

## **STAFF REPORT**

### **Rule 3.23 – Natural Gas-Fired Water Heaters, Small Boilers, and Process Heaters**

#### **Schedule of Meetings**

Public Hearing: October 3, 2016

Feather River AQMD  
541 Washington Avenue,  
Yuba City, California 95991

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**1.0 Executive Summary:**

On October 3, 2016, the Feather River Air Quality Management District (District) Board of Directors will consider the adoption of Rule 3.23 – Natural Gas-Fired Water Heaters, Small Boilers, and Process Heaters.

The District is proposing to adopt the rule to fulfill a previous commitment made in the State Implementation Plan (SIP) with the purpose of reducing the emissions of ozone precursors. The intent of the proposed Rule 3.23 is to reduce nitrogen oxides (NOx) emissions from natural gas-fired water heaters, small boilers, and process heaters. The District is proposing the rule to establish NOx emission limits to affected units that have a heat input capacity of less than 1 million Btu/hr to greater than or equal to 75,000 Btu/hr. The proposed emission limits are equal to or similar to those adopted by neighboring air districts within the Sacramento Federal Ozone Nonattainment Area and in other parts of California.

The emission limits proposed for the affected units are in **Table 1** below:

**Table 1: Rule 3.23 Proposed Emission Limits**

| <b>Category</b>          | <b>Heat Input Capacity</b> | <b>NOx Emission Limit<br/>(as of 1/1/2017)</b>   |
|--------------------------|----------------------------|--|
| Boiler / Water Heater    | 75,000 - <1,000,000        | 14 ng/J or<br>20 ppm NOx @ 3% O <sub>2</sub> Dry |
| Process Heater           | 75,000 - <1,000,000        | 14 ng/J or<br>20 ppm NOx @ 3% O <sub>2</sub> Dry |
| Pool / Spa Heater        | >400,000 - <1,000,000      | 14 ng/J or<br>20 ppm NOx @ 3% O <sub>2</sub> Dry |
| Mobile Home Water Heater | 75,000 - <1,000,000        | 40 ng/J or<br>55 ppm NOx @ 3% O <sub>2</sub> Dry |

Currently the District does not require an Authority to Construct or Permit to Operate for installations of natural gas fired water heaters with a heat input capacity of less than 1 million Btu/hr. Due to the fact that units affected by this rule do not require permitting when considered independently, enforcement of this proposed rule will be done as a “point of sale” regulation with requirements on manufacturers, retailers, and installers. See Section 4.0 – Proposed Rule Requirements for additional information.

Many manufacturers, retailers and installers already comply with the emissions limits in the proposed rule because of existing regulations elsewhere in California.

The proposed rule will neither have a significant nor detrimental effect on the environment. Therefore, District staff has prepared a Notice of Exemption to satisfy the requirements of the California Environmental Quality Act (CEQA). The notice states that the adoption of the rule is exempt from the requirements of CEQA pursuant to Section 15308, *Actions by Regulatory Agencies for Protection of the Environment*.

## **2.0 Background:**

Feather River Air Quality Management District is a Bi-County agency that administers local, state, and federal air quality management programs for Yuba and Sutter counties. Reducing nitrogen oxides emissions is part of the District's strategy for reducing ozone formation as NO<sub>x</sub> reductions are necessary to attain and maintain the federal and state ambient air quality standards for ozone.

Ground level ozone is a secondary pollutant formed from photochemical reactions of NO<sub>x</sub> and volatile organic compounds (VOCs) in the presence of sunlight. As an air pollutant, ozone has proven to have detrimental health effects on humans as well as cause damage to crops. Decreased lung function, development of asthma, and increased risk of cardiovascular problems are all adverse health effects correlated to ozone exposure in humans.

Because portions of the District have been designated as nonattainment for failure to meet the federal 8-hour ground-level ozone standard, the United States Environmental Protection Agency (US EPA) requires the District to implement measures to reduce ozone precursors. The District has committed to implement control measures and reduce pollution through the State Implementation Plan (SIP). The SIP is federally enforceable through the US EPA and the Federal Clean Air Act (CAA).

Under the provisions of the California Clean Air Act (CCAA) of 1988, Yuba County and the northern portion of Sutter County have been designated as "nonattainment-transitional" for failing to meet the state ozone standard. The southern portion of Sutter County is designated as "severe" nonattainment for failing to meet the state ozone standard. The District must adopt all feasible measures to attain the state ozone standard as expeditiously as practicable.

The combustion of natural gas from stationary sources is a significant source of NO<sub>x</sub> emissions in the Sacramento Federal Ozone Nonattainment Area. Currently, the District has two rules in place that limit NO<sub>x</sub> emissions from stationary equipment using natural gas as a fuel source. District Rule 3.21 regulates large boilers, steam generators, and process heaters with a heat input rating greater than 1 million Btu/hr. District Rule 3.22 limits the NO<sub>x</sub> emissions from stationary internal combustion engines rated at 50 horsepower or higher.

Natural gas-fired water heaters, small boilers, and process heaters in the range of 75,000 Btu/hr to less than 1 million Btu/hr are currently unregulated by the District. These units are typically used to provide hot water and/or steam for large residences, communal buildings, small commercial operations, small industrial operations, and other similar sized buildings with the need for hot water and/or steam. By establishing emission limitations on units that are newly sold or installed, the District aims at reducing the total NO<sub>x</sub> emissions generated by natural gas combustion within Yuba and Sutter counties.

### **3.0 Legal Mandates:**

The US EPA and Air Resources Board (ARB) have adopted ambient air quality standards to determine outdoor pollutant levels considered safe for the public. The standards are health-based and designed to provide protection for the most sensitive groups. Areas that do not meet the standards are required to adopt control measures to limit emissions of certain pollutants.

#### **Federal Mandate**

The Clean Air Act (CAA) requires air districts not attaining the ozone standards to prepare a plan describing how the National Ambient Air Quality Standard (NAAQS) will be met<sup>1</sup>. The southern portion of Sutter County is part of the Sacramento Federal Nonattainment Area (SFNA) for ozone. The SFNA was designated as severe nonattainment for the 1997 8-hour Ozone NAAQS and the 2008 8-hour Ozone NAAQS. The District committed as part of the 2009 Sacramento Regional 8-Hour Ozone Attainment and Reasonable Further Progress Plan<sup>2</sup> (2009 Ozone Plan) to reduce NOx from natural gas-fired water heaters, small boilers, and process heaters.

#### **State Mandate**

The California Clean Air Act (CCAA) requires areas designated as nonattainment for ozone to develop a plan to achieve California's ambient air quality standard by the earliest practical date by adopting cost-effective control measures<sup>3</sup>. The SFNA portion of Sutter County is designated as "severe" nonattainment for the state ozone standard. CH&S Code §40920 requires the District to adopt a control measure that will use Best Available Retrofit Control Technology (BARCT) for all existing stationary sources in this area. BARCT, as defined in the CH&S, is as "an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy and economical impacts by each class or category of source."

Yuba County and the northern area of Sutter County are designated as "nonattainment-transitional" for the state ozone standard. CH&S Code §40925.5 requires the District to adopt a control measure that will use RACT for all existing stationary sources in these areas.

California Health and Safety Code section 40914 requires the District's plan to demonstrate that it includes "every feasible measure" to control emissions. All feasible control measures are those which have the most effective regulatory emissions standards demonstrated in California's air districts. The District's 2015 Triennial Air Quality Attainment Plan<sup>4</sup> was adopted by the Board of Directors on December 7, 2015. This Plan includes the District's commitments for adopting feasible control measures. The District committed to adopting the Control Measure in 2016.

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<sup>1</sup> <http://www.arb.ca.gov/fcaa/fcaa.htm>

<sup>2</sup> <http://airquality.org/plans/federal/ozone/8hr1997/index.shtml>

<sup>3</sup> California Health and Safety Code section 40913

<sup>4</sup> <http://www.fraqmd.org/AQPlans.html>

#### **4.0 Proposed Rule Requirements:**

The District is proposing Rule 3.23 which will reduce the NO<sub>x</sub> emissions from the use of natural gas-fired water heaters, small boilers, and process heaters.

The proposed rule will prohibit the sale or installation of any natural gas-fired unit subject to the rule with NO<sub>x</sub> emissions in excess 14 ng/J (20 ppmv corrected to 3 percent oxygen). The exception to this limit is for mobile home water heaters subject to the rule which will be limited to 40 ng/J (55 ppmv corrected to 3 percent oxygen). The limits established by the proposed rule will take effect on January 1, 2017.

To demonstrate compliance with the NO<sub>x</sub> emission limits, the reseller or manufacturer of any units subject to the rule will be required to submit to the District's Air Pollution Control Officer (APCO) a report that demonstrates compliance with the emission limits established by the rule. The rule will require that the compliance report be submitted to the APCO at least 30 days prior to the sale or installation of the unit. The compliance report will be required to have the following information:

- General Information:
  - o Name and address of the manufacturer;
  - o Brand name and model/ model number;
  - o Unit description; and
  - o Rated heat input capacity
  
- Test Report:
  - o All compliance test procedures and results for each unit model; and
  - o All calculations for determining compliance of each unit model.
  
- Compliance Statement:
  - o A signed and dated statement attesting to the accuracy of all information in the compliance report.

In place of submitting a compliance report with the requirements listed above, the reseller or manufacturer of any unit subject to the rule will have the option to submit to the District a South Coast Air Quality Management District (SCAQMD) certification pursuant to SCAQMD Rules 1121 or 1146.2. Similar to the compliance report, the rule will require that the certification be submitted to the APCO at least 30 days prior to sale or installation of the unit.

Regardless of whether the compliance report or the SCAQMD certification is submitted to the District, each unit will be required to display the model number of the unit complying with the requirements specified in the rule on the shipping carton and rating plate. Additionally, the manufacturer will be required to keep certification reports, test reports, and certification statements demonstrating compliance with the rule for as long as the unit is offered for sale, sold, or installed within the District, or five years, whichever is longer. The rule will require that all records be made available to the APCO upon request.

## 5.0 Socioeconomic Impact:

California Health and Safety Code §40728.5 requires, 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.”

However, districts with a population of less than 500,000 persons are exempt from the provisions of CH&S §40728.5 (a). The District’s population is estimated to be approximately 170,000, which is well below the 500,000 person threshold. Therefore, a socioeconomic analysis for this rulemaking is not required.

## 6.0 Estimated Emissions Impact:

The District staff used the ARB CEPAM<sup>5</sup> emissions inventory to estimate NOx emissions information for units subject to the proposed rule. The inventory for NOx generated by natural gas combustion in the service and commercial industries as well as the residential sector is presented below in **Table 2** for the current year (2016) as well as for every five years starting from 2017 through 2036. Projected emissions data was only available from ARB through 2035; however, District staff linearly extrapolated the data through 2036 in order to approximate a complete reduction estimate.

**Table 2: FRAQMD’s NOx Emission Inventory for Natural Gas-Fired Water Heaters, Small Boilers, and Process Heaters**

| EIC Code          | EIC Description             | NOx Emission Inventory (tpd) |               |               |               |               |               |
|-------------------|-----------------------------|------------------------------|---------------|---------------|---------------|---------------|---------------|
|                   |                             | 2016                         | 2017          | 2021          | 2026          | 2031          | 2036          |
| 060-005-0110-0000 | Service and Commercial      | 0.0059                       | 0.0059        | 0.0062        | 0.0063        | 0.0065        | 0.0067        |
| 610-608-0110-0000 | Residential Fuel Combustion | 0.0991                       | 0.0989        | 0.1008        | 0.1026        | 0.1053        | 0.1068        |
| <b>TOTAL</b>      |                             | <b>0.1050</b>                | <b>0.1048</b> | <b>0.1070</b> | <b>0.1089</b> | <b>0.1119</b> | <b>0.1135</b> |

During the development of Rule 1121 and 1146.2, the South Coast Air Quality Management District conducted surveys of water heaters and small boilers within the South Coast Air Basin and documented the results in their staff reports. In the absence of county specific data, District staff used the data gathered in SCAQMD surveys to break down the emission inventory into the less than 75,000 Btu/hr, 75,000 Btu/hr to less than 400,000 Btu/hr, and 400,000 Btu/hr to less than 1,000,000 Btu/hr ranges.

<sup>5</sup> <https://www.arb.ca.gov/app/emsinv/fcemssumcat2009.php>

Once the affected units were categorized, the emissions from each category group were calculated based off of the emission factors and unit capacity factors for each category. The capacity factors were determined by calculating the ratio of fuel actually burned to the rated heat input capacity. The capacity factors and emission factors used in the calculations were obtained from the above-mentioned SCAQMD staff reports.

District staff estimated the useful lives of the units between 75,000 Btu/hr and less than 400,000 Btu/hr to be 15 years and the units greater than 400,000 Btu/hr to less than 1,000,000 Btu/hr to be 20 years. Based on the estimated lifespans, District staff assumed a unit replacement rate of 6.67% and 5% per year, respectively, beginning in 2017. It was assumed that the emissions of mobile home water heaters greater than 75,000 Btu/hr are negligible due to the fact that mobile home water heaters are typically much smaller than 75,000 Btu/hr. **Table 3** below summarizes the various factors and assumptions used to calculate the reductions from Rule 3.23.

**Table 3: Emission Factors and Emission Distribution Data by Unit Size for Natural Gas Fired Water Heaters, Small Boilers, and Process Heaters**

| Unit Size (Btu/hr)    | % of Emissions | Capacity Factor <sup>a</sup> | Uncontrolled Emission Factor lbs/MMBtu (ppm @ 3% O <sub>2</sub> ) | Useful Lifetime (years) |
|-----------------------|----------------|------------------------------|---|-------------------------|
| <75,000 (EXEMPT)      | 56.3           | 0.061                        | 0.067 (55)  | N/A                     |
| 75,000 to <400,000    | 25.3           | 0.215                        | 0.140 (115)   | 15                      |
| 400,000 to <1,000,000 | 18.4           | 0.215                        | 0.174 (143)   | 20                      |

<sup>a</sup> Capacity Factors are used to determine the % of emissions for each size category (See appendix B of SMAQMD's Rule 414 Staff Report)

Using the ARB emissions inventory information from **Table 2** in conjunction with the emission factors and emission distribution data from **Table 3**, District staff calculated the potential emission reductions from Rule 3.23 beginning in the implementation year, 2017, through 2036 which is the projected year that 100% of the affected units will be replaced with Rule compliant units. **Table 4** below summarizes the NOx emission reductions in five year increments.

**Table 4: Estimated NOx Emission Reductions by Unit Size Ranges**

| Unit Size (Btu/hr)            | NOx Emission Reductions (tpd) |               |               |               |               |
|-------------------------------|-------------------------------|---------------|---------------|---------------|---------------|
|                               | 2017                          | 2021          | 2026          | 2031          | 2036          |
| <75,000 (EXEMPT) <sup>c</sup> | 0.0000                        | 0.0000        | 0.0000        | 0.0000        | 0.0000        |
| 75,000 to <400,000            | 0.0015                        | 0.0075        | 0.0152        | 0.0234        | 0.0237        |
| 400,000 to <1,000,000         | 0.0023                        | 0.0042        | 0.0086        | 0.0133        | 0.0180        |
| <b>TOTAL</b>                  | <b>0.0023</b>                 | <b>0.0117</b> | <b>0.0238</b> | <b>0.0367</b> | <b>0.0417</b> |

<sup>c</sup> Units less than 75,000 Btu/hr are not subject to Rule 3.23; therefore no reductions are calculated



## 7.0 Estimated Cost Impact:

CH&SC §40703 requires the District, in the process of the adoption of any rule or regulation, to consider and make public its findings related to the cost effectiveness of the rule. Cost effectiveness for rulemaking purposes is calculated by dividing the cost of air pollution controls required by the rule by the amount of air pollution reduced.

District staff compiled a cost estimate for natural gas-fired units subject to Rule 3.23 in the size range of 75,000 Btu/hr to less than 400,000 Btu/hr (see Appendix A). Cost data for units in the size range of 400,000 Btu/hr to less than 1,000,000 Btu/hr was not readily available for retailers in the Feather River Air Quality Management District; therefore, District staff used cost estimate data from Sacramento Metropolitan Air Quality Management District’s Rule 414 Staff Report for units in that size range. It is assumed that the cost data used from SMAQMD’s Rule 414 Staff Report is cost conservative due to the fact that production and availability of units capable of meeting the “Ultra Low NOx” capabilities has substantially increased since January of 2010 when SMAQMD’s Rule 414 Staff Report was published. Table 5 below summarizes the additional costs of Rule 3.23 compliant units.

**Table 5: Additional Costs of a Rule 3.23 Compliant Unit**

| Unit Size (Btu/hr)                 | Average Additional Cost |
|------------------------------------|-------------------------|
| 75,000 to <400,000                 | \$984                   |
| 400,000 to <1,000,000 <sup>d</sup> | \$7,359 <sup>d</sup>    |

<sup>d</sup> Cost data for this size range is from SMAQMD’s Rule 414 Staff Report (January 2010) and has not been adjusted for inflation or other economic factors.

The cost effectiveness was calculated by dividing the annualized additional cost of the new units purchased by the annual emission reduction achieved by those units. For the calculation, a Capital Recovery Factor (CRF) of 0.078 was used for the units with a 15 year lifespan and a CRF of 0.061 was used for the units with a 20 year lifespan. These CRFs correspond to 2.00% interest rate (*i*) with a period (*n*) in years as shown below in **Equation 1**.

$$\text{Equation 1} \quad - \quad CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

In order to estimate the annual NOx reductions per unit, a midpoint unit size was selected for each size category. For units greater than or equal to 75,000 Btu/hr and less than 400,000 Btu/hr, a midpoint size of 240,000 Btu/hr was selected. For units greater than or equal to 400,000 Btu/hr and less than 1,000,000 Btu/hr, a midpoint size of 700,000 Btu/hr was selected. Using the midpoint size for each category, the NOx inventory, emission factor, and the capacity factor, District staff estimated the annual emission reductions per unit. The overall cost effectiveness of the proposed rule is \$1.82 per pound of NOx reduced and the total cost per year of replacing the affected units is estimated to be \$2,499.

## **8.0 Environmental Review and Compliance:**

The proposed rule 3.23 – Natural Gas-Fired Water Heaters, Small Boilers, and Process Heaters is categorically exempt from the California Environmental Quality Act (CEQA) under Sections 15307 and 15308 of the State CEQA Guidelines and no exceptions to these exemptions apply. This exemption is allowed when the proposed rule will help improve air quality in Yuba and Sutter counties. California Public Resources Code (Section 21159) requires an environmental analysis of the reasonably foreseeable methods of compliance. The District has determined that the adoption of Rule 3.23 will not have significant effect on the environment. In addition, the proposed Rule 3.23 is considered an affirmative action to protect the environment. Therefore, staff has determined that the project is categorically exempt from the requirements of the CEQA pursuant to Section 15308, Actions by Regulatory Agencies for Protection of the Environment.

**9.0 Required Findings:**

The California Health and Safety Code, Division 26, Air Resources, requires 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 6 findings that the District must make when developing, amending, or repealing a rule. These findings and their definitions are listed in the following table.

| <b>FINDING</b>  | <b>DEFINITION</b>  | <b>REFERENCE</b>   |
|-----------------|--|--|
| Authority       | A district shall adopt rules and regulations and do such acts as may be necessary or proper to execute the powers and duties granted to, and imposed upon, the district by this division and other statutory provisions.                         | California Health and Safety Code, Sections 40000, 40001, and 40702 are provisions of law that provide air districts with the authority to adopt these proposed rules.                       |
| Necessity       | The District has demonstrated that a need for the rule, or for rule amendment or repeal.   | It is necessary for the District to adopt this rule to achieve emission reductions to attain ambient air quality standards.  |
| Clarity         | The rule is written or displayed so that its meaning can easily be understood by the persons directly affected by it.  | There is no indication, at this time, that the proposed rule is written in such a manner that it cannot be easily understood by persons affected by the rule.                                |
| Consistency     | This rule is in harmony with, and not in conflict with or contradictory to, existing statutes, court decisions, or State or federal regulations.   | The rule is not in conflict with existing statutes, court decisions, or State or Federal regulations.  |
| 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 and proper to execute the powers and duties granted to, and imposed upon, the district. | The proposed rule does not impose requirements that duplicate existing laws or regulations.  |
| Reference       | Any statute, court decision, or other provision of law that the district implements, interprets, or makes specific by adopting, amending, or repealing a regulation.   | In adopting the proposed rule, the District is implementing the requirements of Clean Air Act section 172(c)(1), and California Health and Safety Code sections 40914(b)(2) and 40918(a)(2). |

## 10.0 Rule Analysis

Section 40727.2 requires a written analysis comparing the proposed rules with existing federal regulations, state regulation, and any other AQMD existing or proposed rules and regulations that apply to the same source type. The analysis compared the following air pollution control requirements as directed by 40727.2(d): Averaging provisions, units, and other pertinent provisions associated with emission limits; Operating parameters and work practice requirements; and monitoring, reporting, and recordkeeping requirements, including test methods, format, content and frequency.

### Comparison of Proposed Rule 3.23 and Feather River AQMD Rules and Regulations

| District Rules and Regulations  | Does proposed rule conflict or contradict any provisions? |
|---|---|
| Regulation 1 – General Provisions   | No  |
| Regulation 2 – Open Burning   | No  |
| Regulation 3 – Prohibition – Stationary Emission Sources                  | No  |
| Regulation 4 – Stationary Emission Sources Permit System and Registration | No  |
| Regulation 5 – Hearing Board Procedures                                   | No  |
| Regulation 6 – Variances  | No  |
| Regulation 7 – Fees   | No  |
| Regulation 8 – Penalties and Abatement                                    | No  |
| Regulation 9 – Enforcement Procedures                                     | No  |
| Regulation 10 – New Source Review   | No  |
| Regulation 11 – Air Toxic Control Measure                                 | No  |

### Comparison of Proposed Rules and other Federal and State Regulations

There are no existing federal or state regulations regarding the limitations of NOx emissions from natural gas-fired water heaters, small boilers, and process heaters with a heat input capacity of less than 1 million Btu/hr to greater than or equal to 75,000 Btu/hr that would be in conflict with or are contradictory to the proposed rule.

## References

1. CEPAM: 2009 Almanac – Standard Emission Tool, [www.arb.ca.gov/app/emsinv/fcemssumcat2009.php](http://www.arb.ca.gov/app/emsinv/fcemssumcat2009.php)
2. Feather River Air Quality Management District Rule 3.21 (Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters) – Adopted 06/05/2006
3. Feather River Air Quality Management District Rule 3.22 (Stationary Internal Combustion Engines) – Last Amended 10/06/2014
4. Sacramento Metropolitan Air Quality Management District Rule 414 (Natural Gas-Fired Water Heaters) – Adopted August 1, 1996.
5. Sacramento Metropolitan Air Quality Management District – *Staff Report for Proposed Amended Rule 414 (Natural Gas-Fired Water Heaters)*, January 15, 2010.
6. South Coast Air Quality Management District Rule 1121 (Control of Nitrogen Oxides from Residential Type Natural Gas-Fired Water Heaters) – Amended September 3, 2004.
7. South Coast Air Quality Management District – *Staff Report for Proposed Amended Rule 1121 (Control of Nitrogen Oxides from Residential Type Natural Gas-Fired Water Heaters)*, November 1999.
8. South Coast Air Quality Management District Rule 1146.2 (Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters) – Amended May 5, 2006.
9. South Coast Air Quality Management District – *Staff Report for Proposed Amended Rule 1146.2 (Emissions of Oxides of Nitrogen from Large Water Heaters and Small Boilers and Process Heaters)*, April 2006.
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