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PROPOSED AMENDMENTS TO RULE 2.27, BOILERS

DRAFT STAFF REPORT

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I. EXECUTIVE SUMMARY

In 2019, the Yolo-Solano Air Quality Management District (District) Board of Directors will consider the proposed amendments to Rule 2.27, BOILERS. Rule 2.27 contains the Nitrogen Oxides (NOx) and Carbon Monoxide (CO) limitations for all institutional, commercial, and industrial boilers, steam generators and process heaters within our jurisdiction. The amendments being proposed to Rule 2.27 will lower the applicability level from 5 MMBtu/hr rated heat input to 1 MMBtu/hr and will require more stringent NOx emission limits for new and existing units.

The proposed amendments will not have a significant or detrimental effect on the environment. Therefore, staff prepared a Notice of Exemption to satisfy the requirements of the California Environmental Quality Act (CEQA). The notice states that the revisions to Rule 2.27 are exempt from the requirements of CEQA pursuant to Title 14, California Code of Regulations, Section 15308, Actions by Regulatory Agencies for Protection of the Environment.

A. BACKGROUND

History

Under the provisions of the Federal Clean Air Act Amendments of 1990, the Yolo-Solano Air Quality Management District has been designated as "severe non-attainment" for the federal ozone standard. The District is also classified as non-attainment for the state ozone standard, which is stricter than the federal standard. Ozone is a strong irritant that attacks the respiratory system, leading to damage of lung tissue. Asthma, bronchitis and other respiratory diseases, as well as cardiovascular diseases, are aggravated by exposure to ozone. Because it is not emitted directly, ozone is classified as a secondary pollutant. It is formed when volatile organic compounds (VOC) react with nitrogen oxides (NOx) in the presence of sunlight, and is one component of "smog".

The primary District strategy to attain federal and state ozone standards has been to develop rules to control VOC and NOx emissions from a variety of stationary sources. These rules are then incorporated into the California State Implementation Plan (SIP), which is reviewed by the EPA for its efficacy in reaching attainment of air pollution standards. On May 26, 1988, the EPA issued a SIP call under Section 110(a)(2)(H) of the Federal Clean Air Act (CAA), based on a finding that California's SIP was substantially inadequate to provide for timely attainment of the federal ozone standard. Notification of the SIP call was published in 53 FR (Federal Register) 34500, September 7, 1988. The SIP call noted deficiencies in District rules throughout California. In addition, the District was notified that it was deficient in rule completion for major sources of nitrogen oxides (NOx). On January 13, 1993, the California Air Resources Board submitted a revision to the SIP that consisted of commitments to adopt nitrogen oxides (NOx) reasonably available control technology rules (RACT commitments) that includes the Yolo-Solano AQMD. This RACT commitment is based upon the District's Air Quality Attainment Plan adopted in February of 1992.

In response to EPA mandates contained in the SIP call and RACT commitments, and pursuant to Section 182(a)(2)(A) of the CAA, Rule 2.27, INDUSTRIAL, INSTITUTIONAL, AND COMMERCIAL BOILERS, STEAM GENERATORS, AND PROCESS HEATERS, was adopted. The District estimated that compliance with Rule 2.27 would reduce District NOx emissions from boilers, steam generators, and process heaters by 39 percent.

In addition to the deficiencies noted by the EPA, the California Clean Air Act of 1988 requires the implementation of Best Available Retrofit Control Technology (BARCT), pursuant to California Health and Safety Code (CH&SC) Section 40919(a). The California Air Resources Board (CARB), in

conjunction with the California Air Pollution Control Officers Association (CAPCOA) has developed a BARCT determination for industrial, institutional, and commercial boilers, steam generators, and process heaters. This determination is an effort to provide a set of guidelines to all the air districts in the state and will meet the EPA RACT requirements. This guidance is incorporated in Rule 2.27, which was adopted by the Yolo-Solano AQMD Board on October 27, 1993.

Rule 2.27 was submitted to EPA by CARB on May 24, 1994. EPA did not finalize processing this submittal due to deficiencies in the rule. YSAQMD amended Rule 2.27 and corrected the deficiencies on August 14, 1996 and this version was submitted by CARB on October 16, 1996. Rule 2.27 was revised in 1996 in order to be approved by U.S. EPA and be incorporated into the California State Implementation Plan to attain federal and state ozone standards.

Overview of source category

This rule applies to boilers, steam generators, and process heaters with rated heat inputs of greater than or equal to one million Btu per hour, used in all industrial, institutional, and commercial operations.

II. DISCUSSION OF PROPOSED RULE 2.27 AMENDMENTS

The proposed amendments to Rule 2.27 are as follows:

Section 100 General

The current rule provides for an exemption from the NOx limits for units with an annual heat input of less than 90,000 therms. The proposed changes replace that exemption with an exemption from the NOx and CO emissions standards as well as from performance testing requirements for units with a permitted capacity factor of four percent or less, meaning the permitted fuel use or hours of operation are limited to four percent or less of the maximum physical capacity on an annual basis. A broad exemption from the standards of the rule has been included for units operating under curtailment conditions provided the curtailment fuels are not burned more than 200 cumulative hours in a calendar year. An exemption from the standards of the rule for process heaters operated less than 250 hours per calendar year has been retained. An exemption from the performance testing requirements has been added for units rated at less than five million Btu per hour certified to comply with the emission limits of the rule. The current rule provides complete exemption for combustion units in certain categories. The proposed changes add to that complete exemption the categories of hot water pressure washers as well as boilers with rated heat input ratings less than five million Btu per hour that are installed prior to January 1, 2020.

Section 200 Definitions

Definitions for “Certified Unit”, “Curtailment Conditions”, “Dryer”, “Hot Water Pressure Washer”, “Permitted Capacity Factor”, and “Waste Heat Recovery Boiler” were added. Definitions that have been made obsolete by other proposed changes have been deleted.

Section 300 Standards

The applicability for Rule 2.27 will encompass all units rated at or above one million Btu per hour (MMBtu/hr) input, extended from applicability to five million Btu per hour. The NOx emission levels for new and existing units are summarized in tables 1 & 2.

Table 1. Proposed BARCT Emissions Limits – Gaseous Fuel

Unit Size/Description MMBtu/hr Input	NOx Limits ppmv @ 3% O2	
	Existing	Proposed
≥ 1 - < 5	-	30
≥ 5 - ≤ 20	30	15
> 20	30	9

Table 2. Proposed BARCT Emissions Limits – Nongaseous Fuel

Unit Size/Description MMBtu/hr Input	NOx Limits ppmv @ 3% O2	
	Existing	Proposed
≥ 1 - < 5	-	40
≥ 5	40	40

Section 302 lists the performance testing requirements for units in different categories of rated heat input range. A source test will be required every 12 months for units with heat input ratings greater than 20 MMBtu/hr. Source tests every 24 months will be required for units with heat input ratings in the range of 5 to 20 MMBtu/hr. Units with heat input ratings less than 5 MMBtu/hr will be subject to an initial test by a portable gas analyzer.

Section 303 specifies the requirements for units exempt from the emissions standards and compliance determination obligations pursuant to the exemptions for low fuel usage or certified units to either be operated in a manner that maintains stack-gas oxygen concentrations to 3.00% or less by volume on a dry basis or be tuned not less than once every 12 months.

Section 304 details requirements for monitoring boiler operation for units subject to the rule. Owners/operators of units with a rated heat input greater than 20 MMBtu/hr shall install a dedicated non-resetting, totalizing fuel meter in each fuel line. Owners/operators of units with a heat input rating less than or equal to 20 MMBtu/hr may install non-resetting, totalizing hour meters or computerized tracking systems in lieu of dedicated fuel meters.

Section 400 Administrative Requirements

The compliance schedule specifies increments of progress for units that need to be modified or replaced to achieve compliance with the standards of the rule. By July 1, 2019 owners/operators shall submit an application for an Authority to Construct to claim the low-use exemption for units that will be limited to a permitted capacity factor of four percent or less. By December 31, 2019 owners/operators of subject units shall submit a plan with a description of the method of achieving compliance. Authority to Construct applications to carry out the method of achieving compliance shall be submitted by December 31, 2021. By December 31, 2023 all units shall demonstrate final compliance with Rule 2.27.

Section 404 states requirements of the documentation which must be maintained for owners/operators of units subject to the requirement for regular tune-ups.

Section 500 Monitoring and Records

The usage monitoring requirements in Section 501 have been simplified.

Section 502 has been modified with the inclusion of the formats required for conducting both portable analyzer and source tests.

Section 600 Tuning Procedure

Specific procedures for conducting boiler tune-ups have been deleted from the rule.

III. COMPARISON WITH OTHER APPLICABLE REGULATIONS AND REQUIREMENTS

Health and Safety Code Section 40727.2 requires districts to prepare a written analysis (usually in the form of a matrix) that identifies all existing federal air pollution control requirements, including, but not limited to, emission control standards constituting best available control technology (BACT) that apply to the same equipment or source type as the rule or regulation proposed for adoption or modification by the District. In addition, the analysis shall identify any other District rule or regulation that applies to the same equipment or source type.

Rule 2.27 applies broadly to various boilers, steam generators, and process heaters except for units in certain specific categories which are entirely exempted from the rule. Units subject to Rule 2.27 in certain categories may also be subject to the requirements of New Source Performance Standards (NSPS) contained in Title 40, Code of Federal Regulations, Part 60 (40 CFR 60) Subparts D, Db, and Dc depending upon their rated heat inputs and the date upon which the unit was constructed, modified, or reconstructed. Units subject to Rule 2.27 may also be subject to the requirements of National Emission Standards for Hazardous Air Pollutants (NESHAP) contained in 40 CFR 63 Subparts DDDDD and JJJJJJ depending upon whether a unit is located at a major or area source of Hazardous Air Pollutants (HAP).

Table 3. Comparison of Proposed Rule Revision Requirements with Federal Regulations

	40 CFR 60, Subpart D	40 CFR 60, Subpart Db	40 CFR 60, Subpart Dc	40 CFR 63, Subpart DDDDD	40 CFR 63, Subpart JJJJJJ	Rule 2.27
NOx Emission Limits	Lowest limit is 0.20 lb/MMBtu	Lowest limit is 0.10 lb/MMBtu	No NOx limit in the regulation	No NOx limit in the regulation	No NOx limit in the regulation	Highest limit equates to 0.05 lb/MMBtu
CO Emission Limits	0.15 lb/MMBtu limit for certain sources*	0.15 lb/MMBtu limit for certain sources*	0.15 lb/MMBtu limit for certain sources*	Lowest CO limits are 130 ppm and 150 ppm**	420 ppm as 3-run average or 10-day rolling average	400 ppm limit equates to 0.25 - 0.29 lb/MMBtu depending on fuel type
Emissions Monitoring	Initial test plus CEMS & COMS at most	Initial test plus CEMS & COMS at most	Initial test plus CEMS & COMS at most	Initial test plus CEMS & COMS at most	Initial test plus CEMS & COMS at most	Source test once every 12 months at most
Fuel Monitoring	Fuel usage records not absolutely	Daily or monthly records of	Daily or monthly records of	Daily or monthly records of	Daily or monthly records of	Quarterly records of fuel usage

	required	fuel usage	fuel usage	fuel usage	fuel usage	
Recordkeeping	No record retention period specified	Record retention for two years	Record retention for two years	Record retention for five years	Record retention for five years	Record retention for five years

* In the regulation compliance with the CO limit is one requirement for sources that elect not to install and operate a Continuous Opacity Monitoring System (COMS).
** The 130 ppm limit is the lowest limit for any category of emissions unit for which compliance is determined by the average of three test runs and the 150 ppm limit is the lowest limit for a unit in any category that is equipped with a Continuous Emissions Monitoring System (CEMS) determined as a 30-day rolling average.

All Feasible Measure Requirements: CH&SC Section 40914 requires each district plan to demonstrate that it includes "every feasible measure." Districts must adopt the most effective control measures to reduce NOx emissions from boilers, steam generators, and process heaters. The emissions standards proposed for the revised rule are equivalent to the emissions standards for units in similar categories of fuel type and heat input rating found in the prohibitory rules of the Bay Area Air Quality Management District, the Sacramento Metropolitan Air Quality Management District, the San Joaquin Valley Air Pollution Control District, and the South Coast Air Quality Management District. The emissions standards proposed for the revised rule satisfy the all feasible measures requirements.

Best Available Retrofit Requirements: CH&SC Section 40919 requires districts designated as serious nonattainment for ozone to adopt Best Available Retrofit Control Technology (BARCT) for all existing sources. BARCT means an emission limitation that is based on maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of sources (CH&SC Section 40406). The proposed NOx requirements meet the BARCT requirement, and therefore the proposed rule meets the requirements of CH&SC Section 40919.

Expedited BARCT Implementation Requirements: CH&SC Section 40920.6(c) requires each air district that is a nonattainment area for one or more pollutants to adopt by, January 1, 2019, an expedited schedule for implementation of BARCT. The regulation requires the expedited schedule to apply to each industrial source that, as of January 1, 2017, was subject to a specified market-based compliance mechanism and implementation of BARCT may not be later than December 31, 2023. On October 10, 2018 the District adopted an expedited BARCT schedule for industrial sources subject to California Greenhouse Gas (GHG) Cap-and-Trade requirements. The schedule identified three industrial sources subject to the expedited BARCT schedule. Boilers/steam generators contribute substantially to the GHG emissions at two of these three sources. The proposed revisions to the rule would require compliance with all rule standards by December 31, 2023 at the latest. The proposed rule revisions therefore meet the requirements of CH&SC Section 40920.6(c).

IV. IMPACTS OF THE PROPOSED RULE

Emissions Impacts

An estimated 213 units will be affected by the proposed revisions to Rule 2.27. Out of the 213 units, there are 157 units that have a size rated from 1 - < 5 MMBtu/hr. The total estimated NOx emissions from these units are 16.56 tons per year. The existing units in this category would be exempt from the provisions of the rule based on the exemption specified in Section 110.6, but it is estimated that at least 49 boilers in this size range already comply with the proposed emissions limit (based on information in the Permit to Operate and manufacturer's data). Existing units in this range of heat

input rating will be exempt from the emission standards of the rule, but it is likely that many will be replaced with rule-compliant models as the existing units reach the end of their design life. It is estimated that the proposed amendments will result in approximately 44% overall reduction in NOx emissions from the replacement of these units, or 7.25 tons per year reductions in NOx emissions from the 1 - < 5 MMBtu/hr units (based on surveyed fuel usage data).

There are 56 (of the 213) permitted boilers that are rated at or above 5 MMBtu/hr. The total estimated NOx emissions from these boilers are 30.86 tons per year. There are 19 boilers in this size range that already comply with the proposed emission standards. It is anticipated that the additional 37 of the permitted boilers will have to comply with the proposed emission standards, although 4 units have historic fuel usages demonstrating the possibility to comply with the low-use exemption level in the rule. Based on fuel usage data collected by the District, Staff estimates that the proposed amendments will result in approximately 53.47% overall reduction in NOx emissions from these units, or 14.36 tons per year of NOx reductions from the 5 MMBtu/hr or greater units.

Cost Effectiveness [1]

CH&SC Section 40703 requires that the District consider and make public its findings relating to the cost effectiveness of implementing an emission control measure. CH&SC Section 40920.6 requires that the District, in adopting rules or regulations to meet the requirement for BARCT, identify one or more potential control options which achieve the emission reduction objectives for the regulation and calculate the incremental cost-effectiveness for the potential control options identified. The incremental cost-effectiveness is calculated as the difference in the costs for control options divided by the difference in the emission reduction potentials between the options.

Cost to the District: The District will need to consider the time needed to evaluate the applications for Authority to Construct and Permit to Operate for retrofitting the existing units and the time needed to observe and evaluate the initial source tests. The permitting impact should be limited up to 48 months after the date of amending this rule, when all permits should be processed.

Cost to Businesses: The proposed amendments will require retrofitting or replacing existing units rated greater than or equal to five million BTU per hour to meet the proposed NOx emission limits. The amendments will also require units in the same heat input rating category installed after the amendments of the rule to meet the most stringent NOx limits in the rule upon installation. Existing units rated less than five million BTU per hour will be exempt from the rule, but units in this category installed after January 1, 2020 will be required to meet the NOx limits in the rule. The cost impact was analyzed for:

1. Cost of retrofitting or replacing the existing unit,
2. Cost differential of installing new compliant units;
3. Cost for initial source testing and source test monitoring,
4. Cost for fuel meter and equipment tuning if it is exempt based on annual fuel usage, and
5. Authority to Construct and Permit to Operate modification fee.

The following assumptions and formulas were used for calculating the absolute cost effectiveness of lowering the NOx emissions limits.

1 Cost effectiveness analyses for this rule has been referenced from SMAQMD Rule 411, "NOx from Boilers, Process Heaters and Steam Generators," October 27, 2005 staff report, SJVAPCD Rule 4306 "Boilers, Steam Generators, and Process Heaters – Phase 3," October 16, 2008 staff report, EPA Control Cost Manual, Section 4, Chapter 1, and EPA "Air Pollution Control Technology Fact Sheet" for Selective Non-Catalytic Reduction. Cost data have been corrected for inflation from each respective information source.

1. Annualized Compliance Cost (ACC)
$$ACC = Cost \times Capital\ Recovery\ Factor\ (CRF)$$

2. $$CRF = \frac{i(1+i)^n}{(1+i)^n-1} = \frac{0.1(1+0.1)^{20}}{(1+0.1)^{20}-1} = 0.117$$

Where: i = interest rate (10%)
n = equipment life (10 years assumed for low-NOx/ultra low-NOx burners, 20 years assumed for SNCR, and 25 years assumed for SCR)

Boilers 1 - <5 MMBtu/hr

Low-NOx burners (LNB) are a control option capable of limiting NOx emissions to the 30 ppmv @ 3% O2 standard proposed for the rule. Selective Catalytic Reduction (SCR) is capable of reliably controlling boiler emissions to 5 ppmv @ 3% O2. This technology includes spraying ammonia into the boiler exhaust flow upstream of a catalyst material to reduce NOx to nitrogen gas and water vapor. A BACT Determination made by the Sacramento Metropolitan Air Quality Management District (SMAQMD) determined that boilers in this size range typically do not run continuously throughout the day and therefore their exhaust temperatures do not maintain the minimum necessary for the optimum performance of the catalytic reduction[2]. The SMAQMD BACT Determination declared SCR to be technologically infeasible for boilers/heaters of this size range. Selective Non-Catalytic Reduction (SNCR) is also capable of controlling boiler emissions to 5 ppmv @ 3% O2. In SNCR, either an ammonia or urea reducing agent is injected into the exhaust within a specific temperature zone to control NOx emissions. No catalyst material is used. According to a U.S. Department of Energy description of SNCR, "the acceptable temperature range for the reduction reaction is 1,400 to 2,000°F, but temperatures above 1,700°F are preferred"[3]. As the exhaust temperature of boilers in this size range do not reach up to the minimum at which SNCR is effective, this technology is not considered technologically feasible. Based on the analysis, the cost effectiveness of the proposed amendments is summarized in the table below.

2 Sacramento Metropolitan Air Quality Management District BACT Determination No. 128 (February 16, 2016).
3 Guide to Low-Emission Boiler and Combustion Equipment Selection, Oak Ridge National Laboratory (April, 2002).

Table 4. Summary of costs for 1 - <5 MMBtu/hr boilers

	Costs			
		Expense	**Individual Annualized Costs**	**Total Annualized Cost**
Existing Exempt Units	No Rule Compliance Obligations	-	-	-
Certified/Low Fuel Usage Units	Fuel Meter	$506 - $1,898	$82 - $309	$82 - $1,068
	Annual Tune-up	$759	-	
Non-Certified Units	Fuel Meter	$506 - $1,898	$82 - $309	$236 - $1,327
	Independent Source Test	$1,898	$309	
	Source Test Monitoring/Evaluation	$1,254	$204	
	Portable Analyzer Test (Purchase/Use)	$3,542 - $7,338	$576 - $1,194	
	Independent Portable Analyzer Test	$633	$103	
	Portable Analyzer Screening Observation	$312	$51	

Existing units that fall into this category of heat input rating will be exempt under the proposed amendments and will not have any compliance costs.

There will be no compliance costs for existing low fuel usage units exempted from the standards of the rule as: process heaters used less than 250 hours per calendar year, or boilers operating under curtailment conditions provided that the curtailment fuels are not burned more than 200 cumulative hours in a calendar year.

Exempt certified units have a one-time capital cost of installing a fuel meter estimated to cost[4] $1,898. Exempt certified units also have the option of using a non-resetting hour meter rather than a fuel meter, estimated to cost[5] $506. Such units shall be tuned not less than once every 12 months by a technician qualified to perform a tune-up or be operated in a manner that maintains stack-gas oxygen concentrations at less than or equal to 3.00 percent by volume on a dry basis during normal, steady state operation (or at the optimum level specified by the manufacturer). An annual tune-up is estimated to cost[6] $759. These costs will also apply to units which are exempt from the emissions standards and performance testing requirements of the rule as low fuel usage units with a permitted capacity factor of four percent or less.

New units which are not exempt as certified or low fuel use units will be subject to the one-time capital cost of installing a fuel meter or a non-resetting hour meter as well. Non-exempt units will also be subject to a requirement for an initial portable analyzer test to determine compliance with the emissions standards of the rule. Boiler owners/operators will have the option to purchase and use their

4 A fuel meter cost of $1,500 cited in the SMAQMD Rule 411 Staff Report has been adjusted for inflation since October, 2005.
5 An hour meter cost of $400 cited in the SMAQMD Rule 411 Staff Report has been adjusted for inflation since October, 2005.
6 A tune-up cost of $600 cited in the SMAQMD Rule 411 Staff Report has been adjusted for inflation since October, 2005.

own District-approved portable analyzer to perform the initial test. It is estimated the purchase and use of a portable analyzer will cost[7] approximately $3,542 - $7,338. Owners/operators will have the option to hire a third party to perform the initial portable analyzer screening, which is estimated to cost[8] approximately $633. The District charges an hourly fee of $104 for witnessing a portable analyzer test and approving the results and it is estimated the complete cost will be $312. A boiler owner/operator may choose to hire a third party testing company for performance of a source test in lieu of conducting a portable analyzer test. A source test is estimated to cost[9] $1,898 and the District will charge a fee of $1,254 for the monitoring and evaluation of the source test.

Boilers 5 MMBtu/hr and greater

Ultra low-NOx burners (ULNB) combined with flue gas recirculation (FGR) is a control option capable of limiting NOx emissions to 9 ppmvd @ 3% O2 for units rated from 5 MMBtu/hr to less than 20 MMBtu/hr heat input and is capable of limiting emissions to the same concentration for some units rated above 20 MMBtu/hr. The Xonon™ cool combustion technology controls NOx emissions through stages of preheating air, premixing fuel and air, partial fuel combustion in a catalyst module, and homogenous combustion of the remainder of the fuel immediately downstream of the catalyst module. Although the Xonon™ cool combustion technology may be adaptable to use in large boilers, the technology has thus far only been demonstrated on a limited number of combustion turbines, and a December 2000 report for the EPA Environmental Technology Verification Program[10] states that the design of each Xonon™ combustor is customized to a particular model turbine. For these reasons, Xonon™ cool combustion technology will not be considered technologically feasible for use on boilers, steam generators, and process heaters. SCR systems are capable of limiting NOx emissions to 5 ppmvd @ 3% O2 for units rated equal to or greater than 5 MMBtu/hr. SNCR systems are capable of limiting NOx emissions to 9 ppmvd @ 3% O2 for units rated equal to or greater than 5 MMBtu/hr. Based on the analysis, the cost effectiveness of the proposed amendments is summarized in the table below.

Table 5. Summary of costs for 5 MMBtu/hr boilers and greater

	Costs			
		Expense	**Individual Annualized Costs**	**Total Annualized Cost**
Potentially Exempt Units (with hour/fuel meter in place)	Fuel meter (in place)	$0	-	$861
	Permit Modification	$625	$102	
	Annual Tune-up	$759	-	
Potentially Exempt Units (with no hour/fuel meter in place)	Fuel Meter	$506 - $1,898	$82 - $309	$943 - $1,170
	Permit Modification	$625	$102	
	Annual Tune-up	$759	-	

7 A cost range of $2,800 - $5,800 for purchasing and operating a portable analyzer cited in the SMAQMD Rule 411 Staff Report has been adjusted for inflation since October, 2005.
8 A third party portable analyzer test cost of $500 cited in the SMAQMD Rule 411 Staff Report has been adjusted for inflation since October, 2005.
9 An estimated cost of $1,500 for a source test by an independent contractor cited in the SMAQMD Rule 411 Staff Report has been adjusted for inflation since October, 2005.
10 Environmental Technology Verification Report: NOx Control Technologies, Catalytica Combustion Systems, Inc. Xonon™ Flameless Combustion System (December, 2000).

Already complies with proposed limit	Independent Source Test	$1,898	-	$3,152
	Source Test Monitoring/Evaluation	$1,254	-	
Replace to comply with proposed limit	Equipment/Installation Costs	$170,787 - $948,818	$27,795 - $154,416	$29,714 - $157,670
	Permit Modification	$625	$102	
	Independent Source Test	$1,898	$1,094 - $1,898	
	Source Test Monitoring/Evaluation	$1,254	$723 - $1,254	
Retrofit: Ultra low-NOx burners and Flue Gas Recirculation	Equipment/Installation Costs	$44,857 - $296,034	$7,300 - $48,178	$11,849 - $97,913
	Electricity Costs	-	$2,281 - $40,720	
	Operations & Maintenance	-	$349 - $5,760	
	Permit Modification	$625	$102	
	Independent Source Test	$1,898	$1,094 - $1,898	
	Source Test Monitoring/Evaluation	$1,254	$723 - $1,254	
Retrofit: Selective Catalytic Reduction	Equipment/Installation Costs	$222,540 - $471,261	$24,517 - $51,918	$33,336 - $247,492
	Direct Annual Costs	-	$3,969 - $188,891	
	Indirect Annual Costs	-	$2,965 - $3,463	
	Permit Modification	$625	$69	
	Independent Source Test	$1,898	$1,094 - $1,898	
	Source Test Monitoring/Evaluation	$1,254	$723 - $1,254	
Retrofit: Selective Non-Catalytic Reduction	Equipment/Installation Costs	$210,521 - $866,851	$24,728 - $101,820	$61,871 - $143,385
	Operations & Maintenance	-	$9,070 - $90,704	
	Permit Modification	$625	$73	
	Independent Source Test	$1,898	$1,094 - $1,898	
	Source Test Monitoring/Evaluation	$1,254	$723 - $1,254	

Exempt units fit into three categories: units that are currently exempt; units that are potentially exempt and already have a fuel/hour meter; and units that are potentially exempt and do not have a fuel/hour meter. The units that are currently exempt would already have a fuel/hour meter and are already required to meet the annual tune-up or the 3% O2 requirements. Therefore, there are no additional costs for these units from the proposed amendments of the rule.

For units that are potentially exempt and already have a fuel/hour meter, there is a one-time permit modification cost of $625. In addition, an annual tune-up cost of $759 is required if electing not to comply with the 3% O2 limit. It is assumed that sources will elect the tune up option.

For units that are potentially exempt and do not have a fuel/hour meter, there is a one-time cost of installation of a fuel meter and permit modification to add the fuel limitation. A fuel meter is estimated to cost $1,898 and the permit modification is $625. Exempt units also have the option of using a non-resetting hour meter rather than a fuel meter, estimated to cost $506 (Cost of the fuel meter is used rather than the cost for an hour meter when calculating cost impacts). In addition, an annual tune-up cost of $759 is required if electing not to comply with the 3% O2 limit. It is assumed that sources will elect the tune up option.

Non-exempt units fit into three categories: units that already comply with the proposed limits, units that need to be retrofitted/replaced, and new units. Units that already comply with the proposed limits would already be subject to existing source testing requirements, and therefore will require no additional costs from the proposed amendments of the rule.

For units that need to be retrofitted/replaced to meet the proposed limits, the cost effectiveness is based on the assumption that all of the units rated from 5 to less than 20 MMBtu/hr need to be replaced as a worst case scenario since the number of units that need to be retrofitted is unknown and that all units rated 20 MMBtu/hr and higher will be retrofitted with SCR to comply with the new NOx emission standard of the rule. The estimated cost for new equipment and installation ranges from $170,800 - $949,000. There is also a permit modification cost of $625, an independent source test cost of $1,898, and a cost of $1,254 for the source test observation and report evaluation fee.

For new units that will be installed after adoption of the rule, the cost effectiveness is evaluated for the incremental cost between installation of a compliant unit and a non-compliant unit. All new units installed after the adoption of the rule will be required to meet the proposed limits unless the units adopt a permitted capacity factor of four percent or less. There will be no additional installation permit costs or source testing costs because they are already required. The estimated incremental costs range from $12,650 - $158,150.

Table 6 summarizes the estimated cost effectiveness for needing to retrofit to meet the proposed emission limit with rated heat inputs between 5 and 200.

Table 6. Estimated Cost for Retrofitting Boiler Sizes Greater than or Equal to 5 MMBtu/hr

Boiler Size (MMBtu/hr)	**Cost Effectiveness Range ($/lb)**
	Estimated Annualized Cost for Retrofitting of Existing Equipment
5 – < 20	$6.71 - $35.58
20 – 200	$1.97 - $10.19

Socioeconomic Impacts

CH&SC Section 40728.5(a) requires the District, in the process of the adoption of any rule or regulation, to consider the socioeconomic impact if air quality or emission limits may be significantly affected. However, districts with a population of less than 500,000 persons are exempt from the provisions of Section 40728.5(a). The District's population is estimated to be approximately 331,600, well below the 500,000 person threshold. Therefore, a socioeconomic analysis for this rulemaking is not required.

Incremental Cost Effectiveness

CH&SC Section 40920.6 requires an assessment of the incremental cost-effectiveness for proposed

regulations relative to ozone, Carbon Monoxide (CO), Sulfur Oxides (SOx), Nitrogen Oxides (NOx), and their precursors. Incremental cost-effectiveness is defined as the difference in control costs divided by the difference in emission reductions between two potential control options that can achieve the same emission reduction goal of a regulation.

The following equation was used to calculate the incremental cost:

$$IC/E(\$/ton) = \left(\frac{CC_{option2} - CC_{option1}}{ER_{option2} - ER_{option1}}\right)$$

Where IC = Incremental Cost ($)
E = Emissions reductions (tons)
$CC_{option2}$ = Control costs for option 2 ($/yr)
$CC_{option1}$ = Control costs for option 1 ($/yr)
$ER_{option2}$ = Emission reductions for option 2 (tons)
$ER_{option1}$ = Emission reductions for option 1 (tons)

Table 7. Incremental Costs for Control Options of Units Rated Less Than 5 MMBtu/hr

Option	IC/E ($/ton)	IC/E ($/lb)
Incremental cost between uncontrolled emissions and achieving rule limit by installing a unit with a low-NOx burner	$1,834.41	$0.92

Table 8. Incremental Costs for Control Options of Units Rated 5 to less than 20 MMBtu/hr

Option	IC/E ($/ton)	IC/E ($/lb)
Incremental cost between compliance with former NOx emission standard and adding UNLB and FGR to comply with 15 ppmvd @ 3% O2 NOx standard	$6,380.06	$3.19
Incremental cost between adding UNLB and FGR to comply with 15 ppmvd @ 3% O2 NOx standard and adding SNCR to achieve 9 ppmvd @ 3% O2 NOx emissions	$39,392.28	$19.70
Incremental cost between adding SNCR to achieve 9 ppmvd @ 3% O2 NOx emissions and adding SCR to achieve 5 ppmvd @ 3% O2 NOx emissions	-$21,108.86	-$10.55

Table 9. Incremental Costs for Control Options of Units Rated 20 MMBtu/hr and Higher

Option	IC/E ($/ton)	IC/E ($/lb)
Incremental cost between current rule limit and adding SNCR	$8,497.88	$4.25
Incremental cost between adding SNCR and adding SCR	$3,329.61	$1.66

V. ENVIRONMENTAL IMPACTS OF METHODS OF COMPLIANCE

California Public Resource Code Section 21159 requires the District to perform an environmental analysis of the reasonably foreseeable methods of compliance at the time of adopting a rule requiring

the installation of pollution control equipment or a performance standard. The analysis must include the following information:

1. An analysis of the reasonably foreseeable environmental impacts of the methods of compliance.

2. An analysis of the reasonably foreseeable mitigation measures.

3. An analysis of the reasonably foreseeable alternative means of compliance with the rule or regulation.

The proposed amendments will strengthen the existing rule and reduce emissions from boilers, process heaters, and steam generators. The amendments do not create new requirements that may have an adverse effect on the environment. Pursuant to state CEQA Guidelines, the District's Environmental Coordinator finds the adoption of the proposed amendments to the rule is exempt from CEQA (Class 8 Categorical Exemption, Action by Regulatory Agencies for Protection of the Environment, Section 15308 State CEQA Guidelines).

VI. REGULATORY FINDINGS

Section 40727(a) of the CH&SC requires that, prior to adopting or amending a rule or regulation, an air district's board make findings of necessity, authority, clarity, consistency, nonduplication, and reference. The findings must be based on the following:

1. Information presented in the District's written analysis, prepared pursuant to CH&SC Section 40727.2;

2. Information contained in the rulemaking records pursuant to CH&SC Section 40728; and

3. Relevant information presented at the Board's hearing for adoption of the rule.

The required findings are:

Necessity: It is necessary for the District to adopt this amended rule in order to achieve additional NOx emission reductions from boilers and heaters. The additional NOx reductions will assist the District in its effort to attain air quality standards and comply with state all feasible measures requirements (Health and Safety Code 40914 and California Code of Regulations, Section 70600). [CH&SC Section 40727(b)(1)]

Authority: The District is authorized to adopt rules and regulations by CH&SC, Sections 40001, 40702, 40716, 41010 and 41013. [CH&SC Section 40727 (b)(2)]

Clarity: The proposed rule is written so that the meaning can be easily understood by the persons directly affected by it. In addition, the record contains no evidence that the persons directly affected by the rule cannot understand the rule. [CH&SC Section 40727(b)(3)]

Consistency: The proposed rule does not conflict with and is not contradictory to, existing statutes, court decisions, or state or federal regulations. [CH&SC Section 40727(b)(4)]

Non-Duplication: The proposed rule does not duplicate any state laws or regulations, regarding the attainment and maintenance of state and federal air quality limits. [CH&SC Section 40727(b)(5)]

Reference: The District must refer to any statute, court decision, or other provision of law that the District implements, interprets, or makes specific by adopting, amending or repealing the rule. [CH&SC Section 40727(b)(6)]

VII. PUBLIC COMMENTS AND STAFF RESPONSES

Staff will hold a public workshop on January 31, 2019, to discuss the proposed amendments to Rule 2.27. Notification was sent to surrounding Air Districts, City Managers within the District, building/planning/community development departments within the YSAQMD, all city and county libraries within the District, all Board members, and all affected sources. The workshop notice will be published in the Vacaville Reporter, Woodland Democrat, and the Davis Enterprise.

A copy of the public workshop notice, the draft staff report, and draft rule language, will be posted on the District's web page prior to the public workshop.

VIII. REFERENCES

- SMAQMD Rule 411, "NOx from Boilers, Process Heaters and Steam Generators," EPA Approved – August 1, 2007 (74 FR 10520).
- SCAQMD Rule 1121, "Control of Nitrogen Oxides from Residential Type, Natural Gas-Fired Water Heaters," EPA Approved – April 17, 2008 (74 FR 10520)
- SJVUAPCD Rule 4308, "Boilers, Steam Generators, and Process Heaters – 0.075 MMBtu/hr to less than 2.0 MMBtu/hr," EPA Approved – January 31, 2011 (72 FR 14679).

ATTACHMENT A

PROPOSED RULE 2.27, GENERAL PROVISIONS AND DEFINITIONS
STRIKE-OUT UNDERLINE VERSION

ATTACHMENT B

NOTICE OF EXEMPTION FROM CEQA GUIDELINES

Notice of Exemption

To: ☐ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

☒ County Clerk
County of Yolo
625 Court Street Room 105
Woodland, CA 95695

☐ County Clerk
Solano County
600 Texas Street
Fairfield, CA 94533

From: Yolo-Solano Air Quality Management District
1947 Galileo Court, Suite 103
Davis, CA 95618

Project Title: Revision of Rule 2.27- BOILERS, STEAM GENERATORS, AND PROCESS HEATERS

Project Location: Yolo-Solano Air Quality Management District

Project description: The District is proposing to amend Rule 2.27, BOILERS. The District is proposing to reduce the emission limits for oxides of nitrogen (NOx) and lower the applicability of the rule to units with a rated heat input equal to or greater than one million BTUs per hour.

Name of Public Agency Approving Project: Yolo-Solano Air Quality Management District
Name of Person or Agency Carrying Out Project: Yolo-Solano Air Quality Management District

Exempt Status:

☐ Ministerial
☐ Emergency Project
☒ Categorical Exemption (CEQA Guidelines Section 15308, Action by Regulatory Agency for Protection of the Environment)
☐ Statutory Exemption

Reason why project is exempt: The revision of Rule 2.27 is an action taken to maintain and protect the environment and is therefore exempt from CEQA because it constitutes a Class 8 categorical exemption pursuant to CEQA Guidelines 15308.

Lead Agency Contact Person: Mat Ehrhardt, Air Pollution Control Officer
Telephone Number: (530) 757-3650

Signature: _____ **Date:** _____ **Title:** _____

Notice of Exemption

To: ☐ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

☐ County Clerk
County of Yolo
625 Court Street Room 105
Woodland, CA 95695

☒ County Clerk
Solano County
600 Texas Street
Fairfield, CA 94533

From: Yolo-Solano Air Quality Management District
1947 Galileo Court, Suite 103
Davis, CA 95618

Project Title: Revision of Rule 2.27- INDUSTRIAL, INSTITUTIONAL, AND COMMERCIAL BOILERS, STEAM GENERATORS, AND PROCESS HEATERS

Project Location: Yolo-Solano Air Quality Management District

Project description: The District is proposing to amend Rule 2.27, BOILERS. The District is proposing to reduce the emission limits for oxides of nitrogen (NOx) and lower the applicability of the rule to units with a rated heat input equal to or greater than one million BTUs per hour.

Name of Public Agency Approving Project: Yolo-Solano Air Quality Management District
Name of Person or Agency Carrying Out Project: Yolo-Solano Air Quality Management District
Exempt Status:

☐ Ministerial
☐ Emergency Project
☒ Categorical Exemption (CEQA Guidelines Section 15308, Action by Regulatory Agency for Protection of the Environment)
☐ Statutory Exemption

Reason why project is exempt: The revision of Rule 2.27 is an action taken to maintain and protect the environment and is therefore exempt from CEQA because it constitutes a Class 8 categorical exemption pursuant to CEQA Guidelines 15308.

Lead Agency Contact Person: Mat Ehrhardt, Air Pollution Control Officer
Telephone Number: (530) 757-3650

Signature: _____ **Date:** _____ **Title:** ____

ATTACHMENT C

RESOLUTION NO. 19-XX

RESOLUTION NO. 19-XX

RESOLUTION AMENDING YOLO-SOLANO AIR QUALITY MANAGEMENT DISTRICT RULE 2.27

WHEREAS, California Health and Safety Code section 40702 provides that an air quality management district shall adopt rules and regulations as may be necessary or proper to execute the powers and duties granted to, and imposed upon, the district by Division 26 of the Health and Safety Code; and

WHEREAS, Health and Safety Code section 40727 provides that before adopting, amending, or repealing a rule or regulation, a district board shall make findings of necessity, authority, clarity, consistency, nonduplication, and reference, based upon information developed pursuant to section 40727.2, information in the rulemaking record maintained pursuant to section 40728, and relevant information presented at the public hearing required by section 40725; and

WHEREAS, section 15308 of the CEQA Guidelines provides that actions taken by regulatory agencies as authorized by state law to assure the maintenance, restoration, or enhancement of the environment where the regulatory process involves procedures for protection of the environment, are categorically exempt from CEQA review (Class 8 Categorical Exemption); and

WHEREAS, District staff identified requirements which were unclear or missing within Rule 2.27, Solvent Cleaning and Degreasing which required updating for consistency with federal and state policy.

NOW, THEREFORE, BE IT RESOLVED that the Board of Directors of the Yolo-Solano Air Quality Management District hereby finds, authorizes, directs and declares as follows:

1. The Board of Directors has considered and hereby adopts by reference the staff report prepared in this matter.

2. The Board of Directors makes the following findings pursuant to Health and Safety Code section 40727:

    a. Necessity: Information in the District's rulemaking record maintained pursuant to Health and Safety Code section 40728 demonstrates a need for amending District Rule 2.27;
    b. Authority: Health and Safety Code section 40702 permits the District to amend District Rule 2.27;
    c. Clarity: District Rule 2.27 as amended is written so that its meaning can be easily understood by the persons directly affected by it;
    d. Consistency: District Rule 2.27 as amended is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations;

e. Nonduplication: District Rule 2.27 as amended does not impose the same requirements as an existing state or federal regulation;
f. Reference: By adopting District Rule 2.27, the District meets the requirements of Health & Safety Code Sections 40702.

3. The Board of Directors finds that the District has complied with the procedural requirements set forth in Chapters 6 and 6.5 of Part 3 of Division 26 of the Health and Safety Code.

4. The Board of Directors finds that amending District Rule 2.27 is an action taken by a regulatory agency as authorized by state law to assure the maintenance, restoration, or enhancement of the environment where the regulatory process involves procedures for protection of the environment, and is therefore categorically exempt from CEQA review as a Class 8 Categorical Exemption.

5. The Board of Directors hereby amends District Rule 2.27 as set forth in Exhibit 1 (Attachment A of the Staff Report), which is attached and incorporated by reference. The amendment is effective MONTH XX, 2019.

PASSED AND ADOPTED by the Board of Directors of the Yolo-Solano Air Quality Management District this Xth day of MONTH, 2019, by the following vote:

Ayes:

Noes:

Absent:

Abstain:

_____
Tom Stallard, Chair Board of Directors
Yolo-Solano Air Quality Management District

Attest:

_____
Denise Almaguer, Clerk
Board of Directors

Approved as to Form:

_____
Hope Welton, District Counsel

ATTACHMENT D

WRITTEN COMMENTS RECEIVED