging delivered through media throughout the Valley.

Expanding New Media Outreach

The most significant evolution of *Check Before You Burn* messaging has occurred with the expanded and accelerated use of new media: Facebook and Twitter posts. Facebook "likes" have nearly doubled from the 2012-13 season, to more than 1,100 at the end of the 2013-14 season. This has proven to be a valuable way to deliver immediate messaging regarding wood-burning statuses, in addition to providing a platform for direct, two-way interaction with the public.

Strengthening Media Partnerships

The District maintains partnerships with television, newspaper, radio, outdoor and print, as well as more non-traditional media, such as on-screen messaging in local movie theaters, internet advertising and video loops in medical offices. During seasonal *Check Before You Burn* campaigns, the District runs media on 11 broadcast television stations in the Fresno and Bakersfield markets, including four Spanish stations, as well as 10 cable networks in four cable markets including zoned cable in Stockton, Modesto, Turlock and Manteca. In the Sacramento market, which includes the District's northern counties, the wood-burning message runs on two English language broadcast television stations and one Spanish language broadcast television station.

The District also typically runs messaging on 42 radio stations and 18 newspapers (six of them Spanish) throughout the eight-county area. *Check Before You Burn* outdoor messaging appears on more than 100 outdoor billboards (including large-format vinyl billboards) and smaller "one-sheets" in Environmental Justice communities throughout the Valley. With these purchases come added value in the form of bonus spots, news sponsorships, and extra billboards and overages in outdoor messaging. Outdoor messaging is strategically placed in high-traffic areas as well as neighborhood and rural communities to ensure a wide reach in those areas where residential wood burning might be common.

The District's print campaign includes major papers such as the *Bakersfield Californian*, *Fresno* and *Modesto Bees* and *Stockton Record*, but also rural newspapers such as the

Arvin Tiller, *Manteca Bulletin* and *Shafter Press*. The District also appears in each issue of the Bakersfield Business Journal, which offers the opportunity to promote seasonal campaigns. Media buys allow leveraging buying power that typically returns an additional $100,000+ in media placement. The related Cinemedia campaign is also regularly featured on 100 movie screens from Stockton to Bakersfield, with more than 25,000 spots that reach more than 475,000 people.

Evaluation Findings

Even though wood burning fireplaces and wood burning heaters are not a significant source of NOx or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4901 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from wood burning fireplaces and wood burning heaters in the Valley.

C.21 RULE 4902 RESIDENTIAL WATER HEATERS

Discussion

Rule 4902 is a point-of-sale rule, adopted on July 17, 1993, to limit 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). Since its adoption, the rule has been amended once. The March 2009 amendments 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 water heaters. NOx emissions have been controlled by approximately 88% for this source category. EPA finalized approval for Rule 4902 on May 5, 2010.

Source Category

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 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 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 is circulated through a heat exchanger in a storage tank.

Manufacturers have focused on combustion modification to meet the lower NO_x limit as required in other California air districts. Combustion modification systems are designed to reduce thermal NO_x formation by changing the flame characteristics to reduce peak flame temperature. Combustion modification for residential water heaters is achieved by different burner designs such as low NOx and ultra-low NOx burners. 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.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.21	0.21	0.21	0.22	0.22	0.22	0.22	0.23	0.23
NOx	2.21	2.19	2.17	2.16	2.14	2.12	2.11	2.09	2.08
SOx	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Winter Average - Tons per day								
PM2.5	0.28	0.28	0.29	0.29	0.29	0.30	0.30	0.31	0.28
NOx	2.91	2.89	2.87	2.84	2.82	2.80	2.78	2.77	2.91
SOx	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.09	0.08

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from residential water heaters are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for residential water heaters.

How does District Rule 4902 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for 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?

SCAQMD

- Rule 1121 (Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters)

The District evaluated the requirements contained within SCAQMD Rule 1121 and found no requirements that were more stringent than those already in Rule 4902.

BAAQMD

- Regulation 9 Rule 6 (Nitrogen Oxides Emissions from Natural Gas-Fired Boilers and Water Heaters)

The District evaluated the requirements contained within BAAQMD Regulation 9 Rule 6 and found no requirements that were more stringent than those already in Rule 4902.

SMAQMD

- Rule 414 (Water Heaters, Boilers and Process Heaters Rated Less than 1,000,000 BTU Per Hour)

The District evaluated the requirements contained within SMAQMD Rule 414 and found no requirements that were more stringent than those already in Rule 4902.

VCAPCD

- Rule 74.11 (Natural Gas-Fired Water Heaters)

The District evaluated the requirements contained within VCAPCD Rule 74.11 and found no requirements that were more stringent than those already in Rule 4902.

Additional Emission Reduction Opportunities

Units subject to Rule 4902 are fired on PUC quality natural gas, and are inherently low-emitters of SOx and PM2.5 emissions. Given the significant efforts and investments already made to reduce emissions from this source category, there are little remaining opportunities for obtaining additional emissions reductions.

Electric Water Heaters

The District evaluated the potential opportunity to replace natural gas and propane water heaters with electric units. A comparison of three water heaters that utilize the different fuel types with an emissions reductions and cost effectiveness analysis for these units is summarized below.

Table C-34 Emissions Reductions and Cost Effectiveness of Water Heaters by Fuel Type

Fuel Type	Low NOx Natural Gas	Propane	Electricity
Capacity[1]	50 gallons	50 gallons	50 gallons
Shipping Weight[1]	180 lbs	151 lbs	109 lbs
Energy Factor[1]	0.62	0.59	0.91
Purchase Price[1]	$902.00	$899.00	$473.25
Estimated Life Expectancy[2]	13 years	13 years	13 years
Lifetime Energy Use[2]	3,133 therms	2,867 gallons of LP	62,439 kWh
Lifetime Energy Costs[3]	$3,568	$7,176	$9,834
Lifetime NOx Emissions[4]	30.60 lbs	48.09 lbs	0.00 lbs
Annual NOx Emissions	2.35 lbs	3.70 lbs	0.00 lbs
Comparing Natural Gas and Propane to Electricity			N/A
Annualized capital cost[5]	$76.99	$76.99	

Fuel Type	Low NOx Natural Gas	Propane	Electricity
Annual Operating Cost Savings Compared to Electric	$482.00	$204.46	
Cost per pound NOx	$237.87	$76.07	
Cost per ton NOx	**$475,736**	**$152,135**	

[1] Unit specifications and prices acquired from Grainger Industrial Supply as of August 7, 2012
[2] Data from US Department of Energy – Energy Cost Calculator for Electric and Gas Water Heaters http://www1.eere.energy.gov/femp/technologies/eep_waterheaters_calc.html
[3] Cost data based on the average cost of units of energy in 2010 according to the US Energy Information Administration. http://www.eia.gov/
[4] Emissions factors derived from Appendix EA-1 of US Department of Energy's Energy Assessment for Proposed Energy Conservation Standards for Residential Clothes Washers
[5] The annualized capital equipment cost is calculated by multiplying the installed equipment cost by the capital recovery factor of 0.1627.

The operating cost for electric water heaters is higher than for propane and natural gas units, due to the higher cost of electricity compared to propane and natural gas. However, the initial purchase price is lower for electric units. Converting to an electric water heater also may require modifications to the residence and have associated costs.

Evaluation Findings

Although residential water heaters are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4902 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from residential water heaters in the Valley.

C.22 RULE 4905 NATURAL GAS-FIRED, FAN-TYPE CENTRAL FURNACES

Discussion

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 within 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.

The rule was adopted on October 20, 2005 to establish NOx limits for residential central furnaces supplied, sold, or installed in the Valley. The rule set a NOx emission limit of 0.093 pounds per million Btu of heat output (lb/MMBtu). EPA finalized approval for Rule 4905 on May 30, 2007. Rule 4905 was amended on January 22, 2015 to:

- Lower the NOx emission limit for residential units from 40 ng/J (0.093 lb/MMBtu) to 14 ng/J
- Expand the rule applicability to include non-residential units with a NOx emission limit of 14 ng/J and units installed in manufactured homes with a NOx limit of 40 ng/J, to be lowered to 14 ng/J in 2018
- Additional labeling requirements

The January 2015 amendments exceeded SCAQMD Rule 1111 requirements and made Rule 4905 the most stringent rule in the nation for this source category.

Source Category

Affected parties include furnace manufacturers, residential heating wholesalers, supply stores, contractors and end-users. The point-of-sale approach has allowed the District to achieve NOx reductions without placing an undue financial burden on the residents, operators and businesses that sell these units in the Valley.

Applicable units are used in approximately 71% of Valley residences and are not labeled for retail as “residential” or “commercial” furnaces. Units used in commercial buildings, which are subject to the requirements of Rule 4905 as of the January 2015 amendments, are essentially the same as residential units with the exception of possible differences in usage patterns and indoor/outdoor location. Research for the analyses in the January 2015 amendments estimated 1,252,190 residential and commercial units will be operating in the Valley in 2017. Replacement will occur gradually as these units reach the end of the 20-year useful life.

The most common residential and commercial heat sources are boilers and furnaces; other heating options include heat pumps, active solar heating, electric heating, wood or pellet stoves, portable and direct vent wall heaters, and fireplaces.[87] Heat distribution systems are either central heating, where heat is generated in a central location and

[87] Department of Energy. (2013, December 16). *Energy Saver 101: Everything You Need to Know About Home Heating*. Retrieved 12/17/13 from http://energy.gov/articles/energy-saver-101-infographic-home-heating.

distributed throughout the building, or point-of-use or space heating, meaning supplemental heat is provided to a specific room. Types of central heating systems include forced air, steam radiant, radiant, hot water baseboards, and electric baseboards. Types of space heaters include wood or pellet stoves, portable and direct vent wall heaters, and fireplaces. Fuel types include natural gas, propane, heating oil, electricity, and solid fuels such as wood or pellets.

All heating systems have three basic components: a heat source, a heat distribution system, and a control system. The control system is usually a programmable thermostat. The heat source, which generally determines the type of distribution system used, is selected based on many factors. The most important factor is geographical location, which determines the climate and types of available fuel. Most commercial and residential buildings in the Valley have access to natural gas, which is typically the cheapest and most convenient fuel source in areas where it is available.

Rule 4905 applies to furnaces fueled by natural gas that use forced air distribution, the most common type of heating system for residential and commercial buildings. Central furnaces are controlled by a thermostat, which sends signals to turn the device 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 combust the gas directly into the heat exchangers. A blower pulls air from outside the building through a filter, across the heat exchanger, and through 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 utilize 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, meaning all of the combustion air is taken from outside the building. These units also pre-heat the air, typically to 50-60°F, using a concentric vent where the combustion air is drawn in through the outer ring, while exhaust gases are vented through the inside core of the vent pipe. The air is pre-heated because the cold outside air does not mix well with the fuel, while pre-heated air blends well and allows for quieter ignition and combustion. Furnaces installed in manufactured homes also have to comply with strict space restrictions.[88]

[88] U.S. Department of Energy. (2014, July 7). *Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnace Fans.* Retrieved 9/23/14 from https://www.federalregister.gov/articles/2014/07/03/2014-15387/energy-conservation-program-for-consumer-products-energy-conservation-standards-for-residential.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.22	0.22
NOx	2.46	2.49	2.52	2.55	2.58	2.61	2.64	2.68	2.72
SOx	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06
	Winter Average - Tons per day								
PM2.5	0.27	0.27	0.27	0.27	0.28	0.28	0.28	0.29	0.27
NOx	3.28	3.31	3.35	3.39	3.43	3.47	3.51	3.56	3.28
SOx	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from natural gas-fired, fan-type central furnaces are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for natural gas-fired, fan-type central furnaces.

How does District Rule 4905 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 4905 compare to rules in other air districts?

SCAQMD

- Rule 1111 (Reduction of NOx Emissions from Natural Gas-Fired, Fan-Type Central Furnaces)

The District evaluated the requirements contained within SCAQMD Rule 1111 and found no requirements that were more stringent than those already in Rule 4905.

BAAQMD

- Regulation 9 Rule 4 (Nitrogen Oxides from Fan Type Residential Central Furnaces)

The District evaluated the requirements contained within BAAQMD Regulation 9 Rule 4 and found no requirements that were more stringent than those already in Rule 4905.

SMAQMD

- Rule 414 (Water Heaters, Boilers and Process Heaters Rated Less than 1,000,000 BTU Per Hour)

The District evaluated the requirements contained within SMAQMD Rule 414 and found no requirements that were more stringent than those already in Rule 4905.

VCAPCD

- Rule 74.22 (Natural Gas-Fired, Fan-Type Central Furnaces)

The District evaluated the requirements contained within VCAPCD Rule 74.22 and found no requirements that were more stringent than those already in Rule 4905.

Evaluation Findings

Even though natural gas-fired, fan-type central furnaces are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 4905 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from natural gas-fired, fan-type central furnaces in the Valley.

C.23 RULE 8011 GENERAL REQUIREMENTS

Discussion

The provisions of Rule 8011 are applicable to specified outdoor fugitive dust sources. The definitions, exemptions, requirements, administrative requirements, recordkeeping requirements, and test methods set forth in this rule are applicable to all rules under District Regulation VIII (Fugitive PM10 Prohibitions). The Regulation VIII series was adopted in November 2001, and subsequently amended in 2004. 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.

Emissions Inventory

There is no specific emissions inventory associated with Rule 8011.

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	N/A	N/A	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	N/A	N/A
SOx	N/A	N/A	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	N/A	N/A
NOx	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SOx	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

How does District Rule 8011 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT guidelines for this source category. The following federal regulations apply to sources covered under Rule 8011:

- 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 Rule 8011.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures (BACM))

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 Rule 8011.

State Regulations
There are no state regulations applicable to this source category.

How does District Rule 8011 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

SCAQMD
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8011.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD 1157 and found no requirements that were more stringent than those already in Rule 8011.

SMAQMD
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8011.

VCAPCD
- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8011.

Clark County Department of Air Quality (CCDAQ)
- Section 41 (Fugitive Dust)

The District evaluated the requirements contained within CCDAQ Section 41 and found no requirements that were more stringent than those already in Rule 8011.

Additional Emission Reduction Opportunities
This rule is administrative in nature, and is intended to be a supplementary rule to the other District Regulation VIII rules. Opportunities for emission reductions would be found with each of the other Regulation VIII rules and would not be identified as a possibility for this rule. As such, there are no emission reduction opportunities for Rule 8011.

Evaluation Findings

The District has evaluated all potential requirements achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8011 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from outdoor fugitive dust sources in the Valley.

C.24 RULE 8021 CONSTRUCTION, DEMOLITION, EXCAVATION, EXTRACTION, AND OTHER EARTHMOVING ACTIVITIES

Discussion

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, 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 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.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	1.46	1.47	1.48	1.48	1.49	1.50	1.51	1.52	1.53
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day								
PM2.5	1.34	1.34	1.35	1.36	1.37	1.38	1.39	1.39	1.40
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from construction, demolition, excavation, extraction, and other earthmoving activities are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for construction, demolition, excavation, extraction, and other earthmoving activities.

While District Regulation VIII was critical in the District's attainment of the PM10 standards, a variety of studies have been conducted which may 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. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are

effective for reducing PM2.5 for earthmoving activities. Modeling results show that the geologic fraction of PM2.5 found in the Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

How does District Rule 8021 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8021:

- 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 Rule 8021.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

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 Rule 8021.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 8021 compare to rules in other air districts?

There are no analogous rules for this source category in BAAQMD.

SCAQMD

- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8021.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8021.

SMAQMD

- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8021.

VCAPCD

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8021.

Clark County Department of Air Quality (CCDAQ)

- Section 94 (Permitting and Dust Control for Construction Activities)

The District evaluated the requirements contained within CCDAQ Section 94 and found no requirements that were more stringent than those already in Rule 8021.

Additional Emission Reduction Opportunities

District analysis identified one potential opportunity for this source category; to require signs to be posted at certain size work sites, asking the public to contact the District if the work site is producing significant dust emissions. While this potential opportunity would increase the awareness of the workers and the public, there is no conclusion that it would result in reduced emissions. If emissions are reduced, it is not likely to result in quantifiable emission reductions.

Evaluation Findings

Even though construction, demolition, excavation, extraction, and other earthmoving activities are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8021 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from construction, demolition, excavation, extraction, and other earthmoving activities in the Valley.

C.25 RULE 8031 BULK MATERIALS

Source Category

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 use control measures to ensure that visible dust emissions 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, 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 8031 was amended to require construction and maintenance of wind barriers when handling bulk materials.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day								
PM2.5	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from bulk materials are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for bulk materials.

Also, while District Regulation VIII was critical in the District's attainment of the PM10 standards, a variety of studies have been conducted which may 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 8031 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for bulk materials. Modeling results show that the geologic

fraction of PM2.5 found in the Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has a relatively low toxicity.

How does District Rule 8031 compare with federal and state rules and regulations?

Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8031:

- 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 Rule 8031.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

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 Rule 8031.

State Regulations
There are no state regulations applicable to this source category.

How does District Rule 8031 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

SCAQMD
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8031.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8031.

SMAQMD
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8031.

VCAPCD

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8031.

Clark County Department of Air Quality (CCDAQ)

- Section 41 (Fugitive Dust)

The District evaluated the requirements contained within CCDAQ Section 41 and found no requirements that were more stringent than those already in Rule 8031.

Additional Emission Reduction Opportunities

Rule 8031 currently employs the best dust mitigation techniques; there are no additional potential opportunities for further emissions reductions from this source category. Rule 8031's requirement of limiting opacity to 20% is as or more stringent than any other district's rule and compliance with the standard requires significant mitigation efforts from sites that store bulk materials.

Evaluation Findings

Even though storage and handling of bulk materials are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8031 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from bulk materials handling in the Valley.

C.26 RULE 8041 CARRYOUT AND TRACKOUT

Source Category

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; thresholds for any site with 150 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.

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 8041 was amended to require a threshold for vehicles with three or more axles to takes actions for carryout/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/trackout, and specifications for dust collectors, gravel pads, and paved surfaces.

Emissions Inventory

The emissions from this source category are included in Rule 8061 (Paved and Unpaved Roads).

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	N/A	N/A	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	N/A	N/A
SOx	N/A	N/A	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	N/A	N/A
NOx	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
SOx	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

While District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may 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 8041 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for carryout and trackout. Modeling results show that the geologic fraction of PM2.5 found in the Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

How does District Rule 8041 compare with federal and state rules and regulations?

Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8041:

- 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 Rule 8041:

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

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 Rule 8041.

State Regulations
There are no state regulations applicable to this source category.

How does District Rule 8041 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

SCAQMD
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8041.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8041.

SMAQMD
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8041.

VCAPCD
- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8041.

Clark County Department of Air Quality (CCDAQ)

- Section 94 (Permitting and Dust Control for Construction Activities)

The District evaluated the requirements contained within CCDAQ Section 94 and found no requirements that were more stringent than those already in Rule 8041.

Additional Emission Reduction Opportunities

Two potential opportunities to reduce emissions were identified, evaluated, and determined to not be feasible.

The first potential emission reduction opportunity would be to reduce the threshold for daily trips per worksite that requires a carryout and trackout prevention system (currently 150 trips). Reducing this threshold would require smaller worksites to install costly trackout prevention equipment like wheel washers, metal grates, and gravel pads. At these smaller worksites the emission reductions that would be achieved would be minimal and not cost effective because of the small size of the sites.

The second potential opportunity would be to shorten the distance from the nearest unpaved exit point of a site at which trackout must be immediately cleaned (currently 50 feet). Lowering this threshold would significantly increase the use of street sweepers and their associated emissions, which are more toxic to human health (see Chapter 3). Therefore, this opportunity has been determined to not be feasible.

Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8041 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from carryout and trackout of mud and dirt onto public paved roads in the Valley.

C.27 RULE 8051 OPEN AREAS

Source Category

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 visible dust emissions (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.

In 2004, the District adopted amendments to Regulation VIII that upgraded existing RACM level rules to meet the more stringent BACM level required in serious PM10 nonattainment areas. Rule 8051 was amended to add applicability thresholds for rural and urban areas.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.34	0.34	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	0.00	0.00
SOx	0.00	0.00	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	0.21	0.21
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from open areas are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for open areas.

Also, while District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may 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 8051 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for open areas. Modeling results show that the geologic fraction of PM2.5 found in the San Joaquin Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

How does District Rule 8051 compare with federal and state rules and regulations?

Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8051:

- 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 Rule 8051.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

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 Rule 8051.

State Regulations
There are no state regulations applicable to this source category.

How does District Rule 8051 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

SCAQMD
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8051.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8051.

SMAQMD
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8051.

VCAPCD
- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8051.

Clark County Department of Air Quality* (*CCDAQ)

- Section 90 (Fugitive Dust from Open Areas and Vacant Lots)

The District evaluated the requirements contained within CCDAQ Section 90 and found no requirements that were more stringent than those already in Rule 8051.

Additional Emission Reduction Opportunities

The District's analysis did not identify any potential opportunities to further reduce emissions from this source category beyond those emissions that are already being reduced by rule requirements. As a part of due diligence efforts in seeking addition emission reduction opportunities, the following two potential opportunities have been identified to improve rule clarity. Language could be added to the rule to clarify that it applies to off-road recreational vehicle use areas. Also, the rule provides an exemption for weed abatement activity utilizing mowing and/or cutting. Adding language to specify that weed abatement by tilling is not exempt would also add clarity to the rule. While these opportunities could clarify rule language, neither would likely generate emissions reductions from this source category.

Evaluation Findings

Even though open areas are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8051 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from open areas in the Valley.

C.28 RULE 8061 PAVED AND UNPAVED ROADS

Source Category

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 also establishes thresholds that when exceeded require that roads are treated to reduce visible dust emissions.

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 8061 was amended to replace the existing 75 maximum daily vehicle trip threshold with a 26 annual average daily vehicle trips (AADT) threshold on unpaved roads, and require all new unpaved roads within urban areas be paved.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	7.59	7.71	7.83	7.98	8.13	8.28	8.41	8.55	8.69
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day								
PM2.5	6.63	6.75	6.87	7.00	7.14	7.28	7.41	7.55	7.67
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

While District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may 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 8061 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for paved and unpaved roads. Modeling results show that the geologic fraction of PM2.5 found in the San Joaquin Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

How does District Rule 8061 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source

category. The following federal regulations apply to sources covered under Rule 8061:

- 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 Rule 8061.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

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 Rule 8061.

State Regulations
There are no state regulations applicable to this source category.

How does District Rule 8061 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

SCAQMD
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8061.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8061.

SMAQMD
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8061.

VCAPCD
- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8061.

Clark County Department of Air Quality (CCDAQ)

- Section 91 (Fugitive Dust from Unpaved Roads, Unpaved Alleys, and Unpaved Easement Roads)

The District evaluated the requirements contained within CCDAQ Section 91 and found no requirements that were more stringent than those already in Rule 8061.

- Section 93 (Fugitive Dust from Paved Roads and Street Sweeping Equipment)

The District evaluated the requirements contained within CCDAQ Section 93 and found no requirements that were more stringent than those already in Rule 8061.

Additional Emission Reduction Opportunities

The following potential opportunity to reduce emissions from paved and unpaved roads was determined to be infeasible. Section 5.2.1 of the rule requires dust control measures for any unpaved road segments with 26 or more annual average daily trips. A potential opportunity to reduce emissions would be to lower this threshold. This would require more owners/operators to implement at least one control measure to reduce fugitive emissions.

Analysis of the emission inventory indicates that the majority of the particulate emissions attributable to unpaved roads are generated from unpaved roads already subject to the mitigation requirements of Rule 8061. Therefore, the remaining portion of emissions associated with unpaved roads (less than 26 AADT) does not provide an opportunity for additional emissions reductions.

Additionally, emissions from unpaved roads are lowest in the winter months, when the District's PM2.5 24-hour exceedances occur. District staff believes the winter average PM2.5 emission inventory is overestimated for the following reasons:

- ARB methodology assumes that rainfall of at least 0.01 inch on any day mitigates unpaved road dust for 24 hours
- 71% of the days with precipitation occur during the winter months.
- Many US Forest and Park Roads are inaccessible during winter months due to increased amounts of rain and snow, yet emissions from these roads make up a larger percentage of the total unpaved road emissions in winter (42.8%) than in the annual average (40.7%)

For these reasons, lowering the trip threshold is not a viable emission reduction opportunity.

Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8061 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new

attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from paved and unpaved roads in the Valley.

C.29 RULE 8071 UNPAVED VEHICLE/EQUIPMENT TRAFFIC AREAS

Source Category

Rule 8071 is applicable to unpaved vehicle/equipment areas, parking, fueling and service areas, and shipping, receiving, and transfer areas. The rule contains requirements for when vehicle traffic reaches or exceeds specified thresholds, limitations on visible dust emissions (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.

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 8071 was amended to remove the 1.0 acre or larger threshold; change the vehicle threshold from 75 vehicle daily trips to 50 annual average daily trips; 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 whenever 25 or more three-axle vehicle trips will occur on an unpaved vehicle/equipment traffic area.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.59
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	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	0.60	0.60	0.60	0.60	0.60	0.60	0.60
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from unpaved vehicle/equipment traffic areas are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for unpaved vehicle/equipment traffic areas.

Also, while District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may 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 8071 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5

emission control factors are not well defined and it is not known if PM10 controls are effective for reducing PM2.5 for unpaved vehicle/equipment traffic areas. Modeling results show that the geologic fraction of PM2.5 found in the San Joaquin Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

How does District Rule 8071 compare with federal and state rules and regulations?

Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8071:

- 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 Rule 8071.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

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 Rule 8071.

State Regulations
There are no state regulations applicable to this source category.

How does District Rule 8071 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD.

SCAQMD
- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8071.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8071.

SMAQMD
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8071.

VCAPCD

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8071.

Clark County Department of Air Quality (CCDAQ)

- Section 92 (Fugitive Dust from Unpaved Parking Lots and Storage Areas)

The District evaluated the requirements contained within CCDAQ Section 92 and found no requirements that were more stringent than those already in Rule 8071.

Additional Emission Reduction Opportunities

Section 5.2.1 of current rule language requires dust control measures for any unpaved traffic area with 50 or more annual average daily trips. Analysis of lowering this threshold to determine if it is a feasible option to reduce emissions determined that this is not a cost effective opportunity. Lowering the trip threshold of Rule 8071 would result in direct PM emission reductions, but would also result in the requirement that owners and/or operators implement a dust control measure. The most common control measures are watering and covering with gravel. Local cost estimates indicate that installing a 2 inch gravel base with another 2 inches of top gravel would cost approximately $1.90 per square foot, or around $83,000 per acre. Based on the small size of the emissions from this source category, and the estimated mitigation costs, requiring control measures for areas with such minimal activity is not a cost effective option.

Evaluation Findings

Even though unpaved vehicle/equipment traffic areas are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8071 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from unpaved vehicle/equipment traffic areas in the Valley.

C.30 RULE 8081 AGRICULTURAL SOURCES

Source Category

Rule 8081 applies to "off-field" agricultural sources including, but not limited to, unpaved roads, unpaved vehicle/equipment traffic areas, and bulk materials. The rule contains requirements to limit visible dust emissions (VDE) and/or to comply 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.

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. The amendments added an exemption to the rule for vehicle/equipment traffic areas if they are less than one acre in size and more than one mile from an urban area; expanded rule applicability by updating the vehicle threshold from 75 vehicle daily trips to 50 annual average vehicle trips; and added a requirement specific to whenever 26 or more three-axle vehicle trips will occur on an unpaved vehicle/equipment traffic area.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	1.21	1.21	1.20	1.20	1.19	1.19	1.18	1.18	1.17
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Winter Average - Tons per day								
PM2.5	0.75	0.75	0.75	0.74	0.74	0.74	0.73	0.73	0.73
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from agricultural sources are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for agricultural sources.

Also, while District Regulation VIII was critical in the District's attainment of the PM10 standard, a variety of studies have been conducted which may 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 8081 and to indicate the level of significance of those PM2.5 emissions. At this time, PM2.5 emission control factors are not well defined and it is not known if PM10 controls are

effective for reducing PM2.5 for agricultural sources. Modeling results show that the geologic fraction of PM2.5 found in the San Joaquin Valley makes a relatively small contribution to overall PM2.5 mass. In addition, studies have shown that geologic dust alone has relatively low toxicity.

How does District Rule 8081 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under Rule 8081:

- 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 Rule 8081.

- EPA-450/2-92-004 (Fugitive Dust Background Document and Technical Information Document for BACM)

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 Rule 8081.

State Regulations

There are no state regulations applicable to this source category.

How does District Rule 8081 compare to rules in other air districts?

There are no analogous rules for this source category in BAAQMD.

SCAQMD

- Rule 1156 (Further Reductions of Particulate Emissions from Cement Manufacturing Facilities)

The District evaluated the requirements contained within SCAQMD Rule 1156 and found no requirements that were more stringent than those already in Rule 8081.

- Rule 1157 (PM10 Emission Reductions form Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in Rule 8081.

SMAQMD

- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SMAQMD Rule 403 and found no requirements that were more stringent than those already in Rule 8081.

VCAPCD

- Rule 55 (Fugitive Dust)

The District evaluated the requirements contained within VCAPCD Rule 55 and found no requirements that were more stringent than those already in Rule 8081.

Clark County Department of Air Quality (CCDAQ)

- Section 91 (Fugitive Dust from Unpaved Roads, Unpaved Alleys, and Unpaved Easement Roads)

The District evaluated the requirements contained within CCDAQ Section 91 and found no requirements that were more stringent than those already in Rule 8081.

Additional Emission Reduction Opportunities

The District's analysis did not identify any potential opportunities to further reduce emissions from this source category. However, a potential opportunity to improve enforceability of this for this source category has been identified. Section 5.4 of the rule references California Vehicle Code section 23112-23113 for prevention of carryout and trackout. This section could be removed and replaced with specific language from the vehicle code, however, as previously stated, this amendment would not result in emissions reductions.

Evaluation Findings

Even though off-field agricultural sources are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rule 8081 currently has in place the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from off-field agricultural sources in the Valley.

C.31 SC 001 LAWN AND GARDEN EQUIPMENT

Source Category

This source category includes the commercial and residential lawn and garden sectors. The commercial sector includes larger businesses that employ licensed contractors, public agencies and organizations that maintain their own properties or provide landscape services, and small businesses serving residential properties. The residential sector of lawn and garden equipment includes equipment purchased by the public for personal use. A survey conducted in 2003 by the California Air Resources Board (ARB) estimated that there are approximately 13 million pieces of lawn and garden equipment statewide: 12% in the commercial sector and 88% in the residential sector. Although there are more pieces of equipment used by the residential sector, the survey showed that the commercial sector accounts for 68% of annual use of all lawn care equipment.

Lawn and garden equipment includes the following: chainsaws, chippers, commercial turf equipment, front mowers, lawn and garden tractors, lawn mowers, leaf blowers and vacuums, rear-engine riding mowers, shredders, snow blowers, tillers, trimmers, edgers, brush cutters, wood splitters, and other lawn and garden equipment.

Handheld lawn and garden tools (such as leaf blowers) typically use two-stroke engines, while larger machines (such as lawn and garden tractors) use four-stroke engines. Lawn mowers are available with either type of engine. Two-stroke engines rely on oil mixed with the gasoline to lubricate the engine components. Much of this oil is not completely combusted by the engine thus creating high exhaust emissions. The major pollutants from a two-stroke engine, for example, are oil-based particulates, PM2.5, NOx, and a mixture of hydrocarbons, which combine with other gases in the atmosphere to form ozone, carbon monoxide, and other toxic air contaminants. Overall, four-stroke engines emit significantly lower emissions than their two-stroke counterparts, with significantly lower levels of hydrocarbons and particulate matter. Lawn care equipment, particularly leaf blowers, can also cause a significant amount of fugitive dust depending on the work practices employed such as blowing on bare dirt or very dusty paved surfaces. These types of activities would increase fugitive emissions including PM, toxic air contaminants (TAC) and ultrafine particles (UFP) resulting in a negative health impact on those in proximity to the activity.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
NOx	0.58	0.57	0.57	0.56	0.55	0.55	0.54	0.54	0.53
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PM2.5	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
NOx	0.54	0.53	0.53	0.52	0.51	0.50	0.50	0.49	0.49
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from lawn care equipment are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for lawn care equipment.

How would District SC 001 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category. The following federal regulations apply to sources covered under SC 001:

- EPA Rule 40 CFR Part 90 (Small Non-Road Spark-Ignition Engine Rule)

The EPA regulation required exhaust emission standards by 2011 and 2012, depending on the class of the engine.

State Regulations

The following state regulations apply to sources covered under SC 001:
(Small Off-Road Engines)

- 13 CCR 2403 (Exhaust Emission Standards)
- 13 CCR 2404 (Emission Control Labels)
- 13 CCR 2405 (New Engine Compliance)

How would District SC 001 compare to rules in other air districts?

There are no analogous rules for this source category in BAAQMD, SMAQMD, or VCAPCD.

SCAQMD

- Rule 1623 (Credits for Clean Lawn and Garden Equipment)

The District evaluated the requirements contained within SCAQMD's Rule 1623 and found it was not approved by EPA and is not currently being implemented.

Additional Emission Reduction Opportunities

ARB and EPA have regulatory authority over engine standards. ARB and EPA rules rely on natural turnover and do not push zero emissions technology; therefore, there are still opportunities to reduce emissions by closing the emissions gap and accelerating the use of zero emissions technology. While the District cannot establish new engine standards, it could regulate the use of lawn and garden equipment. Given the Valley's air quality challenges and the potential benefits, the District may explore in-use regulatory options as a long-term strategy. The District's analysis of potential opportunities to reduce emissions includes evaluations of emerging technologies and potential control strategies such as an in-use rule, best management practices, episodic controls, and zoning.

Emerging Technologies

There have been recent improvements in the availability and applications of zero emissions lawn care technology. Manufacturers are producing more electric lawn care equipment options and are developing ways to allow for this equipment to be used in the commercial sector, such as carrying additional battery packs. Examples of more recent advances in new electric options include the following:

- Lawn mowers
  - Riding mowers
  - Robotic mowers
  - Self-propelled walk behind mowers
  - Cordless electric lawn mowers
- Battery powered leaf blowers
- Electric sweepers and backpack vacuums
- Battery powered chainsaws
- Electric line trimmers/edgers
- Electric hedge trimmers
- Stronger batteries and battery chargers

Though zero-emitting or battery operated lawn equipment has significantly improved in recent years, the viability of cordless electric technology has not been proven in the commercial sector. This is largely due to the need for a longer battery life and durability to allow for more frequent and prolonged equipment use. On March 21, 2012, the District hosted a conference on lawn care, landscaping, and air quality. The conference highlighted challenges operators face when using lower emitting equipment and commercial viability. Local operators expressed concerns about the cost and reliability of cordless electric equipment, and how this equipment might affect productivity and competition with other operators.

In 2013, the District completed the *Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program*. The program was funded with State Air Quality Improvement Program and District program funds and provided eligible cordless zero-emission commercial lawn and garden equipment to commercial landscape professionals who conduct business within the boundaries of the San Joaquin Valley. The final report was submitted to ARB in 2013 with plans to allocate future incentive funds for cordless zero-emission lawn and garden equipment.

Potential Strategies to Reduce Emissions

In evaluating potential control strategies, the District's analysis identified a number of potential regulatory and outreach opportunities. However, there are no recommended regulatory actions at this time due to the need to revise the emissions inventory. The District will continue evaluating which of the following regulatory approaches are feasible from a regulatory standpoint as well as from a public health standpoint.

In-Use Rule

One potential control strategy would be to require the use of the cleanest available equipment by prohibiting the use of gas combustion equipment. This could be achieved through a point-of-sale rule implementing a tiered approach or by phasing in restrictions as lower or zero-emissions technology becomes more available in the future. This type of control measure could potentially eliminate the portion of emissions resulting from the combustion of fuel. There might also be a need to bifurcate this type of regulation due to the varying availability of low or zero-emitting equipment in the residential sector versus commercial sector.

Best Management Practices

Another potential control strategy would be to require operators to implement Best Management Practices (BMPs) using a menu approach for the use of lawn and garden equipment in the commercial sector. Some examples of potential BMPs include:

- Restrictions near schools and other heavily populated areas
- Courtesy practices (e.g. don't point at people or open windows, don't blow material onto public roads, sidewalks, or neighboring properties)
- Particulate prevention practices (e.g. no leaf blower use on bare dirt surfaces or very dusty paved surfaces, etc.)

This BMP option would focus on providing education on safety and more efficient use of equipment. Enforcing this type of rule could be challenging due to the large number of operators, variation in size of businesses, and the widespread distribution of operator activities. Operators could be required to complete a certification course so that they can be educated on proper work practices. The District could also require operators to show a certificate of completion to purchase gas equipment after a certain date, to ensure contractors operating gas equipment are using the most effective work practices to protect public health and decrease emissions.

Episodic Control

Episodic control provides another potential control strategy where use of gas equipment could be limited or prohibited during high-pollution days. There has also been precedence set throughout California with numerous cities and counties adopting ordinances banning or prohibiting the use of leaf blowers on specified days, times, distances from residential areas, or noise levels. The District could create a model ordinance for cities and counties to adopt throughout the Valley to limit or prohibit the use of gas equipment and/or leaf blowers. One example was found where the City of Menlo Park prohibited the use of gas equipment on Spare the Air days in the BAAQMD. This could be an option for future regulatory control in the Valley to reduce emissions, especially on high pollution days.

Table C-35 City Bans of Leaf Blowers

Cities	Ban Type
Dana Point San Diego	Decibel and hours of operations restrictions
Foster City Los Angeles Palo Alto	Restrictions on distance from residential unit and hours allowed to operate
Sacramento Sunnyvale	Restrictions on decibels, hours of operations, and distance from residential areas
Berkeley Beverly Hills Claremont Lawndale Los Altos Santa Barbara	Bans gas blowers
Burlingame	Restrict commercial use to one day per week dependent on determined city districts; Residential areas restricted by days and hours of operation
Menlo Park	Prohibited on Sundays, observed federal holidays, and on "Spare the Air" days as declared by the BAAQMD
Laguna Beach Santa Monica	Bans all blowers

Zoning

Another potential opportunity to reduce emissions could be through the promotion of “zones,” where gas equipment would be prohibited or limited in designated zones, such as those close to schools, parks, etc. This approach, known as “greenzoning,” is currently being pioneered in Los Angeles County. Greenzoning could potentially be included as a part of the Healthy Air Living outreach program to individual businesses, schools, cities, and counties. A related option could be limiting gas powered equipment use in certain zones to designated days of the week, similar to days allowed to water residential yards. This approach was recently adopted by the city of Burlingame for leaf blower use only. Cleaner electric equipment would have an advantage by still being able to be operated on the days or areas that gas powered equipment is limited. This strategy would also be a win-win by reducing noise nuisances in neighborhoods and

near schools. The District could provide model ordinances to cities and counties to adopt to assist them in implementing this type of measure.

Non-Regulatory Actions

There are no recommendations for new incentive or technology advancement programs at this time. The recommendation is to continue to run the *Clean Green Yard Machine Residential Lawn Mower Incentive Program,* as well as evaluate the commercial lawn care equipment technologies capable of reducing emissions in the Valley that were demonstrated as a part of the *Cordless Zero-Emission Commercial Lawn and Garden Equipment Demonstration Program*. The District, along with the technology demonstrators, submitted their Cordless Zero-Emission Commercial Lawn and Garden Equipment evaluation to ARB in June 2013.

Evaluation Findings

Even though lawn and garden equipment are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. The District cannot establish new engine standards; therefore, it is recommended the District continue current incentive programs in order to close the emissions gap and accelerate the use of zero emissions technology, ultimately exceeding both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from lawn and garden equipment in the Valley.

C.32 SC 002 ENERGY EFFICIENCY

Source Category

This category does not include specific emissions inventory sources in the Valley, but rather the opportunity to reduce emissions from all Valley sectors through the promotion of energy efficiency and conservation measures. Generally, emissions reductions could be obtained from reductions in electrical power generation or fuel through the implementation of such measures. Potential areas of focus include residential and commercial buildings, manufacturing and industrial facilities, agricultural operations, and oil/gas production and processing facilities.

Additional Emission Reduction Opportunities

Energy use is not a regulated activity; however, emissions from the generation of electricity are regulated at power plants. Overall, electricity generation in California is relatively clean when compared to emission factors (criteria pollutants and greenhouse gases (GHG)) from other states. California has been on the forefront of developing renewable energy sources, and has implemented regulations to ensure cleaner non-renewable energy. Whereas coal-fired electricity generation provides a significant percentage of electricity in other parts of the country, especially the eastern states, California relies more heavily on natural gas-fired power plants, which have lower emission rates for criteria pollutants and GHGs.

California imports 30% of its electricity from surrounding states (2010 data from California Energy Commission (CEC)). The state's four major utility companies use this electricity, as well as resources from around the state to supply continuous, reliable electricity to its customers. The inter-related nature of California's electricity transmission leads to a complex relationship between local energy efficiency programs and emissions reductions. Energy dispatch for needed demand is time and market dependent; the closest plant does not necessarily supply energy to the closest demand. In some cases, peak energy demand is met for areas outside the Valley, including Los Angeles and San Diego, with marginal (peaker) power plants within the Valley. Likewise, Valley demand may be met with electricity from marginal power plants outside the Valley. To complicate matters, which marginal plant is used can depend on the time of day, the minute-by-minute energy market, or other highly variable factors.

In 2010, the CEC commissioned an evaluation of energy usage and potential reductions from energy efficiency and renewable energy measures. Using sophisticated dispatch modeling, Synapse Energy Economics Inc. (Synapse) was able to estimate NOx emissions reductions for renewable energy and energy efficiency projects within California and within each of the four major utility companies.[89] In preliminary model runs, Synapse showed that approximately 45 pounds of NOx could be reduced for each gigawatt of displaced base load electricity. Likewise, 76 pounds of NOx could be

[89] Synapse Energy Economics, Inc. for CEC Public Interest Energy Research (PIER) Program. CEC-500-2011-XXX. (2011, May). *Emission Reductions from Renewable Energy and Energy Efficiency in California Air Quality Management Districts: Final Project Report* (Draft).

reduced for each gigawatt of displaced peak load electricity displaced by targeted energy efficiency efforts during peak demand hours.

In 2012, EPA released a roadmap manual[90] to assist state, tribal, and local air agencies with quantifying and including emissions reductions from energy efficiency and renewable energy in State Implementation Plans (SIPs). The document focuses on emission benefits from energy policies and programs in the electric power sector. The complex nature of electricity transmission and dispatch, combined with import and export of electricity into and out of the District and California, will require sophisticated energy modeling to pinpoint emissions reductions attributable to potential energy efficiency and renewable energy control measures.

The District's involvement in energy efficiency and renewable energy is guided by its Regional Energy Efficiency Strategy (REES), which was adopted in January 2010.[91] This policy document identifies the District's commitment to fostering energy efficiency and clean energy alternatives as opportunities for emissions reductions. The District has initiated several projects that exemplify this policy guidance.

Non-Regulatory Actions

The District currently has incentive and technology advancement programs aimed at reduced energy use in the Valley. To date, the projects include the following:

- The administration of approximately $4 million in federal and state Energy Efficiency and Conservation Block Grant funds made available to 37 small jurisdictions in the Valley. The majority of the funding was used to retrofit municipal facilities with lighting and other cost effective energy efficiency retrofits, resulting in about 1.8 MkWh of electricity savings per year.
- The funding of an innovative pilot program to assess the potential to operate more efficiently, thus saving money and using less energy.
- The funding of an outreach program showing governmental and service organizations the benefits of "going green." This program started in Stockton through the Stockton Chamber of Commerce, and with the District's help has expanded to the central and southern San Joaquin Valley.
- The allocation of $4 million for the District's Technology Advancement Program. Two of the three focus areas for FY 2014–2015 are renewable energy and waste solutions, which take into account energy efficiency.

While there are no recommendations for new incentive programs at this time, the District will continue supporting existing incentive and technology advancement programs.

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[90] EPA. (2012) *Incorporating Energy Efficiency/Renewable Energy in State and Tribal Implementation Plans*. Retrieved July 10, 2012 from http://www.epa.gov/airquality/eere/.

[91] SJVAPCD. (2010). *Approval of the District's Regional Energy Efficiency Strategy*. Memorandum to the SJVAPCD Governing Board. Public Hearing, January 21, 2010. Retrieved from http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2010/January/Agenda_Item_7_Jan_21_2010.pdf.

Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. The District cannot regulate energy use; therefore, it is recommended the District continue current incentives and technology advancement programs in order to close the emissions gap and accelerate the use of energy efficient technologies. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities for improving energy efficiency to reduce emissions in the Valley.

C.33 SC 003 FIREWORKS

Source Category
This category consists of fireworks sold and/or used in the Valley. This includes consumer fireworks for home displays, as well as professional products for use by licensed operators in public displays.

Emissions Inventory
The emissions inventory for this category has not been quantified.

How would District SC 003 compare with federal and state rules and regulations?

Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

State Regulations
The following state regulations apply to sources covered under SC 003:

- California Health and Safety Code, Section 12500 – 12759 (Law)
- Title 19, California Code of Regulations, Chapter 6 (Regulation)

How would District SC 003 compare to rules in other air districts?
There are no references to the use of fireworks or pyrotechnics for entertainment purposes in BAAQMD, SMAQMD, or VCAPCD.

SCAQMD
- Rule 219 (Equipment not Requiring a Written Permit Pursuant to Regulation II)

Rule 219 exempts pyrotechnic equipment, special effects, or fireworks paraphernalia equipment used for entertainment purposes from permit requirements.

- Rule 444 (Open Burning)

Fireworks and fireworks displays and pyrotechnics used for creation of special effects at theme parks are excluded from the open burning requirements of Rule 444.

- Rule 401 (Visible Emissions)
- Rule 402 (Nuisance)

Rules 401 and 402 do not explicitly exempt fireworks displays.

Additional Emission Reduction Opportunities
Fireworks usage in the Valley is limited to occasional displays at a small number of entertainment venues (minor league sporting events, for example) and Independence Day (July 4th). On July 4th, with widespread consumer fireworks use, the Valley's air

monitors typically show peak PM2.5 concentrations for several hours on the evening of July 4th and into July 5th. These hourly PM2.5 concentrations are much higher than normal PM2.5 concentrations during the summer, although 24-hour average PM2.5 concentrations on July 4th and 5th do not always go above the level of EPA's standard. In addition, exceedances of the air quality standard due to fireworks qualify as an exceptional event under federal regulations and, with proper documentation and EPA concurrence, do not count against an area's attainment status.[92] However, the clear relationship between fireworks activity and ambient PM2.5 levels; the location of emissions in populated areas; and the fact that the PM2.5 species associated with fireworks are health-impacting metals and carbons all demonstrate the value of reducing emissions from fireworks as part of the District's Health-Risk Reduction Strategy. Fireworks emissions are reduced by limiting the use of fireworks. For several years, the District has utilized public education to inform residents of the risks associated with firework emissions, and the dangers to sensitive populations. Enhancements to future outreach efforts may include partnering with other state and local agencies' outreach efforts.

Despite the strong public affinity for July 4th fireworks, many parts of the country are moving away from pyrotechnic fireworks displays and towards laser light-based shows – particularly in regions with severe drought conditions and extreme fire danger. According to the International Laser Display Association, laser-light-based shows are gaining popularity steadily as more and more communities are moving in this direction. Several companies in California and throughout the country are engaged in the business of incorporating laser-light based shows into 4th of July celebrations.

Some fireworks are lower-emitting than others. Disneyland Theme Park started using a patented air launch pyrotechnics system in 2004 to reduce noise and pollution. Use of such a system appears to be limited, and is likely most effective in situations where fireworks displays are frequent enough to justify the cost and permanent installation.

Non-Regulatory Action

In 2012, the District launched an incentive program for municipal laser-light shows to replace fireworks displays. Due to timing, the District was unable to fund shows that year, and has yet to reevaluate the program for implementation in future years.

On August 16, 2012, the District's Governing Board voted to adopt a position in opposition of California Senate Bill (SB) 1468 (Calderon), which would have allowed for the sale of safe and sane fireworks during the period of December 6th to January 2nd for two years, as a pilot for considering whether such an expanded use of fireworks should continue. This legislation would have thus expanded the use of fireworks to winter months when the Valley experiences stagnant conditions that trap particulates for extended periods of time. Given the potential for extreme adverse impact to public health, the District opposed SB 1468. Ultimately, the bill was not enacted, likely for

[92] 40 CFR 50.14 (b)(2), (2011). *Treatment of Air Quality Monitoring Data Influenced by Exceptional Events*.

financial reasons associated with the data collection and analysis associated with the bill.

Evaluation Findings

The District has evaluated all potential emission reduction opportunities for fireworks achieved in practice in other areas or included in other SIPs. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from fireworks in the Valley.

C.34 SC 004 SAND AND GRAVEL OPERATIONS

Source Category

Particulate matter emissions from sand and gravel operations occur as excavated aggregate material is conveyed, screened, crushed, and stored.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.09	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.11
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PM2.5	0.09	0.09	0.10	0.10	0.10	0.11	0.11	0.11	0.11
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from sand and gravel operations are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for sand and gravel operations.

How would District SC 004 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NESHAP, and MACT requirements for this source category.

NSPS

- 40 CFR Part 60, Section 111 of the Clean Air Act (40 FR 58416)

State Regulations

There are no state regulations applicable to this source category.

How would District SC 004 compare to rules in other air districts?

There are no analogous rules for this source category in in BAAQMD, SMAQMD, or VCAPCD.

SCAQMD

- Rule 1157 (PM10 Emission Reductions from Aggregate and Related Operations)
- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SCAQMD's Rules 1157 and 403 and found no requirements that were more stringent than those already in District Rules 8011, 2201, and 4101.

Additional Emission Reduction Opportunities

Generally, sand and aggregate materials are wet or moist when handled and emissions are often negligible. For processes where water is not an appropriate method for minimizing emissions, baghouse and filter technology and achieved-in-practice controls are generally sufficient to limit visible dust emissions to less than 20 percent opacity, as required by District Rule 8011 (General Requirements for Regulation VIII) and District Rule 4101 (Visible Emissions).

While other districts have specific rules for aggregate and related operations (SCAQMD Rule 1157), the ultimate limits for dust emissions is the same as opacity and visible emissions standards used for District operations. SCAQMD provides guidance for specific activities (e.g. loading, conveying, crushing, screening, and storage), but the emissions limits are the same as the District's limits. The District reviews any new or modified stationary source under Rule 2201 (New and Modified Stationary Source Review), which in most cases will trigger BACT requirements, thus requiring operators to apply the best controls to reduce emissions during operational activities including crushing, screening, and conveying.

Evaluation Findings

Even though sand and gravel operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rules 2201, 8011 and 4101 currently have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from sand and gravel operations in the Valley.

C.35 SC 005 ASPHALT/CONCRETE OPERATIONS

Source Category

This source category includes emissions from asphalt and concrete production operations. Cement concrete production includes cement manufacturing and concrete production. There are only a few cement plants in California, but none within the Valley. However, many operations contribute to potential emissions associated with concrete production, which include the blending of cement powder, water, sand, and coarse aggregate. Similarly, there are operations producing asphalt concrete, which is primarily used for paving parking lots and on-road surfaces and is commonly made by hot-mixing asphalt with size-graded aggregate in drums or batches. If a cement production plant were to be built within the Valley, it would be reviewed and evaluated under District Rule 2201 (New and Modified Stationary Source Review) and would trigger BACT requirements for equipment and processes associated with the production of cement.

Emissions Inventory

Source	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
Mineral Processes – PM2.5	0.82	0.84	0.86	0.89	0.92	0.94	0.97	0.99	1.01
Mineral Processes – NOx	0.20	0.20	0.21	0.22	0.22	0.23	0.24	0.24	0.25
Mineral Processes – SOx	0.36	0.37	0.38	0.40	0.41	0.42	0.43	0.44	0.45
Mineral Processes – VOC	0.22	0.22	0.23	0.24	0.24	0.25	0.26	0.26	0.27
Asphalt Mixing and Application – VOC only	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.78
	Winter Average - Tons per day								
Mineral Processes – PM2.5	0.79	0.81	0.84	0.86	0.89	0.91	0.94	0.96	0.98
Mineral Processes – NOx	0.18	0.18	0.19	0.19	0.20	0.20	0.21	0.21	0.22
Mineral Processes – SOx	0.35	0.36	0.37	0.38	0.39	0.40	0.42	0.42	0.43
Mineral Processes – VOC	0.20	0.20	0.21	0.21	0.22	0.23	0.23	0.24	0.24
Asphalt Mixing and Application – VOC only	0.76	0.76	0.76	0.76	0.77	0.77	0.77	0.77	0.77

The emissions inventory table above illustrates that the PM2.5, NOx, and SOx emissions from asphalt/concrete operations occur during the mineral processes for asphalt/concrete production. Asphalt mixing and application processes only generate VOC emissions, which occur via off-gassing. There would be NOx emissions from the combustion equipment used for asphalt mixing and application; however, those emissions are accounted for in District Rule 4309 (Dryers, Dehydrators, and Ovens) and off-road equipment.

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 1.4 tons per day (tpd) for PM2.5 combustion, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from asphalt/concrete operations are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a

control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for asphalt/concrete operations.

How would SC 005 compare with federal and state rules and regulations?

Federal Regulations
There are no EPA CTG, ACT, or MACT requirements for this source category.

NSPS
- 40 CFR 60 Subpart OOO (Standards of Performance for Nonmetallic Mineral Processing Plants)
- 40 CFR 60 Subpart I (Standards of Performance for Hot Mix Asphalt Facilities)
- 40 CFR 60 Subpart UU (Standards of Performance for Asphalt Processing and Asphalt Roofing Manufacturing)

The District evaluated the requirements contained within the above NSPSs and found no requirements that were more stringent than those already in Rules 4101 (Visible Emissions), 2201 (New and Modified Stationary Source Review), and 4309 (Dryers, Dehydrators, and Ovens).

NESHAP
- 40 CFR 63 Subpart LLLLL (Asphalt Processing and Asphalt Roofing Manufacturing for Major Sources)
- 40 CFR 63 Subpart AAAAAAA (Asphalt Processing and Asphalt Roofing Manufacturing for Area Sources)

The District evaluated the requirements contained within the above NESHAPs and found no requirements that were more stringent than those already in Rule 4101 (Visible Emissions), Rule 2201 (New and Modified Stationary Source Review), and Rule 4309 (Dryers, Dehydrators, and Ovens).

State Regulations
There are no state regulations applicable to this source category.

How would SC 005 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD, SMAQMD, and VCAPCD.

SCAQMD
- Rule 1157 (PM10 Emission Reductions from Aggregate and Related Operations)

The District evaluated the requirements contained within SCAQMD Rule 1157 and found no requirements that were more stringent than those already in District Rule 4101 (Visible Emissions), Rule 2201 (New and Modified Stationary Source Review), and Rule 4309 (Dryers, Dehydrators, and Ovens).

- Rule 403 (Fugitive Dust)

The District evaluated the requirements contained within SCAQMD Rule 403 and found no requirements that were more stringent than those already in District Rules 4101 (Visible Emissions), 2201 (New and Modified Stationary Source Review), and 4309 (Dryers, Dehydrators, and Ovens).

Additional Emission Reduction Opportunities

Liquid asphalt is unworkable at ambient temperatures, so most asphalt mixtures are manufactured, spread, and compacted at temperatures higher than 300°F (>150°C) to temporarily reduce the viscosity, thereby making the mixture workable. Working at these high temperatures produces greenhouse gases and other criteria and hazardous air pollutant emissions, in addition to creating an undesirable working environment. These emissions are minimized by achieved-in-practice controls meeting the opacity requirements of District Rule 4101 (Visible Emissions) and Rule 2201 (New and Modified Stationary Source Review). Additionally, new technologies allowing for warm-mix asphalt techniques provide better emissions control at lower temperatures.

Achieved-in-Practice Controls for Concrete and Asphalt Processes

For concrete production operations, achieved-in-practice controls include baghouses for screens, crushers, and concrete weight batchers; bin vent filters for concrete and fly ash silos; and water spray for other emissions points. For asphalt operations, achieved-in-practice controls include oil mist collectors and "blue smoke" control with electrostatic precipitators or filter packs. Dryers used for drying aggregate in the asphalt production process are regulated under District Rule 4309 (Dryers, Dehydrators, and Ovens), which limits NOx and CO to 4.3 and 42 ppmv, respectively, for gaseous-fuel fired units.

Warm-mix Asphalt (WMA)

Asphaltic concrete, or pavement, is used worldwide for road construction. An asphaltic concrete mix consists of aggregate and liquid asphalt. Liquid asphalt, also termed asphalt cement, is a natural hydrocarbon substance primarily derived from the heaviest part of petroleum crude oil. The aggregate, which is basically rocks of different size, angularity, and hardness, is bound with the liquid asphalt to make the strongest and most durable pavement combination for expected road conditions.

The performance of liquid asphalt depends on the chemistry of the crude oil source and how it was refined. The physical properties of the liquid asphalt can also be adjusted with various additives, such as polymers or hydrated lime. The performance of the aggregate depends on the physical chemistry of the rock as well as its shape and size. The performance of the final asphalt mixture depends on the quality and proportions of the components and the quality of the construction. Asphalt pavements are typically 95% by weight aggregate and 5% asphalt binder.[93]

[93] MyAsphaltPavingProject.Com. (2011). "What are the Specifications?" Retrieved from http://www.myasphaltpavingproject.com/whatisasphalt/what-are-the-specifications/.

The high viscosity[94] inherent to liquid asphalt makes it suitable for paving projects, but requires added heat during mixing and application. Liquid asphalt is unworkable at ambient temperatures, so most asphalt mixtures are manufactured, spread, and compacted at temperatures higher than 300°F (>150°C) to temporarily reduce the viscosity, thereby making the mixture workable. Working at these high temperatures produces greenhouse gases and other criteria and hazardous air pollutant emissions, in addition to creating an undesirable working environment.[95]

Heating and mixing takes place at a batch or drum plant where dry, and sometimes heated, aggregate is mixed with heated liquid asphalt. Once mixed, the asphalt is loaded into trucks and transported to a job site where a paver lays the asphalt mix. The laid asphalt mix is then compacted with rollers to reduce air voids.

European and American companies have developed several techniques, collectively known as warm-mix asphalt (WMA), to increase the workability of asphalt by lowering the viscosity at temperatures as much as 100°F below that of hot-mix asphalt (HMA). WMA was introduced in Europe in 1997 and in the United States (U.S.) in 2002. Techniques for WMA include the use of mechanical methods, specifically foaming and water injection, and the use of organic or chemical additives. Mechanical methods may require some plant modifications, but the use of additives can, in most cases, be accommodated using existing plant and production technology. In all cases however, WMA technologies may require more finesse in controlling moisture in the aggregate and in the overall system operation, such as tuning of the burner to run efficiently at lower temperatures. Improper burner adjustment can cause the burner to not add enough air to burn all the fuel and may cause mix contamination.

Mechanical methods for WMA have been shown to reduce the production temperature by 25-90°F. These methods include, but are not limited to, adding water-containing products, water-based foaming processes, and using hot coarse aggregate mixed with wet sand. Chemical additives for WMA have been shown to reduce the production temperature by 59-86°F. The additives include, but are not limited to, organic wax, chemical packages, cationic surfactants, surface-active agents, processing aids, and polymers. Additive dosages range from 0.2% to 3% by mass or weight.[96]

WMA has shown potential for reducing emissions associated with the production of asphalt for paving projects when compared to HMA. Lower temperatures required for production, storage, transport, and application translates to lower fuel consumption, which in turn reduces the criteria air pollutant emissions associated with combustion. In a 2013 California Department of Transportation (Caltrans) report[97], WMA was

[94] Viscosity is a material's resistance to gradual deformation when stress is applied.
[95] Rubio et al. (2013). "Comparative Analysis of Emissions from the Manufacture and Use of Hot and Half-Warm Mix Asphalt." *Journal of Cleaner Production, 41*, 1-6.
[96] Rubio et. al. (2012). "Warm-mix Asphalt: An Overview". *Journal of Cleaner Production, 24*, 76-84.
[97] Caltrans. (2013, April). *Caltrans Activities to Address Climate Change: Reducing Greenhouse Gas Emissions and Adapting to Impacts. Retrieved from:* http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/Caltrans_ClimateChangeRprt-Final_April_2013.pdf

recognized as potentially yielding 25–35% fuel savings and thus contributing to a significant level of emissions reductions from manufacturing, mixing, and laying the asphalt.

Asphaltic concrete production plants are regulated by District Rule 2201 (New and Modified Stationary Source Review Rule), Rule 4301 (Fuel Burning Equipment), Rule 4309 (Dryers, Dehydrators, and Ovens), and Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations), which have all been approved by EPA to meet or exceed RACT requirements.

Benefits of WMA

The use of WMA was initially promoted as a means of reducing emissions from road projects, especially in nonattainment areas[98]. However, after extensive research and numerous case studies, the potential benefits of WMA have expanded beyond reduced emissions. Benefits include, but are not limited to the following:

- **Improved performance**: WMA improves workability and ease of compaction, which is critical to long-term performance of the mixture. [99]
- **Energy Savings**: By lowering the production, storage, transport, and application temperatures, manufacturers require less energy to heat aggregate and liquid asphalt. Energy savings could potentially offset the added cost of additives or needed modifications to plants, especially where energy costs are high. Reduced plant temperatures may also cause less wear on plant equipment, thus reducing plant maintenance costs. [100]
- **Increased Capacity for Reclaimed Asphalt Pavement**: WMA allows for higher percentages of reclaimed asphalt pavement (RAP) to be used in the mixture with no effect on ultimate pavement performance. The use of RAP is less expensive than producing an asphalt mixture from raw materials, and additional savings can be generated from avoiding landfill disposal or recycling fees.
- **Potential Cost Savings**: Fuel savings, increase in reclaimed asphalt pavement content, and reductions in fuel and labor during the process of installing WMA translate to reduced costs for WMA projects. One cost assessment indicated $3,000-$6,000 in savings per lane mile.[101] Life cycle assessments have shown reduced agency costs, user costs, and environmental costs.

[98] St. Martin P.E., J., California Asphalt Pavement Association. (2013, March 28). "Warm-mix Asphalt. Presentation to the League of California Cities Public Works Officers Institute. Sacramento, California." Retrieved from http://www.cacities.org/UploadedFiles/LeagueInternet/f2/f257a42c-2d27-47d1-a641-068a32289b71.pdf.

[99] MyAsphaltPavingProject.Com. (2011). "What are the Specifications?" Retrieved from http://www.myasphaltpavingproject.com/whatisasphalt/what-are-the-specifications/.

[100] Caltrans. (2013, April). *Caltrans Activities to Address Climate Change: Reducing Greenhouse Gas Emissions and Adapting to Impacts. Retrieved from:* http://www.dot.ca.gov/hq/tpp/offices/orip/climate_change/documents/Caltrans_ClimateChangeRprt-Final_April_2013.pdf

[101] Leng & Al-Qadi. Illinois Center for Transportation, University of Illinois at Urbana-Champaign, Champaign, Illinois. (2011). "Comparative Life Cycle Assessment between Warm SMA and Conventional SMA."

- **Extended paving season**: A smaller difference between the asphalt temperature and ambient temperature reduces the rate of cooling, which means paving can take place during colder weather.
- **Longer transport time**: Lower temperatures required for storage allow the asphalt to be transported to more remote locations and introduces more flexibility in transportation schedules.
- **Shorter cooling time**: The lower temperature allows cooling to take place in a shorter time, increasing the project completion rate and opening roads to traffic more quickly.
- **Safer working conditions**: VOC and other hazardous emissions are significantly reduced with WMA, as is a potential burn hazard.

Potential Emissions Reductions from WMA

As previously mentioned, WMA production has the potential to reduce combustion emissions by reducing the amount of energy (fuel) needed to heat aggregate and liquid asphalt. While fuel savings have been reported to be from 20% to over 50% for some WMA technologies, U.S. studies have reported burner fuel savings of zero to 30%, with 15% to 25% being typical.[102] These fuel savings translate into reductions in criteria pollutants, such as NOx.

European studies have documented the reduction of NOx emissions associated with the use of WMA. The table below summarizes the range of NOx emission reductions expected from the use of WMA; however, actual emissions reductions for U.S. production of WMA will vary depending on the fuel used for combustion, control technology, and local regulations.

Table C-36 NOx Emission Reductions for Warm-mix Asphalt

	Vaitkus et al.[103,104]	Larsen, O.R.[105]	D'Angelo et al.[106]	Evotherm[107]
NO_x Reduction	60–70%	62%	60–70%	58%

The emissions inventory for asphaltic concrete production in the Valley includes emissions from asphalt plants, dryers, storage piles, and vehicle traffic. As evidenced by the emissions inventory table for this source category, the NOx emissions from this source category are extremely small. In addition, only 88% of these NOx emissions are

[102] California Asphalt Pavement Association. (2013, March 28). "Warm-mix Asphalt. Presentation to the League of California Cities Public Works Officers Institute. Sacramento, California." Retrieved from http://www.cacities.org/UploadedFiles/LeagueInternet/f2/f257a42c-2d27-47d1-a641-068a32289b71.pdf.
[103] Vaitkus, A., Cygas, A., Laurinavicius, A. Perveneckas, Z. (2009a). Analysis and Evaluation of possibilities for the use of Warm Mix Asphalt in Lithuania. The Baltic Journal of Road and Bridge Engineering, 4(2), 80–86.
[104] Vaitkus, A., Vorobjovas, V. Ziliut, L. (2009b). The Research on the Use of Warm Mix Asphalt for Asphalt Pavement Structures. Road Department, Vilnius Gediminas Technical University, Vilnius, Lithuania.
[105] Larson, O.R. (2001). Warm Asphalt Mix with Foam—WAM™FOAM. International Road Federation, 2001 Partie B: Themes Techniques, S.00469. Kolo Veidekke, Norway.
[106] Vaitkus et al., 2009a,b.
[107] Evotherm® (2010, March). Stack Emissions & Jobsite Fumes Reductions using Evotherm® Warm Mix Asphalt. Available at: http://www.meadwestvaco.com/mwv/groups/content/documents/document/mwv017395.pdf

from production processes, as about 12% of these emissions account for associated vehicle traffic.[108]

Feasibility of WMA

As more tests and case studies are run in the U.S., WMA is proving to perform as effective as or better than HMA. Caltrans and the University of California Pavement Research Center have been evaluating WMA technology and its performance by testing rutting and cracking performance, moisture sensitivity, durability, aging, emissions, and stability of multiple types of WMA production.[109] WMA has so far been shown to have equal or better overall performance compared to HMA, less smoke and odor, and increased workability. [110]

The use of WMA in the U.S. has been growing steadily since the first test section was completed in 2004. Caltrans use of WMA has grown from laying about 67,000 tons of WMA between 2006 and 2009, to just over 2 million tons by 2012.[111] To further encourage the use of WMA, in June 2012 Caltrans issued a directive that provided guidance for implementing a contractor-requested option to use an approved WMA technology to encourage the use of WMA by contractors.[112] On a national scale, there are estimates that while 19.2 million tons of WMA had been placed by 2009 that value has increased to an estimated 500 million tons per year in 2013.[113] WMA is even being used in situations where safety is looked at closely, such as airport runways for Boston Logan and Chicago O'Hare airports.

WMA is on the uptake and will become more widely used over time. The U.S. Department of Transportation Federal Highway Administration (FHWA) has chosen WMA for rapid deployment under its *Every Day Counts* (EDC) initiative. In 2013, 30% of paving in the U.S. was WMA, and FHWA has a goal that by 2015, half of all the asphalt used in the U.S. will be WMA.[114] As a result of these efforts, the use of WMA is continuing to grow in the Valley with the current backing from state and national transportation agencies.

Despite the technological feasibility of using WMA as a substitute for HMA, the cost of converting equipment to produce WMA remains a potential barrier to adoption. Certain facilities would incur more costs than others to employ this technology. More research into the capital costs of converting production equipment is needed to determine

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[108] EPA, 2000,Table 1; excludes mobile source emissions; average for batch and drum plants

[109] St. Martin P.E., J., California Asphalt Pavement Association. (2013, March 28). "Warm-mix Asphalt. Presentation to the League of California Cities Public Works Officers Institute. Sacramento, California." Retrieved from http://www.cacities.org/UploadedFiles/LeagueInternet/f2/f257a42c-2d27-47d1-a641-068a32289b71.pdf.

[110] Rubio, M.C., Martínez, G., Baena, L. & Moreno, F. (2012). Warm Mix Asphalt: An Overview. Journal of Cleaner Production, 24, 76–84. doi:10.1016/j.jclepro.2011.11.053

[111] St. Martin, 2013.

[112] California Department of Transportation (Caltrans). (2012, June 7). Contractor Option for Use of Warm Mix Asphalt Technologies in Hot Mix Asphalt. Available at: http://www.dot.ca.gov/hq/construc/CPDirectives/CPD12-2.pdf

[113] St. Martin, 2013.

[114] St. Martin P.E., J., California Asphalt Pavement Association. (2013, March 28). Warm Mix Asphalt. Presentation to the League of California Cities Public Works Officers Institute. Sacramento, California. Available at: http://www.cacities.org/UploadedFiles/LeagueInternet/f2/f257a42c-2d27-47d1-a641-068a32289b71.pdf

whether WMA is cost effective for asphalt production facilities in the Valley. In addition, some applications may not be suitable for WMA. Just as with HMA use and application, WMA use is not a one-size-fits-all product. Continued studies and field tests are showing which product, mix, and application are best for specific uses and conditions.

While the benefits of WMA are far-reaching, more research into the capital costs associated with converting production equipment to handle WMA and other feasibility issues is still needed to fully determine whether WMA would be feasible and cost effective to require for all Valley asphalt production facilities. Therefore, as discussed in Chapter 8 (Commitment to Leave No Stone Unturned to Evaluate Additional Opportunities), the District is committing to further evaluate warm mix asphalt for additional opportunities.

Cutback Asphalt

District Rule 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations) contains an exemption for the use of cutback (medium cure) asphalt where the National Weather Service official forecast of the high temperature for the 24-hour period following application is below 50°F. The use of cutback asphalt results in VOC emissions, which do not contribute significantly to the formation of PM2.5. As such, this is not a potential emission reduction opportunity for this *2015 PM2.5 Plan*. Although the use of cutback asphalt has declined in recent years, Rule 4641 maintains the exemption based on the following:

- The exemption for cutback asphalt during colder ambient temperatures, which occurs during winter (non-ozone) season, is analogous to EPA's Blue Book on Cutback and Emulsified Asphalt recommended seasonal exemptions (i.e. outside of the ozone season).
- During colder ambient temperatures, VOCs do not evaporate rapidly, especially from medium cure asphalt that is limited by Rule 4641 to no more than 5% organic compounds that evaporate at 500°F.
- Road construction and road repairs using asphalt are very minimal during the colder winter months, except for emergency road repairs. In addition, during winter months, the Valley experiences the majority of rainfall, including long periods of fog. In these conditions, asphalt will not properly cure or harden due to the increased moisture on the surfaces or areas where asphalt is applied and therefore, this type of activity is minimal.

Evaluation Findings

Although asphalt/concrete operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District evaluated the feasibility of all potential emissions reductions measures for this source category. As demonstrated in the above control measure evaluation, existing District regulations for this source category (Rules 4309 and 4641) currently implement BACM and MSM for these sources.

In addition, as discussed above, WMA is potentially a viable alternative to HMA and the benefits obtained by switching from HMA to WMA have contributed to the fast growing use of WMA throughout California and the Valley. FHWA's goal of achieving 50% of

WMA paving by 2015 has further accelerated the widespread adoption of this technology throughout the country and will likely further increase the use of WMA in the Valley in future years.

Although current District rules already meet BACM and MSM requirements for this source category, as previously mentioned, the District is committing to further evaluate warm mix asphalt for additional opportunities. See Chapter 8 for more information.

C.36 SC 006 ALMOND HULLING/SHELLING OPERATIONS

Source Category

This control measure source category would apply to almond hulling and shelling operations. Almonds are harvested from orchards and transported to almond processing facilities, where the almonds are hulled and shelled leaving the nut, or meat. Orchard debris, soil, and pebbles represent 10-25% of the field weight of material brought to the almond processing facility. Clean almond meats are obtained as about 20% of the field weight. Processes for removing the debris and almond hulls and shells are potential sources of air emissions. The Valley harvests 86% of the almonds produced in California. Production has roughly doubled in the last decade, with the 2010/2011 crop year reaching 1.4 billion pounds.[115]

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.38	0.39	0.40	0.40	0.41	0.42	0.42	0.43	0.44
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PM2.5	0.24	0.24	0.24	0.25	0.25	0.26	0.26	0.27	0.27
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from almond hulling/shelling operations are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for almond hulling/shelling operations.

How would District SC 006 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, and MACT for this source category.

State Regulations

There are no state regulations applicable to this source category.

[115] The Tioga Group. (2012). *SJV Nut Industry Profile Preliminary Draft.* Retrieved from http://www.sjvcogs.org/pdfs/2012/Nut%20Industry%20030612.pdf.

How would SC 006 compare to rules in other air districts?

There are no analogous rules for this source category in SCAQMD, BAAQMD, VCAPCD, or SMAQMD.

Additional Emission Reduction Opportunities

Evaluation of emission reduction opportunities for almond hulling and shelling operations included a review of ongoing research efforts, and the technologicial feasibility and cost effectiveness of polytetrafloroethylene (PTFE) bags.

Ongoing Research Efforts

Research is currently being conducted by Texas A&M University in partnership with almond harvesting equipment manufacturers, almond farmers, United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), and the District to compare "low dust" almond harvesters and an exhaust abatement devices to conventional harvesters in the harvesting of almonds at a Valley farm. No differences were detected in the particle size distribution (PSD) characteristics of PM emitted from each harvester, with the exception of the exhaust abatement device, where large particles were efficiently captured by the cyclone. Emissions of total suspended particulates (TSP) and PM10 trended lower for all new harvesters and were significantly lower for most harvesters. There were significant reductions of PM2.5 ranging from 61-69% observed from the harvesters and a 95% reduction in PM2.5 from the Clean Air Concept cyclone. The results of these tests imply that new harvest technologies are able to reduce PM emissions without affecting product quality.

Polytetrafloroethylene Bags

District BACT guidelines for almond hullers and shellers require the use of a baghouse, which controls PM by moving the contaminated flow of air through bag type filters. The technology has been achieved in practice in the District. Standard polyester bags are the most commonly used type of bag for baghouses in the almond hulling/shelling industry. A layer of dust (dust cake) collects on the upstream side of these bags and filtering efficiency increases as the layer grows; however, they are not designed to provide high PM2.5 control. On the other hand, membrane type bags treated with polytetrafloroethlyene (PTFE) contain extremely small pores and filtering occurs on the bag surface instead of in a dust cake. These types of filters are capable of controlling 99.9%[116] of PM2.5 emissions, whereas baghouses with polyester bags control PM2.5 emissions by 95-99%.[117]

The costs of using baghouses with PTFE bags rather than standard polyester bags were calculated. The pressure drop across polyester and PTFE bags is about the same so there should not be a significant increase in electrical costs by using one bag over another. Additionally, existing baghouses would not require modifications to accommodate PTFE bags so the increased cost lies solely in the cost of the bags. A

[116] EPA, Control Technology Center, Verified Technologies. (2012) *Baghouse: PTFE Filters*. Retrieved February 19, 2015 from http://www.baghouse.com/products/dust-collector-filters/baghouse-filter/ptfe-filters/.
[117] Roberts, C. (2009). *Information on Air Pollution Control Technology for Woody Biomass Boilers.* Northeast States for Coordinated Air Use Management and the EPA Office of Air Quality Planning and Standards.

PTFE bag typically costs $23, whereas a polyester bag costs $12. The lifetime of both bags is approximately 2 years. The following cost differential was calculated, with knowledge that some facilities in the Valley have up to 2-3 baghouses, each with 500 bags. District permits also require facilities to have replacement bags accounting for 10% of the total number of bags; therefore 550 bags will be used for the following calculations.

Additional Costs for Using PTFE Bags

550 bags x ($23/ PTFE bag - $12/ polyester bag) / 2 years = **$3,025/ year** (per baghouse)

3 baghouses x $3,025/ year = **$9,075/ year** (for 3 baghouses)

Potential PM2.5 Emission Reductions from Using PTFE Bags

The control efficiency for PM2.5 for polyester bags is assumed to be equivalent to the control efficiency for PM10.
(99.9% control efficiency from PTFE bags – 99% control efficiency of polyester bags) = 0.9% additional control efficiency

2015 emission inventory is 0.40 tons/day
(0.40 tons/day PM2.5) x (0.9% additional control from using PTFE bags)
= **0.0036 tons/day reduced**

(0.0036 tons/day reduced from using PTFE bags) x (365 days/year)
=**1.314 tons/year reduced**

Potential Cost Effectiveness of Using PTFE Bags

101 baghouses in the Valley

(101 baghouses) x (PTFE bag costs $3,025/ year) = **$305,525/year**

($305,525/year) / (1.314 tons/year reduced) = **$232,515.22/ton**

The cost effectiveness of replacing polyester bags was also calculated at the lower end of the emission control efficiency scale (95%) with the PTFE bags to determine what a more conservative cost effectiveness analysis would reveal; the cost effectiveness from 95% polyester bags to 99.9% PTFE bags is $42,706.88/ton PM2.5 reduced.

Although the initial annual capital cost may seem relatively low; in terms of cost effectiveness, PTFE bags are not a cost effective alternative to standard bags. The additional control efficiency gains are in the fractions of tons of incremental emissions reductions. Additionally, as mentioned above, the emission inventory used in these calculations (0.40 tons/day PM2.5) includes the emissions of both almond hulling and

pistachio hulling, meaning the actual inventory is smaller, and making the actual cost effectiveness even higher than calculated.

The cyclone is another technology in common use at Valley facilities for PM control in almond hulling/shelling; however, like baghouses with polyester bags, the technology primarily provides PM10 control. Additionally, cyclones typically achieve 80-85% control efficiency. Approximately 37 facilities in the Valley use cyclones to control PM emissions. Therefore, if these facilities were required to replace cyclones with baghouses, the cost effectiveness would be as follows:

Potential PM2.5 Emission Reductions for Replacing Cyclones with Baghouses with PTFE Bags

The PM2.5 control efficiency for cyclones is assumed to be equivalent to the control efficiency for PM10
(99.9% control efficiency of baghouse – 85% control efficiency of cyclone)
= 14.9% additional control efficiency

2015 emission inventory is 0.40 tons/day
(0.40 tons/day PM2.5) x (14.9% control with use of baghouse)
= **0.0596 tons/day reduced**

(0.0596 tons/day reduced) x (365 days/year)
= **21.754 tons/year reduced**

Potential Cost Effectiveness for Replacing Cyclones with Baghouses with PTFE Bags

37 facilities to install baghouses at a minimum of $150,000 each

With a 10 year amortization factor and 10% interest, the annualized cost for a $150,000 baghouse would be:

(0.1627 CRF) x ($150,000) = **$24,405/year**

(37 facilities) x (capital cost of baghouse $24,405/year) = **$902,985/year**

($902,985/year) / (21.754 tons/year reduced) = **$41,508.92/ton**

Replacing the existing cyclones with baghouses with PTFE bags would cost $41,508.92/ton, which does not include additional costs of installation, electrical system upgrades, ductwork, demolition or disposal of the cyclone. Therefore, replacing cyclones with baghouses is not a cost effective control option. As previously stated, the emissions inventory used in these calculations (0.40 tons/day PM2.5) includes the emissions of both almond hulling and pistachio hulling, meaning the actual inventory is smaller, and making the actual cost effectiveness even higher than stated.

Evaluation Findings

Even though almond hulling/shelling operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, current control techniques have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from almond hulling/shelling operations in the Valley.

C.37 SC 007 PISTACHIO HULLING/SHELLING OPERATIONS

Source Category

This control measure source category would apply to pistachio hulling and shelling operations within the Valley. Pistachio hulling operations are permitted under the same permit with the pistachio receiving and pre-cleaning portions of the operation. These operations use 1D-3D cyclones to control PM emissions from the pre-cleaning portion of the process, which is the Best Available Control Technology (BACT) standard. Typically pistachio processing equipment, located after the pre-cleaning section and prior to the pistachio dryers, is of a wet-process design; PM emissions from this portion of the operation are assumed to be negligible. California produces 98.5% of U.S. pistachios and production has expanded greatly in the last decade. Pistachio acreage doubled between 1997 and 2010, and production looks like it will continue to increase in the near future.[118] In the interest of identifying every possible strategy to reduce PM2.5 emissions, pistachio hulling and shelling operations were evaluated for potential opportunities to reduce emissions; see the discussion below.

Emissions Inventory

The emissions inventory for this category is included as a part of the emissions inventory for the control measure source category for almond hulling. Refer to the emission inventory table presented in SC 006 for this combined inventory.

How would District SC 007 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

State Regulations

There are no state regulations applicable to this source category.

How would SC 007 compare to rules in other air districts?

There are no analogous rules for this source category in SCAQMD, BAAQMD, SMAQMD, or VCAPCD.

Additional Emission Reduction Opportunities

Pistachio shelling operations are served by a baghouse, which is the industry standard for shelling operations. While there is no specific BACT guideline for shelling operations, baghouses are typically attributed to a PM2.5 control efficiency of 95-99%. As discussed above in SC 006 (Almond Hulling/Shelling Operations), polytetrafloroethylene (PTFE) bags have the potential to provide additional PM2.5 control when used in baghouses but are not cost effective due to the already high

[118] The Tioga Group. (2012). *SJV Nut Industry Profile Preliminary Draft.* Retrieved from http://www.sjvcogs.org/pdfs/2012/Nut%20Industry%20030612.pdf.

control efficiency of existing practices. Refer to SC 006 (Almond Hulling/Shelling Operations) for the cost effectiveness analysis.

Unlike almonds which are shaken on the ground and vacuumed off the soil during harvesting, pistachios are caught with a canvas catcher before they hit the ground, which allows for a very small amount of dust and debris in addition to the pistachios. Much of the PM emissions associated with the processing of pistachios occur during the pre-cleaning stage, which is controlled by cyclones. The hulling stage is a wet process as the nuts are floated on water; PM emissions from this portion of the operation are assumed to be negligible. At this time, the District's analysis indicates that there are no feasible opportunities for additional emission reduction regulatory strategies for this source category.

Evaluation Findings

Even though pistachio shelling operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. While there is no specific rule or guideline for pistachio shelling, the industry-standard baghouse operation described above meets or exceeds both BACM and MSM requirements. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from pistachio shelling operations in the Valley.

C.38 SC 008 AGRICULTURAL MATERIAL SCREENING/SHAKING OPERATIONS

Source Category
This control measure source category would be applicable to the handling and processing of agricultural materials in biomass, composting, and other agricultural material handling facilities.

Emissions Inventory
The emissions inventory for this category is accounted for in other control measure source categories. Refer to Appendix B for the emissions inventory.

How would District SC 008 compare with federal and state rules and regulations?

Federal Regulations
There are no EPA CTG, ACT, NSPS, NESHAP, and MACT requirements for this source category.

State Regulations
There are no state regulations applicable to this source category.

How would District SC 008 compare to rules in other air districts?
There are no analogous rules for this source category in BAAQMD, SMAQMD, or VCAPCD.

SCAQMD
- Rule 1131.1 (Chipping and Grinding Activities)

The District evaluated the requirements contained within SCAQMD 1131.1 and found no requirements that were more stringent than those already in New Source Review Rule 2201.

Additional Emission Reduction Opportunities
District analysis of potential emission reduction opportunities includes an evaluation of the efficacy of wet suppression systems and enclosing conveyors and transfer points.

Wet Suppression System
A wet suppression system can achieve between 40-65% control of PM2.5.[119] In a wet suppression system, water is generally applied to all emissions units, transfer points, and raw material stockpiles to ensure that adequate moisture is provided to the operation to successfully reduce PM emissions. No emissions would be reduced by requiring a wet suppression system because this control is currently in use at all identified facilities in the Valley and would be required at any new facility triggering BACT under the New Source Review Rule 2201.

[119] Environmental Protection Agency [EPA]. (1995). *Compilation of Air Pollutant Emission Factors, Table B.2-3.*

Enclosed Conveyors and Transfer Points

Enclosing conveyors and transfer points to limit the emissions of PM is a practice used in addition to water spray at seven facilities in the Valley. This control option would potentially reduce emissions at the drop or transfer points on the conveyors. However, in addition to the control efficiency of enclosed conveyors being unknown, conveyors are already operated so that they move very slowly to avoid entraining dust and limit visible emissions. Therefore, the potential to reduce emissions is minimal and reduced emissions would not be quantifiable.

Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, current business practices have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from agricultural material screening/shaking operations in the Valley.

C.39 SC 009 TUB GRINDING

Source Category

This control measure source category would apply to operations using a tub grinder for agricultural material processing. Tub grinders are used to grind organic materials such as wood and agricultural materials for biomass fuel processing facilities, composting facilities, landscape material manufacturing (e.g. wood bark, mulch, etc.), or agricultural waste grinding (e.g. orchard removal, land clearing, etc.). These units are typically powered by diesel-fired internal combustion engines (ranging from 100 horse power (hp) to 1,600 hp) and mounted on wheels to be transportable, which allows the units to be towed to the jobsite where the piles of material are to be ground. In addition, these units may also be self-propelled and track-mounted; in this case the diesel engine powering the equipment is also used for motive power and is exempt from District permits since it is considered to be mobile equipment. The diesel engines powering the transportable units are subject to District Rule 4702 (Internal Combustion Engines) and Best Available Control Technology (BACT) Guideline 3.2.11. This control measure source category discussion addresses the particulate matter (PM) emissions from the loading, grinding, and conveying of the process materials.

Emissions Inventory

Emissions generated by the engines of the tub grinders are accounted for as a part of the inventory for District Rule 4702 (Internal Combustion Engines). The fugitive particulate emissions from these units are accounted for as a part of the stationary and area source emissions inventory. See Appendix B.

How would District SC 009 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, and MACT requirements for this source category.

State Regulations

There are no state regulations applicable to this source category.

How would SC 009 compare to rules in other air districts?

There are no analogous rules for this source category in BAAQMD, SMAQMD, or VCAPCD.

SCAQMD

- Rule 1131.1 (Chipping and Grinding Activities)

The District evaluated the requirements contained within SCAQMD Rule 1131.1 and found no requirements that were more stringent than those already in District Rules 2201 (New Source Review) and 4101 (Visible Emissions) and BACT guideline 6.4.2.

Additional Emission Reduction Opportunities

Currently, fugitive particulate emissions from transportable and self-propelled tub grinders are controlled with a water sprinkler system during loading, grinding, and unloading of the process materials to prevent visible emissions in excess of 5% opacity per Rule 2201 (New Source Review) and BACT guideline 6.4.2. Water sprinkler systems achieve between 40-65% control of PM2.5.[120] It is standard practice to use water spray on this type of equipment to meet the visible emission requirements of Rule 4101 (Visible Emissions); therefore, requiring water control for tub grinding operations would not result in additional emission reductions from this source category. A potential control option considered would be to require a baghouse to be installed onto the trailer of the equipment to capture fugitive PM emissions. Due to the large size of the additional equipment required to be installed onto the trailer and the limited space available, a baghouse is not technologically feasible for a transportable unit.
No technologically feasible or alternative basic equipment were identified in the District's BACT guidelines.

Evaluation Findings

The District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, Rules 2201, 4101, and District BACT guideline 6.4.2 currently have in place the most stringent measures feasible to implement in the Valley and therefore meet or exceed both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from tub grinding in the Valley.

[120] Environmental Protection Agency [EPA]. (1995). *Compilation of Air Pollutant Emission Factors, Table B.2-3.*

C.40 SC 010 ABRASIVE BLASTING

Source Category

Abrasive blasting involves the cleaning or preparing of a surface by forcibly propelling a stream of abrasive material against such surface. Abrasive blasting can occur in a confined or an unconfined area, depending on the type of surface or application. Abrasive materials commonly used are walnut shells, various mineral or metal products, garnet, sand or aggregate, slag, steel grit abrasive, or steel shot.

Emissions Inventory

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019	2020
	Annual Average - Tons per day								
PM2.5	0.33	0.34	0.35	0.36	0.37	0.38	0.40	0.40	0.41
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PM2.5	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41
NOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SOx	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

As detailed in Chapter 5, the significance thresholds for source categories for the purpose of evaluating the application of BACM and MSM requirements are 4.0 tons per day (tpd) for PM2.5 dust, 13.1 tpd for NOx, and 1.0 tpd for SOx. As identified in the above table, emissions from abrasive blasting are lower than the BACM/MSM significance thresholds. Therefore, the Clean Air Act does not require a control measure evaluation for this source category for the purpose of satisfying BACM/MSM requirements; however, the District has still conducted a full control measure evaluation for abrasive blasting.

How would District SC 010 compare with federal and state rules and regulations?

Federal Regulations

There are no EPA CTG, ACT, NSPS, NESHAP, or MACT requirements for this source category.

NESHAP/ MACT

- 40 CFR 63, Subpart XXXXXX (National Emission Standards for Hazardous Air Pollutants Area Source Standards for Nine Metal Fabrication and Finishing Source Categories)

The District evaluated the requirements contained within 40 CFR 63, Subpart XXXXXX and found no requirements that were more stringent than those already in District Rule 4102 (Nuisance) and 17 CCR 6 92200 (Opacity) through 92500 (Performance Standards).

State Regulations
The following state regulations apply to sources covered under SC 010:

- 17 CCR 6, Sections 92000-92530 (Abrasive Blasting).

How would District SC 010 compare to rules in other air districts?
No rule from another air district has requirements beyond what is already required in state standards. BAAQMD Regulation 12, Rule 4 (Sandblasting), SCAQMD Rule 1140 (Abrasive Blasting), and VCAPCD Rule 74.1 (Abrasive Blasting) regulate abrasive blasting operations and activities, but all simply conform to the state standards.

Additional Emission Reduction Opportunities
Achieved-in-practice BACT controls for sandblasting include baghouses, filters, or cartridge dust collectors. With such technologies, 99% control efficiency can be achieved. As emissions sources, sandblasting operations within the District are subject to District Rule 4102 (Nuisance) and the standards of 17 California Code of Regulations (CCR) Section 92200 (opacity) and 17 CCR Section 92500 (performance standards such as CARB-certified abrasives).

Opportunities for further emissions reductions are limited because of the CH&SC stipulation that air districts cannot impose stricter rules on sandblasting operations. The District's analysis has determined that there are no feasible opportunities for additional emissions reductions for this source category.

Evaluation Findings
Even though abrasive blasting operations are not a significant source of PM2.5, NOx, or SOx in the Valley, the District has evaluated all potential control technologies and all control technologies achieved in practice in other areas or included in other state implementation plans. As demonstrated above, the California Code of Regulations and District Rule 4102 currently provide the most stringent measures feasible to implement in the Valley and therefore meets or exceeds both BACM and MSM requirements for this source category. As the District continues to develop new attainment plans that address more stringent National Ambient Air Quality Standards, the District will continue to evaluate potential opportunities to reduce emissions from abrasive blasting operations in the Valley.

C.41 AMMONIA CONTROLS

Under Subpart 4 of the CAA, regions are required to address ammonia as a precursor in BACM/MSM analyses and other areas of the plan unless EPA determines that ammonia sources do not contribute significantly to PM concentrations. To improve public health while also ensuring effective use of resources, additional ammonia controls should only be required when there is clear scientific evidence that reasonable measures to reduce ammonia emissions would be effective in significantly reducing ambient PM2.5 concentrations.

Extensive scientific research and technical analyses (see Appendix A) demonstrate that ammonia reductions do not contribute to the Valley's PM2.5 attainment; as such, ammonia does not need to be addressed in this BACM/MSM analysis for the 1997 PM2.5 standard. Even though ammonia is an insignificant PM2.5 precursor in the Valley, the following analysis shows that the Valley's ammonia emissions have been significantly reduced through stringent regulations, that additional ammonia control measures are infeasible, and that Valley sources currently implement BACM and MSM.

As demonstrated in Appendix B of this *2015 PM2.5 Plan*, the three main sources of ammonia emissions in the Valley from stationary and area sources that account for 95% of the Valley's ammonia emissions are as follows (based on 2015 estimates):

- Farming Operations with 198.0 tons per day (tpd),
- Solvent evaporation from Agricultural Fertilizers at 116.3 tpd, and
- Composting Solid Waste Operations at 9.0 tpd.

The following discussion evaluates:

- Confined Animal Facilities (District Rule 4570)
- Agricultural Fertilizers
- Organic Material Composting (District Rule 4566)
- Biosolids, Animal Manure, and Poultry Litter Operations (District Rule 4565)
- Major Sources of Ammonia

Confined Animal Facilities (District Rule 4570)

I. District Rule Description

District Rule 4570, was originally adopted on June 15, 2006 and was most recently amended on October 21, 2010. The purpose of this rule is to limit emissions of volatile organic compounds (VOC) from Confined Animal Facilities (CAF). District Rule 4570 applies to facilities where animals are corralled, penned, or otherwise caused to remain in restricted areas and primarily fed by a means other than grazing for at least 45 days in any twelve-month period. In addition to limiting VOC emissions, District Rule 4570 also includes measures that limit ammonia (NH3) emissions from these operations; the

required measures have reduced ammonia emissions by over 100 tpd[121] (this reduction is reflected in the emissions inventory data above). The analysis below focuses on how District Rule 4570 limits NH3 emissions in comparison to other rules and regulations.

A. Types of Confined Animal Facilities

Confined Animal Facilities are used for the raising of animals including, but not limited to, cattle, calves, chickens, ducks, goats, horses, sheep, swine, rabbits, and turkeys, which are corralled, penned, or otherwise caused to remain in restricted areas for commercial agricultural purposes and fed by a means other than grazing. (CH&SC §39011.5 (a)(1)). The major categories of Confined Animal Facilities are listed below.

- Dairy Operations - Dairy operations are those operations producing milk or animals for facilities that produce milk.
- Poultry Operations - Poultry facilities operate either as layer ranches for egg production or as broiler ranches where birds are grown for the fresh meat market.
- Beef Cattle Feeding Operations – Beef cattle facilities are facilities that raise beef cattle (heifers and steers) for their meat.
- Swine Operations – These operations raise pigs for their meat. The production cycle for hogs has three (3) phases: farrowing (giving birth), nursing, and finishing.

B. Rule 4570 Applicability Thresholds

The thresholds for a facility to be classified as a large CAF in the Valley and the thresholds for a facility to be subject to District Rule 4570 are shown in the following table. The large CAF thresholds are based on the definition of a large CAF adopted by ARB as required by California Senate Bill (SB) 700. District Rule 4570 applies to confined animal facilities that have the capacity to house a number of animals equal to or exceeding the Rule 4570 regulatory thresholds, which are lower than the large CAF thresholds for certain facilities.

[121] Appendix F of the Staff Report for the June 2009 re-adoption of Rule 4570, starting on the 329th page of the pdf available here http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2009/June/Agenda%20Item_10_June_18_2009.pdf

Rule 4570 Thresholds for Regulation		
Livestock Category	SJVAPCD Large CAF Thresholds	Rule 4570 Regulatory Thresholds
Dairy	1,000 milking cows	500 milking cows
Beef Feedlots	3,500 beef cattle	3,500 beef cattle
Other Cattle Facility	7,500 calves, heifers, or other cattle	7,500 calves, heifers, or other cattle
Poultry Facilities		
Chicken	650,000 head	400,000 head
Duck	650,000 head	400,000 head
Turkey	100,000 head	100,000 head
Swine Facility	3,000 head	3,000 head
Horses Facility	3,000 head	3,000 head
Sheep and Goat Facilities	15,000 head of sheep, goats, or any combination of the two	15,000 head of sheep, goats, or any combination of the two
Any livestock facility not listed above	30,000 head	30,000 head

C. Emission Control Requirements of District Rule 4570

District Rule 4570 requires multiple mitigation measures from the following CAF categories: Dairy, Beef Feedlots, Other Cattle Facilities, Swine Facilities, Poultry facilities, and various other smaller operations. Each of these facilities consists of multiple sources of emissions within the facility. Since these facilities generally cover a large area and have different processes, a single mitigation measure or technology is generally not sufficient to control overall emissions from the facility. Mitigation measures required by Rule 4570 have been tailored for each source of emissions, thereby ensuring that the overall emissions from a facility are reduced. The current methodology in Rule 4570 allows for the greatest overall control from the entire facility.

District Rule 4570 recognized the following five emission sources for all of the CAFs: Feed, Housing, Solid Waste, Liquid Waste, and Land Application of Manure. Rule 4570 requires each CAF to implement a certain number of mitigation measures for each of these sources. District Rule 4570 also distinguishes between the different types of housing configurations (freestall vs open corrals) for cattle and, as such, requires specific mitigation measures for each type of housing. By requiring mitigation measure(s) for each source of emissions at a facility, District Rule 4570 ensures that reductions are achieved throughout the facility.

The following describes some of the mitigation measures and the ways in which these measures reduce ammonia emissions:

- Nutritional management: Ammonia emissions result from the decomposition of undigested nitrogen compounds in animal waste. Proper nutritional management, with diets formulated to feed proper amounts of protein, improves nitrogen utilization by the animal, reducing production of ammonia from animal waste.

- Increased cleaning and removal of manure and litter from animal housing areas: Because animal waste is the primary source of ammonia emissions, increased removal of waste from animal housing areas will reduce emissions by reducing the exposed area. Proper management of the waste will stabilize the nitrogen compounds in the waste, which will reduce the rate that these compounds are converted to ammonia that can be lost to the atmosphere. In addition, ammonia is highly soluble in water; therefore, when a flush system is used, ammonia emissions will be reduced because much of the ammonia will dissolve in the water rather than volatilize to the air.
- Incorporation of manure into fields: Incorporation of manure in fields reduces volatilization of gaseous pollutants by minimizing the amount of time that the manure is exposed to the atmosphere. Once the waste has been incorporated into the soil, VOCs and ammonia are absorbed onto soil particles, providing the opportunity for these soil microbes to oxidize these compounds into carbon dioxide, water, and nitrates.

One area to which some of these rules may apply is silage and silage-based total mixed ration (TMR) used as feed for cattle. Research has demonstrated that silage and TMR are one of the largest sources of VOC emissions at cattle facilities but are not significant sources of NH3 emissions, which primarily results from the animal waste at CAFs; therefore, the measures that specifically apply to management of silage and TMR will not be discussed in detail in this analysis.

II. How does District Rule 4570 compare with federal rules and regulations?

A. EPA-Control Technique Guidelines (CTG)

There is no EPA CTG guidance document for confined animal facilities.

B. EPA - Alternative Control Technology (ACT)

There is no EPA ACT guidance document for confined animal facilities.

C. Standards of Performance for New Stationary Sources (NSPS)

There is no NSPS guidance document for guidance document for confined animal facilities.

D. National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Maximum Achievable Control Technologies (MACTs)

There is no NESHAP guidance document for confined animal facilities.

III. How does District Rule 4570 compare to rules in other air districts?

As the largest agricultural area in California, the District took the lead in devising a list of mitigation measures for the various emission sources during the initial development of

District Rule 4570. This list of mitigation measures was essentially utilized, almost identically, by all air districts in their rules. However, during the last amendments to District Rule 4570, all of the mitigation measures were reevaluated in light of the latest available science. In comparison to the previous version of the rule, the current rule lowered threshold limits to bring in additional CAFs, requires additional mitigation measures, clarified previous mitigation measures, and added additional monitoring, testing, and recordkeeping to improve enforceability.

The following California air district rules were compared to District Rule 4570:

- SCAQMD Rule 223, adopted June 2, 2006
- SCAQMD Rule 1127, adopted August 6, 2004
- BAAQMD Regulation 2 Rule 10, adopted July 19, 2006
- VCAPCD Rule 23 (Exemptions), amended April 8, 2008
- SMAQMD Rule 496, adopted August, 24, 2006
- Imperial County APCD (ICAPCD) Rule 217 and Policy Number 38, adopted October 10, 2006
- Butte County AQMD (BCAQMD) Rule 450, adopted December 21, 2006

Idaho Administrative Procedure Act (IDAPA) 58.01.01 Sections 760-764 was also compared with District Rule 4570 and the analysis is shown below.

It is important to note that only District Rule 4570, SMAQMD Rule 496, and SCAQMD Rule 1127 are prohibitory rules. For this reason, these rules include detailed recordkeeping as well as monitoring and testing requirements. Generally, the level of detail in a prohibitory rule is absent from permits rules because the purpose of a permit rule is different from the purpose of a prohibitory rule.

A. SCAQMD Rule 223

Applicability/Exemption/Large CAF Definition

SCAQMD Rule 223 was adopted on June 2, 2006 and has not been amended.

SCAQMD Rule 223 applies to large CAFs as defined by ARB. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas SCAQMD Rule 223 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

Therefore, Rule 4570 is more stringent regarding applicability.

Requirements for Dairy CAFs

Feed Mitigation Measures

District Rule 4570 has seven mitigation measures for feed and two mitigation measures for silage. Operators must implement four mandatory feed mitigation measures and chose another one from a list of three, for a total of five mitigation measures required for feed. In the SCAQMD rule, there are nine feed mitigation measures, from which the operator must implement five. Both rules require selection of five mitigation measures for feed, excluding silage, but four of the five feed mitigation measures are mandatory in District Rule 4570. Therefore, overall District Rule 4570 is more stringent.

Milk Parlor Mitigation Measures

The milk parlor mitigation measures for SCAQMD includes one Class One and one Class Two mitigation measure. District Rule 4570 contains the same mitigation measures included in the SCAQMD rule as Class One and has removed the Class Two mitigation measures due to infeasibility; see the Staff Report for the October 21, 2010 amendments to Rule 4570 for more detail. Therefore, both rules will be considered identical in this category.

Freestall Mitigation Measures

District Rule 4570 has five mitigation measures, two of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SCAQMD Rule 223 has eight Class One mitigations measures, from which facilities are required to implement at least two. District Rule 4570 requires one additional mitigation measure; therefore, District Rule 4570 is more stringent.

SCAQMD Rule 223 has three Class One mitigation measures that require increased frequency in comparison to the corresponding District Rule 4570 measures: (*inspect water pipes and troughs and repair leaks; remove animal waste that is not dry from individual cow freestall beds; and rake, harrow, scrape, or grade bedding in freestalls*). The South Coast rule requires pipes and troughs to be inspected daily, and manure from freestall beds to be removed daily, whereas District Rule 4570 does not require inspection of pipes and troughs in freestall barns. In the Valley, the majority of freestall barns use flush systems for manure management and may also use misters or water sprays to keep animals cool; therefore, inspection of the pipes and troughs in the freestall barns was determined to be irrelevant since this is already a wet system. SCAQMD Rule 223 requires freestall beds to be raked/harrowed/graded at least twice every seven days, whereas District Rule 4570 requires this measure to be carried out once every 7 days for large dairies and once every 14 days for medium dairies.

Although, SCAQMD Rule 223 has a higher frequency for these measures, the emissions generated from these sources are not significant, including the reductions achieved from the overall dairy. In addition, the CAF stakeholders have questioned the cost effectiveness of a daily frequency.

Corral Mitigation Measures

District Rule 4570 has nine mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SCAQMD Rule 223 has 14 Class One mitigation measures and two Class Two mitigation measures, from which facilities are required to choose at least six. District Rule 4570 requires one additional mitigation measure; therefore, District Rule 4570 is more stringent.

SCAQMD Rule 223 has one Class One mitigation measure (*inspect water pipes and troughs and repair leaks*) that require increased frequency in comparison to the corresponding District Rule 4570 measure. SCAQMD Rule 223 requires this measure to be carried out daily, whereas District Rule 4570 requires it to be carried out only once every seven days. Although, SCAQMD Rule 223 has a higher frequency for this measure, the difference in the emissions reductions from the two frequencies is not expected to be significant.

Solid Waste and Separated Solids Mitigation Measures

District Rule 4570 contains only two mitigation measures, from which operators are required to choose at least one. SCAQMD Rule 223 has three Class One mitigation measures and three Class Two mitigation measures, from which facilities are required to choose at least two.

Available studies have indicated that NH3 emissions from stored solid waste and separated solids pile to be a very small fraction of total NH3 emissions at dairies. Since the NH3 emissions from solid manure account for a very small fraction of emissions from the overall dairy, there would not be a significant increase in NH3 emission reductions if more measures are required from this category.

Liquid Waste Mitigation Measures

District Rule 4570 has four mitigation measures, from which operators are required to choose at least one. SCAQMD Rule 223 has five Class One mitigation measures and five Class Two mitigation measures, from which operators are required to choose at least one. Since only one measure is required by both rules, the rules are similar in stringency.

Manure Land Application Mitigation Measures

District Rule 4570 has two mitigation measures required out of six optional measures. SCAQMD Rule 223 has four mitigation measures, from which

facilities are required to choose at least two. All the mitigation measures are similar in stringency.

Requirements for Poultry CAFs

There is a large degree of variability in the manure management practices, housing techniques, and potential feeding practices for the different type of poultry operations in the Valley. Due to these differences, District Rule 4570 separates poultry CAFs into the following categories: 1) layers and 2) broilers, ducks, and turkeys.

Although on the surface the poultry requirements results in fewer mitigation measures compared to the other rules, the segregating of the types of poultry has allowed the mitigation measures to be tailored specifically to the type of poultry operation. In addition, all measures for poultry in District Rule 4570 are now mandated rather than left as options. Due to this reconfiguration and taking into consideration the latest science, the District Rule 4570 requirements for poultry are more stringent than SCAQMD Rule 223.

Requirements for Other CAF Categories

In addition to dairy and poultry CAF mitigation measures discussed above, District Rule 4570 provides specific mitigation measures for beef cattle feedlots, other cattle, and swine CAFs. SCAQMD Rule 223 does not address mitigation measures for these additional CAF categories. For these types of large CAFs, District Rule 4570 is more stringent.

Requirements – Suspension and Substitution of Mitigation Measures

Both rules allow the temporary suspension of a mitigation measure upon the determination by a certified veterinarian or nutritionist that such a suspension is necessary for animal health purposes. The District must be notified within 48 hours, and a new measure must be implemented if the suspension is expected to last longer than 30 days. In addition, both rules allow for substitution of one mitigation measure with an equivalent or more stringent one with the submission of the appropriate information. Therefore, the suspension and substitution requirements of both rules are equally stringent.

Conclusion – Comparison with South Coast AQMD Rule 223

Based on the analysis of the CAF categories in District Rule 4570 and SCAQMD Rule 223, it is clear that District Rule 4570 is more stringent than SCAQMD Rule 223. There are differences in the frequency with which some mitigation measures are to be implemented. However, as stated earlier, many of these sources are a small portion of a dairy's overall emissions. The amended version of District Rule requires facilities to choose more mitigation measures and makes several mitigation measures mandatory.

District Rule 4570 also provides mitigation for more CAF categories (beef feedlots, other cattle, and swine) that are not addressed by SCAQMD Rule 223, and also has much more detailed recordkeeping requirements to demonstrate implementation of selected mitigation measures. In addition, SCAQMD recently identified District Rule 4570 as the most stringent rule for this source category in their ozone Reasonably Available Control Technology (RACT) Demonstration.[122]

B. SCAQMD Rule 1127

Applicability/Exemption/Large CAF Definition

SCAQMD Rule 1127 was adopted on August 4, 2004 and has not been amended.

SCAQMD Rule 1127 applies to dairies with 50 or more cows, heifers, and/or calves. The rule applies to dairy farms and related operations such as heifer and calf farms and the manure produced on them. By comparison, District Rule 4570 applies to dairy CAFs with at least 500 milking cows, but applies to more than just manure-handling operations. Although the SCAQMD Rule has a lower applicability threshold, the overall control effectiveness of Rule 1127 when compared to District Rule 4570, is far less stringent.

Requirements for Dairy CAFs

Milking Parlor and Freestall Mitigation Measures

For the milking parlor, the District rule has one mandatory mitigation measure. District Rule 4570 has five mitigation measures for freestalls, two of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three to implement. SCAQMD Rule 1127 does not address these operations. Therefore, overall District Rule 4570 is more stringent than SCAQMD Rule 1127.

Corral Mitigation Measures

District Rule 4570 has nine mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SCAQMD Rule 1127 has eight mitigation measures, from which facilities are required to choose at least six. The mitigation measures required by SCAQMD Rule 1127 specify the removal of manure from the corrals, the minimization of water in the corrals, and the cleaning schedule and cleaning strategy for the corrals. While the mitigation measures in the two rules are not

[122] South Coast Air Quality Management District (June 6, 2014). Reasonably Available Control Technology Demonstration. http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2014/2014-jun6-031.pdf?sfvrsn=2

phrased the same way, they cover similar requirements. District Rule 4570 requires one additional measure; therefore, Rule 4570 is more stringent.

Solid Waste, Separated Solids, and Liquid Waste, and Manure Land Application Mitigation Measures

District Rule 4570 has two mitigation measures for solid waste/separated solids, from which operators are required to choose at least one. For liquid waste, District Rule 4570 has four mitigation measures for liquid waste, from which operators are required to choose at least one. District Rule 4570 has two mitigation measures for land application of manure required out of six optional measures. SCAQMD Rule 1127 states that manure removed must be either treated at an approved manure processing operation, or applied on agricultural land with local approval. SCAQMD Rule 1127 does not specify different mitigation measures for solid waste, separated solids, or liquid waste. District Rule 4570 has specific mitigation measures for each of these operations; therefore, it is able to better target the reduction of emissions from these the different operations. District Rule 4570 is therefore as stringent as or more stringent than SCAQMD Rule 1127.

Requirements for Other CAFs

District Rule 4570 provides specific mitigation measures for beef cattle feedlots, other cattle facilities, poultry facilities, and swine facilities. SCAQMD Rule 1127 does not address mitigation measures for these additional CAF categories. Therefore, District Rule 4570 is more stringent for this category.

Requirements – Suspension and Substitution of Mitigation Measures

SCAQMD Rule 1127 provides one exemption per year from one of the corral clearings required every 90 days if the moisture content in the corrals is greater than 50%. The operator is required to notify SCAQMD 30 days before the required cleaning, and test moisture content weekly. If moisture content is still above 50% when the cleaning is due, the operator may claim the exemption.

In comparison, District Rule 4570 allows an operator to temporarily suspend any mitigation measure as long as the suspension is recommended by a licensed veterinarian of animal nutritionist on the basis of animal health. The operator must notify the District within 48 hours prior to the suspension. If the suspension is expected to last longer than 30 days, then the operator must submit a new mitigation plan that identifies a new mitigation measure to be implemented in place of the suspended one.

District Rule 4570's exemption under this category is much more stringent because it is only a temporary suspension that cannot exceed 30 days, whereas SCAQMD Rule 1127's exemption may be permanent, without any requirement to substitute another measure.

Therefore, in this category of mitigation measure suspensions/substitutions, District Rule 4570 is more stringent than SCAQMD Rule 1127.

Testing, Monitoring, Recordkeeping Requirements

Both SCAQMD Rule 1127 and District Rule 4570 require monitoring, record keeping and source testing as appropriate and sufficient to provide evidence of each mitigation measure being implemented.

In addition to recordkeeping, Rule 1127 requires an annual report of manure being shipped out from the dairy. No annual reporting is required by Rule 4570. Rule 1127 requires records be retained for 3 years for minor sources and 5 years for major sources, whereas Rule 4570 requires records be retained for five years for all sources.

Overall, the monitoring, testing and recordkeeping requirements are similar for both rules.

Conclusion – Comparison with SCAQMD Rule 1127

For dairy CAFs, District Rule 4570 is more stringent than SCAQMD Rule 1127. District Rule 4570 requires emission reductions from additional emission categories - milk parlors, freestall barns, and liquid manure - that are not addressed by SCAQMD Rule 1127 as well as requiring emission reductions from CAFs from other animal species. As mentioned above, the current version of District Rule 4570 requires facilities to choose more mitigation measures and makes several mitigation measures mandatory. District Rule 4570 also provides specific mitigation measures for beef cattle feedlots, other cattle, poultry, and swine CAFs, while SCAQMD Rule 1127 does not. District Rule 4570 is therefore more stringent than SCAQMD Rule 1127.

C. BAAQMD Regulation 2 Rule 10 (Rule 2-10)

BAAQMD Rule 2-10 is a permit rule. As such, it has fewer specifics about large CAFs than District Rule 4570, which is a prohibitory rule.

Applicability/Exemption/Large CAF Definition

BAAQMD Rule 2-10 was adopted on July 19, 2006 and has not been amended.

BAAQMD Rule 2-10 applies to large CAFs as defined by ARB. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas BAAQMD Rule 2-10 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

Therefore, Rule 4570 is more stringent regarding applicability.

Requirements for CAFs

The BAAQMD permit conditions must implement control measures that represent Reasonably Available Control Technology (RACT) to reduce emissions of VOC, NOx and PM from the facility. BAAQMD Rule 2-10 requires RACT mitigation measures rather than the more stringent BARCT controls required by District Rule 4570 as specifically noted in the BAAQMD staff report for their rule. District staff previously contacted BAAQMD staff and verified that there is no list of RACT mitigation measures in place should a large CAF apply for a permit. In this respect, District Rule 4570 is more stringent than BAAQMD Rule 2-10.

Testing, Monitoring, Recordkeeping Requirements

District Rule 4570 requires records to be maintained and retained for at least five years, whereas BAAQMD Rule 2-10 requires records to be retained for three years. District Rule 4570 therefore has a more stringent record retention requirement.

District Rule 4570 requires facilities not subject to the mitigation measure requirements to maintain sufficient records to demonstrate their exemption status. Facilities subject to the mitigation measure requirements must maintain sufficient records to demonstrate implementation of each mitigation measure selected. Facilities must also maintain animal population records. BAAQMD Rule 2-10 requires the maintenance of animal population records but does not require specific records needed to demonstrate implementation of each mitigation measure selected. District Rule 4570 is therefore more stringent in the type of records that must be maintained.

Conclusion – Comparison with Bay Area AQMD Regulation 2 Rule 10

District Rule 4570 requires facilities to choose specific mitigation measures and makes several mitigation measures mandatory. In addition, District Rule 4570 has lower applicability thresholds for dairies, chickens, and ducks. Based on this information and the discussion above, District Rule 4570 is far more stringent than BAAQMD Rule 2-10.

D. VCAPCD Rule 23 – Exemptions from Permit

In response to California Senate Bill (SB) 700, VCAPCD revised its "Exemptions from Permit" rule to remove an exemption for agricultural operations, including CAFs. VCAPCD does not have a specific rule for CAFs. In its staff report for the rule revision, VCAPCD staff noted that no facilities in their jurisdiction would meet the "large CAF" definition and there was no expectation that a large CAF would move into the area in the foreseeable future; therefore, no separate CAF rule was necessary.

Applicability/Exemption/Large CAF Definition

VCAPCD Rule 23 adopted ARB's definition of large CAFs. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas VCAPCD Rule 23 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

Therefore, Rule 4570 is more stringent regarding applicability.

Requirements for CAFs

There are no facilities that would trigger the large CAF threshold within Ventura County, as stated in the VCAPCD staff report for amending Rule 23. The VCAPCD New Source Review Rule does not list mitigation measures for large CAFs. Instead, BACT would be triggered by a new CAF that met the "large CAF" definition or BACT would be triggered if an existing CAF expanded operations enough to meet the "large CAF" definition. At that point, VCAPCD staff would determine BACT for the CAF.

Conclusion – VCAPCD Rule 23

VCAPCD does not have a specific rule for CAFs; therefore, District Rule 4570 is more stringent.

E. SMAQMD Rule 496

Like District Rule 4570, SMAQMD Rule 496 is a prohibitory rule, meaning that there are detailed requirements for operators.

Applicability/Exemption/Large CAF Definition

SMAQMD Rule 496 was adopted on August 24, 2006 and has not been amended.

SMAQMD Rule 496 applies to large CAFs as defined by ARB. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas SMAQMD Rule 496 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies - 1,000 milk cows to 500 milk cows
- Broilers/ducks and Layers – 650,000 – 400,000

Therefore, Rule 4570 is more stringent regarding applicability.

Requirements for Dairy CAFs

Feed Mitigation Measures

District Rule 4570 has seven mitigation measures for feed and two mitigation measures for silage. Operators must implement four mandatory feed mitigation measures and chose another one from a list of three, for a total of five mitigation measures required for feed.

SMAQMD Rule 496 has seven Class One mitigation measures for feed and two Class One mitigation measures for silage. Operators must implement four feed mitigation measures and one silage mitigation measure.

District Rule 4570 requires a total of five feed mitigation measures, excluding silage, which is greater than the four feed mitigation measures required by SMAQMD Rule 496. In addition, four of the five feed mitigation measures are mandatory in District Rule 4570. Therefore, District Rule 4570 is more stringent.

Milk Parlor Mitigation Measures

District Rule 4570 has one required milk parlor mitigation measure. SMAQMD Rule 496 also only requires one mitigation measure for milk parlors. Since both rules only require the use of one mitigation measure, both rules will be considered identical for this category.

Freestall Mitigation Measures

District Rule 4570 has five freestall mitigation measures, two of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SMAQMD Rule 496 has eight Class One mitigations measures and one Class Two mitigation measure from which facilities are required to implement at least two.

Rule 4570 is more stringent since it requires more mitigation measures.

Corral Mitigation Measures

District Rule 4570 has nine corral mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. SMAQMD Rule 496 has 15 Class One mitigation measures, which are all optional, and three Class Two mitigation measures, from which facilities are required to choose at least six. District Rule 4570 requires one additional mitigation measure; therefore in this respect District Rule 4570 is more stringent.

SMAQMD Rule 496 has one Class One mitigation measure (*inspect water pipes and troughs and repair leaks*) that requires increased frequency in comparison to the corresponding District Rule 4570 measure. SMAQMD Rule 496 requires this measure to be carried out daily, whereas District Rule 4570 requires it to be carried out only once every seven days. Although, SMAQMD Rule 496 has a higher frequency for this measure, the difference in the emissions reductions from the two frequencies is not expected to be significant. Overall, District Rule 4570 is more stringent.

Solid Waste and Separated Solids Mitigation Measures

District Rule 4570 contains only two mitigation measures, from which operators are required to choose at least one. SMAQMD Rule 496 has five Class One mitigation measures and three Class Two mitigation measures, from which facilities are required to choose at least two.

Available studies have indicated that NH3 emissions from stored solid waste and separated solids pile to be a very small fraction of total NH3 emissions at dairies. Since the NH3 emissions from solid manure account for a very small fraction of emissions from the overall dairy, there would not be a significant increase in NH3 emission reductions if more measures are required from this category.

Liquid Waste Mitigation Measures

District Rule 4570 has four mitigation measures mitigation measures, from which operators are required to choose at least one. SMAQMD Rule 496 has four Class One mitigation measures and four Class Two mitigation measures, from

which facilities are required to choose at least one. Since only one measure is required, both rules are equivalent in this respect.

Manure Land Application Mitigation Measures

District Rule 4570 has two mitigation measures required out of six measures. SMAQMD Rule 496 has six Class One mitigation measures, from which facilities are required to choose at least two. Since two mitigation measures are required, both rules are equivalent in this respect.

Requirements for Poultry Large CAFs

There is a large degree of variability in the manure management practices, housing techniques, and potential feeding practices for the different type of poultry operations in the Valley. Due to these differences, District Rule 4570 separates poultry CAFs into the following categories: 1) layers and 2) broilers, ducks, and turkeys.

Although on the surface the poultry requirements results in fewer mitigation measures compared to the other rules, the segregating of the types of poultry has allowed the mitigation measures to be tailored specifically to the type of poultry operation. In addition, all measures for poultry in District Rule 4570 are now mandated rather than left as options. Due to this reconfiguration and taking into consideration the latest science, District Rule 4570 requirements for poultry are more stringent than SMAQMD Rule 496.

Other CAFs

In addition to dairy and poultry CAF mitigation measures discussed above, District Rule 4570 provides specific mitigation measure option tables for beef cattle feedlots, other cattle facilities, and swine facilities. SMAQMD Rule 496 does not address mitigation measures for these additional CAF categories. For these types of large CAFs, District Rule 4570 is more stringent.

Requirements – Suspension and Substitution of Mitigation Measures

Both rules allow for substitution of one mitigation measure with an equivalent or more stringent measure with the submission of the appropriate application. District Rule 4570 also allows the temporary suspension of a mitigation measure upon the determination by a certified veterinarian or nutritionist that such a suspension is necessary for animal health purposes. The District must be notified within 48 hours, and a new measure must be implemented if the suspension is expected to last longer than 30 days. SMAQMD Rule 496 does not have a specific provision for temporary suspension of mitigation measures. As discussed above, District Rule 4570 is as stringent as SMAQMD Rule 496.

Testing, Monitoring, Recordkeeping Requirements

The testing, monitoring, and recordkeeping provisions of District Rule 4570 and SMAQMD Rule 496 are nearly identical and are of equal stringency.

Conclusion – Comparison with Sac Metro AQMD Rule 496

For dairy CAFs, District Rule 4570 is more stringent than SMAQMD Rule 496. District Rule 4570 requires emission reductions from four additional emission categories - milk parlors, feed, freestall barns, and liquid manure - that are not addressed by SMAQMD Rule 496 as well as having specific requirements for other types of CAFs. District Rule 4570 also requires facilities to choose more mitigation measures and mandates several mitigation measures. In addition, Rule 4570 applies to dairies with greater than 500 milk cows and 400,000 layers and broilers while SMAQMD Rule 496 applies to dairies with 1,000 milk cows or more and broiler and layer operations with more than 650,000 birds. As shown in the discussion above, District Rule 4570 is more stringent than SMAQMD Rule 496.

F. ICAPCD Rule 217 – Large Confined Animal Facilities Permits Required and ICAPCD Policy Number 38 – Recommended Mitigation Measures for Large Confined Animal Facilities

ICAPCD Rule 217 is a permits rule. ICAPCD Rule 217 requires that owners or operators of large CAFs submit an emissions mitigation plan that demonstrates that the facility will use RACT to reduce emissions of pollutants that contribute to the non-attainment of any ambient air quality standard and are within the ICAPCD's regulatory authority.

ICAPCD Rule 217 requires operators of large CAFs to implement the control measures identified in their emissions mitigation plan, which may be selected from the ICAPCD Policy Number 38, Recommended Mitigation Measures for Large Confined Animal Facilities. ICAPCD Policy Number 38 specifies the number of mitigation measures the operator should implement for each operation within the CAF. The following discussion compares the recommended mitigation measures in ICAPCD Policy Number 38 to the measures in District Rule 4570. However, since the mitigation measures in ICAPCD Policy Number 38 are only recommended by ICAPCD Rule 217 rather than being explicitly required, it is clear that District Rule 4570 is more stringent.

Applicability/Exemption/Large CAF Definition

ICAPCD Rule 217 was adopted on October 10, 2006 and has since not been amended.

ICAPCD adopted ARB's definition of large CAF. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines

a large CAF for horses as having at least 3,000 head, whereas ICAPCD Rule 217 defines a large CAF for horses as having at least 2,500 head. There are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

ICAPCD Policy Number 38 only lists mitigation measures for dairy operations and beef feedlot operations while District Rule 4570 covers additional CAFs (swine, chicken layer, chicken broiler, duck and turkey, and other CAFs). Therefore, more CAFs are subject to the requirements of District Rule 4570 than ICAPCD Rule 217 and Policy Number 38.

Therefore, Rule 4570 is more stringent regarding applicability.

Requirements for Dairy CAFs

Milk Parlor Mitigation Measures

ICAPCD Policy Number 38 has only one mitigation measure for the milk parlor. The District rule also only has one mitigation measure. Since the mitigation measure is identical, both rules are identical under this section.

Freestall Mitigation Measures

District Rule 4570 has five freestall mitigation measures, two of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. ICAPCD Policy Number 38 has eight mitigation measures, from which operators are required to choose at least two. Since District Rule 4570, requires three mitigation measures and mandates two out of the three, District Rule 4570 is more stringent than ICAPCD Policy Number 38.

Corral Mitigation Measures

District Rule 4570 has nine mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. ICAPCD Policy Number 38 has eight mitigation measures, from which facilities are required to choose at least four.

For three of the mitigation measures, the compliance times differ between the District rule and ICAPCD Policy Number 38. For these measures, ICAPCD Policy Number 38 allows longer time periods between repeated performance of

the measures than District Rule 4570. For these three mitigation measures, District Rule 4570 is more stringent because District Rule 4570 requires repeated performance of the otherwise identical mitigation measures in shorter time periods.

For two of the mitigation measures, the maximum depth of manure differs significantly between the District Rule 4570 and ICAPCD Policy Number 38. For these measures, ICAPCD Policy Number 38 allows manure depths that are deeper than allowed by District Rule 4570. For these two mitigation measures, District Rule 4570 rule is more stringent because the District Rule 4570 requires shallower manure depths for otherwise identical mitigation measures.

Therefore, District Rule 4570 is far more stringent than the ICAPCD Policy Number 38.

Solid Waste and Separated Solids Mitigation Measures

District Rule 4570 has two solid waste and separated solids mitigation measures, from which operators are required to choose at least one. ICAPCD Policy Number 38 has four mitigation measures from which facilities are required to choose at least one. Therefore, both rules are identical in this category.

There are a few differences in ICAPCD Policy Number 38 mitigation measures when compared to District Rule 4570. ICAPCD Policy Number 38 policy requires that manure piles are covered year round whereas District Rule 4570 requires that the piles be covered from October through May – the months in the Valley in which rainfall is most likely. However, because of the greater depth of manure allowed in corrals and increased duration (up to two years) for removal of manure from the corrals allowed by ICAPCD Policy Number 38, CAFs in the ICAPCD are able to allow manure to accumulate in the corrals until it can be hauled offsite. Few, if any, CAFs in the ICAPCD are expected to actually store manure onsite outside of corrals, so it is likely that no facilities in ICAPCD are actually choosing and implementing this measure. Separated solids piles are not specifically addressed in ICAPCD Policy Number 38. Overall District Rule 4570 is as stringent as ICAPCD Policy Number 38.

Liquid Waste Mitigation Measures

District Rule 4570 has four liquid waste mitigation measures, from which operators are required to choose at least one. ICAPCD Policy Number 38 has four mitigation measures, from which operators are required to choose at least one. ICAPCD Policy Number 38 contains an option to manage the facility so that lagoons only contain waste from milking parlor and storm water as a mitigation measure. District Rule 4570 does not contain this option. This difference, although worth noting, is not expected to influence the overall effectiveness of District Rule 4570; District Rule 4570 is as stringent as ICAPCD Policy Number 38.

Manure Land Application Mitigation Measures

District Rule 4570 has two mitigation measures that are mandatory if applicable. ICAPCD policy has a menu of five mitigation measures from which operators are required to choose two. Since two measures are required by both ICAPCD Policy Number 38 and District Rule 4570, they will be considered identical under this category.

Requirements for Beef Feedlot CAFs

Animal Housing Mitigation Measures

District Rule 4570 has nine mitigation measures, six of which are mandatory. The facility is also required to choose one additional mitigation measure from the remaining three. ICAPCD Policy Number 38 has nine mitigation measures, from which facilities are required to choose at least four. Since operators in Imperial County are required to implement fewer mitigation measures, District Rule 4570 is more stringent.

For three of the mitigation measures, the compliance times differ between the District rule and ICAPCD Policy Number 38. For these measures, ICAPCD Policy Number 38 allows longer time periods between repeated performances of the measures than District Rule 4570. For these three mitigation measures, the District rule is more stringent because the District Rule 4570 requires repeated performance of the otherwise identical mitigation measures in shorter time periods.

For two of the mitigation measures, the maximum depth of manure differs significantly between the District Rule 4570 and ICAPCD Policy Number 38. For these measures, ICAPCD Policy Number 38 allows manure depths that are deeper than allowed by District Rule 4570. For these two mitigation measures, District Rule 4570 rule is more stringent because the District Rule 4570 requires shallower manure depths for otherwise identical mitigation measures.

Solid Waste and Separated Solids Mitigation Measures

District Rule 4570 has two solid waste and separated solids mitigation measures, from which operators are required to choose at least one. ICAPCD Policy Number 38 has four mitigation measures from which facilities are required to choose at least one. Therefore, both rules are identical in this category.

ICAPCD Policy Number 38 policy requires that manure piles are covered year round whereas District Rule 4570 requires that the piles be covered from October through May – the months in the Valley in which rainfall is most likely. However, because of the greater depth of manure allowed in corrals and increased duration (up to two years) for removal of manure from the corrals allowed by ICAPCD Policy Number 38, CAFs in the ICAPCD are able to allow manure to

accumulate in the corrals until it can be hauled offsite. Few, if any, CAFs in the ICAPCD are expected to actually store manure onsite outside of corrals, so it is likely than no facilities in ICAPCD are actually choosing and implementing this measure. Overall District Rule 4570 is as stringent as ICAPCD Policy Number 38.

Liquid Manure Handling

ICAPCD Policy Number 38 does not address liquid manure handling for beef feedlot operations. This is likely because beef feedlot facilities in ICAPCD do not generally use liquid manure management systems. District Rule 4570 requires one measure to be selected out of a menu of options, if applicable. Therefore, Rule 4570 is more stringent in this category.

Manure Land Application Mitigation Measures

District Rule 4570 has two mitigation measures that are mandatory if applicable. ICAPCD Policy Number 38 has a menu of five mitigation measures from which operators are required to choose two. Since two measures are required by both ICAPCD Policy Number 38 and District Rule 4570, they will be considered identical under this category.

Requirements for Other CAFs

In the same manner as for dairy and beef feedlot operations, District Rule 4570 specifies mitigation methods for confined animal facilities other than dairies and beef feedlots. ICAPCD Policy Number 38 only has mitigation measures for dairy and beef feedlot operations. In comparing the two documents, District Rule 4570 is therefore more comprehensive and stringent.

Requirements – Suspension and Substitution of Mitigation Measures

District Rule 4570 and ICAPCD Policy Number 38 allow for substitution of one mitigation measure with an equivalent or more stringent one with the submission of the appropriate application. District Rule 4570 also allows the temporary suspension of a mitigation measure upon the determination by a certified veterinarian or nutritionist that such a suspension is necessary for animal health purposes. The District must be notified within 48 hours, and a new measure must be implemented if the suspension is expected to last longer than 30 days. ICAPCD Policy Number 38 allows for temporary suspension of mitigation measures under circumstances similar to District Rule 4570. Based on the discussion, Rule 4570 is as stringent as ICAPCD Policy Number 38.

Testing, Monitoring, Recordkeeping Requirements

District Rule 4570 requires records to be maintained and retained for at least five years, whereas ICAPCD Rule 217 requires records to be retained for two years. District Rule 4570 therefore has a more stringent record retention requirement.

District Rule 4570 requires facilities not subject to the mitigation measure requirements to maintain sufficient records to demonstrate their exemption status. Facilities subject to the mitigation measure requirements must maintain sufficient records to demonstrate implementation of each mitigation measure selected. Facilities must also maintain animal population records. ICAPCD Rule 217 requires the maintenance of animal population records but does not require specific records needed to demonstrate implementation of each mitigation measure selected. District Rule 4570 is therefore more stringent in the type of records required to be maintained.

Conclusion- Comparison with ICAPCD Rule 217 and ICAPCD Policy Number 38

ICAPCD Rule 217 requires operators of large CAFs to implement the control measures identified in their emissions mitigation plan, which may be selected from the ICAPCD Policy Number 38, Recommended Mitigation Measures for Large Confined Animal Facilities; however, compliance with ICAPCD Policy Number 38 is not explicitly required by the rule. District Rule 4570 contains several mandatory mitigation measures, unlike the optional nature of the mitigation measures in ICAPCD Rule 217. District Rule 4570 also has a lower applicability threshold for dairies (500 milk cows). In addition, ICAPCD Policy Number 38 only lists mitigation measures for dairy operations and beef feedlot operations while District Rule 4570 covers additional CAFs (swine, chicken layer, chicken broiler, duck and turkey, and other CAFs). As shown the discussion above, District Rule 4570 is far more stringent than ICAPCD Rule 217 and ICAPCD Policy Number 38.

G. BCAQMD Rule 450 – Large Confined Animal Facilities

BCAQMD Rule 450 is a permits rule. It outlines, in general terms, the requirements for a complete permit application and how the staff would evaluate and approve/disapprove the permit application.

Applicability/Exemption/Large CAF Definition

BCAQMD Rule 450 was adopted on December 21, 2006 and has since not been amended.

BCAQMD adopted ARB's definition of large CAF. District Rule 4570 defines large CAFs the same way except for large CAFs for horses. District Rule 4570 defines a large CAF for horses as having at least 3,000 head, whereas BCAQMD Rule 450 defines a large CAF for horses as having at least 2,500 head. There

are currently no CAFs in the Valley with the capacity to house at least 2,500 horses and no CAFs for horses in the Valley are expected to exceed this threshold in the foreseeable future.

In addition to applying to large CAFs, District Rule 4570 lowers the applicability thresholds for the following CAFs:

- Dairies – from 1,000 milk cows to 500 milk cows
- Broilers/Ducks and Layers – from 650,000 birds to 400,000 birds

Therefore, Rule 4570 is more stringent regarding applicability.

CAF Requirements

BCAQMD Rule 450 requires large CAFs to obtain a permit and to submit and implement a mitigation plan; however, the rule does not list mitigation measures or specify the number of mitigation measures required. District Rule 4570 has a menu of specific mitigation measures and stipulates the number of mitigation measures an operator is required to implement. In this regard, District Rule 4570 is more stringent than BCAQMD Rule 450.

Testing, Records, and Reporting Requirements

BCAQMD Rule 450 requires that all CAFs record the daily number of animals on-site. These records are to be kept on-site for two years and presented if requested. District Rule 4570 requires testing and records be kept to demonstrate compliance with the operator's selected mitigation measures. The records are to be kept for five years and presented upon the request of EPA or the District. Because District Rule 4570 covers testing, as well as having a longer record retention time, it is more stringent than BCAQMD Rule 450.

Conclusion – Comparison with Butte County AQMD Rule 450

District Rule 4570 contains specifies the actual mitigation measures that facilities are required to implement. In addition, District Rule 4570 has lower applicability thresholds for dairies, chicken facilities, and duck facilities. As shown in the discussion above, District Rule 4570 is more stringent than BCAQMD Rule 450.

H. IDAPA 58.01.01 Sections 760-764: Rules for the Control of Ammonia from Dairy Farms

Applicability/Exemption

IDAPA 58.01.01 Sections 760-763 was adopted on March 30, 2007 and IDAPA 58.01.01 Subsection 764.02: Table – Ammonia Control Practices for Idaho Dairies was last amended on May 8, 2009.

Pursuant to IDAPA 58.01.01 Section 761, Sections 760-764 apply to dairies of the following sizes. The thresholds are based on estimating the number of cattle required to produce 100 tons of ammonia emissions annually. Different thresholds are given for drylot dairies, dairies with scraped freestalls, and dairies with flushed freestalls. The thresholds are given on the basis of Animal Units (AU) (1,000 lbs of live weight) and on a mature cow equivalent basis (1,400 lbs of live weight).

SUMMARY: Animal Unit (AU) or mature cow threshold to produce 100 tons NH3/year

Animal Unit (AU) Basis	Drylot	Free Stall/Scrape	Free Stall/Flush
	AU (100 t NH3) Threshold		
No land app	7,089	3,893	2,293
27% volatilization[1]	6,842	3,827	
80% volatilization[2]	6,397	3,700	
	Total Cows (100 t NH3) Threshold		
Cow Basis (1,400 lb)	**Drylot**	**Free Stall/Scrape**	**Free Stall/Flush**
No land app	5,063	2,781	1,638
27% volatilization[1]	4,887	2,733	
80% volatilization[2]	4,589	2,643	
No land app	5,063	2,781	

1 Assumes expected level of N->NH3 volatilization for drop-hose or ground level liquid manure application.
2 Assumes expected level of N->NH3 volatilization for center pivot or other conventional sprinkler irrigation liquid manure application

The smallest dairy to which IDAPA 58.01.01 Sections 760-764 applies would have the equivalent of at least 1,638 mature cows in flushed freestalls and a larger number of animals in scraped freestalls or corrals. In comparison, District Rule 4570 applies to dairy CAFs with at least 500 milking cows (at least 700 AU or 500 mature cows). In addition, District Rule 4570 applies to other types of confined animal facilities, including beef cattle feedlots, other cattle facilities, poultry facilities, and swine facilities. Therefore, District Rule 4570 is more stringent regarding applicability.

Requirements for Dairies

Each dairy farm subject to IDAPA 58.01.01 Sections 760 - 764 must employ Best Management Practices (BMPs) for the control of ammonia. The BMPs are applied to the following systems at a dairy: Waste Storage and Treatment Systems, General Practices, Freestall Barns, Open Lots and Corrals, Animal Nutrition, Composting Practices, and Land Application. A total of twenty-seven (27) points must be achieved for the BMPs employed. The table located in Subsection 764.02 lists the approved BMPs and their associated point values. During development of the regulation, a point system with a maximum of 20 points was assigned to each practice. A practice receiving 20 points equates to

a system or practice that is considered to result in major reduction in ammonia emissions for that specific process. However, according to the supporting documentation, this point system is "arbitrary".[123] Therefore, there is no direct correlation from the points required and the amount of emission reductions achieved. In fact, due to the flexibility allowed in this rule, even if all points have been met by the rule and depending on which mitigation measures are selected, the overall ammonia emission reductions may not be substantial. The Idaho Department of Environmental Quality (IDEQ) may also determine a practice not listed in the table constitutes a BMP and assign a point value. Points may also be obtained through third party export with sufficient documentation.

The paper Commentary *Ammonia-Based Air Quality Permits for Idaho Dairies*[124] indicated that, "Solid separation of manure, corral harrowing, low-pressure irrigation, composting, and rapid manure removal from outdoor lots were found to be the most common BMPs."

Solids Separation

In the Idaho regulation, solids separation refers to "gravity or mechanical separation system to remove manure solids from liquid waste stream." This practice has been implemented by almost all dairies in the Valley subject to District Rule 4570 to comply with the liquid manure mitigation measure requirements of District Rule 4570.

Corral Harrowing/Cleaning

In the Idaho regulation corral harrowing refers to harrowing to distribute deposited manure, reshaping corral surface, and/or removing manure from corral surface and rapid manure removal from outdoor lots refers to the removal of winter time manure and corral bedding from an open lot surface in spring or as quickly as practicable. District Rule 4570 has much more stringent requirements for corral cleaning and maintenance at dairies. For corrals, District Rule 4570 requires dairies to implement the following measures: a) Cleaning manure from corrals at least four times per year with at least 60 days between cleaning, or b) Cleaning corrals at least once between April and July and at least once between September and December; a) Scraping, vacuuming, or flushing concrete lanes in corrals at least once every day for mature cows and every seven days for support stock, or b) Cleaning concrete lanes such that the depth of manure does not exceed twelve inches at any point or time; inspection of water pipes and troughs and repairing leaks at least once every seven days; and a) Sloping the surface of the corrals at least 3% where the available space for each animal is 400 square feet or less and Sloping the surface of the corrals at least 1.5%

[123] Idaho Department of Environmental Quality (2006). Scientific Basis for the Control of Ammonia from Dairy Farms Best Management Practices 7/18/2006 by Ron E. Sheffield, Waste Management Engineer, University of Idaho and Bruce Louks, Air Quality Division, Idaho Department of Environmental Quality. http://www.deq.idaho.gov/media/635665-58_0101_0502_scientific_basis_final.pdf

[124] Sheffield, R. E. and Louks, B. (2008). COMMENTARY: Ammonia-Based Air Quality Permits for Idaho Dairies. Environmental Practice, 10, pp 13-19. doi:10.1017/S1466046608080046. http://journals.cambridge.org/action/displayAbstract?fromPage=online&aid=1888928

where the available space for each animal is more than 400 square feet per animal, b) Maintaining corrals to ensure proper drainage preventing water from standing more than forty-eight (48) hours, or c) Harrowing, raking, or scraping corrals sufficiently to maintain a dry surface. In addition, District Rule 4570 requires dairies to choose an additional corral mitigation measure, requiring corrals to be managed such that the manure depth in the corral does not exceed twelve inches at any time or point, except for in-corral mounding. Therefore, the corral cleaning and maintenance requirements of District Rule 4570 are far more stringent than IDAPA 58.01.01 Sections 760 – 764.

Previous emission studies conducted in the Valley have demonstrated that the corrals and pens are the sources with the greatest potential for NH3 emissions in Valley dairies[125] and, therefore, the much more stringent corral cleaning and maintenance measures required by District Rule 4570 have the potential for far greater NH3 reductions.

Liquid Manure Application

In the Idaho regulation, Low Energy/Pressure Application Systems refers to use of center pivot and liner-move irrigation strategy that applies liquids at low pressures using drop nozzles. The guidance for the regulation states that larger droplets result in lower emissions but may cause infiltration problems on some soils. The use of center pivot and liner-move irrigation to apply liquid manure is very uncommon in the Valley and may be prohibited in the use permits for many dairies. In the Valley it is much more common to apply liquid manure to cropland through flood or furrow irrigation after it has been diluted with fresh irrigation water as generally required by either the Water Quality Board or the local County and as a means to avoid damage to growing crops. Because of the reduced surface area, flood and furrow irrigation have even lower emissions than low pressure sprinkler irrigation systems. Dilution of the liquid manure with fresh irrigation water further reduces NH3 emissions and is also listed as a BMP in the Idaho regulation. Therefore, the liquid manure practices utilized in the Valley are more stringent than the Idaho regulation.

Composting

In the Idaho regulation "composting" refers to stacking and drying of separated manure solids or corral manure. Almost all dairies in the Valley utilize this practice to prepare solid manure and/or separated solids for bedding and/or for use on cropland. In addition, District Rule 4570 requires that dairies implement one of the following measures for solid manure or separated solids: 1) within 72 hours of removal from housing, either: a) Remove dry manure from the facility, or b) Cover dry manure outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering,

[125] See: Schmidt, C. and Card, T. (2006) Dairy Air Emissions Report: Summary of Dairy Emission Estimation Procedures (May 2006). Final Report to California Air Resource Board (ARB).
http://www.arb.ca.gov/ag/caf/SchmidtDairyEmissions2005.pdf
http://www.arb.ca.gov/ag/caf/SchmidtDairyTestData2005.pdf

not to exceed 24 hours per event; or 2) Within seventy-two hours of removal from the drying process, either: a) Remove separated solids from the facility, or b) Cover separated solids outside the housing with a weatherproof covering from October through May, except for times when wind events remove the covering, not to exceed 24 hours per event. Therefore, the general management practices conducted on dairies in the Valley and the requirements of District Rule 4570 are far more stringent than the Idaho regulation.

For dairy corrals, which are the largest source of NH3 emissions at dairies in the Valley, District Rule 4570 requires more stringent mitigation measures and a greater number of these measures. District Rule 4570 is also more specific in regards to mitigation measures required from other processes at dairies and the number of mitigation measures that must be implemented for each process; as a result, District Rule 4570 is able to better target the reduction of emissions from these different operations. Therefore, District Rule 4570 is more stringent than IDAPA 58.01.01 Sections 760- 764.

Requirements for Other Confined Animal Facilities

As stated above, District Rule 4570 provides specific mitigation measures for beef cattle feedlots, other cattle facilities, poultry facilities, and swine facilities. IDAPA 58.01.01 Sections 760-764 does not address mitigation measures for these additional categories. Therefore, District Rule 4570 is more stringent for this category.

Requirements – Suspension and Substitution of Mitigation Measures

IDAPA 58.01.01 Subsection 762.03 provides that if a dairy farm not subject to Sections 760-764 becomes subject to these regulations as a result of an emergency (for example if a dairy farmer takes additional cows due to unforeseen circumstances), the dairy farm must notify the IDEQ in writing within 14 days explaining the emergency circumstances. The dairy farm would be exempt from these requirements for up to one year as long as the consequences of the emergency continue. In the event of unforeseen equipment upsets and breakdowns, so long as corrective action is taken within a reasonable time, the event does not reduce the BMP point value.

In comparison, District Rule 4570 allows an operator to temporarily suspend any mitigation measure as long as the suspension is recommended by a licensed veterinarian or animal nutritionist on the basis of animal health. The operator must notify the District within 48 hours prior to the suspension. If the suspension is expected to last longer than 30 days, then the operator must submit a new mitigation plan that identifies a new mitigation measure to be implemented in place of the suspended one.

District Rule 4570's exemption under this category is much more stringent because it is a temporary suspension that cannot exceed 30 days, whereas the

IDAPA 58.01.01 Sections 760-764 exemption may last much longer, without any requirement to substitute another measure.

Therefore, in this category of mitigation measure suspensions/substitutions, District Rule 4570 is more stringent than IDAPA 58.01.01 Sections 760-764.

Testing, Monitoring, Recordkeeping Requirements

Compliance with the requirements of IDAPA 58.01.01 Sections 760-764 is primarily determined by inspections by the Idaho State Department of Agriculture. The Idaho regulations do not specify what records must be kept or have any requirement that the records be maintained for a certain period of time.

District Rule 4570 includes specific requirements for monitoring, source testing as appropriate and recordkeeping to ensure mitigation measure are being implemented. Facilities must also maintain animal population records. District Rule 4570 also requires facilities not subject to the mitigation measure requirements to maintain sufficient records to demonstrate their exemption status. District Rule 4570 requires records be retained for five years for all sources. District Rule 4570 is therefore more stringent in this area.

Conclusion – Comparison with IDAPA 58.01.01 Sections 760-764

For dairy facilities, District Rule 4570 is far more stringent than IDAPA 58.01.01 Sections 760-764. Unlike IDAPA 58.01.01 Sections 760-764, District Rule 4570 requires specific practices for the various operations at dairies. District Rule 4570 also provides specific mitigation measures for beef cattle feedlots, other cattle facilities, poultry facilities, and swine facilities, while IDAPA 58.01.01 Sections 760-764 does not. The measures required by the Idaho regulation are also based on an arbitrary point system and as such do not guarantee a specific degree of control. District Rule 4570 is, therefore, more stringent than IDAPA 58.01.01 Sections 760-764.

IV. Evaluation of Additional Control Measures

Recent studies have cited the episodic application of sodium bisulfate (SBS) onto manure at dairies as a potential control strategy to reduce ammonia emissions. SCAQMD included a potential control measure within their 2012 Air Quality Management Plan (AQMP) to evaluate the use of SBS at dairies to determine the technical and economic feasibility of its application in reducing ammonia emissions as well as potential impacts to groundwater. The District did not find any agency requiring the use of SBS. The District has evaluated SBS as a potential control measure and determined that for a variety of reasons that this control strategy is infeasible and ineffective for reducing PM2.5 concentrations in the Valley.

SBS is an acid salt that has been used to reduce pH and bacterial levels in the bedding for dairy cattle. Application of SBS on fresh manure or corral surfaces has the potential to reduce ammonia emissions by reducing the pH of the manure or corral surface. With a lower pH, a greater fraction of the ammonia is converted to non-volatile ammonium (NH4+). The ammonium combines with sulfate to form ammonium sulfate, which is retained in the manure or on the surface of the corral.

There are a number of potential issues that need to be considered related to the application of SBS at dairies including, but not limited to, the health and safety of dairy workers and dairy cattle, impacts on water quality, and overall cost and effectiveness. The SCAQMD 2012 AQMP states: that potential use of SBS would be specific to dairies in the SCAQMD and may be unique to localized operations, that "the requirements may not be applicable to dairies elsewhere where a site-specific assessment would need to be made relative to those particular conditions", and that it is likely that each air district would need to conduct an assessment as to the feasibility of SBS application in their jurisdiction.

The SCAQMD AQMP focuses on episodic controls to reduce ammonia emissions during periods of high PM2.5 concentrations. PM concentrations in the Valley are highest during the winter season (November – February). Unlike the SCAQMD where the majority of dairies are open corral facilities, most dairies in the Valley utilize a freestall design and generally restrict the cows' access to corrals during the winter months since the corrals are wet and muddy. As a result, there would be very little to no fresh manure excreted in corrals during the winter period. In addition, once wet conditions set in, it is not feasible to utilize tractors in the corrals to apply SBS since the tractors tend to get stuck in mud. Application by hand at large dairies would be very labor intensive, time consuming, be extremely costly, and would potentially pose health and safety risks to the workers.

Although SBS is generally considered to be safe in small quantities, excessive loading of salts is a major water quality concern in the central and southern regions of the Valley where many dairies are located. In addition, applying SBS to corrals, which for many dairies can be greater than several acres in size, is not practical or feasible. Applying SBS to large areas also requires significant amounts of SBS to be applied, which as discussed below can be quite cost-prohibitive. The application of SBS will also be short lived and conflict with requirements from Rule 4550 which requires dairies to scrape their corrals on a frequent basis at least once every two weeks, making the application of SBS ineffective and even more costly due to the constant need to reapply.

A dairy would also need to work with the Regional Water Quality Control Board to determine if the application of SBS is allowed and if a dairy's nutrient management plan would need to be revised since the water quality surrounding dairies is a major concern and any additional impacts would need to be

thoroughly reviewed. This may require hauling manure significant distances to areas that would not be adversely affected by the increased salinity, which would result in increased emissions and costs related to hauling.

There are significant costs associated with the application of SBS. Iowa State University Extension estimates the costs of SBS to be $660/ton. District estimates show that 1,304 lb-1,955 lb/cow-yr of SBS would be needed for application to one entire corral area, costing $430-$645/cow-yr. Using the District's corral ammonia emission factor for milk cows and assuming a conservatively high estimate of 50% reduction in overall ammonia emissions, the cost of the ammonia reductions would be at least $41,067/ton to $61,601/ton or higher depending on corral size. Information from Iowa State shows reduced costs of $129-$193/cow-yr for only treating heavy use areas, such as feed bunks and water troughs. It is not clear how much manure is excreted in heavy use areas, but even if the resulting cost per ton of reduction was cut in half, the costs would still be significant.

Also, because flush dairies are common in the Valley (both freestall and open corral), the heavy use areas will generally be paved, and frequent flushing of the freestall or corral lanes (as required by Rule 4570) already significantly reduces ammonia emissions; therefore, application of SBS to only these areas would not provide significant additional reductions in ammonia emissions. By design, SBS will be flushed to a lagoon or pond where the high buffering capacity would render it ineffective and possibly increase H2S emissions.

Overall, given the insignificant PM2.5 reduction achieved per ton of ammonia reduction (as demonstrated in this plan), the cost effectiveness associated with implementing SBS translates to a much higher relative cost effectiveness when compared to other, more effective strategies, such as NOx reductions.

V. Conclusion

While BACM and MSM requirements do not apply to ammonia since it is not a significant precursor to PM2.5 formation in the Valley, District staff concludes that District Rule 4570 meets BACM and MSM requirements for ammonia emissions from CAFs. The District evaluated the feasibility of additional ammonia emissions reductions and did not identify any additional feasible measures. In fact, the SCAQMD recently identified District Rule 4570 as the most stringent rule for this source category.[126]

Agricultural Fertilizers

Farms have continued to improve methods of fertilizer application over the years to maximize nitrogen use efficiency and minimize environmental impacts. Best

[126] South Coast Air Quality Management District (June 6, 2014). Reasonably Available Control Technology Demonstration. http://www.aqmd.gov/docs/default-source/Agendas/Governing-Board/2014/2014-jun6-031.pdf?sfvrsn=2

management practices are being implemented to minimize nitrate leaching in irrigated crop production. Researchers at UC Cooperative Extension have been studying the nitrogen use efficiency for various crop types and have begun identifying the point at which the application of additional nitrogen no longer significantly increases crop quality and yields. This will allow growers to apply fertilizer with more precision to reduce the amount of nitrogen left in the soil.

Agricultural operations in California are regulated by the State Water Resources Control Board, which is charged by the state Legislature in enforcing state and federal water quality protection laws. The State Water Resources Control Board consists of Regional Water Quality Control Boards (Regional Boards) that develop objectives and plans to protect the beneficial uses of water, recognizing local differences in climate, topography, geology and hydrology. All dairy farms in California's Central Valley are regulated by the Central Valley Regional Water Quality Control Board ("Regional Board"). The vast majority of dairies—about 1,200 dairies—are regulated under a Regional Board General Order[127] and the remainder are regulated via individual orders that ensure compliance with the same requirements. These requirements include:

- A Nutrient Management Plan (NMP), prepared by a certified professional crop advisor or equivalent, designed to control nutrient losses for protection of surface water and groundwater;
- A Waste Management Plan (WMP), prepared by a licensed engineer;
- Environmental sampling and monitoring of soil, manure, water and plant tissue for compliance;
- Routine site inspections, recordkeeping, and reporting; and
- Additional groundwater monitoring to assess ongoing water quality protection

A major purpose of these regulations is to ensure responsible storage and use of manure as an important crop fertilizer and soil builder, thus preventing unnecessary runoff or leaching of nitrogen compounds to the environment, where they can impact water quality. The NMP is designed to assure that the amount of nitrogen excreted by milking cows and support stock is in reasonable balance with the needs of crops grown at the dairy farm. Manure nitrogen in excess of crop needs should be exported off the farm to where it can be used by other farmers. Nitrogen used on the farm is required to be stored safely until it is used (the major purpose of the WMP) and then only applied to agricultural fields when needed for crop growth and in the amounts needed. Over-application or mistimed application of nitrogen fertilizers can result in unnecessary losses of nitrogen to the environment, both as seepage below the root zone (in the form of nitrate or other nitrogen compounds)[128] or as air emissions of ammonia gas, ammonium, and oxides of nitrogen.
The University of California suggested in 2005 that "…optimal N loading rates of 1.4 to 1.65 times the crop N harvest removal are practical and, based on field observations,

[127] http://www.waterboards.ca.gov/centralvalley/board_decisions/adopted_orders/general_orders/r5-2013-0122.pdf
[128] See "Managing Dairy Manure in the Central Valley of California," published by the University of California Committee of Experts on Dairy Manure Management, 2005. http://groundwater.ucdavis.edu/files/136450.pdf

achievable if the production field is properly managed."[129] The UC assessment was the ultimate basis for performance standards set by the Regional Board in the General Order, which was adopted in 2007 and revised and reissued in 2013. Research suggests that to achieve the more stringent targets in the General Order, many dairies had to greatly increase the precision of their manure and fertilizer applications, while also reducing the overall amount of nitrogen applied to their crops compared to plant uptake.[130] On a group of Valley dairy farms, it was estimated that prior to adoption of the General Order in 2007, losses of nitrogen to groundwater alone ranged from 370 to 570 pounds per acre compared to 500 pounds of uptake by crops.[131] Similar or larger amounts of nitrogen are expected to volatilize to the atmosphere as ammonia and other compounds following excretion of manure from animals, during storage of manure in ponds or corrals, and in the process of applying manure to soil as a crop nutrient.[132] Thus, as a result of full implementation of the General Order, losses of nitrates to groundwater on dairies may be reduced by up to 85 percent compared to pre-General Order conditions, though this number will be smaller for dairies where manure was managed more precisely prior to the General Order's adoption.

Increasing crop nutrient uptake is also expected to reduce air emissions by providing for application of less excess fertilizer to crops, and therefore, less opportunity for volatilization in the fields. Some research already conducted found lower emissions with moderate nitrogen applications and suggested, "…synchronizing N applications with crop N demand. Once the N requirement for each crop stage is known, the N applications can be adjusted accordingly. This strategy should lead to improved N use efficiency and likely lower N2O emissions."[133]

Other nitrogen compounds such as ammonia can also volatilize to air during application to fields. The University of California Committee of Experts on Dairy Manure Management has suggested that during application of manure water to crops, significant ammonia emissions can occur when manure water is not properly diluted (to below 100 ppm NH3/N) or applied during early growth of the crop. However, "in systems with frequent, but well diluted manure water applications, ammonia losses from the ground surface will commonly be minimal during the irrigation (10% or less)."[134]

Although additional research will be helpful in quantifying the environmental benefits of improved waste management and nutrient applications, the weight of evidence suggests that managing nutrient applications to fields as prescribed in the General Order, especially compared to pre-General Order management on some dairy farms, has significantly reduced losses of nitrogen compounds to the environment, including

[129] Ibid., p. 47
[130] "Cow Numbers and Water Quality – is there a magic limit?" (Harter, Menke 2005), http://groundwater.ucdavis.edu/files/136451.pdf
[131] Ibid., Harter.
[132] Ibid., "Managing Dairy Manure in the Central Valley of California."
[133] "Assessment of Nitrous Oxide Emissions in California's Dairy Systems, DRAFT FINAL REPORT, California Air Resources Board, Contract No. 09-325, William R. Horwath, Martin Burger, Stuart Pettygrove, http://www.arb.ca.gov/research/rsc/10-18-13/item6dfr09-325.pdf
[134] Ibid., "Managing Dairy Manure in the Central Valley of California," p. 41.

leaching of nitrogen compounds to groundwater and air emissions such as ammonia and nitrous oxide.

Organic Material Composting (District Rule 4566)

I. District Rule Description:

District Rule 4566 (Organic Material Composting) is the most stringent rule in the nation for controlling emissions from composting operations; additional controls are infeasible. Additionally, as discussed in Appendix E of this *2015 PM2.5 Plan,* one of the technology focus areas for the District's Technology Advancement Program is for waste solutions that focus on waste systems or technologies that minimize or eliminate emissions from existing waste management systems and processes, including waste-to-fuel systems, such as dairy digesters and other bio-fuel applications. The District has taken every regulatory action feasible to reduce emissions from this source and continues to seek additional methods to reduce emissions through innovative strategies such as the support of research and technology demonstrations with potential to reduce emissions further.

District Rule 4566, was adopted on August 18, 2011, to limit VOC emissions from composting facilities whose feedstock consists of greenwaste and/or foodwaste. District Rule 4566 applies to operations that stockpile and compost greenwaste and foodwaste. In addition to limiting VOC emissions, District Rule 4566 also limits NH3 emissions from these operations. The analysis below focuses on how District Rule 4566 limits NH3 emissions in comparison to other rules and regulations.

II. How does District Rule 4566 compare with federal rules and regulations?

A. EPA-Control Technique Guidelines (CTG)

There is no EPA CTG guidance document for greenwaste or foodwaste composting operations.

B. EPA - Alternative Control Technology (ACT)

There is no EPA ACT guidance document for greenwaste or foodwaste composting operations.

C. Standards of Performance for New Stationary Sources (NSPS)

There is no NSPS guidance document for greenwaste or foodwaste composting operations.

D. National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Maximum Achievable Control Technologies (MACTs)

There is no NESHAP or MACT guidance document for greenwaste or foodwaste composting operations.

III. How does District Rule 4566 compare to rules in other air districts?

District staff compared District Rule 4566 with the rules for greenwaste and foodwaste composting operations from other California air districts. The results of the analysis are discussed below. District staff only located one other air district rule that applied to similar sources: SCAQMD Rule 1133.3. No other air district rules that applied to greenwaste or similar sources were found.

A. SCAQMD Rule 1133.3 - Emission Reductions from Greenwaste Composting Operations (Adopted July 8, 2011)

The purpose of SCAQMD Rule 1133.3 is to reduce emissions of VOCs and NH3 from greenwaste and foodwaste composting operations. The table below compares the significant similarities and differences between SJVAPCD Rule 4566 and SCAQMD Rule 1133.3. For purposes of this analysis, the ammonia control efficiencies achieved by the requirements of SJVAPCD Rule 4566 are assumed to be the same as the VOC control efficiencies since the same control measures will reduce both VOC and NH3 from these operations. It is worth noting that greenwaste/foodwaste composting produces about 16% of the ammonia emissions on a per ton basis compared to co-composting.[135]

[135] SCAQMD Rule 1133.3, baseline NH_3 emissions from greenwaste/foodwaste composting = 0.46 lb-NH3/ton-throughput. SCAQMD Rule 1133.2, baseline NH_3 emissions from co-composting = 2.93 lb-NH3/ton-throughput.

Rule Section	SCAQMD Rule 1133.3	District Rule 4566	Explanation of Differences
Applicability	New and existing greenwaste and foodwaste composting operations.	New and existing organic material composting and stockpiling facilities. (Organic material is defined as green material, food material, or mixtures of the two, with <100 ton/yr biosolids or manure.)	SCAQMD Rule 1133.3 limits foodwaste stockpiling time (48 hr), whereas District Rule 4566 limits organic material stockpiling time (3 or 10 days, depending on throughput).
Exemptions	Applicability/exemptions based on facility type, not throughput.	Applicability/exemptions based on facility type, not throughput.	The same types of facilities are exempt in both rules: facilities subject to a co-composting rule (SCAQMD Rule 1133.2 or District Rule 4565), nursery, household, recreational, and community composting facilities. District Rule 4566 also exempts agricultural facilities which are subject to District Rules 4204, 4550, or 4570.
Composting Control Requirements	• ≤5,000 ton/yr foodwaste or ≤20% manure (watering and finished compost cover or ≥20% control for NH3) • >5,000 ton/yr foodwaste, (emission control device with ≥80% control for NH3)	• <200,000 ton/yr organic material (watering system or ≥19% control for NH3) • ≥200,000 and <750,000 ton/yr organic material (watering system and finished compost cover or ≥60% control for NH3) • ≥750,000 ton/yr organic material (emission control device with ≥80% control for NH3)	The throughput/control levels in Rule 4566 are based on cost effectiveness and socioeconomic studies conducted by the District as part its Final Staff Report for the Revised Proposed New Rule 4566 (Appendices C and D, August 18, 2011). Rule 4566 requires the same management practices and control requirements as Rule 1133.3; however, the throughput levels at which the stricter control requirements in Rule 4566 become triggered are much higher than in Rule 1133.3. Thus, on paper, Rule 1133.3 appears to be more stringent than Rule 4566. However, SCAQMD does not have any greenwaste composting facilities (that are not under an experimental research permit) subject to the 80% control requirements of Rule 1133.3.

As shown in the table above, based on discussions with SCAQMD permitting and rule development staff, SCAQMD does not have any greenwaste composting production facilities subject to the 80% ammonia reduction requirement of Rule 1133.3. SCAQMD has recently issued Authority to Construct permits for two experimental research greenwaste composting facilities located in Fontana and Riverside operated by Burrtec. The permits authorize Burrtec to perform greenwaste composting for one year (with the possibility of an extension) in order to evaluate the feasibility of three different compost emissions control technologies and conduct emissions testing for each technology. If at

the end of the permitted experimental research period, Burrtec wanted to convert one or both facilities into a regular greenwaste composting production facility, they would need to obtain new ATC permits. The Burrtec facilities then are not representative of a commercial production greenwaste composting facility.

Because SCAQMD has no existing production greenwaste composting facilities that are subject to the 80% ammonia control requirement of Rule 1133.3, and the new facilities are permitted under experimental research exemptions, then Rule 1133.3 cannot be used to establish BACM or MSM as 80% for that category/throughput level of greenwaste composting.

B. No rules that apply to organic materials composting operations were located for the air districts listed below:

- Amador County Air Pollution Control District (ACAPCD)
- Bay Area Air Quality Management District (BAAQMD)
- Eastern Kern County Air Pollution Control District (EKAPCD)
- El Dorado County Air Quality Management District
- Imperial County Air Pollution Control District (ICAPCD)
- Mojave Desert Air Quality Management District (MDAQMD)
- North Coast Unified Air Quality Management District (NCAQMD)
- Placer County Air Pollution Control District (PCAPCD)
- Sacramento Metropolitan Air Quality Management District (SMAQMD)
- San Diego County Air Pollution Control District (SDCAPCD)
- Ventura County Air Pollution Control District (VCAPCD)
- Yolo-Solano Air Quality Management District (YSAQMD)

C. IDAPA 58.01.01 Sections 760-764: Rules for the Control of Ammonia from Dairy Farms

The purpose of IDAPA 58.01.01 Sections 760-764 is to set forth requirements for the control of ammonia through best management practices for certain size dairy farms licensed by the Idaho State Department of Agriculture to sell milk for human consumption.

This regulation only applies to large dairies and does not apply to other agricultural facilities or facilities in which the primary activity is the production of compost. Therefore, it was determined that this regulation is not relevant to the current analysis since it does not specifically limit emissions from composting facilities.

IV. Conclusion

While BACM and MSM requirements do not apply to ammonia since it is not a significant precursor to PM2.5 formation in the Valley, District staff concludes that District Rule 4566 meets BACM and MSM requirements for ammonia emissions from greenwaste and foodwaste composting operations. The District evaluated the feasibility

of additional ammonia emissions reductions and did not identify any additional feasible measures.

Biosolids, Animal Manure, and Poultry Litter Operations (District Rule 4565)

I. District Rule Description:

District Rule 4565, was adopted on March 15, 2007, to limit VOC emissions from facilities whose throughput consists entirely or in part of biosolids, animal manure, or poultry litter. District Rule 4565 applies to operations that landfill, land apply, compost, or co-compost these materials. In addition to limiting VOC emissions, District Rule 4565 also limits NH3 emissions from these operations. The analysis below focuses on how District Rule 4565 limits NH3 emissions in comparison to other rules and regulations.

II. How does District Rule 4565 compare with federal rules and regulations?

A. EPA-Control Technique Guidelines (CTG)

There is no EPA CTG guidance document for biosolids, animal manure, and/or poultry litter operations.

B. EPA - Alternative Control Technology (ACT)

There is no EPA ACT guidance document for biosolids, animal manure, and/or poultry litter operations.

C. Standards of Performance for New Stationary Sources (NSPS)

There is no NSPS guidance document for biosolids, animal manure, and/or poultry litter operations.

D. National Emission Standards for Hazardous Air Pollutants (NESHAPs) and Maximum Achievable Control Technologies (MACTs)

There is no NESHAP or MACT guidance document for biosolids, animal manure, and/or poultry litter operations.

III. How does District Rule 4565 compare to rules in other air districts?

District staff compared District Rule 4565 with the rules for biosolids, animal manure, and poultry litter operations from other California air districts. The results of the analysis are discussed below. District staff only located one other air district rule that applied to similar sources, which was SCAQMD Rule 1133.2. No other air district rules that applied to similar sources were found.

A. SCAQMD Rule 1133.2 - Emission Reductions from Co-Composting Operations (Adopted January 10, 2003)

SCAQMD adopted SCAQMD Rule 1133.2. This rule applies to new and existing co-composting operations in the SCAQMD.
Staff notes that there are some differences between District Rule 4565 and SCAQMD Rule 1133.2. This does not mean that one rule is more stringent than the other; rather the differences are due to the following factors:

1. Technology has changed significantly since SCAQMD Rule 1133.2 was adopted on January 10, 2003;
2. Additional research projects regarding mitigation measures have been completed since SCAQMD Rule 1133.2 was adopted; and
3. The socioeconomic climate of the SCAQMD is significantly different from that of the District.

The table below summarizes the significant differences between SCAQMD Rule 1133.2 and SJVAPCD Rule 4565. Below are the important differences between the two rules. For purposes of this analysis, the NH3 control efficiency for the requirements of District Rule 4565 are assumed to be the same as the VOC control efficiency for these requirements since the same measures will generally reduce both VOC and NH3 from these operations.

Category	SCAQMD Rule 1133.2	SJVUAPCD Rule 4565	Reason
Facilities Other Than Co-Composting (Landfilling, Land Applying)	Rule does not apply to these operations	Management practice requirements	Knowledge of control options has increased since Rule 1133.2 adoption and staff believes that cost effective methods of controlling VOC and NH3 emissions from these facilities exist.
Co-Composting Threshold for Applicability	Facilities with at least 1,000 tpy throughput	Facilities that handle 100 tpy or more of biosolids, animal manure, or poultry litter	Staff believes that there are reasonable options that are not exceedingly costly for facilities with throughputs of ≥100 tpy that would not impose an undue burden on operators.
Composting Control Requirements	In-vessel composting with 70% control efficiency for VOC and NH3 for existing facilities and 80% control efficiency for VOC and NH3 for new facilities	Control efficiency of 10%-80% for VOC (and NH3) depending on type of operation and facility throughput	Management practices (mitigation measures) are effective, reasonable, and have been achieved in practice for smaller facilities. In-vessel composting is not cost-effective for smaller or medium facilities and there are no known, unsubsidized facilities in the SCAQMD that would comply with such rule requirements.

It should also be noted that in practice, the facilities that are actually subject to SCAQMD Rule 1133.2 will have much larger throughputs than 1,000 ton per year

throughput threshold given in the rule. SCAQMD Rule 1133.2 includes the following exemptions for existing co-composting operations with a design capacity of less than 35,000 tons of throughput per year containing no more than 20 percent biosolids by volume and new and existing municipal facilities using aeration and processing less than 5,000 tons of biosolids or manure per year. In addition many operations in the SCAQMD have found it to be economical to transport these materials to other jurisdictions for processing. An example of this is the Synagro South Kern Compost Manufacturing Facility, which is a newer facility located in the Valley and processes biosolids transported from SCAQMD.

Because some mitigation measures are only cost-effective for larger facilities, District staff developed the concept of Class One and Class Two mitigation measures. Class One mitigation measures are cost effective options for all facilities, regardless of size. These measures are management practices found to be best practices for all composting operations.

Class Two mitigation measures are the technology options and achieve reductions greater than Class One mitigation measures; however, they were determined to not be cost effective for facilities with throughputs of less than 100,000 wet tons per year.

District Rule 4565 requires reductions from two additional categories (landfilling and land applying) when compared to SCAQMD Rule 1133.2. For the third category, composting, District staff determined it is not cost effective to require in-vessel (enclosed) composting.

B. No rules that apply to biosolids, animal manure, and/or poultry litter operations were located for the air districts listed below

- Amador County Air Pollution Control District (ACAPCD)
- Bay Area Air Quality Management District (BAAQMD)
- Eastern Kern County Air Pollution Control District (EKAPCD)
- El Dorado County Air Quality Management District
- Imperial County Air Pollution Control District (ICAPCD)
- Mojave Desert Air Quality Management District (MDAQMD)
- North Coast Unified Air Quality Management District (NCAQMD)
- Placer County Air Pollution Control District (PCAPCD)
- Sacramento Metropolitan Air Quality Management District (SMAQMD)
- San Diego County Air Pollution Control District (SDCAPCD)
- Ventura County Air Pollution Control District (VCAPCD)
- Yolo-Solano Air Quality Management District (YSAQMD)

C. IDAPA 58.01.01 Sections 760-764: Rules for the Control of Ammonia from Dairy Farms

The purpose of IDAPA 58.01.01 Sections 760-764 is to set forth requirements for the control of ammonia through best management practices (BMPs) for certain size dairy farms licensed by the Idaho State Department of Agriculture to sell milk for human consumption.

This regulation only applies to large dairies and does not apply to other agricultural facilities or facilities in which the primary activity is the production of compost. Therefore, it was determined that this regulation is not relevant to the current analysis since it does not specifically limit emissions from composting facilities.

IV. Conclusion

While BACM and MSM requirements do not apply to ammonia since it is not a significant precursor to PM2.5 formation in the Valley, District staff concludes that District Rule 4565 meets BACM and MSM requirements for ammonia emissions from biosolids, animal manure, and poultry litter operations. The District evaluated the feasibility of additional ammonia emissions reductions and did not identify any additional feasible measures.

Major Sources of Ammonia

The facilities listed below were identified as potential major sources of NH3 in the Valley. In all cases, the NH3 emissions from the facilities were entirely or primarily the direct result of the use of catalytic emission controls to reduce NOx emissions to acceptable levels as determined by regulatory agencies including, EPA, ARB, the District, and, in one case the California Energy Commission (CEC). Because the Valley is primarily a rural NOx-limited area, NOx reductions are the most critical element of District's plans to reach attainment with the federal ambient air quality standards for both PM2.5 and ozone. Therefore, controls that reduce NH3 while increasing NOx would increase the formation of PM2.5 and ozone in the Valley and would be detrimental to the goals of reaching attainment with the federal ambient air quality standards.

Facility Name: J.R. Simplot Company; District Facility #C-705
This facility produces fertilizers. The NH3 emissions from this facility are associated with the Nitric acid production plant at the facility. Although ammonia is used in the production of nitric acid, the vast majority of the ammonia introduced is consumed in the production of the nitric acid or recovered. The ammonia emissions from the nitric acid are the result of the use of a non-selective catalytic reduction (NSCR) system to reduce NOx emissions from the nitric acid plant. The tail gas from nitric acid plants contains large amounts of NOx and this plant uses NSCR to reduce NOx to comply with 40 CFR 60 Subpart G (Standards of Performance for Nitric Acid Plants) and federally-enforceable New and Modified Source Review (NSR) limits. The NSR permit for this facility includes conditions minimizing the allowable amount of NH3 slip with associated

emissions testing. Because the NH3 emissions are the direct result of the use of NSCR, which is required to comply with federal NSPS and NSR requirements, and reducing the amount of NH3 would increase NOx emissions, this facility is considered to satisfy BACM and MSM for NH3.

Facility Name: Covanta Delano Inc.; District Facility #S-75
This facility is a biomass power plant. The NH3 emissions from this facility are the result of the use of NH3 injection for Selective Non-Catalytic Reduction (SNCR) to control NOx from two biomass-fired boilers at the facility. Use of the SNCR to reduce NOx is required by the EPA-issued Prevention of Significant Deterioration (PSD) Permit PSD ATC SJ 90-01 and federally-enforceable NSR conditions and also required to comply with 40 CFR 60 Subpart Db (Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units). The NSR permits state, "*Ammonia shall be injected into boiler at a rate, in pounds per ton of biomass fuel introduced into boiler, which results in compliance with the NOx emission limitation.*" Permit PSD ATC SJ 90-01 states "… *A SNCR system utilizing ammonia injection shall be incorporated within the boilers. Ammonia shall be injected continuously during all periods of operation at a rate which results in compliance with the NOx emission limits.*" Because a perfect reaction cannot be achieved, some excess NH3 must be injected in the boiler stacks to reduce NOx to acceptable levels and this excess unreacted NH3 escapes the stack as slip. The facility incurs a cost for all of the NH3 injected into the boiler stacks, so there is an incentive to minimize NH3 slip to reduce costs associated with compliance with the NOx limits. In addition, the NSR permits for the biomass-fired boilers include conditions limiting the allowable amount of NH3 slip.

The NH3 emissions from the biomass boilers are the direct result of the use of SNCR, which is required by NSR conditions and the EPA-issued PSD Permit PSD ATC SJ 90-01 and required to comply with the requirements of Federal NSPS. The NSR permits for the biomass-fired boilers include conditions limiting the allowable amount of NH3 slip with associated emissions testing, and further reducing the amount of NH3 could potentially increase NOx emissions; therefore, this facility is considered to satisfy BACM and MSM for NH3.

Facility Name: Northern California Power; District Facility #N-2697
This facility is a natural gas power plant. The NH3 emissions from this facility are the result of the use of NH3 injection for Selective Catalytic Reduction (SCR) to control NOx from two natural gas-fired turbines at the facility. Use of the SCR to reduce NOx is required by federally-enforceable NSR conditions and also required to comply with the federally-enforceable requirements of District Rule 4703 (Stationary Gas Turbines), which is included in the SIP. Because a perfect reaction cannot be achieved, some excess NH3 must be injected to reduce NOx to acceptable levels. The excess unreacted NH3 escapes the stack as slip. The facility incurs a cost for all of the NH3 injected into the stacks, so there is an incentive to minimize NH3 slip to reduce costs associated with the compliance with the NOx limits. In addition, the NSR permits for the natural gas-fired turbines include conditions limiting the allowable amount of NH3 slip.

The NH3 emissions from the natural gas-fired turbines are the direct result of the use SCR, which is required by NSR conditions and required to comply with the federally-enforceable requirements of District Rule 4703. The NSR permits for the natural gas-fired turbines include conditions limiting the allowable amount of NH3 slip and associated emissions testing, and further reducing the amount of NH3 could potentially increase NOx emissions; therefore, this facility is considered to satisfy BACM and MSM for NH3.

Conclusion

While BACM and MSM requirements do not apply to ammonia since it is not a significant precursor to PM2.5 formation in the Valley, District staff concludes that major sources of ammonia in the Valley satisfy BACM and MSM requirements for NH3. The District evaluated the feasibility of additional ammonia emissions reductions and did not identify any additional feasible measures.

Table C-37 Emission Inventory Codes

Control Measure	Emission Inventory Codes
Rule 4103 (Open Burning)	670-660-0262-9842; 670-660-0262-9862; 670-660-0262-9874; 670-660-0262-9884; 670-660-0262-9888; 670-660-0262-9892; 670-662-0262-9878; 670-668-0200-9858; 670-668-0200-9872; 670-668-0200-9886; 670-995-0240-9848
Rule 4104 (Reduction of Animal Matter)	420-995-6004-0000
Rule 4106 (Prescribed Burns)	670-666-0200-0000; 670-670-0200-0000
Rule 4203 (Particulate Matter Emissions from the Incineration of Combustible Refuse)	010-005-0243-0000
Rule 4204 (Cotton Gins)	420-418-6028-0000; 420-420-6028-0000
Rule 4301 (Fuel Burning Equipment)	
Rule 4307 (Boilers, Steam Generators and Process Heaters 2 – 5 MMBtu/hr)	010-005-0110-0000; 010-005-0124-0000; 010-005-0130-0000; 010-005-0300-0000; 010-005-1220-0000; 020-005-0110-0000; 030-005-0110-0000; 030-005-0124-0000; 030-005-0130-0000; 030-005-1220-0000; 030-005-1530-0000; 030-010-0110-0000; 030-010-0130-0000; 030-010-1220-0000; 030-010-1600-0000; 030-015-0110-0000; 030-015-0130-0000; 040-005-0110-0000; 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; 050-005-0320-0000; 050-005-1100-0000; 050-005-1220-0000; 050-005-1510-0000; 050-005-1520-0000; 050-005-3220-0000; 050-010-0110-0000; 050-010-0120-0000; 050-010-0320-0000; 050-010-1220-0000; 050-010-1500-0000; 052-005-0110-0000; 052-005-0124-0000; 052-005-1220-0000; 052-010-0110-0000; 052-010-0120-0000; 052-010-1224-0000; 060-005-0110-0000; 060-005-0122-0000; 060-005-0124-0000; 060-005-0130-0000; 060-005-0142-0000; 060-005-0144-0000; 060-005-0320-0000; 060-005-1220-0000; 060-005-1510-0000; 060-005-1520-0000; 060-010-0100-0000; 060-010-0110-0000; 060-010-0120-0000; 060-010-0142-0000 The EICs are the same for Rules 4306/4320, 4307, and 4308; the three rules share a combined emission inventory. Baseline emissions from the 2008 and 2009 rule amendments of these rules were used to determine the percentage of emissions for each rule. Those respective percentages are applied to the combined inventory to get the individual emission inventories.
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. Baseline emissions from the 2008 and 2009 rule amendments of these rules were used to determine the percentage of emissions for each rule. Those respective percentages are applied to the combined inventory to get the individual emission inventories. See Rule 4307 for the EICs.

Control Measure	Emission Inventory Codes
Rule 4309 (Dryers)	430-422-7078-0000; 430-424-7006-0000; 430-995-7000-0000; 499-995-0000-0000; 499-995-5630-0000
Rule 4311 (Flares)	110-132-0130-0000; 110-132-0146-0000; 120-132-0136-0000; 130-132-0110-0000; 130-132-0130-0000; 130-132-0136-0000; 310-320-0010-0000; 310-320-0110-0000; 310-320-0120-0000; 310-320-0130-0000; 310-320-0136-0000; 310-320-1600-0000; 320-320-0010-0000; 320-320-0110-0000; 320-320-0120-0000; 320-320-0130-0000
Rule 4313 (Lime Kilns)	Lime kilns are not included in the ARB emissions inventory. There are no lime kilns currently operating in the Valley.
Rule 4320 (AERO for Boilers, Steam Generators, and Process Heaters >5 MMBtu/hr)	The EICs are the same for Rules 4306/4320, 4307, and 4308; the three rules share a combined emission inventory. Baseline emissions from the 2008 and 2009 rule amendments of these rules were used to determine the percentage of emissions for each rule. Those respective percentages are applied to the combined inventory to get the individual emission inventories. 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; 020-005-0218-0000; 020-005-0230-0000; 030-005-0214-0000; 050-005-0214-0000; 050-005-0240-0000; 050-005-0254-0000; 052-005-0240-0000; 060-005-0240-0000; 060-005-0264-0000
Rule 4354 (Glass Melting Furnaces)	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 4641 (Cutback, Slow Cure, and Emulsified Asphalt, Paving and Maintenance Operations)	540-560-0400-0000; 540-562-0400-0000; 540-564-0400-0000; 540-566-0400-0000
Rule 4692 (Commercial Charbroiling)	690-680-6000-0000
4693 (Bakery Ovens)	420-412-6012-0000; 420-412-6037-0000
Rule 4702 (Internal Combustion Engines)	010-040-0110-0000; 010-040-1200-0000; 020-040-0110-0000; 020-040-1200-0000; 030-040-0110-0000; 030-040-0124-0000; 030-040-1200-0000; 030-040-1210-0000; 040-040-0110-0000; 050-040-0012-0000; 050-040-0110-0000; 050-040-0124-0000; 050-040-1200-0000; 052-040-0110-0000; 052-040-1200-0000; 052-042-0110-0000; 052-042-1200-0000; 052-042-1200-0010; 052-042-1200-0011; 060-040-0110-0000; 060-040-0124-0000; 060-040-0142-0000; 060-040-0146-0000; 060-040-1100-0000; 060-040-1200-0000; 060-040-1210-0000; 060-995-1220-0000; 099-040-1200-0000
Rule 4703 (Stationary Gas Turbines)	010-045-0110-0000; 010-045-1200-0000; 020-045-0110-0000; 030-045-0110-0000; 040-045-0134-0000; 050-045-1200-0000; 060-045-0110-0000; 060-045-1200-0000
Rule 4802 (Sulfuric Acid Mist)	410-400-2058-0000

Control Measure	Emission Inventory Codes
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 Residential Central Furnace)	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)	630-622-5400-0000; 630-624-5400-0000; 630-626-5400-0000; 630-628-5400-0000; 630-634-5400-0000
Rule 8031 (Bulk Materials)	430-436-7006-0000; 430-436-7078-0000; 430-995-7064-0000
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 Traffic)	645-645-5400-0000; 645-647-5400-0000. The ARB Emissions Inventory database does not contain emissions data on unpaved vehicle and equipment traffic areas.
Rule 8081 (Ag Sources)	645-646-5400-0000

Control Measure	Emission Inventory Codes
SC 001 (Source Category: Lawn Care Equipment)	860-902-1100-4065; 860-902-1100-4094; 860-902-1100-4095; 860-902-1100-4102; 860-902-1100-4103; 860-902-1100-4112; 860-902-1100-4113; 860-902-1100-4124; 860-902-1100-4125; 860-902-1100-5672; 860-902-1100-5673; 860-902-1100-5684; 860-902-1100-5685; 860-902-1100-5692; 860-902-1100-5693; 860-902-1100-5704; 860-902-1100-5705; 860-902-1100-5724; 860-902-1100-5725; 860-902-1100-7604; 860-902-1100-7605; 860-902-1100-7614; 860-902-1100-7615; 860-902-1100-8104; 860-902-1100-8105; 860-902-1100-8112; 860-902-1100-8113; 860-902-1100-8344; 860-902-1100-8345; 860-902-1100-8352; 860-902-1100-8353; 860-902-1100-8364; 860-902-1100-8365; 860-902-1100-8372; 860-902-1100-8373; 860-902-1100-8384; 860-902-1100-8385; 860-902-1100-9074; 860-902-1100-9075; 860-902-1100-9542; 860-902-1100-9543; 860-902-1100-9554; 860-902-1100-9555; 860-902-1100-9834; 860-902-1100-9835; 860-903-1100-1394; 860-903-1100-1395; 860-903-1100-1404; 860-903-1100-1405; 860-903-1100-4084; 860-903-1100-4085; 860-903-1100-5744; 860-903-1100-5745; 860-903-1100-5754; 860-903-1100-5755; 860-903-1210-1190; 860-903-1210-1200; 860-903-1210-1210; 860-903-1210-1220; 860-903-1210-1230; 860-903-1210-1240; 860-903-1210-1250; 860-903-1210-1350; 860-903-1210-1380; 860-903-1210-4050; 860-903-1210-4070; 860-903-1210-4130; 860-903-1210-4140; 860-903-1210-4150; 860-903-1210-5710; 860-903-1210-5730; 860-903-1210-8390; 860-903-1210-8400; 860-903-1210-8410
SC 002 (Energy Efficiency)	None
SC 003 (Fireworks)	None
SC 004 (Sand and Gravel Operations)	430-422-7078-0000; 430-426-0210-0000; 430-426-7078-0000; 430-426-7092-0000
SC 005 (Asphalt/Concrete Operations)	430-424-7006-0000; 430-424-7050-0000; 430-429-7016-0000; 430-430-7016-0000; 430-430-7018-0000; 430-436-7006-0000; 430-995-7006-0000; 430-995-7012-0000; 430-995-7016-0000; 430-995-7018-0000; 430-995-7050-0000; 430-995-7072-0000
SC 006 (Almond Hulling/Shelling Operations)	420-418-6003-0000
SC 007 (Pistachio Hulling/Shelling Operations)	The EIC is included in SC 006
SC 008 (Agricultural Material Screening/Shaking Operations)	None
SC 009 (Tub Grinding Operations)	None
SC 010 (Abrasive Blasting)	430-428-6084-0000; 430-428-7000-0000; 430-428-7036-0000; 430-428-7078-0000; 430-428-7084-0000; 430-428-7088-0000; 430-428-7090-0000
SC 011 (Bakery Ovens)	N/A

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