

SANTA BARBARA COUNTY AIR POLLUTION CONTROL DISTRICT

Draft Staff Report for:

**Amended Rule 361. Boilers, Steam Generators, and Process Heaters
(Between 2 – 5 MMBtu/hr)**

**Amended Rule 342. Boilers, Steam Generators, and Process Heaters
(5 MMBtu/hr and greater)**

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Our Mission

*Our mission is to protect the people and the environment of
Santa Barbara County from the effects of air pollution.*

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1. EXECUTIVE SUMMARY

Rule 361 and Rule 342 are prohibitory rules that regulate oxides of nitrogen (NO_x) and carbon monoxide (CO) emissions from boilers, steam generators, and process heaters with a rated heat input capacity greater than 2 million British thermal units per hour (MMBtu/hr). The proposed amendments are designed to reduce the applicable NO_x limits of these units when they are installed, replaced, or modified. Beginning on January 1, 2020, newly manufactured, installed, and modified equipment units need to meet a lower NO_x emission limit, within the range of 7 to 40 parts per million by volume (ppm), depending on the size of the unit and which fuel is being burned. The amendments also include requirements to meet Best Available Retrofit Control Technology (BARCT) standards by a date-certain, for units that are part of an “Assembly Bill (AB) 617 industrial source.” There are six AB 617 industrial sources in Santa Barbara County.

The amendments fulfill a commitment from the Santa Barbara County Air Pollution Control District’s (District’s) 2016 Ozone Plan, and they are based on similar requirements that have been implemented in other air districts throughout California for the last 5 years. The amendments also fulfill a commitment to implement the BARCT requirements of AB 617 by December 31, 2023.

2. BACKGROUND

2.1 Source Category Description

There are many of types of boilers, steam generators, and process heaters subject to Rule 361 and Rule 342. They range from larger boilers that produce high pressure steam in industrial settings to smaller units that are used to provide domestic hot water for a school or hotel. Other typical applications for this source category may include: oil & gas production, space heating, food processing, garment laundering, or manufacturing. All of these devices function by combusting a fuel and transferring the heat of combustion to water or a process stream.

The two main pollutants of concern for a combustion process are oxides of nitrogen (NO_x) and carbon monoxide (CO). Manufacturers have already designed and focused on a number of different combustion modifications to meet the low emission limits as required in other California air districts. Combustion modification systems are typically designed to reduce thermal NO_x formation by changing the flame characteristics and reducing the peak flame temperature. Some of the design principles used in low NO_x burners include staged air-fuel burners and pre-mix burners, both of which provide a well-controlled, efficient combustion process with minimized emissions.

2.2 Rule 361 Background

The District’s Governing Board initially adopted Rule 361 on January 17, 2008. Rule 361 applies to boilers, steam generators, and process heaters with a rated heat input greater than 2 MMBtu/hr and less than 5 MMBtu/hr. Prior to 2008, these medium-sized units were exempt from the requirement to obtain a Permit to Operate. However, District Rule 202 was also amended in 2008 to lower the permitting threshold from 5 MMBtu/hr to 2 MMBtu/hr.

Existing units were required to apply for a permit by April 2008, but they are not required to comply with the emission standards until January 1, 2020. This 12-year phase-out approach allowed the District to achieve NOx emission reductions without requiring the immediate replacement of any existing units. It was anticipated that the majority of existing units would be replaced during this 12-year period due to the typical life cycle of these units, and the newly installed units are required to comply with the emission standards upon installation.

The 2008 rule implemented a NOx emission limit of 30 ppm for all units, except for existing units that qualified for the low-use exemption. To verify that these emission limits are met, Rule 361 requires the operator of natural gas units to perform a NOx analyzer test every 6 months during the semiannual tune-up. If a unit is fired on a fuel other than natural gas, the unit is required to be source tested every 2 years.

The District submitted the initial rule to the California Air Resources Board (CARB) for forwarding to the Environmental Protection Agency (EPA) as an amendment to the State Implementation Plan (SIP). EPA finalized a limited approval - limited disapproval of the initially adopted Rule 361 on May 31, 2011.

2.3 Rule 342 Background

The District's Governing Board initially adopted Rule 342 on March 10, 1992. Rule 342 applies to boilers, steam generators, and process heaters with a rated heat input of 5 MMBtu/hr and greater. Prior to 1987, the majority of these industrial-sized units were exempt from the requirement to obtain a Permit to Operate. However, District Rule 202 was amended in 1987 to lower the permitting threshold from 250 MMBtu/hr to 10 MMBtu/hr. Rule 202 was further amended in 1992 to lower the permitting threshold from 10 MMBtu/hr to 5 MMBtu/hr.

The 1992 rule implemented a NOx emission limit of 30 ppm for all gaseous-fired units and 40 ppm for non-gaseous-fired units, unless the unit qualified for the low-use exemption. To verify that these emission limits are met, Rule 342 requires the operator of perform a source test every 2 years.

Rule 342 was also amended in 1997, but this was purely an administrative reference change due to the District's 1997 New Source Review amendments. The District submitted the 1997 version of Rule 342 to the California Air Resources Board for forwarding to the EPA as an amendment to the State Implementation Plan. EPA finalized their approval of Rule 342 on September 24, 1999.

2.4 The 2016 Ozone Plan

Ground level ozone is a secondary pollutant formed from photochemical reactions of the precursor pollutants oxides of nitrogen (NOx) and reactive organic compounds (ROC) in the presence of sunlight. Ozone is a strong irritant that adversely affects human health and damages crops and other environmental resources. Both short-term and long-term exposure to ozone can irritate and damage the human respiratory system, resulting in:

- Decreased lung function,
- Development and aggravation of asthma,
- Increased risk of cardiovascular problems such as heart attacks and strokes,
- Increased hospitalizations and emergency room visits, and
- Premature deaths.

The District is in attainment for most of the Ambient Air Quality Standards, including the most recent federal 8-hour ozone standard that was adopted in 2015. However, the District is currently designated as nonattainment-transitional for the state ozone standard.

As required by the California Clean Air Act, the District prepared the 2016 Ozone Plan that included a schedule for implementing control measures to reduce emissions of ozone precursors and help attain the state ozone standard. The District was also required to review the 2016 Ozone Plan's rule schedule, pursuant to California Health and Safety Code section 40925.5, after being designated nonattainment-transitional in 2017. The review and revision to the rule schedule were approved by the District Board of Directors on August 17, 2017.¹

The proposed amendments to Rule 361 and Rule 342 were identified in the District's 2016 Ozone Plan. The District reviewed the possibility of adopting the boiler control measures in Santa Barbara County, and the measures met all of the criteria needed to be considered "feasible measures." Hence, the District's 2016 Ozone Plan and the revised nonattainment-transitional rule schedule included a commitment to achieve NOx emission reductions from these units.

Since the District is designated as nonattainment-transitional, California Health and Safety Code section 40930 also requires the District to do a cost-benefit analysis and provide justification before any new control measure is adopted. That analysis is included in Section 6 of this staff report.

2.5 The AB 617 BARCT Rule Development Schedule

Assembly Bill (AB) 617, enacted in July 2017, has a multitude of requirements to address the disproportionate impacts of air pollution in disadvantaged communities. One of the key components of AB 617 is to reduce air pollutant emissions from facilities that participate in the California Greenhouse Gas (GHG) Cap-and-Trade system. Cap-and-Trade is designed to limit GHG emissions, and allows facilities to comply by either reducing GHG emissions at the source or by purchasing GHG emission allowances. Emissions of criteria pollutants and toxic air contaminants are often associated with GHG-emitting sources, and these pollutants may impact local communities that are already experiencing a disproportionate burden from air pollution.

AB 617 helps alleviate the pollution burden near these communities by requiring each air district to adopt an expedited rule development schedule for Best Available Retrofit Control Technology (BARCT) by January 1, 2019. The District's schedule was adopted at the December 20, 2018

¹ Additional information on the District's change in designation to nonattainment-transitional, and the changes to the 2016 Ozone Plan's control measure implementation schedule, can be found here: <https://www.ourair.org/planning-clean-air/>

Board Hearing, and Rule 342 and Rule 361 were included on the list of measures that needed to be evaluated for BARCT. The District has six facilities that have been identified as industrial sources subject to the California Cap-and-Trade requirements. These facilities are:

- 1) Exxon Mobil – Las Flores Canyon,
- 2) Exxon Mobil – Pacific Offshore Pipeline Company (POPCO),
- 3) Pacific Coast Energy Company (PCEC) – Orcutt Hill,
- 4) ERG Operating Company – Cat Canyon West,
- 5) Imerys Minerals California, and
- 6) Windset Farms.

All of these facilities, except for Las Flores Canyon, use boilers, steam generators, and process heaters that need to be evaluated under the AB 617 requirements. The Rule 361 BARCT analysis for these facilities can be found in Section 3.6, and the Rule 342 BARCT analysis can be found in Section 4.6.

3. PROPOSED RULE AMENDMENTS – Rule 361

3.1 Overview of Proposed Amendments

The District is proposing the following major amendments to Rule 361:

- Lowering the NOx emission limit for newly installed or modified gaseous-fired units from 30 ppm down to 9-25 ppm, depending on the fuel being burned;¹
- Adding in startup and shutdown provisions; and
- Incorporating the BARCT requirements for the AB 617 industrial sources.

All of the amendments are described in further detail in their corresponding sections below.

3.2 Rule Title

When Rule 361 was initially adopted in 2008, it was named “Small Boilers, Steam Generators, and Process Heaters.” This name, by itself, informs the reader that if you have a boiler or steam generator, you should read the rule to learn if there are any applicable requirements to your equipment unit. Yet the naming becomes more convoluted when comparing it to other District-adopted boiler rules.

Hence, the District is in the process of implementing a new naming convention to minimize the confusion between the various boiler rules. Proposed Rule 361 will be named “Boilers, Steam Generators, and Process Heaters (Between 2 – 5 MMBtu/hr).” This title creates a simplified boiler rule naming convention that conveys the applicability without having to open the rule, which will help the public quickly identify the applicable rule for their equipment unit.

3.3 Requirements - Emission Limits

Natural gas-fired and Field gas-fired units

The focus of this rule amendment is to lower the emission limits for new and modified natural gas and field gas units from 30 ppm to the 9-12 ppm NOx emission limits, beginning on January 1, 2020. To meet these lower standards, most boilers will have to be equipped with ultra-low NOx burners. Ultra-low NOx burners are designed to achieve low emissions while maintaining good flame stability and heat transfer characteristics. Furthermore, these burners may increase thermal efficiencies by reducing the amount of excess air needed for combustion. This has the added benefit of reducing fuel usage, which results in energy savings.

For most systems, a blower will be required to mix the fuel and air prior to combustion. Even atmospheric boilers, where the burners are not totally enclosed, may still need a blower to pre-mix the fuel and air. Due to the design criteria of these atmospheric boilers, it is only feasible to have them reach the 12 ppm NOx limit, as opposed to the 9 ppm limit for non-atmospheric boilers. It is possible to reach both the 9 and 12 ppm NOx limits without the use of Flue Gas Recirculation (FGR), yet some operators may still choose to use this technology.

¹ All parts per million by volume (ppm) measurements are expressed on a dry gas basis and corrected to 3% stack gas oxygen.

Other fuels

Not all fuel types can easily meet the ultra-low NOx standard. Units that are fired on alternative fuel types, such as boilers that are fired on digester gas at a waste water treatment plant, can't easily achieve these emission levels. This is mainly due to the fluctuations or impurities in the fuel. As such, these other fuels have different standards to reflect what is feasible with the available technologies.

The proposed NOx limit for landfill gas-fired units is 25 ppm, and the proposed NOx limit for digester gas is 15 ppm. Both of these standards are based on the NOx limits for equipment subject to SCAQMD Rule 1146.1. In addition, a NOx limit of 20 ppm is proposed for liquefied propane gas or propane-fired units, which is equivalent to the emission standard in Ventura County Rule 74.15.1.

3.4 Startups and Shutdowns

Due to the previous deficiency that was noted by the EPA in their limited approval-limited disapproval of Rule 361, the District has added new definitions and requirements for startups and shutdowns. These changes are necessary to clearly define the startup and shutdown time frames because the emission limits of the rule do not apply during these periods. Air emissions must still be minimized during all startups and shutdowns, and the proposed provisions are consistent with the EPA policy as discussed in an EPA memorandum, dated February 15, 1983, "Policy on Excess Emissions During Startup, Shutdown, Maintenance and Malfunctions."

3.5 Testing & Tune-up Procedures

Rule 361, as adopted in 2008, requires the applicable units to be source tested every 2 years to demonstrate compliance with the emission limits in the rule. As an alternative to the source test, units that are fired on natural gas and existing units that were eligible for the low-use fuel exemption are allowed to have the operator perform a unit tune-up two times per year in lieu of the required source test. These testing requirements will remain unchanged in the revised rule.

However, the District Tune-Up Procedures are being updated to reflect the revised emissions limits and to reference the South Coast Air Quality Management District (SCAQMD) Combustion Gas Periodic Monitoring Protocol (May 1, 2009). The District has found that the SCAQMD protocol is more commonly used by boiler technicians to calibrate and maintain their NOx analyzers, as opposed to the procedure used by the American Society for Testing and Materials (ASTM).

3.6 AB 617 – Rule 361 BARCT Amendments

Rule 361, as adopted in 2008, requires all existing units (those units installed before 2008) to meet the 30 ppm NOx emission standard by January 1, 2020. Even though lower-emitting units have become readily available and cost-effective over the course of the last decade, the District's 2016 Ozone Plan stated that the Rule 361 amendments would be focused only on new and modified boilers. However, due to the AB 617 BARCT requirements, the District evaluated the possibility of requiring the existing units at the AB 617 industrial sources to meet the lower emission standards at an earlier date.

Rule 361 – BARCT Analysis

Based on the District's review of this source category, the proposed emission limits of 9-12 ppm NOx in Rule 361 represent the current BARCT determination for Santa Barbara County. Under the proposed amendments, most gaseous-fired units will have to comply with the BARCT emission standard of 9-12 ppm when they are modified on or after January 1, 2020.

AB 617 also requires implementation of the BARCT emission standard at the AB 617 industrial sources by no later than December 31, 2023. When reviewing the applicable units, the District found that some of the units still have uncertified, conventional burners. These units are scheduled to meet the 30 ppm NOx limit by January 1, 2020, as required under 2008 version of Rule 361. The District acknowledges that it would not be cost-effective to replace or modify these boilers to 30 ppm NOx in 2020, and then replace them again in 2023 to meet the BARCT standard.

The District evaluated the facilities and concluded that it would be feasible to have these uncertified units meet the BARCT standard no later than one year after the rule amendments are approved by the District Board of Directors. This change effectively delays the existing January 1, 2020 compliance date, but it makes up for the delayed emission benefit by requiring the ultra-low NOx standard sooner than December 31, 2023. A one-year timeline will give the facilities enough time to scope out and install new equipment that can meet the BARCT standard. This requirement would affect boilers at the following two facilities:

- ERG Operating Company – Cat Canyon West, and
- Imerys Minerals California.

This determination meets the AB 617 mandate by achieving emission reductions at the largest industrial sources in the County, and all of the BARCT requirements for AB 617 are satisfied for this source category.

4. PROPOSED RULE AMENDMENTS – Rule 342

4.1 Overview of Proposed Amendments

The District is proposing the following major amendments to Rule 342:

- Lowering the NOx emission limits for newly installed or modified gaseous-fired units from 30 ppm down to 7-25 ppm, depending on the fuel being burned;
- Adding in startup and shutdown provisions; and
- Incorporating BARCT requirements for the AB 617 industrial sources.

All of the amendments are described in further detail in their corresponding sections below.

4.2 Rule Title

When Rule 342 was initially adopted in 1992, it was named “Control of Oxides of Nitrogen (NOx) From Boilers, Steam Generators, and Process Heaters.” This name, by itself, informs the reader that if you have a boiler or steam generator, you should read the rule to learn if there are any applicable requirements to your equipment unit. Yet the naming becomes more convoluted when comparing it to other District-adopted boiler rules.

Hence, the District is in the process of implementing a new naming convention to minimize the confusion between the various boiler rules. Proposed Rule 342 will be named “Boilers, Steam Generators, and Process Heaters (5 MMBtu/hr and greater).” This title creates a simplified boiler rule naming convention that conveys the applicability without having to open the rule, which will help the public quickly identify the applicable rule for their equipment unit.

4.3 Requirements - Emission Limits

Gaseous-fired units

The focus of this rule amendment is to lower the emission limits for new and modified gaseous units to the more stringent 7-9 ppm NOx emission limit, beginning on January 1, 2020. For the purpose of this rule, gaseous fuels includes natural gas, field gas produced in the oilfields, propane, and any other fuel which is a gas at standard conditions.

To meet these lower standards, most boilers will have to be equipped with ultra-low NOx burners. Ultra-low NOx burners are designed to achieve low emissions while maintaining good flame stability and heat transfer characteristics. Furthermore, these burners may increase thermal efficiencies by reducing the amount of excess air needed for combustion. This has the added benefit of reducing fuel usage, which results in energy savings.

Ultra-low NOx burner systems in the 5-20 MMBtu/hr size range can achieve the 9 ppm NOx limit without the use of Flue Gas Recirculation (FGR). Larger units, those rated at 20 MMBtu/hr or more, are proposed to meet a NOx emission limit of 7 ppm. Most larger units will need FGR to consistently reach sub-7 ppm levels.

Other fuels

Not all fuel types can easily meet the ultra-low NO_x standard. Units that are fired on alternative fuel types, such as boilers that are fired on digester gas at a waste water treatment plant, can't easily achieve these emission levels. This is mainly due to the fluctuations or impurities in the fuel. As such, these other fuels have different standards to reflect what is feasible with the available technologies.

The proposed NO_x limit for landfill gas-fired units is 25 ppm, and the proposed NO_x limit for digester gas is 15 ppm. Both of these standards are based on the NO_x limits for existing equipment subject to SCAQMD Rule 1146, and these limits are also identical to the proposed limits in Rule 361.

4.4 Startups and Shutdowns

Unlike Rule 361, Rule 342 was not found to have a deficiency during the SIP submittal to the EPA. Nonetheless, the District has still added new definitions and requirements for startups and shutdowns in the rule to be consistent with the current EPA determinations. These changes are necessary to clearly define the startup and shutdown time frames because the emission limits of the rule do not apply during these periods. Air emissions must still be minimized during all startups and shutdowns, and the proposed provisions are consistent with the EPA policy as discussed in an EPA memorandum, dated February 15, 1983, "Policy on Excess Emissions During Startup, Shutdown, Maintenance and Malfunctions."

4.5 Testing & Tune-up Procedures

Rule 342, as amended in 1992, requires source testing to be performed every 2 years for most units subject to the rule. As an alternative to the source testing requirement, existing units that are eligible for the low-use fuel exemption are allowed to perform an annual unit tune-up in lieu of the required source test. Detailed District Tune-Up Procedures were included in the 1992 rule, but they only focused on forced-draft units. Most units in this size range will be forced-draft units, but there is a possibility that a natural draft unit is installed. To make sure that the rule has the appropriate references to natural draft units, the tune-up procedures are being updated.

4.6 AB 617 – Rule 342 BARCT Amendments

Rule 342 – BARCT Analysis

The California Air Resources Board performed a BARCT evaluation for boilers, steam generators, and process heaters back in 1991, and at that time, BARCT was determined to be a 30 ppm NO_x emission standard for units that were 5 MMBtu/hr and greater. Yet technology has progressed rapidly since 1991, and a new BARCT determination is necessary for Rule 342.

Based on the District's review of this source category, the proposed emission limits of 7-9 ppm NO_x in Rule 342 represent the current BARCT determination for Santa Barbara County. Under the proposed amendments, most gaseous-fired units will have to comply with the BARCT emission standard of 7-9 ppm when they are modified on or after January 1, 2020.

AB 617 also requires implementation of the BARCT standard at the AB 617 industrial sources by no later than December 31, 2023. When reviewing the applicable units, the District found that all of the units that are currently permitted at Pacific Coast Energy Company (PCEC) – Orcutt Hill and ERG – Cat Canyon West already comply with the BARCT standard. Hence, the only AB 617 facilities that would be affected by the requirements are:

- Windset Farms,
- Exxon Mobil – Pacific Offshore Pipeline Company (POPCO), and
- Imerys Minerals California.

Rule 342 – Windset Farms Analysis

Windset Farms is an agricultural source that uses six large boilers to generate both heat and carbon dioxide (CO₂) for its greenhouse operations. In this unique scenario, the exhaust gases from the boilers are directed into the greenhouse as a means of supplementing CO₂ to their crops and providing an ideal growing environment. Since these boilers are being used in an agricultural operation and the facility does not require a federal Title V permit, the boilers are currently exempt from obtaining a District Permit to Operate and from the requirements of Rule 342.

Despite being categorized as an agricultural operation pursuant to District rules, Windset Farms is an industrial source that is subject to the California Air Resources Board’s Cap-and-Trade Program; therefore, the AB 617 BARCT requirements apply to the facility. The District performed an evaluation of the boilers at Windset Farms and asked multiple vendors for data regarding the feasibility of retrofitting such agricultural boilers to the ultra-low NO_x standard. Based on the District’s research, the current ultra-low NO_x burners cannot meet the specific parameters required for Windset Farms’ CO₂ dosing process. This is because the boilers need to maintain a near-zero level of carbon monoxide in the exhaust, and the ultra-low NO_x technologies increase the carbon monoxide concentrations above this near-zero level. Windset Farms also completed a similar retrofit analysis which can be found in Attachment B to this staff report.

Accordingly, the District proposes to establish a new BARCT emission standard for the CO₂ dosing process based on what is feasible for these types of units. The BARCT standard is proposed to be 30 ppm NO_x and 10 ppm carbon monoxide (CO). The boilers at Windset Farms currently meet these emission standards. Therefore, no equipment modifications will be needed for their boilers to meet these proposed new emission limits.

To make the BARCT emission standard enforceable, the District proposes to amend the Rule 342.B.1.d exemption so that the boilers at Windset Farms have to comply with Rule 342.¹ New language is also included in the rule that outlines the requirements for a Compliance Plan. The Compliance Plan is a mechanism to verify that the boilers adhere to the BARCT requirements. The Compliance Plan would need to be submitted to the District by January 30, 2023, and it would remain in effect for the life of the units. Furthermore, if any additional boilers are installed at Windset Farms, the Compliance Plan would need to be updated at least 90 days prior to the proposed boiler installation.

¹ All other agricultural boilers at smaller greenhouses would still remain exempt from the rule requirements.

Rule 342 – POPCO and Imerys Analysis

Based on cost estimates presented in Section 6.2, it is cost-effective to retrofit the main boiler at the Imerys facility with an ultra-low NO_x burner. The current actual heat input rates for the back-up boiler at the Imerys facility and the two off-line boilers at the POPCO facility are less than 9,000 MMBtu per year. The District proposes to create a low-use exemption for AB 617 industrial sources using a 9,000 MMBtu per year threshold. Below this threshold, it is not cost-effective to retrofit these three units based on their current actual fuel use. Notwithstanding this exemption, Section D.3 would require ultra-low NO_x burners if these units are ever replaced or modified. Further, Section D.4 requires the units to meet the ultra-low NO_x standard if their operations surpass the low-use threshold by the timeline specified in Section K.4.

5. COMPARISON WITH OTHER AIR DISTRICTS

The District compared Rule 361 and Rule 342 to the following rules in other air districts:

Rule 361

- South Coast Air Quality Management District Rule 1146.1 (Emissions of Oxides of Nitrogen From Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)
- Ventura County Air Pollution Control District Rule 74.15.1 (Boilers, Steam Generators, and Process Heaters)
- San Joaquin Valley Air Pollution Control District Rule 4307 (Boilers, Steam Generators, and Process Heaters - 2.0 MMBtu/hr to 5.0 MMBtu/hr)
- Bay Area Air Quality Management District Regulation 9, Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional and Commercial Boilers, Steam Generators, and Process Heaters)
- Sacramento Metropolitan Air Quality Management District Rule 411 (NO_x from Boilers, Process Heaters And Steam Generators)

Rule 342

- South Coast Air Quality Management District Rule 1146 (Emissions of Oxides of Nitrogen From Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)
- San Joaquin Valley Air Pollution Control District Rule 4320 (Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater Than 5.0 MMBtu/hr)
- Bay Area Air Quality Management District Regulation 9, Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional and Commercial Boilers, Steam Generators, and Process Heaters)
- Sacramento Metropolitan Air Quality Management District Rule 411 (NO_x from Boilers, Process Heaters And Steam Generators)

A comparison of the District's proposed rules to the rules adopted by other nearby air districts is shown below in Tables 5.1 and 5.2. Based on the District's analysis, the proposed rules are not requiring any provisions that are more stringent than what has already been adopted in the other air districts. Furthermore, the rules are written in such a way that they are as consistent as possible with other air districts while still adequately acknowledging the specific needs of the region covered by the Santa Barbara County Air Pollution Control District.

Table 5.1. Comparison of Nearby Air District Rules – Rule 361

DISTRICT		SANTA BARBARA APCD Rule 361 (Proposed)	SOUTH COAST AQMD Rule 1146.1 (2008)	VENTURA APCD Rule 74-15-1 (2015)	SAN JOAQUIN VALLEY APCD Rule 4307 (2008)
Section	Rule Component				
<u>Applicability</u>	MMBtu/hr rating	2 – 5	2 – 5	1 – 5	2 – 5
	Fuel Type	Gas/Liquid/Solid Fuels	Gas/Liquid/Solid Fuels	Gaseous & Liquid	Gaseous & Liquid
	Type of Rule	Point of Installation	3-6 year phase out	Point of Installation	Point of Installation & 1-7 year phase out
	When are the new limits effective?	2020	2012 - 2015	2016	2010 - 2016
<u>Exemptions</u>	Emergency Use	Yes – 168 hours	---	Yes	Yes – 168 hours
	Startups & Shutdowns	Yes	Yes	---	Yes
<u>Emission Limits</u>	NG – non-atmospheric	9 ppm NOx	9 ppm NOx	9 ppm NOx	9 ppm NOx
	NG –atmospheric	12 ppm NOx	12 ppm NOx	12 ppm NOx	12 ppm NOx
	FG – non-atmospheric	9 ppm NOx	---	12 ppm NOx	9 ppm NOx
	FG –atmospheric	12 ppm NOx	---	15 ppm NOx	12 ppm NOx
	Landfill Gas	25 ppm NOx	25 ppm NOx	25 ppm NOx	---
	Digester Gas	15 ppm NOx	15 ppm NOx	15 ppm NOx	---
	LPG/Propane	20 ppm NOx	---	20 ppm NOx	---
<u>Testing</u>	Source Test	<i>Natural Gas:</i> none <i>All others:</i> every 2 years	Every 5 years	Every 4 years	When installed or modified, if not certified
	Tune-up	<i>Natural Gas:</i> Semiannual <i>All others:</i> none	Semiannual	<i>Low-use:</i> Semiannual	Semiannual
	NOx Analyzer	During Tune-ups	Quarterly/Semiannually	Every year a source test is not performed	May be performed in lieu of tune-up
<u>Recordkeeping</u>	Record Duration	5 years	2 years	4 years	5 years

Table 5.2. Comparison of Nearby Air District Rules – Rule 342

DISTRICT		SANTA BARBARA APCD Rule 342 (Proposed)	SOUTH COAST AQMD Rule 1146 (2008)*	SACRAMENTO METROPOLITAN Rule 411 (2007)	SAN JOAQUIN VALLEY APCD Rule 4320 (2008)
Section	Rule Component				
Applicability	MMBtu/hr rating	5+	5+	5+	5+
	Fuel Type	Gas/Liquid/Solid Fuels	Gas/Liquid/Solid Fuels	Gas/Liquid/Solid Fuels	Gaseous & Liquid
	Type of Rule	Point of Installation	3-6 year phase out	2-4 year phase out	2-5 year phase out
	When are the new limits effective?	2020	2012 - 2015	2007 - 2009	2010 - 2014
Exemptions	Emergency Use	Yes – 168 hours	---	Yes – 168 hours	Yes – 168 hours
	Startups & Shutdowns	Yes	Yes	Yes	Yes
Emission Limits	Gaseous (NG/FG/LPG): 5-20 MMBtu/hr	9 ppm NOx	<i>Atmospheric:</i> 12 ppm 5-20 MMBtu/hr: 9 ppm	15 ppm NOx	9 ppm NOx (standard schedule)
	Gaseous (NG/FG/LPG): 20+ MMBtu/hr	7 ppm NOx	20-75 MMBtu/hr: 9 ppm 75+ MMBtu/hr: 5 ppm	9 ppm NOx	7 ppm NOx (standard schedule)
	Landfill Gas	25 ppm NOx	25 ppm NOx	15 ppm NOx	---
	Digester Gas	15 ppm NOx	15 ppm NOx	---	9 ppm NOx
	Nongaseous	40 ppm NOx	40 ppm NOx	40 ppm NOx	40 ppm NOx
Testing	Source Test	Every 2 years	<10 MMBtu/hr: 5 years 20+ MMBtu/hr: 3 years	5-20 MMBtu/hr: 2 years 20+ MMBtu/hr: Annual	Every 1 -3 years
	Tune-up	<i>Low-use:</i> Annual	Semiannual	<i>Low-use:</i> Annual	Semiannual
	NOx analyzer test	---	Semiannual	---	Monthly operating parameter check
Recordkeeping	Record Duration	5 years	2 years	5 years	5 years

* SCAQMD has recently published proposed revisions to Rule 1146 that further lower the emission limits for certain categories of boilers.

6. IMPACTS OF THE PROPOSED RULE

6.1 Emission Impacts

To identify the emission impacts of the rule, the District first needed to identify the applicable units that may get emission reductions under the proposed amendments. The majority of the emission reductions come from natural gas or field gas-fired units, as the District only has a couple of small digester gas-fired and propane-fired units permitted in the County. Accordingly, staff queried the District’s permit database to evaluate how many existing units already have ultra-low NOx burners that meet the proposed standards and how many units may need to meet the lower NOx limits when they are replaced or modified.

For this evaluation, the District also excluded applicable units that have continuously been operated as “Low-Use” units. Low-Use units are limited by their permit conditions to combust less than 1,800 MMBtu for Rule 361 existing units and less than 9,000 MMBtu per year for Rule 342 units. These units are not anticipated to be replaced soon due to their minimal usage which extends their operating life. The results of the District’s permit database query are shown in Table 6-1 below.

Table 6-1: Number of Units in the District based on Permit Database

MMBtu/hr Range	# Ultra-Low NOx Units	# Higher Emitting Units	# Low-Use Units	Total Units
2 – 5	6	122	24	152
5 – 20	12	19	8	39
20+	13	8	2	23
Total Units:				214

An operating capacity factor of 0.25 was chosen as a conservative estimate to help quantify the emission reductions from the higher-emitting boilers. Even though all of these units require a permit from the District, the majority of the units in the 2-5 MMBtu/hr range do not have a totalizing fuel flow meter, and so assumptions have to be made about their operating capacity. It’s important to note that operating capacities of individual units will vary from year-to-year based on the production needs of the facility. Using these assumptions, the estimated emission reductions for each size range are shown in Table 6-2, below.

Table 6-2: Estimated Emission Reductions from Rule 361 and Rule 342 Units

MMBtu/hr Range	# Higher Emitting Units	Δ Emission Factor (lb/MMBtu)	Operating Capacity Factor	hours/year	lbs/ton	NOx emission reductions ¹ (tpy)
2 – 5	122	(0.036 - 0.013) ²	0.25	8,760	2,000	7.7
5 – 20	19	(0.036 - 0.011) ³	0.25	8,760	2,000	3.6
20+	8	(0.036 - 0.009) ⁴	0.25	8,760	2,000	5.0
Total TPY:						16.3

The anticipated emission reductions from these rule amendments is calculated to be 16.3 tons of NOx per year after the rule is fully implemented and all of the older units, excluding low-use units, are replaced. Since this is (with the exception of the AB 617 industrial sources) a point-of-installation and modification rule, the NOx emission reductions from the proposed rule amendments will occur gradually as units are replaced with newer, ultra-low NOx units. For these types of units, the average life expectancy is anticipated to be 15 years. Some units may need to be replaced sooner, and others could last up to 30 years if maintained properly. Overall, it is reasonable to assume that over the course of the next 15 years, all existing heating equipment subject to this rule will be replaced in a linear fashion, with about 6.7% of the boiler inventory replaced each year.

6.2 Cost-Effectiveness

California Health and Safety Code section 40703 requires the District, in the process of the adopting or amending a rule, to consider and make public its findings related to the cost-effectiveness of a control measure. Cost-effectiveness, for rule-making purposes, is calculated by taking the estimated compliance costs of the rule and dividing it by the amount of air pollution reduced.

Estimated compliance costs for a rule can include, but are not limited to, capital equipment costs, engineering design costs, installation costs, and on-going maintenance costs, such as additional labor, fuel, or electrical costs. Because the rule is not (with the exception of the AB 617 industrial sources) forcing additional or early replacement of units, the primary costs that are expected to vary for compliant units is the capital cost of the equipment and any increased operational costs for using additional blowers or flue gas recirculation. Of note, there may be fuel savings associated with the installation of newer, more efficient units, but to be conservative, these cost-effectiveness calculations will not reflect any such fuel savings.

District staff asked various manufacturers for the price differences between units at the proposed standards and units at the current standards to come up with the estimated incremental capital and operational costs. Staff also reviewed the costs published by other Air Districts in their staff

¹ tpy = $\sum [(Unit\ Rating) * (\Delta\ Emission\ Factor) * (Operating\ Capacity\ Factor) * (hrs/year) / (lbs/ton)]$,
Where: Δ Emission Factor = 30 ppm - Amended Rule Emission Factor

² Amended Rule Emission Factor represents an average of the 9 and 12 ppm NOx limits.

³ Amended Rule Emission Factor represents the 9 ppm NOx limit.

⁴ Amended Rule Emission Factor represents the 7 ppm NOx limit.

reports and incorporated the costs as appropriate. The anticipated costs for Santa Barbara County are shown below in Table 6-3.

Table 6-3: Estimated Incremental Costs per Unit

Unit Rating (MMBtu/hr)	Incremental Equipment Cost (\$/installation)	Incremental Operational Costs (\$/yr)
2	\$6,900	\$390
5	\$9,300	\$1,000
10	\$34,200	\$2,000
15	\$35,000	\$3,000
20	\$38,500	\$5,000
25	\$60,000	\$6,000
50	\$60,000	\$12,000

For cost-effectiveness calculations, the District uses the Levelized Cash Flow (LCF) method. In the LCF method, a capital recovery factor (CRF) is used to transform any capital costs into an equivalent annual cost. The CRF is necessary because the one-time capital expenditures reduce emissions over the entire duration of the project life. Hence, the CRF is a function of the real interest rate and equipment life. The annualized costs for various sizes of boilers are shown in Table 6-4, below:

Table 6-4: Estimated Annualized Costs per Unit

Unit Rating (MMBtu/hr)	Incremental Capital Costs (\$/installation)	CRF	Incremental Operational Costs (\$/yr)	Annualized Cost (\$/yr)
2	\$6,900	0.103	\$390	\$1,100
5	\$9,300	0.103	\$1,000	\$1,940
10	\$34,200	0.103	\$2,000	\$5,520
15	\$35,000	0.103	\$3,000	\$6,580
20	\$38,500	0.103	\$5,000	\$8,960
25	\$60,000	0.103	\$6,000	\$12,180
50	\$60,000	0.103	\$12,000	\$18,180

Where:

$$\text{Annualized Cost} = (\text{Incremental Capital Costs} * \text{CRF}) + (\text{Incremental Operational Costs})$$

$$\text{CRF} = \frac{i * (1 + i)^n}{(1 + i)^n - 1} = \frac{0.06 * (1 + 0.06)^{15}}{(1 + 0.06)^{15} - 1} = 0.103$$

i = Real Interest Rate (6%)

n = Equipment Life (15 years)

The total estimated emission reductions calculated for all of the units in these size categories was previously shown as 16.3 tons per year of NOx. The cost-effectiveness calculations, however, depend on the emission reductions from a single unit. The emission reductions per individual unit are determined using similar assumptions and methodology as used in Section 6.1, Emission Impacts.

Table 6-5: Estimated Emissions Reductions per Unit

Unit Rating (MMBtu/hr)	Δ Emission Factor (lb/MMBtu)	Operating Capacity Factor	hrs/year	lbs/ton	NOx emission reductions (tpy)
2	(0.036 – 0.013)	0.25	8,760	2,000	0.05
5	(0.036 – 0.013)	0.25	8,760	2,000	0.13
10	(0.036 – 0.011)	0.25	8,760	2,000	0.28
15	(0.036 – 0.011)	0.25	8,760	2,000	0.42
20	(0.036 – 0.011)	0.25	8,760	2,000	0.56
25	(0.036 – 0.009)	0.25	8,760	2,000	0.77
50	(0.036 – 0.009)	0.25	8,760	2,000	1.54

For calculating the final cost-effectiveness in dollars-per-ton, the annualized cost of a unit is divided by one year’s worth of the estimated emission reductions for the unit. The final cost-effectiveness values for each unit type are as follows:

Table 6-6: Cost-Effectiveness per Unit

Unit Rating (MMBtu/hr)	Annualized Cost (\$/yr)	NOx Reductions (tpy)	Cost-Effectiveness (\$/ton)
2	\$1,100	0.05	\$20,800
5	\$1,940	0.13	\$14,600
10	\$5,520	0.28	\$19,700
15	\$6,580	0.42	\$15,700
20	\$8,960	0.56	\$16,000
25	\$12,180	0.77	\$15,900
50	\$18,180	1.54	\$11,900

These cost-effectiveness values are conservative estimates that are intended to reflect the typical values for a boiler project. Even so, the cost-effectiveness of the rules are within the acceptable range of previously adopted boiler prohibitory rules, and so Rule 361 and Rule 342 are considered to be cost-effective.

6.3 Incremental Cost-Effectiveness

California Health and Safety Code section 40920.6 requires the performance of an incremental cost-effectiveness analysis that identifies more than one control option that meets the emission reduction objective of the regulation. The incremental cost-effectiveness is the difference in cost

between two successively more effective controls, divided by the additional emission reductions achieved.

When comparing alternative technologies available for achieving NO_x reductions for boilers, the most cost-effective means is implementing ultra-low NO_x burners. The District considered requiring a 5 ppm NO_x limit for the largest boilers in the District. Attaining this 5 ppm emission limit typically requires the use of selective catalytic reduction (SCR), which involves injecting aqueous ammonia into the exhaust stream. The ammonia reacts with the flue gas over a catalyst to reduce the NO_x into nitrogen gas, water vapor, and carbon dioxide. These systems are quite expensive to install and maintain, with preliminary cost estimates exceeding \$50,000/ton of NO_x reduced. Accordingly, such a requirement would not be cost-effective for Santa Barbara County.

6.4 Socioeconomic Impacts

California Health and Safety Code section 40728.5 requires Districts with populations greater than 500,000 people to consider the socioeconomic impact of any new rule if air quality or emission limits are significantly affected. In 2016, the population of Santa Barbara County was approximately 445,000 persons based on data from the Santa Barbara County Association of Governments. Using the expected growth rates for the County, the current population estimate is still below the 500,000 person threshold. Therefore, the District is not required to perform a socioeconomic impact analysis for the proposed rule amendment.

6.5 Impact to Industry

The proposed amendments to Rules 361 and 342 will affect boiler, steam generator, and process heater owners and operators within the County. Since the units affected by the proposed amendments are found throughout the commercial, institutional, and industrial sectors, a wide range of businesses may be affected.

The rule amendments will have a fiscal impact on purchasers of new boilers, steam generators, and process heaters. Except for the special cases of the AB 617 industrial source units, the rules do not require businesses to replace their equipment. Instead, when the operators choose to replace the equipment or the equipment has reached the end of its useful life, the operators must purchase the ultra-low NO_x units. New equipment meeting the ultra-low NO_x standard cost approximately 15-25% more than the equipment that meets the 30 ppm standard. These costs were documented in Section 6.2, above. The District has seen that these ultra-low NO_x units are both feasible to install and are cost-effective. Hence, staff concludes that meeting the proposed limits will not significantly impact industry.

6.6 Impact to the District

The proposed amendments are not expected to result in any significant increased workload for District staff since the proposed amended rules will mainly incorporate new requirements for newly-installed and modified units, which already require a permit from the District. For those units that are on existing compliance schedules, the District will reach out to industry to remind them of any upcoming requirements.

7. ENVIRONMENTAL IMPACTS – CEQA

7.1 Environmental Impacts

California Public Resources Code section 21159 requires the District to perform an analysis of the reasonably foreseeable environmental impacts of the methods of compliance. The analysis shall take into account a reasonable range of environmental, economic, and technical factors, population and geographic areas, and specific sites.

The analysis must include the following information on the proposed rule:

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

The amendments to Rule 361 and Rule 342 will affect newly installed and modified units. The newer ultra-low NOx units will replace higher-emitting units over time. Since ultra-low NOx units are expected to have the same useful/operational life as standard units, no additional waste is expected to appear in landfills. In addition, old boilers are frequently recycled. The new ultra-low NOx units are expected to cause no adverse environmental impacts.

2) *An analysis of the reasonably foreseeable mitigation measures.*

Since no adverse environmental impacts are expected, no mitigation measures are proposed.

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

No alternative means of compliance are proposed. The emission standards that are proposed have been in place in other Air Districts for the last 5 years, and there are a number of manufacturers that can supply equipment that complies with the proposed rules. Manufacturers are expected to continue to develop compliant equipment, increasing competition and decreasing costs. The above analysis under Public Resource Code section 21159 further demonstrates that there is no reasonable possibility that the amendment of proposed Rule 361 or Rule 342 will have a significant effect on the environment due to unusual circumstances.

7.2 California Environmental Quality Act (CEQA) Requirements

The District prepared a program Environmental Impact Report (EIR) for the 2010 Clean Air Plan that evaluated the potential environmental impacts related to the implementation of several control measures aimed at reducing emissions of both ROC and NOx. The 2010 Clean Air Plan EIR included an analysis of potential impacts related to amendments to Rule 361 and Rule 342.

Staff evaluated the difference between the control measure description that was evaluated in the 2010 Clean Air Plan EIR and the proposed amendments to Rule 361 and Rule 342, to assess whether the difference would result in new significant environmental impacts. The District found

that there were minor technical changes in the proposed amendments that were not examined in the EIR, but none of the conditions described in State CEQA Guidelines section 15162 or 15163, calling for the preparation of a subsequent EIR or supplement to an EIR, are anticipated to result from these differences. Therefore, pursuant to section 15164 of the State CEQA Guidelines, the District will prepare an Addendum to the 2010 Clean Air Plan EIR which will be considered for Board adoption.

8. PUBLIC REVIEW

Workshops

The District held a public workshop to present, discuss, and hear comments on the draft rules on March 14, 2019 at the Solvang City Council Chambers. To inform the public about the workshop, District staff emailed a public notice to everyone who subscribed to the noticing subscription list. Staff also mailed a hardcopy notice to the 72 companies that may be affected by the rule revisions, and shared information about the workshop on the District's social media.

The draft rules were made available on the District's website and a two week comment period followed the workshop. Verbal comments received during the workshop and written comments received during the comment period were considered and incorporated into the proposed amendments to Rule 361 and Rule 342, as appropriate. The public comments that were received in response to the workshop are included as Attachment B to this report.

Community Advisory Council

To facilitate the participation of the public and the regulated community in the development of the District's regulatory program, the District created the Community Advisory Council (CAC). The CAC is composed of representatives appointed by the District's Board of Directors. Its charter is, among other things, to review proposed changes to the District's Rules and Regulations and make recommendations to the Board of Directors on these changes.

The CAC will meet and discuss the amendments to District Rule 361 and Rule 342 on May 1, 2019.

Public Hearing

In accordance with California Health and Safety Code section 40725, the proposed amendments will be publicly noticed and made available at the District offices and on the District's website prior to the public hearing before the Board of Directors. The public will be invited to the hearing and can provide comments on the proposed amendments prior to or at the hearing.

9. REFERENCES

- 1) South Coast Air Quality Management District – Rule 1146.2 (Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters), Amended November 1, 2013.
- 2) South Coast Air Quality Management District – *Staff Report for Proposed Amended Rule 1146 (Emissions of Oxides of Nitrogen from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)*, August 2008.
- 3) South Coast Air Quality Management District – Rule 1146.1 (Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters), Amended November 1, 2013.
- 4) South Coast Air Quality Management District – *Staff Report for Proposed Amended Rule 1146.1 (Emissions of Oxides of Nitrogen from Small Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters)*, August 2008.
- 5) San Joaquin Valley Unified Air Pollution Control District – Rule 4307 (Boilers, Steam Generators, and Process Heaters - 2.0 MMBtu/hr to 5.0 MMBtu/hr), Amended October 16, 2008.
- 6) San Joaquin Valley Unified Air Pollution Control District – Rule 4320 (Advanced Emission Reduction Options for Boilers, Steam Generators, and Process Heaters Greater Than 5.0 MMBtu/hr), Adopted October 16, 2008.
- 7) San Joaquin Valley Unified Air Pollution Control District – *Staff Report for Rule 4306, 4307, and 4320*, October 16, 2008.
- 8) Sacramento Metropolitan Air Quality Management District – Rule 411 (NOx from Boilers, Process Heaters And Steam Generators), Amended August 23, 2007.
- 9) Sacramento Metropolitan Air Quality Management District – *Staff Report for Rule 411 (NOx from Boilers, Process Heaters And Steam Generators)*, August 8, 2007.
- 10) Bay Area Air Quality Management District – Regulation 9, Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional and Commercial Boilers, Steam Generators, and Process Heaters), Amended May 4, 2011.
- 11) Bay Area Air Quality Management District – *Staff Report for Regulation 9, Rule 7 (Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional and Commercial Boilers, Steam Generators, and Process Heaters)*, June 2008.
- 12) Ventura County Air Pollution Control District –Rule 74.15.1 (Boilers, Steam Generators, and Process Heaters), Amended June 23, 2015.
- 13) Ventura County Air Pollution Control District – *Staff Report for Rule 74.15.1 (Boilers, Steam Generators, and Process Heaters)*, June 23, 2015
- 14) California Air Resources Board – *Determination of Reasonably Available Control Technology and Best Available Retrofit Control Technology for Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters*, July 18, 1991.

10. ATTACHMENTS

10.1 Attachment A. FAQs and Rule Clarification

10.2 Attachment B. Public Comments

ATTACHMENT A

FAQs and Rule Clarification

Attachment A: FAQs and Rule Clarification

The following text provides rule clarifications in the format of frequently asked questions:

1. **Question:** I have an existing Rule 361 boiler that was installed in 2005, and I have to retrofit the boiler to meet the 30 ppm NO_x requirement by January 1, 2020, in accordance with the 2008 version of Rule 361. Under these proposed amendments, will I have to change my plans and have the boiler meet the lower 9-12 ppm NO_x limits?

Response: No. All existing boilers will only have to meet the 30 ppm NO_x limits. The ultra-low NO_x limits for new or modified units begin on or after January 1, 2020.

2. **Question:** My company plans to install a new boiler in the year 2022. Can the newly-installed unit qualify for the low-use exemption at the time of installation?

Response: No. Under both Rule 342 and Rule 361, the low-use exemption is only for existing units.

3. **Question:** According to the proposed rules, does my boiler need to meet the ultra-low NO_x standards if I replace my existing burner with a new burner?

Response: Yes, the Rule 361 and Rule 342 definitions for “modification” include all burner replacements.

4. **Question:** Are these rules applicable to a Heat Recovery Steam Generator associated with a gas turbine cogeneration system?

Response: No. Rule 342 and Rule 361 do not apply to a fired or unfired waste heat recovery boiler associated with a gas turbine cogeneration system. Waste heat recovery boilers include Heat Recovery Steam Generators. BARCT requirements for this type of unit will be addressed under a turbine rule because the unit is designed to work in conjunction with a turbine, and shares a common exhaust stack with the turbine.

5. **Question:** What reference should be used when reporting NO_x emissions?

Response: The District requires NO_x to be reported as NO₂.

ATTACHMENT B

Public Comments



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March 28, 2019

Mr. Timothy Mitro
Santa Barbara County
Air Pollution Control District
260 North San Antonio Rd., Suite A
Santa Barbara, CA 93110

Submitted via email: MitroT@sbcapcd.org

Subject: Comments on Rule 342 - Boilers 5MMBtu/hr and greater

Dear Mr. Mitro:

On behalf of Windset Farms, I am submitting these comments to explain our challenges with complying with the requirements set forth in Rule 342, which apply to the natural gas boilers operated at our greenhouse facility located at 1650 Black Road in Santa Maria, California.

Rule 342 requires Windset Farms to replace the burners in the six boilers we operate to reduce NOx emissions to 7 ppm at 3% Oxygen. Our current NOx emission limit is 30 ppm at 3% Oxygen, and near-zero carbon monoxide, and we have complied with this limit since boiler operations began in 2012.

During a site visit to our facility on February 28, 2019, I was able to demonstrate to yourself, David Harris, and William Sarraf how Windset Farms operates the boilers in a unique way that is different than any other facility in the county. Our boilers and burners are specifically designed for horticultural use to generate heat and CO₂ with near-zero carbon monoxide to provide plant fertilizer and an ideal growing environment for the vegetables we produce. At other facilities the boiler exhaust is a waste stream. At our facility it is a valuable ingredient of our growing recipe and the boiler exhaust is directed into the greenhouses via ducting to allow the plants to absorb the CO₂.

Based on the research we have done to explore our options for replacing the boiler burners to comply with Rule 342, our findings indicate there are no available burner replacements at this time that would allow us to continue operating our boilers to match the combination of outputs we are currently receiving, abundant heat and CO₂, with near-zero carbon monoxide. We have contacted several boiler and burner suppliers and manufacturers, and even though there may be an available replacement burner that reduces NOx emissions to 7 ppm, the resulting carbon monoxide emissions rise to concentrations that endanger our greenhouse workers and plants, and they do not produce the CO₂ we require for the plants.



In your letter dated March 5, 2019 (Appendix A), you requested additional information related to our boiler operations for a technical evaluation. The requested input is provided below:

APCD 1: Does Windset Farms continuously monitor the CO concentration in the boiler exhaust or the ambient levels in the greenhouses?

WF 1: Yes, the CO concentration of the exhaust is continuously monitored by a system manufactured by Zantingh, which also manufactures our burners. The system is installed on the exhaust-side of the boiler and the alarm setpoint is 18 ppm CO. When the monitoring system detects 18 ppm CO it shifts the exhaust valve to direct the flue gas to the outdoors and initiates a boiler shut-down that takes place over several minutes to prevent damaging any equipment.

APCD 2: Does Windset Farms have a written protocol to shut off the boilers if the CO levels are too high? If yes, at what CO level does this occur.

WF 2: We do not have a written protocol as the boiler system already has a monitoring system in place.

APCD 3: Are any of the boilers equipped with an oxygen trim system (or similar) and/or a variable frequency drive?

WF 3: Yes, all boilers are equipped with variable frequency drive motors to supply air to burners.

APCD 4: Please provide a written technical evaluation/assessment on the feasibility of retrofitting the six large boilers at Windset Farms to 7 ppm NOx.

APCD 4a-c: The technical evaluation/assessment should include manufacturer costs and discussions on ultra-low NOx burners, flue gas recirculation, oxygen trim systems, and variable frequency drives.

APCD 4b: The technical evaluation/assessment should also document the expected increase in CO emissions from using the various technologies.

APCD 4c: The technical evaluation/assessment should use verified information from multiple manufacturers. Please include technologies such as fiber mesh burners, ceramic burners, and new ultra-low NOx burner designs.

WF 4a-c: The following suppliers/manufacturers were contacted to evaluate potential burner retrofit options. Below is a summary of the conversations and technical information they provided.

California Boiler: Representatives of California Boiler indicate there are no available burner options at this time that can deliver the CO₂ we require without increased CO concentrations. Email communication included as Appendix B.



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Vitotherm: A representative of Vitotherm stated they do not have burners that can meet these emission requirements. Additionally, they recommended not to use CO₂ from burners that have lower NOx emissions. Email communication included as Appendix C.

Zantingh: (Manufacturer of existing burners) Letter states they do not have retrofit available to comply with these emissions requirements that would allow us to provide the CO₂ required for plants without increasing CO to unsafe concentrations. Letter included as Appendix D.

Thermeta: A representative of Thermeta states they can supply a burner that achieves CO emissions below 5 ppm, however, they were unable to provide specifics on CO₂ generation and NOx. Email communication included as Appendix E.

APCD 5: If your technical evaluation/assessment shows that 7 ppm NOx is not feasible, what is the lowest NOx level that is feasible?

WF 5: This is difficult to determine because our research indicates that none of the available options we have reviewed would provide the outputs of heat and CO₂ that our operation requires.

Based on the information provided above, Windset Farms has demonstrated it is not feasible at this time to retrofit burners to comply with Rule 342 requirements and continue to operate the boilers to produce the CO₂ needed for successful vegetable production without increasing CO concentrations to harmful levels inside the greenhouses. Windset Farms respectfully requests an exemption to Rule 342 for natural gas boilers with capacities of 5MMBtu/hr and greater operated at horticultural greenhouse facilities in Santa Barbara County, until such time that the burner manufacturers provide a solution to comply with your requirements, and also provide the outputs required for successful greenhouse production.

If you have any questions or require additional information, please contact me at (805) 868-8117.

Sincerely,

A handwritten signature in blue ink, appearing to read "Dillon Kass".

Dillon Kass
Regulatory Compliance Manager
Windset Farms
1650 Black Road
Santa Maria, CA 93458
dkass@windset.com



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Appendices:

- A. Letter dated March 5, 2019 from APCD
- B. Email dated March 27, 2019 from California Boiler
- C. Email dated March 21, 2019 from Vitotherm
- D. Letter dated March 21, 2019 from Zantingh
- E. Email dated March 28, 2019 from Thermeta





March 5, 2019

Dillon Kass
Regulatory Compliance Manager
Windset Farms
1650 Black Road
Santa Maria, CA 93458

Re: Follow-up to the Windset Farms Site Visit

Dear Mr. Kass,

Thank you for taking the time to provide us a tour of the Santa Maria facility. The purpose of the site visit was to assist our evaluation of potential boiler Best Available Retrofit Control Technology (BARCT) technology requirements, as mandated by Assembly Bill 617.

The District's initial research shows that large boilers with a maximum rated heat input capacity greater than 20 million British thermal units per hour (MMBtu/hr) are capable of achieving a NOx emission rate of 7 ppm¹ and near-zero carbon monoxide (CO) emissions.

As observed during our site visit, Windset Farms operates the boilers in a different manner than most other facilities. Specifically, the boiler exhaust is vented directly into the greenhouses instead of directly to the atmosphere. You noted that near zero concentrations of CO in the greenhouses are critical to the health of the plants. This clearly differentiates Windset Farms from other facilities.

We are requesting your assistance with our technical evaluation. These are the areas that your input is needed:

1. Does Windset Farms continuously monitor the CO concentration in the boiler exhaust or the ambient levels in the greenhouses?
2. Does Windset Farms have a written protocol to shut off the boilers if the CO levels are too high? If yes, at what CO level does this occur?
3. Are any of the six boilers equipped with an oxygen trim system (or similar) and/or a variable frequency drive?

¹ Parts per million by volume, expressed on a dry gas basis and corrected to 3% oxygen content.

4. Please provide a written technical evaluation/assessment on the feasibility of retrofitting the six large boilers at Windset Farms to 7 ppm NOx.
 - a. The technical evaluation/assessment should include manufacturer costs and discussions on ultra-low NOx burners, flue gas recirculation, oxygen trim systems, and variable frequency drives.
 - b. The technical evaluation/assessment should also document the expected increase in CO emissions from using the various technologies.
 - c. The technical evaluation/assessment should use verified information from multiple manufacturers. Please include technologies such as fiber mesh burners, ceramic burners, and new ultra low-NOx burner designs.

5. If your technical evaluation/assessment shows that 7 ppm NOx is not feasible, what is the lowest NOx level that is feasible?

The 2018 Annual Report that was submitted by Windset Farms made a reference to a future, seventh, boiler (Boiler #6). Under the proposed amendments to District Rule 342, all newly installed equipment with a rated heat input greater than 20 MMBtu/hr will be subject to the 7 ppm NOx emission limit. Please specify the expected timeline for any future boiler installation.

Due to the rulemaking timeline we are under, we are requesting comments (including a response to this letter) on the draft amendments to Rule 342 by March 28, 2019. If you have any additional questions or concerns, please feel free to contact me at (805) 961-8883 or via email at MitroT@sbcapcd.org.

Sincerely,



Timothy Mitro
Air Quality Engineer
Planning Division

cc: Michael Goldman

APPENDIX B

Dillon Kass

From: Dillon Kass
Sent: Thursday, March 28, 2019 9:36 AM
To: Dillon Kass
Subject: FW: replacement burners - CA boiler

From: Roehl Fabay <rfabay@californiaboiler.com>
Sent: Wednesday, March 27, 2019 2:58 PM
To: Dillon Kass <DKass@windset.com>
Cc: Scott Krahn <skrahn@californiaboiler.com>
Subject: RE: replacement burners

Dillon - below is what we told APCD yesterday.

"After looking into the application with CO2 dosing in the green houses I need to look at the exact boiler application. As previous discussed if they go with metal mesh technology it runs higher O2 like 7.5% to 9.5% which will drastically lower the CO2 output which cause a problem with the green house. If we use a Power Flame UCM burner with FGR the higher the required NOX the higher the amount of FGR. With that said the FGR the higher the potential of making CO. I know you want the NOX levels to drop but I think with current technology the CO can be close to near 0 with NOX requirements of 30 PPM and possibly 15 PPM NOX. We can look thru all our testing on the Ultra-low NOX burners with FGR and see what CO levels are normal at different NOX levels and get back to you. I know in China this same burner has a requirement of 15 PPM NOX and 10 PPM CO and has no problem. I will see what information I can come up with and let you know. I know there are several new burner designs for 30PPM NOX without FGR but low O2 and good turn down."

Thanks!

Roehl Fabay
California Boiler

Dillon Kass

Subject: FW: low NOx burner information

From: Ed Roeleveld <eroeleveld@vitothem.nl>
Sent: Thursday, March 21, 2019 2:10 AM
To: Dillon Kass <DKass@windset.com>
Cc: Dennis Van Alphen <dennis@totalenergygroup.com>
Subject: RE: low NOx burner information

Hello Dillon,

We do not have burners for that.
And I would not recommend using CO2 from burners that do 7 or 9 ppm.
Liquid CO2 is than the safest option.

Met vriendelijke groet, Kind Regards,



Vitothem

Ed Roeleveld | Manager Sales
VITOTHERM B.V.- Overgauwseweg 8 - 2641 NE Pijnacker - Nederland
Tel: +31 (0)15-3694757 Direct: +31 (0)6-21819647
E-mail: eroeleveld@vitothem.nl | Web: www.vitothem.nl

Van: Dillon Kass [<mailto:DKass@windset.com>]
Verzonden: woensdag 20 maart 2019 22:04
Aan: info <info@vitothem.nl>
Onderwerp: low NOx burner information

Hello,

Do you make boiler burners that emit 7ppm – 9ppm NOx and near zero carbon monoxide?

We currently have Crone boilers with Zantingh burners and the local Air Pollution Control District is making rules to lower NOx emissions.

We direct the boiler exhaust into our greenhouses and can't have any CO.

Best regards,

Dillon Kass, P.G.
Regulatory Compliance Manager
Windset Farms

1650 Black Road
Santa Maria, CA 93458-9733

Phone: 805 314 2800 x.4443
Cell: 805 868 8117
Email: DKass@windset.com
Web: www.windsetfarms.com



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APPENDIX D

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P.O. Box 255
1430 AG Aalsmeer (NL)
Tel. +31 (0)297 219 100
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www.zantingh.com

To Whom it may concern



ZANTINGH

Contact:	Our reference:	Direct dial:	Date:
BB/RT	Windset	+ 31 (0)297 – 219 100	21 March 2019
		e-mail: info@zantingh.com	

Regarding: Zantingh burners

Dear Madam, Sir,

The low NOx gas burners we supply are well known and common used in glass houses for many years in countries all over the world; not only to provide heat but also as CO2 generators. CO2 dosage in glass houses using the flue gasses of natural gas fired burners is an important issue especially for vegetable growers that are in need of a large CO2 volume for growing their crops. Especially also in your situation were you make use of the high-quality state-of-the-art semi-closed greenhouses. In fact modern growers like Windset reduce the CO2 emission of their heating systems almost to zero by bringing the CO2 they produce as fertilization to their crops, which is a large contribute to the environment.

To be able to provide the best quality flue gasses Zantingh worked hard to develop a low NOx combustion system that provides the lowest possible NOx emission with an optimum CO2 content and absolutely zero ppm CO emission. This is necessary because carbon monoxide is very dangerous for people or animals (working) inside the glass houses when dosing CO2. For the same reason all our systems are provided with CO detectors as an extra safety. Also when having CO in combustion Ethane arises in very low concentrations. Difficult to measure, but Ethane is very harmful for the growth of crops. Finding the right balance between these figures has been a real challenge and we are proud that we have reached this point by using so-called in-furnace combustion technology at our complete burner range in capacities between 1 and 15 MW. Next to reaching the best emission standards it is also necessary to keep the O2 figure as low as possible to be able to reach the highest efficiency of the gas installation. Also a low as possible flue gas temperature from boiler to condenser is required and a turn down ratio as high as possible > 6 -1 or higher.

ABN AMRO 49.42.46.294
BIC ABNANL2A
IBAN NL17ABNA0494246294
KvK. A'dam 34041535
BTW nr. NL0015.13.138.B.01

All by all we managed to get your burners always below 25 ppm NOx at 3% O2 with 0 ppm CO by using the best available technology at this point.

As we know going further down in NOx is possible by using external flue gas recirculation (FGR) but as figures show with huge consequences, especially for the amount of carbon monoxide that occurs (levels even up to 400 ppm). For that reason this technology cannot be used yet when gas burners produce flue gasses that are used for CO2 dosing. In fact at our kind of burner combustion systems FGR is an old-fashioned technology that we used at the beginning of the low NOx development and before we ended up with in-furnace technology; a much more elegant, economical and stable technique that is less complex, using less parts, less energy and asking for less maintenance each year. That also means that if the market demand for lower NOx emissions than 25 ppm increases we definitely need to put more R&D into the development of FGR technologies that don't have these disadvantages.



We trust to have informed you well enough for the moment. If you may have any questions left please do not hesitate to contact us.

With kind regards,



Zantingh BV

APPENDIX E

From: Egbert de Gelder <egbertdegelder@thermeta.nl>
Sent: Thursday, March 28, 2019 7:09 AM
To: Dillon Kass <DKass@windset.com>
Cc: Lorenzo vd Ark <sales@thermeta.nl>
Subject: Re: ultra low NOx burners

Dear Dillon,

I have asked the specialists to inform me the exact CO and NOx-emissions of these two models. One of the specialist is out of the office until monday, so it could take some days.

I expect that the burners will have a CO-emission between 0-5 ppm.

Thermeta is like Zantingh delivering burners for the greenhouse business all over the world. We are situated in the region Westland in The Netherlands, so we know everything about CO₂-dosing and the importance of having no CO in the flue gasses.

Regarding CO in flue gasses, the harmful gas in the flue gas is actually not CO; C₂H₄ (Ethene or Ethylene) is the trouble maker for the crops. When there is C₂H₄ in the combustion then there is also CO and CO-detection is 10 times cheaper than C₂H₄ detection. This is why everyone in the greenhouse business is checking CO to keep the plants healthy instead of checking C₂H₄.

But looking into the proces of forming C₂H₄ it is necessary that there is less Oxygen (O₂) available; only in that situation you will get CO and C₂H₄. In fact C₂H₄ will only exist if there is no O₂ left and there is already 40 ppm (or more) CO in the flue gas. This is why most CO-detectors have their alarm level set to 18 - 20 ppm CO (half way the limit of 40 ppm).

Looking into the proces of forming CO, you can devide this in 2 sections.

1. There is too less oxygen available; as a result you will get CO and C₂H₄
2. There is a surplus of oxygen and the flame becomes too cold to burn 100%; as a result you will get CO but NO C₂H₄ !!!

The burner MTH is always in section 2 with a lot of oxygen; so no C₂H₄ can be formed in standard situation, so it is perfectly safe for the crops / plants. I'm convinced this combustion is also realizing a very low CO emission of lower than 5 ppm.

Kind regards / Met vriendelijke groet,
Egbert de Gelder

Op wo 27 mrt. 2019 om 18:50 schreef Dillon Kass <DKass@windset.com>:

Hello Egbert,

Following up on my questions below, can you please provide some information on carbon monoxide concentrations for these models #420-7 & #504-7?

Your help is greatly appreciated!

Dillon Kass
Windset Farms

Cell: 805 868 8117

Email: DKass@windset.com

From: Dillon Kass
Sent: Tuesday, March 26, 2019 9:56 AM
To: 'Egbert de Gelder' <egbertdegelder@thermeta.nl>
Cc: 'Lorenzo vd Ark' <sales@thermeta.nl>
Subject: RE: ultra low NOx burners

Hi Egbert – one other question: What are the carbon monoxide emissions of the two burner models #420-7 & #504-7?

Dillon Kass
Windset Farms

Cell: 805 868 8117

Email: DKass@windset.com

From: Dillon Kass
Sent: Tuesday, March 26, 2019 8:12 AM
To: 'Egbert de Gelder' <egbertdegelder@thermeta.nl>
Cc: Lorenzo vd Ark <sales@thermeta.nl>
Subject: RE: ultra low NOx burners

Hello Egbert,

We use our existing boilers/burners for heat and CO2 generation for plant growth inside the greenhouses. Could you please describe what concentrations of CO2 we would get with the Burner Models #420-7 and #504-7?

Thanks,

Dillon Kass
Windset Farms

Cell: 805 868 8117

Email: DKass@windset.com

From: Egbert de Gelder <egbertdegelder@thermeta.nl>
Sent: Thursday, March 21, 2019 8:04 AM
To: Dillon Kass <DKass@windset.com>
Cc: Lorenzo vd Ark <sales@thermeta.nl>
Subject: Re: ultra low NOx burners

Hello Dillon,

With a Crone CET boiler our Thermeta burner will produce 35 mg/Nm³ @ 3% O₂ (= 41 mg/Nm³ @ 0% O₂) (= 20 ppm NO_x @ 0% O₂).

However we can provide you an Industrial Combustion burner type MTH which achieves Ultra-low-NO_x emissions up to 9 ppm without FGR. See the attached brochure and technical leaflet.

You will probably need the MTH 504-7 (according to the attached brochure). We can provide you the necessary gas train and boiler control panel for burner, boiler, condenser and CO₂-unit as well.

Please let me know if you are interested and who you would want to install the equipment.

Kind regards / Met vriendelijke groet,

Egbert de Gelder

----- Forwarded message -----

From: Dillon Kass <DKass@windset.com>
Date: wo 20 mrt. 2019 om 22:09
Subject: ultra low NOx burners
To: info@thermeta.nl <info@thermeta.nl>

Hello,

Do you make boiler burners that emit 7ppm – 9ppm NO_x and near zero carbon monoxide?

We currently have Crone boilers with Zantingh burners and the local Air Pollution Control District is making rules to lower NO_x emissions.

We direct the boiler exhaust into our greenhouses and can't have any CO. We are evaluating possible burner replacement options.

Best regards,



Dillon Kass, P.G.
Regulatory Compliance Manager
Windset Farms

1650 Black Road
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