

SACRAMENTO METROPOLITAN AIR QUALITY MANAGEMENT DISTRICT

STAFF REPORT

RULE 411, BOILER NO_x

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BACKGROUND

The District is currently designated as "serious" nonattainment area for ozone. Ozone is a strong irritant that attacks the respiratory system, leading to the damage of lung tissues. Ozone is a secondary pollutant formed from the reaction of volatile organic compounds (VOC's) and nitrogen oxides (NO_x). Since NO_x is a precursor to ozone, one of the strategies to control ozone is to reduce NO_x emissions from existing stationary sources.

Section 182(f) of the Federal Clean Air Act Amendments of 1990 (FCAAA) requires the District to submit NO_x Reasonably Available Control Technology (RACT) rules for stationary sources by November 1992. Implementation of RACT is required by May 31, 1995. The District did not submit NO_x RACT rules in 1992 because it was in the process of conducting photochemical grid modeling to determine the extent of the NO_x contribution to ozone formation before adopting NO_x regulations. Section 110(k)(4) of the FCAAA provided an alternative which extends the deadline by one year by submitting a "Committal SIP" for the NO_x RACT Rules.

The committal SIP is a commitment to complete the photochemical modeling and to adopt RACT for identified major stationary sources. The committal SIP was submitted to EPA through ARB on August 31, 1993. The committal SIP was later deemed complete by EPA in November, 1993. This action stopped the sanctions process. In July 1994, as a result of a National Resources Defense Council suit on other Committal SIPs, EPA rejected the Committal SIP. This action restarted the sanctions process. The imposition of sanctions will occur no later than July, 1995, if the District fails to submit complete NO_x RACT rules.

In addition to federal mandates, a number of state mandates require the adoption of this measure. The 1988 California Clean Air Act strengthened the requirements on Districts to implement regulations to achieve and maintain state ambient air quality standards. One of these requirements is to reduce emissions levels by 5 percent or more beginning 1988 (Health & Safety Code, Section 40914). Section 40910 of the Health and Safety Code requires the District to develop an air quality attainment plan for achieving and maintaining of the state's air quality standards for ozone. The District's Air Quality Attainment Plan was adopted by the District's Board of Directors on June 24, 1991. Volume VII of the District's plan lists various suggested control measures for controlling NO_x emissions from stationary sources. NO_x control for boilers is identified as one of these controls.

Under California air pollution control laws, emission limits more stringent than federal limits often are required for a variety of source categories in non attainment Districts. Given that the District is classified as a "serious" non attainment District, California Health and Safety Code Section 40919 requires Best Available Retrofit Technology (BARCT) for all existing permitted stationary sources.

Rule 411, BOILER NO_x, is being proposed in order to reduce NO_x and limit CO emissions from existing industrial, institutional, commercial boilers, steam generators, and process heaters. Adoption of this measure will satisfy both the federal and state mandates discussed above.

The proposed NO_x and CO retrofit control requirements in this Rule are based on RACT/BARCT guidance published by the California Air Resources Board (CARB). The RACT/BARCT guidance document was developed by the California Air Pollution Control Officers Association (CAPCOA) Technical Review Group (TRG) in cooperation with CARB in 1991. The determination was developed in accordance with the "California Clean Air Act Guidance for Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology" of April 1990.

SUMMARY OF REQUIREMENTS

The proposed rule applies to institutional, commercial, and industrial boilers, steam generators and process heaters rated at 5 million btu per hour heat input or greater which are fired on gaseous, nongaseous, and biomass fuels.

This rule does not apply to the following units:

1. Electric utility boilers used exclusively to generate electricity for sale.
2. Heat recovery units that are used to recover sensible heat from the exhaust of a combustion turbines or reciprocating internal combustion engines.
3. Kilns and furnaces where the products of combustion come into direct contact with the material to be heated.

Boilers are usually used to supply steam or hot water for use in space heating (e.g., schools), food processing and manufacturing of chemical products. Process heaters are usually used in food processing (e.g., drying of fruits and vegetables), and manufacturing processes.

The District has 46 facilities with a total of 135 permitted boilers ranging in size from 5 million Btu input to 151 million Btu input. These facilities represent a wide range of industries (e.g., aerospace, food processing, hospitals, chemical production) and government entities (Air Force Bases, office buildings, prisons, schools).

Emission Limits

The Table below summarizes the proposed NO_x and CO emissions limits. The emissions limits for boilers fired on gaseous and non-gaseous fuels are consistent with those listed in the RACT/BARCT Guidance.

1. RACT Emission Limits

Fuel Type	NO _x Limit	CO Limit
	(ppmv)	(ppmv)
Gaseous (e.g, natural gas, propane)	70	400
Non-gaseous (e.g., diesel fuel, kerosene)	115	400
Non-gaseous (emergency standby usage only)	150	400
Biomass (e.g., wood)	110	400

2. BARCT Emissions Limits

Fuel Type	NO _x Limit	CO Limit
	(ppmv)	(ppmv)
Gaseous (e.g, natural gas, propane)	30	400
Non-gaseous (e.g., diesel fuel, kerosene)	40	400
Non-gaseous (emergency standby usage only)	150	400
Biomass (e.g., wood)	70	400

Alternative Compliance Option

Units rated at 5 million Btu or greater using less than 90,000 therms (9x10⁹ Btu's) or any unit which will be taken out of service by May 31, 1997 need not comply with the above BARCT and RACT NO_x and CO emissions limits if they comply with one of the following:

1. Operate the unit so that the stack-gas oxygen concentrations is maintained at less than or equal to 3.00% by volume on dry basis.
2. Operate the unit with a stack-gas oxygen trim system set at 3.00% by volume oxygen with a tolerance setting of plus or minus 5 percent (±5%).

3. Tune the unit at least once per year by a qualified technician.

Compliance Timelines

The FCAA requires affected units to comply with the RACT limits by May 31, 1995. If a unit must be retrofitted in order to comply with the RACT and BARCT emissions limits then, under this rule proposed, the unit must comply with these limits by May 31, 1997 and meet specified increments of progress.

Air Pollution Control Equipment Needed for Compliance

In order to comply with the above NO_x and CO emissions limits the unit may need to be retrofitted with one or a combination of the following NO_x control technologies:

1. Flue Gas Recirculation System (FGR)

This system utilizes exhaust gases to reduce NO_x emissions. A portion of the exhaust gases are recirculated back and mixed with the combustion air or injected directly into the combustion zone. The externally recirculated flue gases, cooler than the combustion zone temperatures and containing inerts, reduce flame temperatures and NO_x levels. Flue gas recirculation is effective up to 20% recirculation rate. Above such levels, flame stability decreases which results in poor combustion.

Flue gas recirculation is an effective NO_x control technique for gaseous and nongaseous fuel firing. However, it is not effective for reducing NO_x emissions from fuel-bound nitrogen. The control efficiency for a FGR system can range from 60 to 70 percent. The FGR system is not effective for reducing CO emissions and usually will result in an increase in CO emissions.

2. Low NO_x Burners

Low NO_x burners utilize one or a combination of control technologies (e.g., low excess air, fuel and/or air staging) in the design of the burner to reduce NO_x emissions. Low excess air reduces the amount of oxygen available for combustion and thus reducing the number of oxygen atoms available to react with nitrogen to form NO_x. Fuel staging (applicable to gas only) is done by burning part of the fuel at high excess air (low temperature) in a primary combustion zone. The remaining fuel is injected through another set of orifices or a gas gun into a secondary zone where combustion is complete at relatively low excess air. Since the inert products of combustion from the primary zone pass through the secondary zone, temperatures and NO_x are reduced. In air staging, fuel is mixed with part of the air in a fuel rich primary combustion zone at low temperatures and without excess oxygen. Any remaining fuel burns completely with the remaining combustion air in the secondary combustion zone through which the inert products of combustion pass. Temperatures and NO_x are reduced. NO_x control efficiency for a Low NO_x burner can range from 10 to 50%.

3. Selective Catalytic Reduction (SCR)

This system utilizes a catalyst medium (such as titanium oxide) to enhance the chemical reaction between ammonia (NH₃) and NO_x in the flue gas. Ammonia is usually injected into the exhaust stream which reacts with NO_x to form nitrogen and water. A flue gas temperature of 600 to 750 °F is usually needed for best results.

4. Selective Non-Catalytic Reduction (SNCR)

A selective non catalytic reduction system utilizes ammonia injection to reduce NO_x emissions. Ammonia usually is injected into the flue gas stream which reacts with the NO_x to form nitrogen and water. A very high temperature range (1500 °F to 2000 °F) is needed to produce such reaction.

Both SCR and SNCR systems are commonly used for controlling NO_x emissions from biomass fired units. They require high initial capital cost and are expensive to operate and maintain. They also require large area (which is usually not available) to accommodate the air pollution control equipment and the ammonia storage tank. In addition, there are risks (accidental ammonia release) associated with handling ammonia that may limit its utilization near downwind receptors.

Emissions Impacts

Current uncontrolled NO_x emissions from affected units are estimated at 310 tons per year (based on 1993-94 emissions inventory). The proposed rule is estimated to provide 180 tons of NO_x emissions reductions per year (a 58% decrease in NO_x emissions from these sources.)

Cost Impacts

Section 40703 of the California Health and Safety Code requires that the District consider and make public its finding relating to the cost effectiveness of implementing an emission control measure.

Table 1 below summarizes the cost effectiveness data for selected boiler sizes. The cost estimates represent the cost of retrofitting the unit with a FGR system and replacement of an existing burner with a Low NO_x burner. Cost data represent actual cost that was supplied by affected businesses in Sacramento. The actual cost for retrofitting to meet the emissions limits for biomass boilers is not available to the District at this time.

Table 1

Boiler Size Range (mmbtu input)	Cost Effectiveness Range (\$/lb- NO _x)	
	Low	High
5 - <10	1.46	3.71
10 - <20	1.05	1.50
20 - <40	1.35	3.40
40 - <60	2.18	2.35
60 - <80	2.09	2.35
> 100	2.29	NA

One gaseous fuel fired boiler (>100 mmbtu input) in the District is currently permitted at 40 ppmvd for NO_x and already has low NO_x burners and a flue gas recirculation system. Additional NO_x control system is needed in order to meet the 30 ppmvd NO_x emissions limit required by BARCT. The cost effectiveness for this boiler has been calculated at \$15.28/lb-NO_x.

SOCIOECONOMIC IMPACT ANALYSIS

The provisions of Section 40728.5 of the California Health and Safety Code require, in part, that:

"Whenever a district intends to propose the adoption, amendment, or repeal of a rule or regulation that will significantly affect air quality or emissions limitations, that agency shall, to the extent that data are available, perform an assessment of the socioeconomic impacts of the adoption, amendment, or repeal of the rule or regulation. ..."

Section 40728.5 of the California Health and Safety Code applies to this rule since this rule affects air quality and emissions limitations.

Type of Affected Industries and Businesses

Rule 411 applies to boilers, steam generators and process heaters. These equipment are used by various industries and local, state and federal government entities. Examples of affected businesses are food processors, chemical production plants, military bases, public schools, hospitals, and office buildings.

Impact on Employment and Economy in Sacramento

Affected facilities may have to generate revenue to make the modifications necessary to comply with this rule. This could lead to an increase in the price of goods and services provided by the affected facilities. However, the impact of this rule may be offset by the creation of employment in the air pollution control industries and related service industries.

Range of Probable Costs

The range of probable costs is identified in the cost impacts section above.

Availability and Cost Effectiveness of Alternatives

One alternative to this rule is not to adopt it. If the District chooses to do so, it will be subject to sanctions from EPA. Sanctions, if imposed, would result in an increase in emissions offset ratios to 2:1 for new and modified sources of air pollution and a withholding of highway funding. The increased offset requirements will make it difficult to obtain emissions offsets for new businesses and for the expansion of existing facilities. This will result in slowing of the economic recovery and growth in Sacramento. Additionally, should the District not adopt this measure, the EPA will implement a rule of its own for this area.

Necessity

The adoption of this rule is required of the District in order to attain state and federal ambient air quality standards. If the District does not adopt this rule, it will be subject to EPA sanctions as discussed above.

ENVIRONMENTAL REVIEW AND COMPLIANCE

The District's environmental coordinator has prepared an initial study for Rule 411 pursuant to the California Environmental Quality Act (Public Resources Code, Section 21000 et sequitur). The initial study addresses secondary air quality impacts resulting from add-on control equipment, human health impacts and energy use.

As a result of the proposed rule, the District will reduce NO_x and limit CO emissions from existing boilers, steam generators and process heaters. The results on the initial study indicate that a Negative Declaration will be prepared pursuant to state CEQA Guidelines, Section 15063 [b],[2]).

FINDINGS

The California Health and Safety Code, Division 26, Air Resources, require local Districts to comply with a rule adoption protocol as set forth in Section 40727 of the Code. This section has been revised through legislative mandate to contain six findings that the District must make when developing, amending, or repealing a rule. These findings, effective January 1, 1992, and their definitions are listed in the table below.

<u>FINDING</u>	<u>DEFINITION</u>	<u>REFERENCE</u>
Authority	The District is permitted or required to adopt, amend, or repeal the rule by a provision of law or a state or federal regulation.	California Health and Safety Code, Sections 40702 and 41010
Necessity	The District has demonstrated that a need exists for the rule, or for its amendment or repeal.	It is necessary for the District to adopt this rule in order fulfill the requirements of the California Clean Air Act of 1988 (California Health and Safety Code Section 40914) to reduce emissions by 5% or more beginning in 1988. In addition, this rule is required under Section 40910 and 40919 of the California Health and Safety Code and Chapter 1, Title 17 of the California Code of Regulations -- Article 6, Section 70600 (a)(1). Also, this rule is being proposed to meet the requirements of Section 182(f) of the Federal Clean Air Act Amendments.
Clarity	The rule is written or displayed so that its meaning can be easily understood by the persons directly affected by it.	There is no indication at this time that this rule is not written in such a manner that the person affected by the amendments can easily understand them.
Consistency	The rule is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations.	The District has found the requirements of this rule are consistent with the newly promulgated state and federal guidelines.
Non-duplication	The rule does not impose the same requirements as an existing state or federal regulation, unless the District finds that the requirements are necessary or proper to execute the powers and duties granted to, and imposed upon the District.	This rule does not impose new requirements which duplicate existing state regulations.
Reference	Any statute, court decision, or other provision of law that the District implements, interprets, or makes specific by adopting, amending, or repealing the rule. An example of this would be the 1988 EPA State Implementation Plan call to revise District rules.	California Clean Air Act of 1988(California Health and Safety Code Section 40914); California Health and Safety Code Section 40910; and Section 182(f) of the Federal Clean Air Act Amendments.