SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Draft Staff Report

Proposed Amended Rule 1153.1 – Emissions of Oxides of Nitrogen from Commercial Food Ovens

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EXECUTIVE SUMMARY

Proposed Amended Rule 1153.1 – Emissions of Oxides of Nitrogen from Commercial Food Ovens (PAR 1153.1), seeks further emission reduction of oxides of nitrogen (NOx) in the South Coast air district and is part of a suite of "landing" rules for facilities regulated under the REgional Clean Air Incentives Market (RECLAIM) or under another existing source specific rule. The goal is to conduct a Best Available Retrofit Control Technology (BARCT) analysis to ensure that emissions from all equipment subject to PAR 1153.1 are controlled to achieve the maximum technically feasible, cost-effective emission reductions. Control Measure CMB-05 of the Final 2016 Air Quality Management Plan (AQMP) included a five tons per day NOx emission reduction as soon as feasible but no later than 2025, and the adoption resolution for the 2016 AQMP directed staff to transition the RECLAIM program to a command-and-control regulatory structure requiring BARCT as soon as practicable. In addition, the 2022 AQMP established NOx reduction targets that require the transition to zero-emission technologies wherever feasible.

PAR 1153.1 regulates NOx emissions from commercial food ovens that are used to prepare food or products for making beverages for human consumption that require South Coast AQMD permits. PAR1153.1 would affect approximately 97 facilities that operate approximately 224 commercial food ovens. Six facilities operating commercial food ovens are currently part of the RECLAIM program. The emissions limits in the latest version of this rule adopted in 2014 ranged from 40 ppmv to 60 ppmv depending on process temperature. After a comprehensive BARCT assessment which included an analysis of technical feasibility and cost-effectiveness, PAR 1153.1 proposes lower limits for all commercial food oven categories. Upon rule adoption, PAR 1153.1 includes a 30 ppmv Phase I NOx emission limit for commercial food ovens other than tortilla ovens firing infrared burners only, which has a 15 ppmv NOx limit. In addition, PAR 1153.1 includes zero emissions NOx limits for most oven categories at a future effective date. The zero emission limits are technology forcing for most categories, meaning there are currently not a lot of commercially available units. The rule establishes a future effective date of January 1, 2027, for categories where staff has identified comparable zero-emission units under Phase II emission limits; these are mostly smaller units with lower energy demand. The Phase II limits also include a 30/0 ppmv NOx limit that will allow for a hybrid of natural gas/electricity to power larger bakery ovens; the conventional natural gas burners can be used to preheat the oven and electric heating element can be used for routine baking operations. The rule also establishes a future effective date of January 1, 2030, for larger units and units that are only currently available in as smaller units under Phase III emission limits. Units with zero-emission limits will not require permits to limit the NOx or CO emissions and will not have any source test requirements resulting in time and cost savings for the facilities.

PAR 1153.1 also includes an Alternative Compliance Schedule Plan to address additional time that might be needed for a utility to provide the necessary energy to the facility to power the electric oven(s). An alternative compliance schedule will only be considered for upgrades that are outside the control of the facility.

The public process for PAR 1153.1 consisted of seven working group meetings, two public workshops, and multiple meetings with industry stakeholders and technology vendors to obtain feedback. The total NOx emissions inventory for PAR 1153.1 is approximately 0.2 tons per day (tpd) based on 2019 emissions. Estimated NOx emission reductions are 0.19 tons tpd at full implementation by 2047.

CHAPTER 1 : BACKGROUND

INTRODUCTION

The South Coast Air Quality Management District (South Coast AQMD) Governing Board adopted the REgional Clean Air Incentives Market (RECLAIM) program in October 1993. The purpose of RECLAIM was to reduce NOx and Sulfur Oxides (SOx) emissions through a market-based approach for facilities with NOx or SOx emissions greater than or equal to four tons per year. The 2016 Final Air Quality Management Plan (2016 AQMP) included Control Measure CMB-05: Further NOx Reductions from RECLAIM Assessment (CMB-05) to achieve five tons per day of NOx emission reductions as soon as feasible but no later than 2025. Further, the adoption resolution for the 2016 AQMP directed staff to transition the RECLAIM program to a command-and-control regulatory structure requiring BARCT as soon as practicable. In addition, the 2022 AQMP established NOx reduction targets that require the transition to zero-emission technologies wherever feasible.

As facilities transition out of NOx RECLAIM, a command-and-control rule that includes NOx emission standards that reflect BARCT is needed. PAR 1153.1 is a "landing" rule for RECLAIM facilities with permitted commercial food ovens and will establish NOx and CO emissions limits for units subject to the rule at RECLAIM, non-RECLAIM, and former RECLAIM facilities. Staff is proposing zero-emission NOx limits where technology has been identified as technically feasible and cost-effective.

REGULATORY BACKGROUND

On November 7, 2014, South Coast AQMD adopted Rule 1153.1 – Emissions of Oxides of Nitrogen from Commercial Food Ovens (Rule 1153.1). Rule 1153.1 is applicable to commercial food ovens not participating in the RECLAIM program (non-RECLAIM) and establishes NOx and CO limits based on the process temperature.

Table 1-1. Rule 1153.1 NOx Emission Limits

NOx Emission Limit for In-Use Units	
NOx Emission Limit PPMV @ 3% O_2, dry or Pound/MMBtu heat input	
Process Temperature	
≤ 500°F	*> 500°F*
40 ppmv or 0.042 lb/MMBtu	60 ppmv or 0.073 lb/MMBtu

Prior to the adoption of Rule 1153.1, commercial food ovens were regulated under Rule 1147 – NOx Reductions from Miscellaneous Sources (Rule 1147). In 2014, staff proposed moving food ovens, roasters, and smokehouses to a new rule, Proposed Rule 1153.1, which was specific to commercial food ovens. Rule 1153.1 had a higher NOx emissions limit than the corresponding ones in Rule 1147 and delayed compliance dates to address the specific challenges to commercial food ovens. The adoption of Rule 1153.1 allowed commercial food ovens to be placed on a more suitable compliance schedule with achievable emission limitations.

RECLAIM PROGRAM

The RECLAIM program is a market-based program that was adopted in 1993 and applies to facilities with NOx and SOx annual emissions greater than or equal to four tons per year. RECLAIM replaced a series of existing and future command-and-control rules and was designed to achieve BARCT in aggregate. At the start of RECLAIM, facilities received an allocation of RECLAIM Trading Credits (RTCs). At the end of each compliance year, facilities were required to hold RTCs that are equal to or greater than their actual annual emissions.

Under RECLAIM, facilities can install pollution control equipment to reduce NOx emissions or buy or trade RTCs. Any unused RTCs from over control, reduction in throughput, or equipment shutdowns, can be sold or traded. Allocations were based on the facility's reported emission rate since there were no proposed BARCT limits at the time. In response to concerns regarding actual emission reductions and implementation of BARCT under RECLAIM, Control Measure CMB-05 of the 2016 AQMP committed to an assessment of the RECLAIM program to achieve further NOx emission reductions of five tons per day, including actions to transition the program and ensure future equivalency to command-and-control regulations. During the adoption of the 2016 AQMP, the adoption resolution directed staff to modify Control Measure CMB-05 to achieve the five tons per day NOx emission reduction as soon as feasible but no later than 2025, and to transition the RECLAIM program to a command-and-control regulatory structure requiring BARCT-level controls as soon as practicable. PAR 1153.1 is needed to transition RECLAIM facilities with commercial bakery ovens to a command-and-control regulatory structure. PAR 1153.1 will apply to corresponding facilities while they are in RECLAIM and after their transition out of RECLAIM when they become a former RECLAIM facility.

AFFECTED INDUSTRIES

PAR 1153.1 affects manufacturers and operators of commercial food ovens, roasters, and smokehouses produce food and beverage products (NAICS 311 and 312). Staff identified 97 facilities with a total of 202 commercial food ovens that are regulated by PAR 1153.1. Six out of 97 facilities are currently in the RECLAIM program and approximately 45 commercial food oven units are currently located at RECLAIM facilities with the remaining 157 units located at non-RECLAIM facilities. A breakdown of unit categories is shown in Figure below.

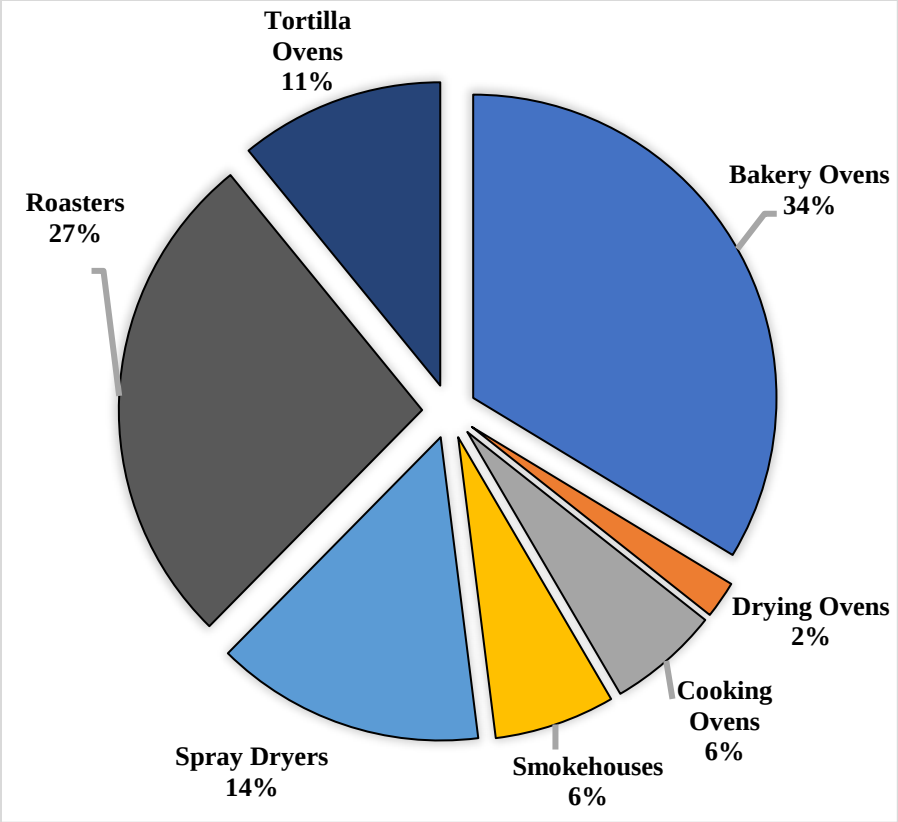

Figure 1-1. Commercial Food Oven Categories Subject to PAR 1153.1

Roasters include coffee roasters and nut roasters which are mostly small units with emissions less than or equal to one pound per day of NOx; therefore, qualify as exempt under the current one pound per day or less rule exemption.

PUBLIC PROCESS

PAR 1153.1 was developed through a public process that included a series of Working Group Meetings. The table below summarizes the Working Group Meetings held throughout the development of PAR 1153.1 and provides a summary of the key topics discussed at each of the Working Group Meetings. Staff began the rule development process second quarter of 2021 and has conducted seven Working Group Meetings to date. Staff also held individual stakeholder meetings as needed and conducted several site visits to the affected facilities. The Working Group is composed of affected facilities, consultants, equipment vendors, and environmental groups. The purpose of the Working Group Meetings was the BARCT assessment and the development of the proposed amendments and NOx limits for PAR 1153.1.

Table 1-2. Summary of Working Group Meetings

Date	Meeting Title	Highlights
July 9, 2021	Working Group Meeting #1	• Rule Development Process • RECLAIM background • Rule 1153.1 background • Potential universe • Equipment types and NOx emissions • BARCT analysis overview
June 8, 2022	Working Group Meeting #2	• Background and Regulatory commitments • Status of Rule Development • Stakeholder comments • Initiated BARCT Assessment (first three steps) • Emission data evaluation for all equipment
July 27, 2022	Working Group Meeting #3	• Follow-up to stakeholder comments from WGM#2 • Baseline emissions • Technology demonstration project and emerging technology • Rondo Energy heat battery system presentation • Continuation of the BARCT Assessment • Presented the results from the fourth step of the technology assessment – "Assessment of Pollution Control Technology" • Proposed initial BARCT limit of 30 ppmv
August 31,2022	Working Group Meeting #4	• Micron Fiber-Tech presented on their metal fiber gas burners and combustion systems • Continued BARCT Assessment and discussed commercial oven categories and burner types • Proposed BARCT limits for categories • Presented cost-effectiveness analysis and Proposed BARCT limits
September 23, 2022	Working Group Meeting #5	• Rule language and structure changes overview
September 16, 2022		Release Preliminary Draft Rule and Staff Report
October 6, 2022		Public Workshop
October 21, 2022		Stationary Source Committee
February 2, 2023	Working Group Meeting #6	• 2022 AQMP and updated cost-effectiveness threshold • BARCT re-assessment and revised proposal
March 3, 2023		Release March Pre-Preliminary Draft Rule Language
March 8, 2023	Working Group Meeting #7	• Rule language updates • Updated compliance schedule

Date	Meeting Title	Highlights
March 17,2023		Release Preliminary Draft Rule Language and Staff Report
March 30, 2023		Public Workshop
April 21, 2023		Stationary Source Committee
May 5, 2023		Set Hearing
June 2, 2023		Public Hearing

CHAPTER 2 : BARCT ASSESSMENT

BARCT ASSESSMENT

The purpose of a BARCT assessment is to assess available pollution controls to establish emission limits for specific equipment categories consistent with the state law. Under California Health and Safety Code Section 40406, BARCT is defined as:

> "an emission limitation that is based on the maximum degree of reduction achievable by each class or category of source, taking into account environmental, energy, and economic impacts."

The BARCT assessment follows a framework through the rule development process and includes public participation. The figure below shows the overall BARCT assessment approach.

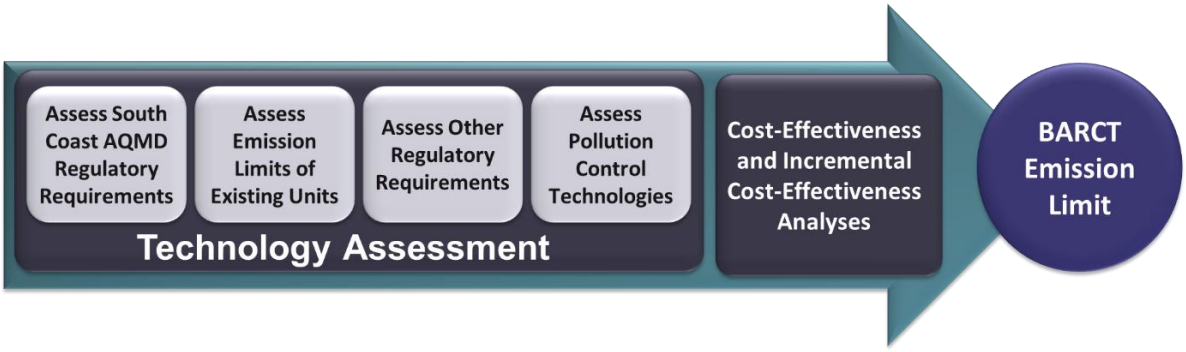

Figure 2-1. BARCT Assessment Approach

Technology Assessment

Staff conducted a thorough technology assessment to evaluate the NOx control technologies that will achieve the BARCT level for commercial food oven equipment at facilities subject to PAR 1153.1. The technology assessment consists of four steps including the assessment of South Coast AQMD requirements, a complete assessment of emission limits of existing units, review of other regulatory requirements, assessment of available pollution control technologies.

Class and Category of Equipment

One of the first steps in the BARCT assessment is to establish the class and category of equipment. Staff collaborated with the stakeholders to establish the class and category by accounting for the type of equipment, burner type, zero-emission units, and other unique operational features of the units. Figure 2-2 lists the category of equipment established for the BARCT assessment of the equipment subject to PAR 1153.1. Based on the BARCT technology assessment, staff initially did not consider class since the size or maximum rated heat input for most units are less than 12.3 MMBtu/hr and only four major categories of commercial food oven equipment were identified. However, after meeting with several stakeholders, staff further separated the bakery ovens into three subcategories based on oven type and unit size.

Equipment Categories and Processes

There are two main types of commercial food ovens – continuous tunnel ovens and batch ovens. Continuous tunnel ovens continually take in food items, cook them, and deliver the cooked product to an area where it cools prior to packaging. One sub-category of a continuous type of oven is a conveyorized type of oven that is often used for hot dog, hamburger bun, and panned bread production. Batch ovens take in food items that are removed when the process is complete. Most bakery and tortilla ovens are conveyor type whereas smokehouse ovens and roasters are batch

operations. Regardless of operation type, most commercial food ovens operate less than 700°F with tortilla ovens operating near the higher temperature operating range. Food ovens are designed with a specific type of burner so that the oven can produce specific food products. There are primarily three types of burners used in commercial food ovens: Ribbon burners, infrared burners, and traditional nozzle-mix cone type burner such as a Maxon Ovenpak or Eclipse Winnox. Each cooked product requires a specific taste, texture, appearance, and other specific qualities unique to the product; therefore, food producers require specific oven and burner combinations. Staff evaluated facility permits and identified commercial food ovens that require specific burner characteristics and categorized commercial food ovens into seven main categories with several subcategories as follows.

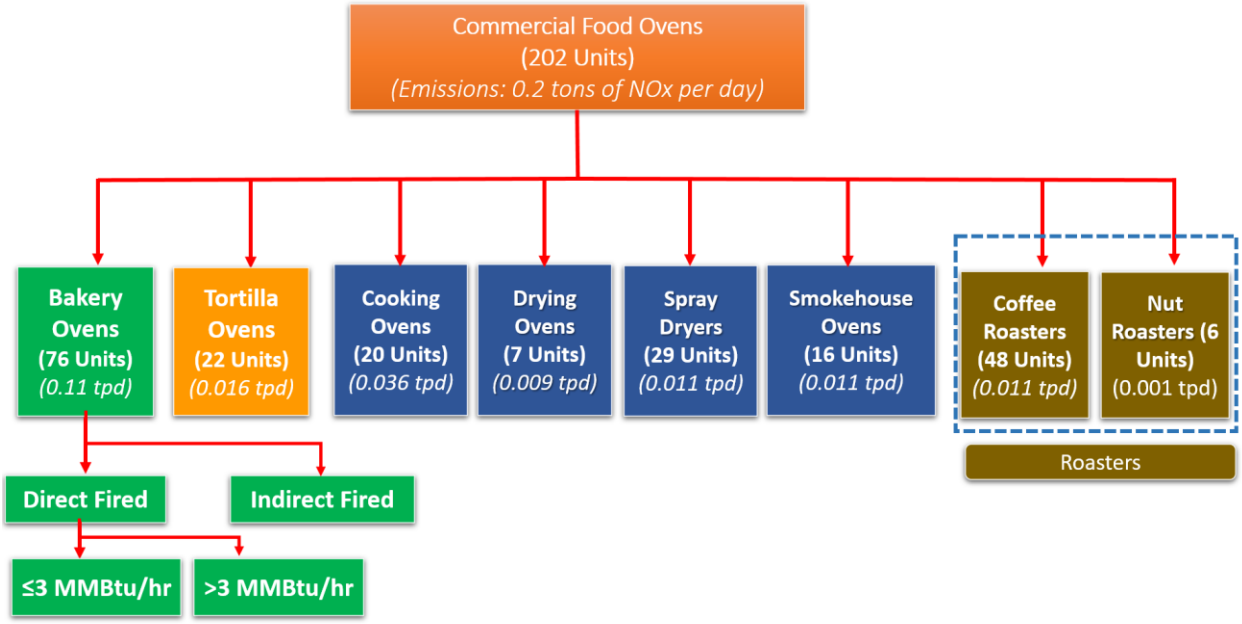

Figure 2-2. Commercial Food Oven Categories

The four categories of commercial food ovens identified are bakery ovens, tortilla ovens, other food ovens, and roasters. The other food oven category grouped cooking ovens, drying ovens, spray dryers, dryers, and smokehouses in one category because these ovens have similar heating and burner characteristics. The roaster category uses similar type of burners as the other food oven category, but units in roasters category differ primarily because they are indirect-fired units where the heat and hot air heats a hotplate or surface in which the product is roasted. Food ovens by design can have multiple burners in a single oven and the number of burners is determined by the type of food product being produced. Depending on size, large conveyor type bakery ovens and tortilla ovens can have from 12 to 181 individual ribbon or infrared burners in a single oven and often separated into several different heating zones, whereas the other food oven category will have one or two nozzle-mix cone type burners. This difference also results in a difference in burner costs. Based on discussions and meeting with technology vendors and industry stakeholders, ribbon burners and infrared burners will typically have a higher cost. To ensure that burner costs and cost-effectiveness is evaluated and captured properly, staff separated the food ovens into the four main categories in which the BARCT assessment will be conducted. The table below

summarizes the initial evaluation of commercial food ovens and the various type of burners used in each category along with considerations gathered from the vendor and industry stakeholder meetings.

Table 2-1. Burner Type used by Commercial Food Oven Categories

Burner Type by Category			
Category	**Description**	**Burner Type**	**Considerations**
Bakery and Tortilla Ovens	• 98 units in Category • Ovens are used to cook bakery or tortilla products • Conveyor type or tunnel type • Air heater • 2019 NOx Emissions: 0.11 tpd	• Ribbon Burners • Infrared (IR) Burners • Low NOx Burners (i.e., Maxon OvenPak type, Eclipse Winnox) • Mesh fiber burners	• Ribbon Burners, and LNB can achieve 30 ppm • IR Burners can achieve 15 ppm • Commercially available • AMF offers an electric tunnel oven but very few real-world installations
Other Food Ovens	• 72 Units in Category • Spray Dryers • Dryers • Cooking Ovens • Smokehouse Ovens • 2019 NOx Emissions: 0.07 tpd	• Low NOx Burners (i.e, Maxon OvenPak type, Eclipse Winnox) • Mesh fiber burners	• Traditional OvenPak style LNB options available • Two smokehouse ovens are electric, but also uses steam • Some units such as dryers use steam as a heat source
Roasters	• 54 Units in Category • Coffee Roasters • Nut Roasters • 2019 NOx Emissions: 0.02 tpd	• Low NOx Burners (i.e, Maxon OvenPak type, Eclipse Winnox) • Mesh fiber burners	• Indirect-fired units • Single burner • Most are small units exempted with permit conditions limiting operation

Assessment of South Coast AQMD Regulatory Requirements

Staff reviewed existing South Coast AQMD NOx regulations for commercial bakery ovens and similar equipment. The combustion equipment used for producing food products for human consumption consist of four main source categories previously discussed (see Figure 2-1). In addition, staff evaluated current South Coast AQMD NOx regulations for other similar combustion equipment to assess potential technology transfer. Since commercial food ovens were originally included in Rule 1147, staff evaluated the current requirements for the rule and includes a review of existing BACT determinations for food ovens. The following table summarizes the current South Coast AQMD NOx rules that staff evaluated as part of the BARCT technology assessment.

Table -2-2. South Coast AQMD Regulatory Requirements

Regulation/Rule Title	Relevant Unit/Equipment	Emission Limits ppmv at 3% O2, dry
Rule 1153.1 – Emissions from Gaseous- and Liquid-Fueled Engines	Commercial Food Ovens	40 ppmv (≤ 500°F) or 60 ppmv (>500°F)
Rule 1147 – NOx Reductions from Miscellaneous Sources	Oven, Dehydrators, Cookers, Roasters	20 ppmv (≤ 1,200°F) or 30 ppmv (>1,200°F)
Rule 1147.1 – NOx Reductions from Aggregate Dryers	Aggregate Dryers (dryers, rotary dryers, fluidized bed, rotary kilns)	30 ppmv
Best Available Control Technology (BACT) Guidelines for Food Ovens	Ribbon Burners, Infrared Burners, Other Direct Fired Burners	• Ribbon Burners: 30 ppmv (≤ 500°F) or 60 ppmv (>500°F) • Other Direct Fired Burners: 30 ppmv • Infrared Burners: 30 ppmv

Assess Emission Limits of Existing Units

Assess Emission Limits of Existing Units

To assess emissions of existing units, staff evaluated source test data for various equipment categories to confirm existing limits were achievable. The assessment confirmed the current performance of NOx control controls for commercial food oven applications. The source test data showed that many units were already performing at or below 30 ppmv with only one unit performing at the 60 ppmv level. Further review of additional permit information, facility survey data, and source test data confirmed that approximately 131 out of the 202 food ovens were already performing below the 30 ppmv level and most units have an existing permit limit of 30 ppmv; 14 of these units were new units which were required to meet Best Available Control Technology (BACT) . For the tortilla oven category, staff identified 12 tortilla ovens that recently installed IR burners utilizing metal fiber technology from Micron Fiber-Tech, and all were achieving 15 ppmv or less NOx measured at 3 percent oxygen – all source test measurements were conducted by a third-party company approved by South Coast AQMD. As a result, staff proposed an additional category for tortilla ovens solely firing IR burners at 15 ppmv NOx since it is currently achieved-in-practice.

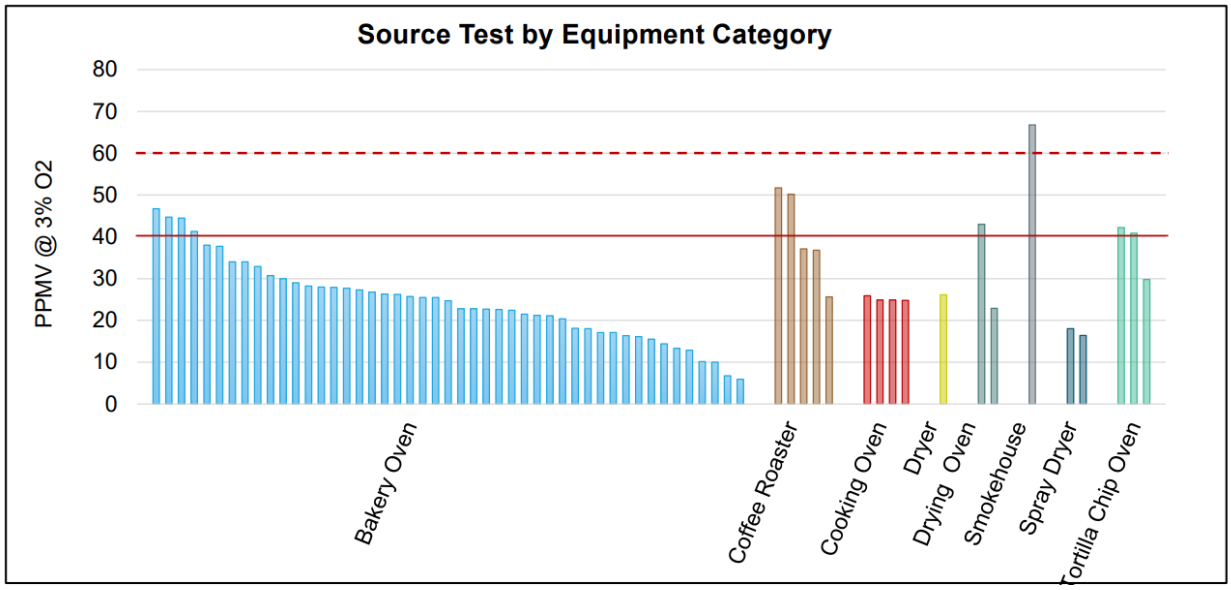

Figure 2-3. Source Test Data for Commercial Food Oven Categories

Assess Other Regulatory Requirements

Other Regulatory Requirements

The next step of the technology assessment is to identify other agencies that regulate the same or similar equipment and compare the regulatory requirements and emissions limits. The purpose of this step is to evaluate if there are applicable emissions limits that should be considered. The table below includes the list of regulations by other agencies which staff reviewed for applicable emissions limits. The specific emission limits and their impact on the BARCT assessment is included for each category is discussed later for each of the equipment categories.

Table 2-32. Other Regulatory Requirements

Regulatory Entity	Regulation/Rule Title	Relevant Units/Equipment
San Joaquin Valley Air Pollution Control District	Regulation 4309 – Dryers, Dehydrators, and Ovens (Units with a total rated heat input capacity of 5 MMBtu/hr or greater) – *Exempts smokehouses, roasting units, and units used to bake or fry food for human consumption*	Milk, Cheese, and Dairy Processing <20 MMBtu/hr: 3.5 ppmv (19% O2) or ~32 ppmv (3% O2)
		Milk, Cheese, and Dairy Processing ≥20 MMBtu/hr: 5.3 ppmv (19% O2) or ~49 ppmv (3% O2)
		Other processes (dryers, dehydrators, or ovens): 4.3 ppmv (19% O2) or ~40 ppmv (3% O2)
Ventura County Air Pollution Control District	Rule 74.34 – NOx Reductions from Miscellaneous Sources (units with total rated heat input capacity of 5 MMBtu/hr or greater)	Ovens, Dryers (besides asphalt, sand, or paper dryer)
		<1,200°F: 30 ppmv or 0.036 lb/MMBtu
		<1,200°F: 60 ppmv or 0.072 lb/MMBtu
Sacramento Metropolitan Air Quality Management District	Rule 419 – NOx from Miscellaneous Combustion Units (≥ 2MMBtu/hr)	Cooking Units
		< 500°F: 40 ppmv or 0.049 lb/MMBtu
		≥ 500°F: 60 ppmv or 0.073 lb/MMBtu

Assessment of Pollution Control Technologies

The next step is to research the commercially available emission control technologies and seek information on any emerging emission control technologies. As part of this assessment, staff met with multiple combustion control vendors and distributors each with over 30 years of experience working on NOx emissions control technologies; some also specialize in tuning and optimizing all burner types to achieve the lowest NOx emissions possible. Staff invited several vendors to present at the Working Group Meetings to address the issue of available and applicable technologies for the purpose of NOx emission reduction performance and its applicability to commercial food ovens. One of the companies invited was Rondo Energy which offers a unique heat storage battery system that may be potentially transferable to commercial food oven applications. Another company that presented was BABBCO, a manufacturer of several types of tunnel ovens which includes combustion ovens, hybrid ovens, and electric zero-emission ovens.

Staff assessed different pollution control technologies as part of the BARCT assessment. Staff presented and discussed the pollution control technology assessment in Working Group Meetings #3 and #6 which were held on July 27, 2022, and February 2, 2023, respectively. The objective is to identify and evaluate control technologies, approaches, and potential emission reductions. Staff considered the following:

- Commercially available NOx control technologies
    - Combustion control
    - Post-Combustion Control
- Zero-emission emission technology

The following vendors and manufacturers were contacted for information regarding burner control technologies, post-combustion control technologies, and zero-emission technologies. Each vendor representative has over 25 years of experience with combustion systems and various commercial food oven technology. All provided technical input and cost estimates that were included in the BARCT assessment and cost-effectiveness analysis of the staff report.

- AMF Den Boer
- BABBCO
- Flynn Burners
- Honeywell/Maxon
- Maurer-Atmos
- Micron Fiber-Tech
- Peerless
- Reading Bakery Systems
- Umicore
- WP Bakery Group

There are several options for reducing NOx emissions from commercial food ovens subject to PAR 1153.1. NOx control techniques can be divided into two control techniques: (1) combustion control and (2) post-combustion control. Combustion control involves retrofit of the existing burners with the latest generation low-NOx design, whereas post-combustion control involves treatment of the flue gas. The third option is to replace the unit with a zero-emission electric unit, which is the most effective option to reduce NOx emissions. One manufacturer offers a retrofit option for tunnel-type ovens where the burners are replaced with electric heating elements, but this option may be limited to a few types of ovens. The likely pathway for implementation of zero-emission electric units is to replace the entire combustion unit with a new zero-emission electric unit.

Burner Technology for Food Ovens

For commercial food ovens, the most frequent option to reduce NOx emissions is by replacing the burner system with newer low-NOx burner technology. In some situations, burners installed within the last 10 years may potentially be tuned and optimized to reduce NOx formation rather than undergoing a complete burner replacement, which will result in cost savings for the facilities. Combustion controls are techniques that reduce NOx by modifying the combustion zone through installation of low NOx burners (LNBs). This control technique employs air staging or fuel staging techniques to maximize NOx reduction. This technique reduces the adiabatic peak flame temperature and is effective at reducing thermal NOx formation.

Low NOx Burners Combustion Systems

The current NOx limit for Rule 1153.1 is between 40 to 60 ppmv corrected to 3% O_2. According to the vendor discussions for commercial food oven applications, a lower NOx limit of 30 ppmv or less is achievable without issue and is technically feasible in commercial food ovens. Commercial food ovens operate at lower temperature that most industrial application and burner vendors will guarantee 30 ppmv NOx levels up to 1,600°F; therefore, higher NOx limits for process temperatures over 500°F, as Rule 1153.1 currently allows; is not necessary for commercial food oven applications. One vendor provided a case study for a ribbon burner retrofit in a commercial bakery where their ribbon burners achieved sub-9 ppmv NOx based on a handheld meter (e.g., diagnostic check) but not demonstrated in a source test conducted by a third-party. Staff reviewed South Coast AQMD's source test data for existing units with similar burners, which confirmed that existing units can perform between 20 to 30 ppmv NOx. In addition, staff identified 131 commercial food ovens that currently have a NOx permit limit of 30 ppmv.

Staff held several meetings with combustion system manufacturers and most confirmed that they will guarantee NOx emissions of a maximum of 30 ppmv up to 1,600°F. Most commercial food ovens regardless of type operate from 130°F to 700°F, which are relatively low temperatures when compared to other industrial processes requiring heat. For this reason, staff believes a high NOx limit of 60 ppmv is no longer required for commercial food ovens that operate above 500°F.

Based on discussion with vendors, in some instances, ovens with ribbon burners or other types LNBs will only require tuning and regular maintenance to lower NOx emissions. In other cases, burners will have to be replaced with newer, lower NOx burner technologies and/or the burner control system will have to be upgraded to lower NOx emissions. As previously mentioned, commercial food ovens can either be batch or conveyor-type food ovens; conveyor-type typically are manufactured with ribbon burners, infrared burners, or air heating type burners such as Maxon Ovenpak or Eclipse Winnox burner, which are the most common burners used.

Ribbon Burners

Ribbon burners are similar to pipe burners which are long sections of pipes with holes down the entire length of the pipe. Fuel gas and a small amount of air is introduced into the pipe where it mixes and exits through the holes along the length of the pipe where it is lit with a pilot flame. The secondary air is provided by oven and mixes with the gas. Ribbon burners incorporate a ribbon-type insert along the length of the pipe that allows for better control of the flame. These ribbon inserts are also designed to provide better premixing of the air with fuel for more efficient combustion and control. The newest types of ribbon burners are made in various ways to help achieve better mixing and distribution of fuel gas in the burner, which helps lower NOx emissions by reducing peak flame temperature and can achieve 30 ppmv.

One manufacturer presented a ribbon burner that incorporates a metal fiber mesh across the length of the burner where overall flame temperature is reduced, resulting in lower NOx levels. These types of mesh metal fiber ribbon burners can run in blue fame or radiant mode. According to the vendor the burner can achieve 9 ppmv or less, but there have been no independent third-party source test data that can validate the performance. The test was primarily done with a handheld meter. However, the vendor has stated that they will provide a vendor performance guarantee of 30 ppmv for the ribbon burners in commercial food oven applications.

Air Heater Burners

Air heating-type burners are traditional nozzle-mix type burners similar to the Maxon OvenPak or Eclipse Winnox burners used in a majority of commercial food oven categories. These types of burners are used in convection ovens where the burner is not in close proximity to the food product being cooked. This type of air heating burners consists of cylindrical housing projecting into the oven where the burner flame is contained. These types of air heating burners are typically flanged mounted with the blowers mounted externally. These types of burner fire into a small space and the external blowers move the air through the main chamber of the oven and can achieve 30 ppmv.

One manufacturer presented a low-NOx versions of these types of burners that utilize a metal fiber mesh on the inside cone or sleeve of the burner. The metal fiber mesh aids in lowering the peak flame temperature which lowers overall NOx emissions. According to the vendor the burner can achieve 9 ppmv or less; however, no third-party source data was provided to validate the performance of the burner. The confirmed that they will provide a vendor performance guarantee of 30 ppmv for the burner in commercial food oven applications.

Infrared Burners

Food ovens can also use radiant systems called infrared burners. Similar to ribbon burners, these types of burners are long sections that consist of ceramic or metal fibers across the length which act as a flame holding surface which produce infrared radiation and a red glow. These types of burners can achieve very low NOx emission levels. IR burners are primarily used in tortilla ovens Based on source test data of existing food ovens, IR burners can achieve 9 ppmv or less in small tortilla ovens with a rated heat input capacity of approximately one MMBtu/hr. Larger tortilla ovens with a rated heat input capacity of approximately 2 MMBtu/hr solely firing IR burners generated source test data between 12 to 14.2 ppmv.

Indirect Fired Units

Lastly, an option to use heat generated by a steam boiler or thermal fluid heater can be an efficient and cost-effective method to heat a process. The heat transfer process requires the use of a heat exchanging system (air-to-air heat exchanger) to warm and heat the incoming air that enters the process chamber and heats the food product. These types of units are indirect fired units that use the heat generated from another unit's combustion process. In this heating arrangement, there are no NOx emissions being emitted from the commercial food oven and essentially zero-emissions, but NOx emissions are generated from the combustion process of other units regulated by other South Coast AQMD NOx rules. There are several examples of these types of units in bakery ovens, spray dryers, and smokehouse ovens that are currently in use. One unique example of this heating method is a smokehouse oven that is currently in operation, which uses an electric burner (14.9 kW) and high-pressure steam as the two sources of heat. However, some indirect-fired units use LNB as the heat source but will typically have small burners with a rated heat input of one MMBtu/hr or less.

Post-Combustion Control Technology for Food Ovens

Post-combustion control involves treating the flue gas by either chemically reducing or oxidizing the NOx and converting the NOx to a different chemical form. Staff evaluated the following control technologies.

Selective Catalytic Reduction

Selective Catalytic Reduction is post-combustion control technology that is commercially available and used to control NOx on a variety of NOx sources. A typical SCR system consist of a reactor where the catalyst is contained, ammonia storage tank, ammonia vaporizer, and ammonia injection system. The technology uses catalyst that consist of a mixture of metals, with vanadium being the primary metal in various proportions. The catalyst selectively reduces the NOx on the presences of ammonia in nitrogen and water. Minimum operating temperature for SCRs is between 600°F to 900°F which is above the process temperature of most commercial food ovens. To reach optimal reaction temperatures, supplementary firing from additional duct burners would be necessary which will increase NOx emissions.

LoTOx™ with Wet Gas Scrubber

LoTOx™ stands for "Low Temperature Oxidation" process where ozone is injected into the flue gas stream to oxidize insoluble NOx compounds into soluble NOx compounds. These soluble compounds can then be removed by various neutralization reagents (caustic solution, lime, or limestone). LoTOx™ is a low temperature operating system in a range of 140°F–325°F, but the optimal temperature is generally less than 300°F.

The LoTOx™ process requires oxygen supply for ozone generation. Unlike SCR technology which requires ammonia storage, the LoTOx™ technology modulates ozone generation on demand as required by the process. A ratio of NOx/O_3 of about 1.75–2.5 is needed to achieve 90–95% NOx conversion and reduction. The ozone that does not react with NOx in the LoTOx™ process is scavenged by sulfite in the scrubber solution and the ozone slip is in a range of zero to 3 ppmv.

Some advantages of LoTOx™ application in comparison to SCR are as follow:

- LoTOx™ does not require heat input to maintain operational efficiency and enables maximum heat recovery of high temperature combustion gases.
- LoTOx™ can be integrally connected to a wet (or semi-wet) scrubber and become a multi-component air pollution control system that can reduce NOx, SOx, and PM in one system whereas SCR is primarily designed to reduce only NOx.
- There is no ammonia slip, SO_3, and ammonium bisulfate issue associated with LoTOx™ application.

Potential drawbacks with LoTOx™ include:

- A significant amount of water is needed for the process, and it consequently generates waste effluent that requires an effluent treatment system. Thus, a water supply and effluent treatment system will need to be constructed to accommodate the LoTOx™ system.
- Since the LoTOx™ system requires high electrical power usage and oxygen demand, annual operating costs for the ozone generator could be potentially high.
- Nitrates in wastewater effluent may be a concern for treatment and/or discharge of the wastewater.

Below is a summary of combustion control and post-combustion control.

Table 2-4. NOx control Technologies Evaluated and Initial Conclusions

Potential Control Technologies			
Control Type	**Key Features**	**Considerations**	**Initial Conclusions**
LoTOx™ w/Wet Gas Scrubber	• Low operating temperature • Multi-pollutant control	• Requires wastewater treatment • Large space requirements • **High capital and operating costs**	• Not technically feasible due to space requirements • Not cost effective due to low emissions and high costs
Selective Catalytic Reduction (SCR)	• High NOx removal • Requires high operating temperatures	• Large space requirements • Hazardous chemical storage • Waste disposal • **High capital and operating cost**	• Not technically feasible due to temperature and space requirements • Not cost effective due to low emissions and high costs
Low-NOx Burners (LNB)	• Low operating cost • Most ovens can be retrofit with low-NOx burners reducing overall costs	• Can have complex designs • May need further fan capacity	• Most Feasible option • Several options and burner types available for various applications

Post combustion control requires significant capital investment, has a high annual operating cost, requires a large footprint, and there are currently no existing installations for commercial food oven applications. SCRs and LoTOx systems can achieve NOx levels of 5 ppmv or less, but both systems are typically employed in large process heater applications that are 30 MMBtu/hr or greater due to the cost versus overall NOx emission reductions. All commercial food ovens are less than 12.3 MMBtu/hr, and due to high capital and annual operating costs, post-combustion technology was ruled out as a feasible control option for PAR 1153.1 equipment. Vendor discussions and cost estimates also confirmed staff's conclusion that post-combustion control is not feasible due to the low operating temperatures of commercial food ovens and significant capital investment necessary for low emission reductions. Furthermore, post combustion control such as selective catalytic reduction (SCR) requires high flue gas temperatures which is beyond the operating temperature of most commercial food ovens and may require supplementary firing from additional burners to raise the flue gas temperature to the optimal operating temperature range between 600°F to 800°F. This will potentially add additional capital costs, NOx emissions, and fuel cost. In addition, post-combustion control requires the use of hazardous chemicals at food manufacturing facilities. Combustion burner control technologies such as LNBs and reducing NOx at the point of formation are the most feasible option for reducing NOx for commercial food oven applications and reducing NOx emissions.

Zero Emission technology

Staff met with industry stakeholders and equipment vendors to inquire about commercial availability, price ranges, installation costs, operation and maintenance costs, and electrical upgrade costs for zero-emission technology across all established equipment categories. While staff did not identify zero-emission technology suitable for commercial production across all equipment categories, staff will continue to monitor the status and development for those categories. Several categories of commercial food ovens were identified where zero-emission technology is commercially available. Specific information on examples of zero emission technologies identified is provided after Figure 24. The categories of zero-emission ovens are identified below.

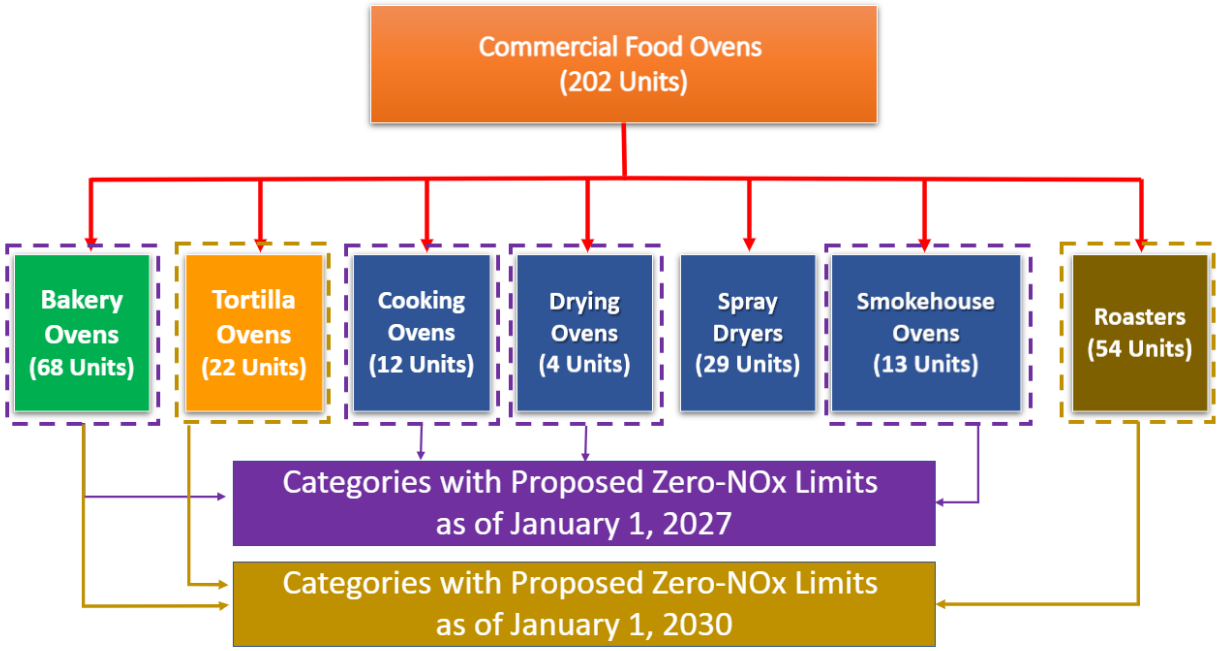

Figure 2-4. Zero-Emission Commercial Food Oven Categories Identified

Based on staff's discussions with the vendor of zero-emission ovens and Southern California Edison (SCE) regarding the challenges for zero-emission commercial food ovens, staff further subcategorized commercial bakery ovens based on oven type and unit size. The commercial bakery oven category was separated into direct-fired and indirect-fired bakery ovens. Direct-fired bakery ovens will have the energy or heat source inside the baking chamber, and the heat source can be gas burner or electric heating elements. The heat transfer process is primarily done by radiation from the flames or electrical heating elements. In contrast, an indirect gas-fired bakery oven is also a radiant type oven but uses exchangers connected to a burning zone that is not within the baking chamber. The baking chamber is indirectly heated by the exchanger, so the baking products do not come in contact with the product of combustions. The direct-fired bakery oven category was further separated based on unit size: greater than 3 MMBtu/hr and less than or equal to 3 MMBtu/hr. SCE advised staff that any commercial bakery oven requiring more than one MW of power would require further evaluation of the electrical grid capacity for the surrounding area of the facility and more than likely require additional time to accommodate necessary upgrades. The 3 MMBtu/hr threshold is equivalent to approximately 900 kW electrical energy demand. For the indirect-fired bakery oven category, staff also identified several bakery units operating in the South Coast AQMD that already operate at zero NOx emissions; for those units the heat source comes from another process or unit.

The following technologies were explored as part of the BARCT assessment:

- One electric zero-emission tunnel oven that is currently in operation and used to produce bread. The oven is a conveyor driven type tunnel oven. The bakery tunnel oven is custom designed by Sellars Manufacturing with dimensions are 6'-0' W x 85'-0"L x 10'-0" with

an electric heater rated at 705 kW (2.4 MMBtu/hr); the max quantity of dough processed through this oven is 87,600 lbs/day. This unit was permitted in 2006.

- Two facilities use smokehouse ovens equipped with electric burners that use electricity as the method of supplying heat to the process. One facility uses a smokehouse manufactured by Friedrich Metal Products, Model FMP-4000-ST (2x2 Tunnel) heated with an electric burner rated at 14.9 kW and high-pressure steam. The unit has dimensions of 10'-10"W x 8'-2.5"L x 8'-4" H. Another facility uses two smokehouse ovens that are electrically heated.
- Electric bakery tunnel and batch oven technology currently commercially available from BABBCO, WP Bakery Group, and Coastline Equipment, Inc. One of the challenges of this technology is the amount of electricity required to operate these ovens, limited real-world installations, and potential product quality issues that may need to be addressed when transitioning to electric cooking.
- Electric nut and coffee roaster technology currently available from Ozstar Machinery and Bellwether but is limited to small applications. The technology is currently not available for commercial size applications.
- Electric meat roaster and smokehouse technology is currently available and in use from Friedrich Metal Products and Maurer-Atmos.
- Electric bakery tunnel oven technology is currently available from AMF Den Boer, but there are very few real-world installations. The heat necessary is generated by electrical elements directly above and under the product line. One of the challenges of this technology is the amount of electricity required to operate the oven.
- Hybrid electric-ribbon burner technology from Flynn Burners. This new technology is currently in the development phase with no real-world installations yet. This technology may be a potential replacement option for bakery tunnel ovens that utilize ribbon burners. The technology uses a gas ribbon burner and electric heating elements where it can be initially fired on gas, then switch to electric mode under normal baking operations. One of the current challenges is increased electricity needed to operate the burners. Some bakery tunnel ovens can use up to 181 ribbon burners.
- Hybrid gas/electric tunnel ovens is a new bakery oven design offering from BABBCO. This type of oven can operate on both gaseous fuels and electric heating elements as a source of heat. The hybrid oven technology can achieve 30 ppmv NOx when operating in combustion mode and then transition to electric after initial "cold" start-up which can decrease the overall electrical demand of a fully electric oven. The hybrid oven also gives the operator the flexibility to transition to full electric operation at a later date.
- Rondo heat battery system was a zero-emission technology evaluated as a potential technology process. The technology is an emerging technology used in other industrial processes as a heat source and consists of a high temperature brick storage system that generates and stores heat from standard electrical input. The bricks store the thermal energy at temperatures up to 2,100°F and an air blower passes air over the brick; the air can then be used to heat a process or generate steam. Technology has not been used in commercial food oven applications.

Several manufacturers offer electric oven options, but they are not widely used at this time. As regulatory agencies and companies who operate large commercial food ovens work to decarbonize and lower emissions, more zero emission commercial oven installations are anticipated. Electric ovens are more commonly installed in areas where natural gas supplies are not readily available. An example presented by BABBCO during Working Group Meeting #7 of a large electric commercial oven is located in Africa. In 2010, BABBCO installed a dual fuel hybrid oven that can operate on electricity or liquid fuels.

BABBCO is also working to commission an electric test oven at their innovation technology facility in the fall of 2023. The facility will allow bakery product manufacturers to compare product bake characteristics using gas and electric since one of the major concerns of commercial bakers is a potential adverse impact electric ovens could have on product quality. A test facility would allow bakers to test bake their specific products and recipes to ensure they could still produce the same quality products.

One of the concerns with zero-emission technology was the electrical requirements necessary to operate commercial electric bakery and cooking equipment. Working with an industry stakeholder who owns and operates two large commercial bakery facilities and several hundred worldwide, staff evaluated and compared the electrical demand necessary to run three electrical ovens at their facility. The facility provided daily electrical consumption for normal day-to-day operations as a baseline for comparison. The baseline was compared to the increased electrical demand which is shown in the table below:

Table 2-5. Electricity Increase Requirement for Bakery Ovens

Bakeries Electricity Requirements			
Facility	Average Daily Electricity Consumption (kWh)	Average Daily Electricity w/Electric Ovens (kWh)	Average Daily Electricity w/Electric Ovens (kWh)
Facility One	37,300 per day	51,400 per day	140% (for 3 Ovens)
Facility Two	9,051 per day	34,300 per day	360% (for 2 Ovens)

Based on the assessment, the facility would require approximately 140% more electricity daily to operate three ovens and the other facility would require over 360% more electricity. This would require the facility to make significant electrical upgrades to handle the increase in electrical load. The additional costs for the electrical upgrades at the facility will be taken into consideration in the cost effectiveness assessment.

As mentioned above, one potential option to address this concern is to transition to hybrid ovens that use a combination of electricity and combustion to mitigate some of the power demand. Hybrid ovens may serve as a bridge to achieving zero-emissions for large commercial bakery ovens. BABBCO recently introduced a multi-fuel hybrid technology that uses gas and electric as the source of heat. The multi-fuel system “hybrid” design can generate heat from standard fuels such as natural gas and electricity. The hybrid design provides bakers the ability to actively switch from one energy source to another or switch at a later date. BABBCO currently can offer the hybrid three ways: (1) All electric, (2) gas/hydrogen and electric, or 3) gas and electric. The advantage of

this technology is that it can reduce the high electrical demand during start-up heating of the bakery oven.

Based on feedback from technology vendors regarding the availability and progress of zero-emission commercial food ovens for most categories, staff believes zero-emission limit is feasible or will be feasible at a future date. The inclusion of a future effective date will allow additional time will allow for the technology to continue to emerge and allow facilities time to address concerns regarding product quality. Staff's conclusion on the technology feasible is based in part on electric ovens operating in our jurisdiction, for example the electric bakery oven rated at 705 kW that is currently in operation and used to produce bread.

INITIAL BARCT EMISSION LIMIT AND OTHER CONSIDERATIONS

After completing the technology assessment, staff recommends an initial BARCT NOx emission limit established using information gathered from the technology assessment. All provided emission concentration values (i.e., initial and final) in this report have the unit of part per million by volume (ppmv) based on a dry basis. Additionally, staff evaluates other considerations that could affect the emission limits that represent BARCT, including limits for those units operating close to the BARCT NOx limits. In addition, staff evaluates units that are considered outliers due to low-emissions, low-use, or high cost-effectiveness. Summary of the BARCT assessment and staff's initial recommendations based on feasibility is shown below in Table 2-6.

Table 2-6. Initial BARCT Recommendation for Proposed Amended Rule 1153.1[1]

	Rule 1153.1	Existing Units	Other Regulatory Agencies	Technology Assessment	Initial BARCT Limit	Proposed BARCT NOx Limit
Bakery Ovens	40 and 60 ppmv	0-45ppmv	40 and 60 ppmv	0 to 30 ppmv	30 and 0 ppmv	*Need to conduct cost-effectiveness and incremental cost-effectiveness*
Tortilla Ovens	40 and 60 ppmv	8.4–52 ppmv	40 and 60 ppmv	15 and 30 ppmv	15 and 30 ppmv	• 15 ppmv (IR burners only) • 30 ppmv (Ribbon/IR)
Cooking Ovens	40 and 60 ppmv	25-30 ppmv	40 and 60 ppmv	0 to 30 ppmv	30 and 0 ppmv	*Need to conduct cost-effectiveness and incremental cost-effectiveness*
Drying Ovens	40 and 60 ppmv	30-40 ppmv	40 and 60 ppmv	0 to 30 ppmv	30 and 0 ppmv	*Need to conduct cost-effectiveness and incremental cost-effectiveness*
Spray Dryers	40 and 60 ppmv	0-26 ppmv	40 and 60 ppmv	30 ppmv	30 ppmv	30 ppmv
Smokehouse Ovens	40 and 60 ppmv	0-52 ppmv	40 and 60 ppmv	0 to 30 ppmv	30 and 0 ppmv	*Need to conduct cost-effectiveness and incremental cost-effectiveness*
Coffee and Nut Roasters	40 and 60 ppmv	25-37 ppmv	40 and 60 ppmv	30 ppmv	30 ppmv	30 ppmv

[1] *Emission limits are corrected to 3% O_2*

COST-EFFECTIVENESS AND INCREMENTAL COST EFFECTIVENESS ANALYSIS

The South Coast AQMD routinely conducts cost-effectiveness analyses regarding proposed rules and regulations that result in the reduction of criteria pollutants (NOx, SOx, VOC, PM, and CO). The analysis is used as a measure of relative effectiveness of a proposal. It is generally used to compare and rank rules, control measures, or alternative means of emissions control relating to the cost of purchasing, installing, and operating control equipment to achieve the projected emission reductions. The major components of the cost-effectiveness analysis are capital and installation costs, operating and maintenance costs, emission reductions, discount rate, and equipment life. The cost-effectiveness for PAR 1153.1 were completed using the discounted cash flow method explained below:

Discounted Cash Flow (DCF)

The DCF method converts all costs, including initial capital investments and costs expected in the present and all future years of equipment life, to present value. Conceptually, it is as if calculating the number of funds that would be needed at the beginning of the initial year to finance the initial capital investments and to set aside to pay off the annual costs as they occur in the future. The fund that is set aside is assumed to be invested and generates a rate of return at the discount rate chosen. The final cost-effective measure is derived by dividing the present value of total costs by the total emissions reduced over the equipment life. The equation below is used for calculating cost-effectiveness with DCF. The equation was presented in the 2016 AQMP Socioeconomic Report Appendix 2-B (p. 2-B-3):

$$Cost - effectiveness = \frac{Initial\ Capital\ Investments\ +\ (Annual\ O\&M\ Costs\ \times\ PVF)}{Annual\ Emission\ Reductions\ \times\ Years\ of\ Equipment\ Life}$$

Where:

$$PVF = \frac{(1+r)^N - 1}{r * (1+r)^N}$$

Where r = real interest rate (discount rate); and N = years of equipment life.

Incremental Cost Effectiveness Assessment

Finally, California Health and Safety Code Section 40920.6(a)(3) states that an incremental cost-effectiveness assessment should be performed on identified potential control options that meet air quality objectives. To determine the incremental cost-effectiveness under this paragraph, South Coast AQMD calculates the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option. Once the BARCT assessment is complete and NOx limits are established, staff considers incrementally more stringent options to demonstrate that the NOx limit represents the "maximum degree of reduction achievable by each class or category". The equation for incremental cost-effectiveness is below:

$$I\text{-}CE\left(\$/_{tons\ NOx\ reduced}\right) = \frac{Incremental\ Difference\ in\ Cost\ (Present\ Worth\ Value)}{Incremental\ Difference\ in\ Emission\ Reductions\ (Lifetime\ Reductions)}$$

Summary of Cost Assumptions

In order to determine cost-effectiveness for the proposed BARCT limits, cost information and estimates for the control equipment were obtained. Staff met with multiple burner manufacturers, oven manufacturers, vendors, distributors, and stakeholders to gather cost data and estimates for various types of burners and ovens. In addition, staff also sent out a survey to the facilities to gather equipment data and cost information for recent NOx control projects.

Burner Technology Costs

To estimate the costs of burner technologies, staff evaluated: (1) Ribbon burners; (2) Infrared (IR) burners; and (3) Air heater cone type burners. Based on quotes and cost estimates, ribbon and IR burners are more expensive than air heating cone type burners. Food ovens such as bakery ovens

and tortilla ovens can use up to 181 burners in a single oven, so cost can be significantly more than other food ovens. The other food ovens such as dryers, smokehouses, cooking ovens, and roasters will typically have one or two burners. Overall burner cost depends on size, type, and number of burners. The useful for the burner control equipment was assumed to be 25 years. Staff also identified several units who have recently retrofitted their units with new burners to meet the existing 40 ppmv or 60 ppmv NOx limits. These facilities will face an issue with stranded assets, so to address the issue of stranded assets, staff is incorporating a compliance schedule that will require facilities to meet the proposed Phase I Emission Limit upon burner replacement or no longer than a 25-year burner life based on burner age.

Ribbon and Infrared Burner Costs

For ribbon and IR burners staff received several budget quotes from two manufacturers for various sizes ranging from 1 to 12 MMBtu/hr. In addition, staff also received cost estimates from two facilities for recent ribbon and IR burner projects which ranged from $300,000 to $4,200,000. The $4,200,000 is for an oven replacement. For the vendor estimates, ribbon burners were based on 2.5" diameter which is commonly used in food ovens for gentle heating and included mounting plates, igniter, and flame sensors. Installation costs were assumed to be three times the capital cost of the burners due to support structure necessary to mount the burners. Total installed cost for ribbon and IR burners ranged from $30,000 to $226,000.

Air Heater Cone Type Low NOx Burners (LNBs)

For these types of traditional nozzle-mix type LNB, budget quotes were received from vendors and installation costs were assumed to be 50% of the burner capital costs. Total installed costs ranged from $14,000 to $45,000 and if a unit required multiple burners, the costs was multiplied by the number of burners.

Once staff complied cost estimates for the types of burners, the next step was to develop a cost-curve based on the cost data which will help determine budgetary estimates for units where no cost information was available. The cost curve developed will be used in the Rule of Sixth-Tenths, a ratio and proportioning method used to estimate budgetary costs for similar equipment. The cost curve will be used to obtain equation by using a power curve fit of the data.

Rule of Sixth-Tenths or 0.6 Power Factor Rule

This methodology is typically used in an engineering design to obtain budget pricing when there is not enough time to obtain firm cost numbers for a project which is a major undertaking and require a complete engineering analysis. The equation is derived from the budgetary quotes received. The costs are then converted to a dollar per MMBtu/hr by dividing the cost by the size of the burner which is then plotted. Using a power curve fit if the plotted data will give us an equation where "N" the size exponent and "CA" the cost of equipment with corresponding size. The equation can use to extrapolate cost for units where no budgetary cost is available. The equation for the Rule of Sixth-Tenths is below:

Equation 1: Rule of Sixth-Tenths Equation

$$C_B = C_A \left(\frac{S_B}{S_A} \right)^N$$

Where,

C_B = approximate cost of equipment having size S_B (MMBtu/hr, hp, scfm, etc.)

C_A = known cost($) of equipment having corresponding size S_A (same units as S_B)

(S_B/S_A) = ratio size factor

N = size exponent (varies 0.3 to >1.0, but average is 0.6)

The following cost-curves were obtained from the cost data. One cost curve was for ribbon and IR burners and another cost-curve was generated for air heater cone type LNBs.

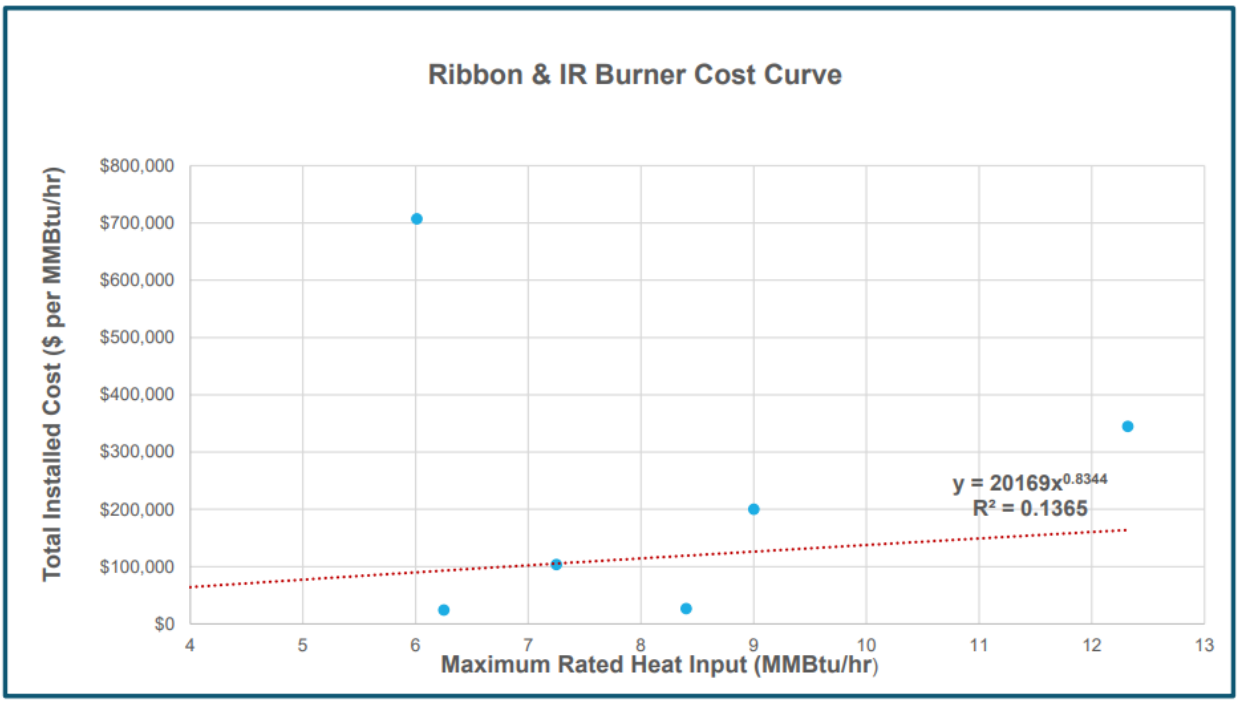

Figure 2-5. Ribbon and IR Burner Cost Curve

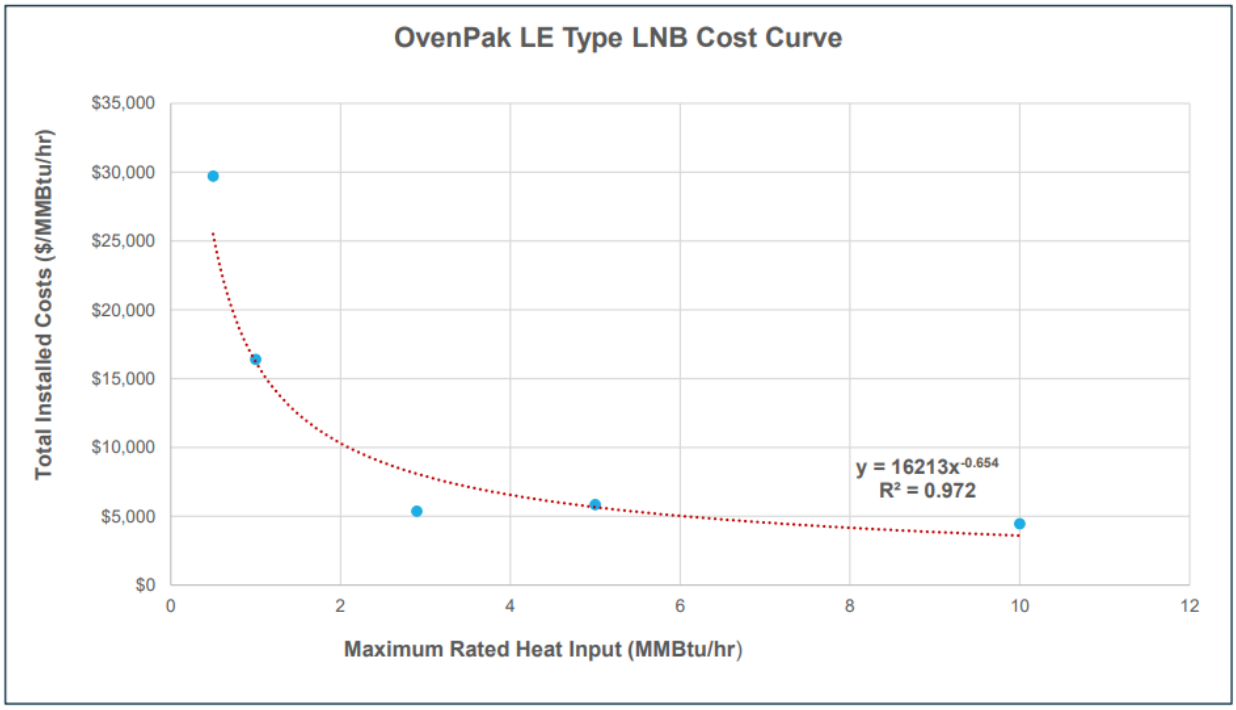

Figure 2-6. OvenPak Type LNB Burner Cost Curve

Burner Operating and Maintenance Cost Assumptions

For annual operating and maintenance costs of burners, staff initially assumed $2,000 for Ribbon and IR burners and $1,000 for air heater cone type traditional LNBs. All annual operation and maintenance costs included compliance and source test cost which was assumed to be $4,000 every five years based on the proposed source test schedule. However, there was some concern from stakeholders with the frequency of component replacement from the use of newer burner control technology and impacts on cost. To address this concern staff increased the annual operating cost for ribbon and IR burners from $2,000 to $2,500 and for air heater cone type LNBs from $1,000 to $1,500. This increase in cost is reflected in the cost effectiveness below which is higher than what was presented in Working Group Meeting #4, but overall, the average cost-effectiveness for each category remains below the $325,000/ton of NOx reduced with some categories labeled as "no additional cost" since these units are already meeting the proposed BARCT limit such as the tortilla oven solely firing IR burners only category.

Electric Oven Cost Assumptions

Staff initially separated food oven categories into four main categories based on combustion characteristics. The categories are bakery ovens, tortilla ovens, roasters, and other food ovens. The other food ovens category consisted of several sub-categories that include cooking ovens, drying ovens, spray dryers, and smokehouse ovens. For the zero-emission analysis, staff believe it was appropriate to assess these categories individually since zero-emission ovens may not be available for each individual category. Furthermore, it was also appropriate to assess the bakery oven category based on subcategories identified.

Some ovens can potentially change or alter their process, so heat is generated by electricity. This method is the most effective in reducing overall emissions and will more than likely require unit

replacement. One manufacturer offers a retrofit option for existing combustion tunnel ovens, but due to variation in oven design, the retrofit option may be limited to a few oven types. For most facilities transitioning to zero-emission electric oven technology, installation of a brand-new unit will be the preferred option. In order to estimate cost for zero-emission electric commercial food ovens, staff identified two main types of commercial food ovens:

- Tunnel Ovens which are large continuous ovens that typically uses a conveyor to move the product through the tunnel. These oven types are primarily used when high volume of product throughput is required. These types of tunnel ovens are mostly used in large commercial bakeries and due to their size, will have higher equipment costs. Bakery ovens and tortilla ovens will typically fall into this category.

- Batch ovens consist of rack type or multi deck type ovens. These types of ovens require manual product input and removal when the cooking or baking process is complete. These oven types are typically for lower product throughput and will have lower equipment costs when compared to tunnel ovens. Most cooking ovens, drying ovens, and smokehouse ovens fall in within these types of ovens. However, some bakery ovens can also be batch type ovens

Overall, zero-emission electric oven cost is dependent on type and size measured in rated heat input capacity. Staff used the existing size equivalent in MMBtu/hr to estimate equivalent kW energy demand for electric ovens. Staff used the equation below to convert between MMBtu/hr to kW equivalent. The zero-emission equipment useful life for both oven types were assumed to be 25 years and $1,000 for O&M costs.

Equation 2: Converting from MMBtu/hr to Kilowatts (kW)

$$kW = \frac{MMBtu}{hr} \times \frac{scf}{1050\ Btu} \times 0.293 \frac{kWh}{scf}$$

Staff reached out to several vendors and facilities to gather cost data for zero-emission electric equipment costs quotes (capital cost). Staff received quotes for the different equipment categories and grouped them accordingly based on whether the units were tunnel type or batch type ovens. The grouping was used to generate a cost curve similar to the rule of sixth tenths methodology used for the low-NOx burners cost estimation. Staff assumed the installation costs to be 25 percent of the estimated capital costs. In addition, staff acknowledges that electrical upgrades will be needed to accommodate the increased electrical demand, staff estimated this cost to be 10% of the estimated capital cost. Total installation costs will include capital cost, installation costs, and electrical upgrades; the total installation costs will be used to calculate cost effectiveness.

Using the rule of sixth tenths along with the gathered cost data staff generated the following two cost-curves. Quotes from vendors were in kW, staff converted the kW to MMBtu/hr which was further used to calculate a dollar per MMBtu/hr. One cost curve was generated for tunnel ovens and another for batch ovens. Using the cost curve, allowed staff to estimate cost for zero-emission units.

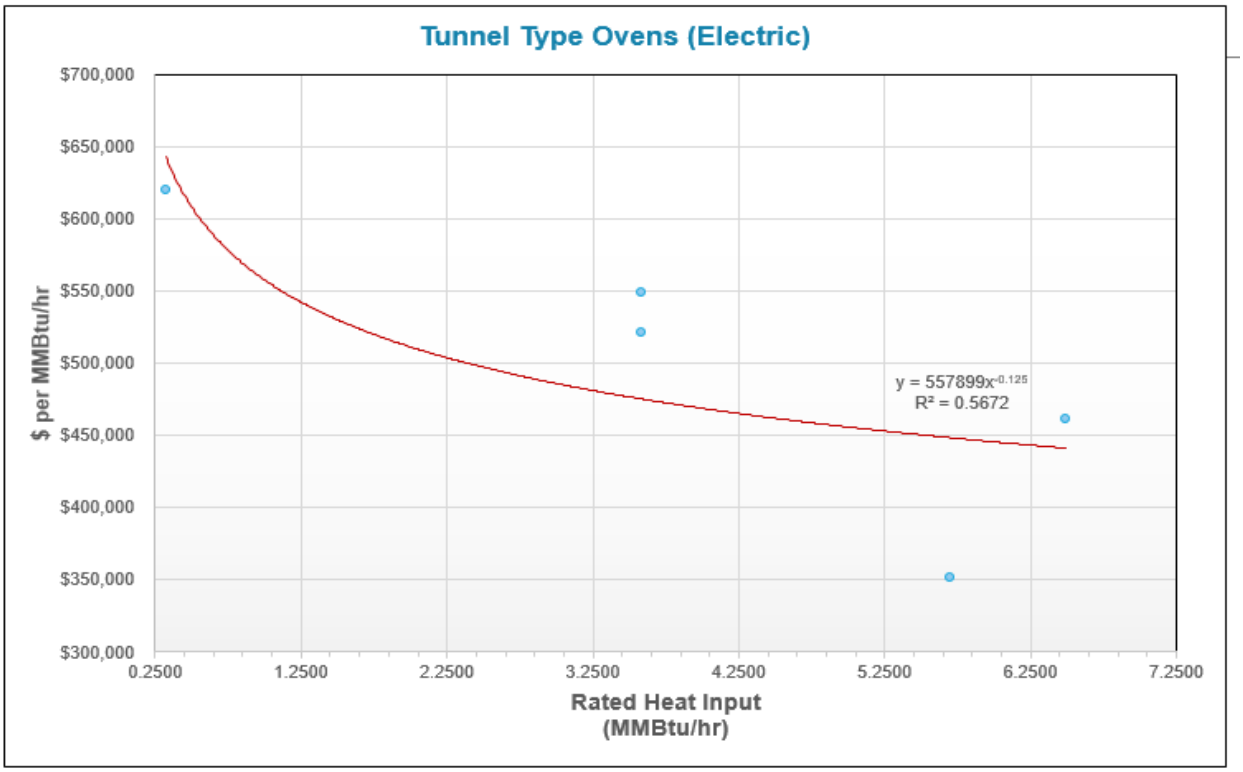

Figure 2-7. Tunnel Oven Cost Curve

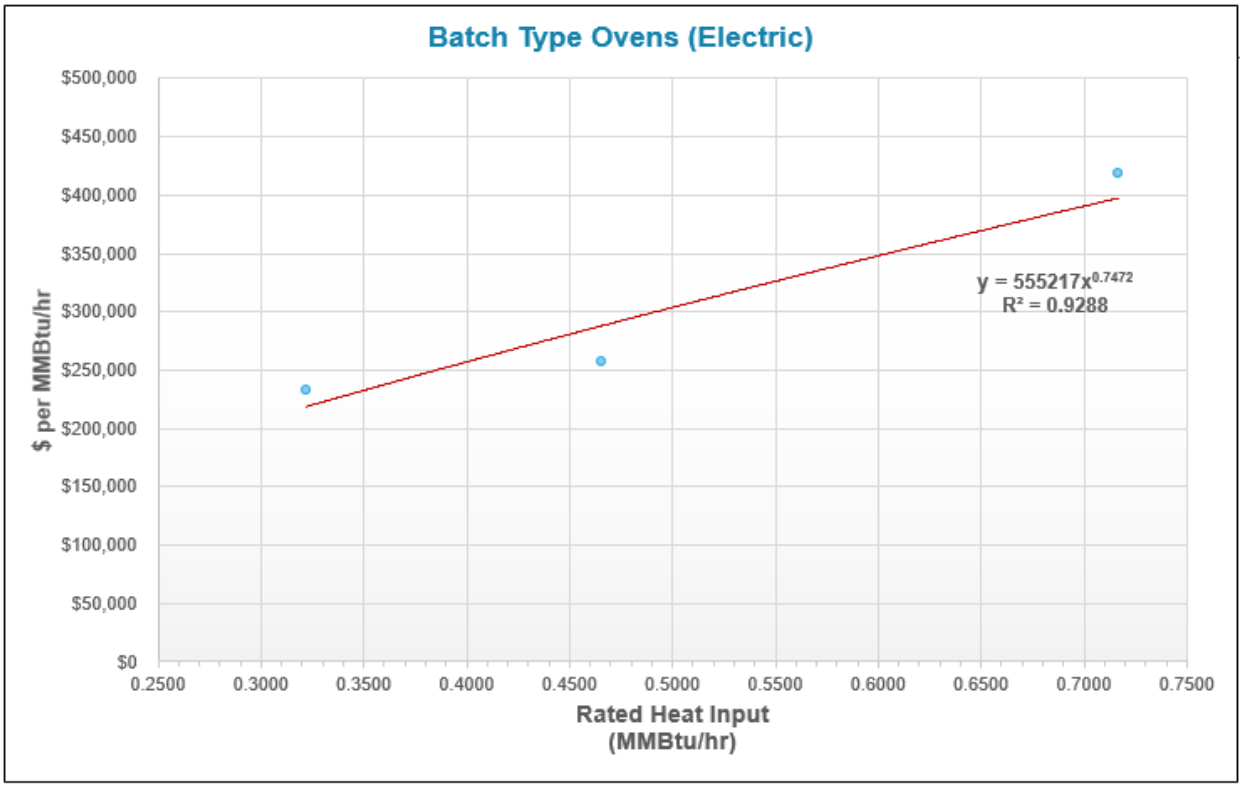

Figure 2-8. Batch Oven Cost Curve

PAR 1153.1 Cost Effectiveness

After cost information was obtained, a bottom-up approach which evaluated each unit subject to PAR 1153.1 and cost-effectiveness analysis was conducted on a per equipment basis. Baseline emissions for each equipment were calculated using the 2019 Annual Emissions Reporting (AER), if available. For units without AER information, staff used the assumption methodology outline earlier in this section and Figure 2-1.

Cost-Effectiveness for all commercial food oven categories in PAR 1153.1 were below $325,000 per ton of NOx and considered cost-effective for 30 ppmv and zero ppmv. A summary of the cost-effectiveness and incremental cost-effectiveness for each category is summarized in the table below.

Table 2-7. Cost-Effectiveness and Incremental Cost-Effectiveness Summary

Equipment Categories	Cost-Effectiveness at 30 ppmv	Cost-Effectiveness at 0 ppmv	Incremental Cost-Effectiveness (30 ppmv to 0 ppmv)
Direct-Fired Bakery Ovens (≤ 3MMBtu/hr)	$27,000	$57,000	$61,000
Direct-Fired Bakery Ovens (>3 MMBtu/hr)	$34,000	$111,000	$119,000
Indirect-Fired Bakery Ovens	$0	$38,000	N/A
Tortilla Ovens	$19,000/ $0 @15 ppmv	N/A	N/A
Cooking Ovens	$0	$38,000	$38,000
Drying Ovens	$36,000	$40,000	$38,000
Spray Dryers	$12,000	N/A	N/A
Smokehouses	$20,000	$9,000	$8,000
Roasters	$41,000	N/A	N/A

Units within the four categories identified as having commercially available zero-emission technology and below the $325,000 per ton of NOx cost-effectiveness threshold will be subject to zero ppmv at a future effective date. In addition, an incremental cost-effectiveness was also conducted for those categories and ranged from $8,000 to $119,000 which represents the

difference of reducing NOx emissions from 30 ppmv to 0 ppmv. There is no cost threshold for incremental cost -effectiveness.

PROPOSED BARCT EMISSION LIMIT

According to California Health and Safety Code Section Sections 40920.6(a)(1) and 40920.6(a)(2), potential controls to meet an air quality objective, which is to assess the BARCT emission limits, must be identified and the cost-effectiveness assessment should be conducted thereafter. The final proposed BARCT emission limit for each class and category is the emission limit that achieves the maximum degree of emission reductions and is determined to be cost-effective. Staff evaluated the cost-effectiveness for the most stringent initial BARCT emission limit. If the most stringent initial BARCT limit is not cost-effective, the next less stringent limit was assessed. The following table summarizes the proposed NOx limits that represent BARCT, the applicable CO limits times for each class and category.

Table 2-8. Proposed NOx and CO Emission Limits for Commercial Food Ovens (ppmv[1])

Equipment Categories		Phase I[2]		Phase II[3]		Phase III[4]	
		NOx	CO	NOx	CO	NOx	CO
Direct-Fired Bakery Oven	≤3 MMBtu/hr	N/A	800	0	0	N/A	N/A
	>3 MMBtu/hr	30	800	30/0[5]	800	0	0
Indirect-Fired Bakery Ovens		30	800	0	0	N/A	N/A
Tortilla Ovens	Heated solely by IR Burners	30	800	N/A	N/A	0	0
	All Other Tortilla Ovens	15	800	N/A	N/A	0	0
Cooking Ovens		30	800	0	0	N/A	N/A
Drying Ovens		30	800	0	0	N/A	N/A
Smokehouses		30	800	0	0	N/A	N/A
Spray Dryers		30	800	N/A	N/A	N/A	N/A
Roasters		30	800	N/A	N/A	0	0

[1]*All NOx Limits are in ppmv referenced at 3% O_2*

[2]*Phase I Emission Limits apply on and after [Date of Adoption]*

[3]*Phase II Emission Limits, when applicable, apply on and after January 1, 2027*

[4]*Phase III Emission Limits, when applicable, apply on and after January 1, 2030*

[5]*Hybrid Oven emission limit pursuant to paragraph (d)(3)*

The combustion-based limits of 30 ppmv and 15 ppmv are referred to as Phase I Emission Limits and are BARCT limits which become effective upon rule adoption. Phase I Emission Limits are commercially available and achievable with current technology. Phase II and Phase III Emission Limits are zero-emission based BARCT limits that become effective at the future effective date to provide time for the technology to mature. The Phase II and Phase III Emission Limits are technology forcing limits, meaning the limits are based on technology that is not widely available at the time of rule adoption. When the South Coast AQMD adopts technology forcing rules, the limits are given a future implementation date to provide sufficient time for the technology to develop. BARCT limits evolve over time as technology improves or new pollution control technologies emerge; setting future effective emission limits is appropriate and the approach has been used and upheld in the courts. Therefore, future effective dates of January 1, 2027 for Phase II and January 1, 2030 for Phase III are established which is based on unit age of 25 years and when the unit is replaced. Follow up discussions with commercial food oven manufacturers and industry stakeholders identified that certain types of ovens may potentially have challenges when attempting to electrify due to the oven format, size, design, and construction. Staff is continuing to evaluate the technical feasibility for these types of ovens.

CHAPTER 3 : SUMMARY OF PROPOSALS

INTRODUCTION

PROPOSED AMENDED RULE STRUCTURE

PROPOSED AMENDED RULE 1153.1

INTRODUCTION

The main objective of Proposed Amended Rule 1153.1 is to propose NOx limits that represent BARCT requirements for applicable equipment and to remove the exclusion of RECLAIM facilities. PAR 1153.1 also proposes periodic monitoring requirements, deleting outdated rule language, reorganizing the rule structure to be consistent with recently amended or adopted rules, and includes an Alternative Compliance Schedule Plan. The proposed revised rule structure and key provisions are discussed below.

PROPOSED AMENDED RULE STRUCTURE

The proposed amended rule separates the purpose and applicability to be consistent with recently adopted and amended rules and several new subdivisions were added to support the rule requirements. The following figure shows a comparison of rule structure of Rule 1153.1 versus PAR 1153.1.

Figure 3-1. Rule 1153.1 and Proposed Amended Rule Structure Comparison

SUMMARY OF PROPOSED AMENDED RULE 1153.1

The following is a summary of the proposed amendments to Rule 1153.1.

Purpose [Subdivision(a)]

The purpose of this rule is to reduce emissions Oxides of Nitrogen (NOx) and Carbon Monoxide (CO) Commercial Food Ovens as defined in this rule. PAR 1153.1 removes the reference to "gaseous and liquid fired combustion equipment" since it includes zero-emission NOx limits likely to be achieved using electric ovens.

Applicability [Subdivision(b)]

Proposed Amended Rule 1153.1 applies to owners and operators of food ovens including, but not limited to, bakery ovens, tortilla ovens, dryers, smokehouses, and roasters with NOx emissions that are used to prepare food or products for making beverages for human consumption. Food ovens that are exempt from requiring a permit under Rule 219 – Equipment Not Requiring a Written Permit Pursuant to Regulation II are not regulated under PAR 1153.1. PAR 1153.1 removes the reference to units that "require South Coast AQMD permits" since it includes zero-emission NOx limits. Zero-NOx emission ovens will not require a permit condition that limits the NOx to zero to comply with Rule 1153.1; however, they may require a permit condition that limits the VOC emissions to comply with Rule 1153 – Commercial Bakery Ovens.

Definitions [Subdivision(c)]

The following are key definitions for Proposed Amended Rule 1153.1 which distinguish the new equipment categories identified as part of BARCT assessment as well as additional definitions necessary for the transition of RECLAIM facilities into PAR 1153.1. For all definitions, refer to the preliminary draft of PAR 1153.1 released with the staff report.

ALTERNATIVE COMPLIANCE SCHEDULE PLAN in paragraph (c)(1), which means:

> *"an alternative implementation plan for an owner or operator of with units subject to Phase II Emission Limits."*

BAKERY OVEN in paragraph (c)(2), which means:

> *"a Commercial Food Oven used to heat, cook, or prepare baked products which includes tunnel ovens, conveyor ovens, tray ovens, and griddle ovens."*

COMMBUSTION-BASED EMISSION LIMIT in paragraph (c)(3), which means:

> *"emission limits that rely on technologies that combust gaseous or liquid fuel fired equipment and include Phase I Emission Limits and emission limits that rely on Hybrid Oven Technologies."*

COMMERCIAL FOOD OVEN in paragraph (c)(5), which means:

> *"a cooking device with a Rated Heat Input Capacity greater than 325,000 btu per hour use to heat, cook, dry, or prepare food or products for making beverages for human consumption that is used as part of a business."*

DECOMMISSION in paragraph (c)(6), which means:

> *"to permanently shut down a Unit by removing the fuel, air, electricity, or other utility source connected to it and to inactivate the Unit's applicable South Coast AQMD permit."*

DIRECT-FIRED BAKERY OVEN in paragraph (c)(7), which means:

> *"a Unit where the energy or heat source is placed directly inside the baking chamber and heat transfer is primarily carried out by radiation from the flames, electrical resistance, or hot surface."*

DRYING OVEN in paragraph (c)(8), which means:

"a heated convection oven or chamber used to remove water or moisture to dry food products.."

ELECTRIC HEATING ELEMENT (c)(9), which means:

" any component of a Commercial Food Oven used to transform electrical energy into heat."

FORMER RECLAIM FACILITY in paragraph (c)(10), which means:

"a facility, or any of its successors, that was in the Regional Clean Air Incentives Market program as of January 5, 2018, as established in Regulation XX, that has received a final determination notification, and is no longer in the RECLAIM program."

HYBRID OVEN in paragraph (c)(13), which means:

"any Unit that uses both a Combustion System and Electric Heating Element installed."

INDIRECT-FIRED UNIT in paragraph (c)(14), which means:

"a radiant baking unit that uses exchangers connected to the burning zone to indirectly heat the baking chamber, where the product being baked do not come into contact with the products of combustion."

OXIDES OF NITROGEN (NOx) EMISSIONS in paragraph (c)(16), which means:

"the sum of nitrogen oxide and nitrogen dioxide in flue gas, collectively expressed as nitrogen dioxide."

PARTS PER MILLION BY VOLUME (ppmv) in paragraph (c)(17), which means:

"for the purpose of this rule, Parts Per Million By Volume of a pollutant corrected to a dry basis at Standard Conditions corrected to three percent oxygen."

PHASE I EMISSION LIMITS in paragraph (c)(18), which means:

"the NOx and CO emission limits specified in Table 1."

PHASE II in paragraph (c)(19), which means:

"the NOx and CO Emission limits specified in Table1, where applicable."

PHASE III in paragraph (c)(20), which means:

"the NOx and CO Emission limits specified in Table1, where applicable."

RECLAIM FACILITY in paragraph (c)(22), which mean

"a facility, or any of its successors, that was in the Regional Clean Air Incentives Market program as of January 5, 2018, as established in Regulation XX."

ROASTERS in paragraph (c)(24), which means:

"a Unit used to dry roast food products that include, but are not limited to, nuts, coffee beans, or other plant seeds. Roasters include units with an integrated afterburner which consists of a single burner used as the heat source for the afterburner and Roaster."

SMOKEHOUSE in paragraph (c)(25), which means:

> *"a Commercial Food Oven in which meat products is cured using smoke and heat."*

SOURCE TEST PROTOCOL in paragraph (c)(26), which means:

> *"a South Coast AQMD approved set of test procedures for determining compliance with emission limits for applicable equipment."*

SPRAY DRYER in paragraph (c)(27), which means:

> *"a Unit where liquids are atomized and dried into powder form by spraying the liquid feed into a heated chamber."*

STANDARD CONDITIONS in paragraph (c)(28), which means:

> "is as defined by Rule 102 – Definition of Terms."

TORTILLA OVEN in paragraph (c)(30) which means:

> *"a Commercial Food Oven used to cook, toast, or bake tortilla products which include tortilla and tortilla chip ovens."*

UNIT in paragraph (c)(31), which means:

> *"any Commercial Food Oven, including, but not limited to, Bakery Oven, Drying Oven, Roasters, Spray Dryer, Smokehouse, or Tortilla Ovens used to prepare food or products for making beverages for human consumption."*

Requirements [Subdivision(d)]

Paragraph (d)(1) - PAR 1153.1 BARCT Emission Limit

PAR 1153.1 establishes updated BARCT NOx emission limits for applicable equipment as shown in the table below. The rule will require an owner or operator of an existing or new Unit subject to this rule shall not operate the Unit in a manner that exceeds the applicable NOx and CO emission limits, ppmv corrected to three percent oxygen, dry, specified in Table 1 according to the compliance schedule in subdivision (e). The emission limits in Table 1 are separated into three Phases. Phase I Emission Limits are combustion-based limits that are effective upon rule adoption. Phase II Emission Limits mostly zero-emission limits with one limit for a hybrid oven and will take effect on January 1, 2027. The emission limit for the hybrid oven is 30 ppmv and zero ppmv for direct-fired bakery ovens greater than 3 MMBtu. Hybrid ovens are capable of operating on both combustion and electric elements as a heat source. Operation of the oven is specified in paragraph (d)(3). Phase III Emission Limits are also zero-emission based limits and will take effect on January 1, 2030.

Table 3-1. PAR 1153.1 Table 1 (NOx and CO Emission Limits)

Equipment Categories		Phase I[2]		Phase II[3]		Phase III[4]	
		NOx	CO	NOx	CO	NOx	CO
Direct-Fired Bakery Oven	≤3 MMBtu/hr	N/A	800	0	0	N/A	N/A
	>3 MMBtu/hr	30	800	30/0[5]	800	0	0
Indirect-Fired Bakery Ovens		30	800	0	0	N/A	N/A
Tortilla Ovens	Heated solely by IR Burners	30	800	N/A	N/A	0	0
	All Other Tortilla Ovens	15	800	N/A	N/A	0	0
Cooking Ovens		30	800	0	0	N/A	N/A
Drying Ovens		30	800	0	0	N/A	N/A
Smokehouses		30	800	0	0	N/A	N/A
Spray Dryers		30	800	N/A	N/A	N/A	N/A
Roasters		30	800	N/A	N/A	0	0

[1]*All NOx Limits are in ppmv referenced at 3% O_2*

[2]*Phase I Emission Limits apply on and after [Date of Adoption]*

[3]*Phase II Emission Limits, when applicable, apply on and after January 1, 2027*

[4]*Phase III Emission Limits, when applicable, apply on and after January 1, 2030*

[5]*Hybrid Oven emission limit pursuant to paragraph (d)(3)*

Paragraph (d)(2) – Emission Rate Limits

An owner or operator may also elect to comply with the emission rate equivalent of the ppmv limits for the applicable equipment category specified in Table 1. The owner or operator must comply with an emission rate of 0.036 lb/MMBtu in lieu of 30 ppmv or an emission rate of 0.018 lb/MMBtu in lieu of 15 ppmv.

Paragraph (d)(3) – Hybrid Oven Requirements

Since hybrid ovens can operate using both combustion burners and electric heating elements as a heat source in the baking chamber, paragraph (d)(3) specifies how the owner or operator shall operate the hybrid oven. The owner or operator shall only operate the combustion system to preheat

the hybrid oven until the oven reaches normal operating temperature. Once the unit reaches operating temperature, the owner or operator shall only operate only the electric heating elements and shut off the combustion system.

Paragraph (d)(4) - Interim Limits for RECLAIM

Units located at non-RECLAIM facilities are already subject to the existing limits in Rule 1153.1; however, there are six RECLAIM facilities that will transition out of RECLAIM and into a command-and-control regulatory structure. PAR 1153.1 includes an interim NOx limit for any Unit that does not have a permitted NOx limit before the facility exits RECLAIM and is subject to a future NOx limit in Rule 1153.1. Interim limits ensure an enforceable regulatory limit remains in place to prevent emission backsliding when facilities exit RECLAIM. For PAR 1153.1, RECLAIM units that do not have an existing NOx concentration limit will be subject to an interim limit of 102 ppmv NOx, which is equivalent to the RECLAIM default emission factor of 130 lbs/MMScf of natural gas.

Paragraph (d)(5) – One Pound or less of NOx per Day Emission Limit

Paragraph (d)(3) of PAR 1153.1 provides an owner or operator of a unit two methods to comply with the alternative NOx emission limit of one pound or less through a daily limit or, the new option, of averaging over a calendar month based on a monthly limit. Both options shall be demonstrated in accordance with subdivision (i). In addition, both methods of compliance will require the owner or operator to install and maintain a unit specific non-resettable totalizing time meter or a unit specific non-resettable totalizing fuel meter in accordance with paragraph (j)(8).

Paragraph (d)(6) – Compliance by Decommissioning the Unit

Paragraph (d)(6) provides the option for an owner or operator of a unit subject to PAR 1153.1 to decommission the unit instead of reducing emissions to comply with the applicable emission limits in Table 1. The provision establishes requirements for decommissioning a unit to comply with Phase I, Phase II, or Phase III Emission Limits. To decommission a unit, the owner or operator must inactivate the permit, disconnect, and blind the fuel lines going to the unit pursuant to schedule in subparagraph (e)(6) for Phase I Emission Limits, or pursuant to the schedule in subparagraph (e)(2)(A) for Phase II Emission Limits, or pursuant to subparagraph (e)(3)(A) for Phase III Emission Limit.

Paragraph (d)(7) – Combustion System Maintenance

Paragraph (d)(7) requires a unit subject to the combustion-based emission limits to conduct combustion system maintenance in accordance with manufacturers schedule and specifications for any unit subject to the Combustion-Based Emission Limits. The owner or operator is also subject to recordkeeping requirement which was originally included in this paragraph in Rule 1153.1. The recordkeeping requirements has been moved to subdivision (i) in PAR 1153.1

Paragraph (d)(8) – Compliance with Pounds Per Million Btu Requirement Prior to Compliance Demonstration

Paragraph (d)(8) requires an owner or operator of a unit electing to comply with the emission rate limit in paragraph (d)(2) expressed as pounds per million Btu to install and maintain a non-resettable totalizing fuel meter prior conducting a source test in accordance with subdivision (g).

Paragraph (d)(9) – Compliance with Pounds Per Million Btu for Fuel and Time Meter Requirement

Paragraph (d)(9) requires an owner or operator of a unit that operates at only one firing rate that is also required to comply with paragraph (d)(2) expressed as pounds per million Btu to install and maintain a non-resettable totalizing time or fuel meter pursuant to subparagraph (j)(8).

Rule 1153.1 Compliance Schedule [Subdivision(e)]

Subdivision (e) provides the compliance schedule for the units subject to the emission limits in subdivision (d).

Paragraph (e)(1) – Compliance Schedule for a Unit that is required to meet the Phase I Emission Limits

Paragraph (e)(1) provides the compliance schedule for Units that are required to meet the NOx and CO Phase I Emission Limit in Table 1. Units subject to the Phase I Emission Limit need to submit a permit application to demonstrate compliance with the Phase I Emission Limits in Table 1 when the burner age reaches 22 years of age pursuant to paragraph (f)(1) or when the burners are replaced after rule adoption. There are three scenarios for replacing burners to meet the Phase I Emission Limit:

(1) When a burner is replaced on or after date of rule adoption, it must meet the Phase I Emission Limits in Table 1.

(2) When the burner(s) becomes 22 years of age on or after date of rule adoption, the owner or operator shall submit a permit application by July 1, 2024.

(3) If a burner is not 22 years of age at time of rule adoption, it must submit an application on or before July 1 of the calendar year when the burner age becomes 22 years of age.

Paragraph (e)(1) also establishes dates when the unit shall be in compliance with the Phase I Emission Limits in Table 1. The dates established are 12 months after a permit is issued, applicable extension date, or when the burner age reaches 25 years, whichever is sooner.

Paragraph (e)(2) – Compliance Schedule for a Unit that is required to meet the NOx Phase II Emission Limits

Paragraph (e)(2) provides the compliance schedule for Units that are required to meet the NOx Phase II Emission Limit and Units with a Hybrid oven emission limit in Table 1. Phase II Emission Limits are zero-emission limits for applicable categories and hybrid oven emission limits are both combustion and zero-emission limits for one category of bakery ovens. Units subject to the requirement must meet the Phase II limits once the unit becomes 25 years of age as determined pursuant to paragraph (f)(2) and when the burner becomes 10 years of age determined pursuant to (f)(1) if the burner was replaced after date of rule adoption and before January 1, 2027. The owner or operator has two options to meet the Phase II Emission Limit and can either elect to replace the unit or modify the unit to meet the Phase II Emission Limit:

If the owner or operator elects to replace the unit, the owner or operator shall decommission a unit that is exceeding the Phase II Emission Limit pursuant to requirements in paragraph (d)(6). For any Unit that is being decommissioned and the unit age is 25 years or older and the burner is 10 years as of January 1, 2027, the owner or operator must decommission the unit on or before July 1, 2027. If a unit is not 25 years of age and the burner is not 10 years of age by January 1, 2027,

the owner or operator must decommission the unit by July 1st of the calendar year the unit reached 25 years of age and when the burner reaches 10 years of age.

If the owner or operator elects to modify or retrofit the unit, the owner or operator shall submit an application to modify the unit that is exceeding the Phase II Emission Limit. For any Unit that is being modified and the unit age 25 years of age or older and the burner is 10 years as of January 1, 2027, the owner or operator must submit an application on or before July 1, 2027, to modify the unit. If a unit is not 25 years of age and the burner is not 10 years of age by January 1, 2027, the owner or operator must submit an application by July 1st of the calendar year the unit becomes 25 years of age and when the burner reaches 10 years of age.

Paragraph (e)(2) also establishes dates when the unit shall be in compliance with the Phase II Emission limits in Table 1. The dates established are 12 months after a permit is issued or applicable extension date; or when the Unit age reaches 25 years, whichever is sooner. Units may also be subject to the permitting requirements for volatile organic compound limits in Rule 1153.

*Paragraph (*e)(3) – Compliance Schedule for Unit that is required to meet the NOx Phase III Emission Limits

Paragraph (e)(3) provides the compliance schedule for Units that are required to meet the NOx Phase III Emission Limit. Phase III Emission Limits is a zero-emission limit for applicable categories. Units subject to the requirement must meet the Phase III limits once the unit becomes 25 years of age as determined pursuant to paragraph (f)(2) and when the burner is 10 years of age determined pursuant to (f)(1) if the burner was replaced after date of rule adoption and before January 1, 2030. The owner or operator has the two options to meet the Phase III Emission Limit and can either elect to replace the unit or modify the unit to meet the Phase III Emission Limit:

If the owner or operator elects to replace the unit, the owner or operator shall decommission a unit that is exceeding the Phase III Emission Limit pursuant to paragraph (d)(6). For any Unit that is being decommissioned and the unit age 25 years of age or older and the burner is 10 years of age as of January 1, 2030, the owner or operator must decommission the unit on or before July 1, 2030. If a unit is not 25 years or age and burner is not 10 years of age by January 1, 2030, the owner or operator must decommission the unit by July 1st of the calendar year the unit reaches 25 years of age and when the burner reaches 10 years of age.

If the owner or operator elects to modify the unit, the owner or operator shall submit an application to modify the unit that is exceeding the Phase III Emission Limit. For any Unit that is being modified and the unit is 25 years of age or older and the burner is 10 years of age as of January 1, 2030, the owner or operator must submit an application on or before July 1, 2030, to modify the unit. If a unit is not 25 years or age by January 1, 2030, the owner or operator must submit an application by July 1st of the calendar year the unit reaches 25 years of age and when the burner reaches 10 years of age.

Paragraph (e)(3) also establishes dates when the unit shall be in compliance with the Phase III Emission limits in Table 1. The dates established are 12 months after a permit is issued or applicable extension date; or when the Unit age reaches 25 years, whichever is sooner.

Units may also be subject to the permitting requirements for volatile organic compound limits in Rule 1153.

*Paragraph (*e)(4) – Alternative Compliance Schedule for Units with a Phase II Emission Limit

Paragraph (e)(4) provides an alternative compliance schedule for an owner or operator of a unit subject to the Phase II Emission Limits where the utility provider cannot provide the necessary power to facility for the unit in the compliance schedule specified in paragraph (e)(2). The owner or operator must submit an Alternative Compliance Plan pursuant to the requirements in subdivision (k).

Paragraph (e)(5) – Compliance Schedule for Units That Fail to Demonstrate Compliance with One Pound or less of NOx per day

Paragraph (e)(5) provides the compliance schedule for Units electing to comply with the one pound or less of NOx per day and fails to demonstrate compliance in accordance with subdivision (h). The owner or operator is required to submit a permit application for the limits in Table 1 within 180 days of the date of the failure to demonstrate and meet the Table 1 limits no later than 12 months after the permit is issued or expiration date of the issued permit.

Paragraph (e)(6) – Compliance Schedule for Decommissioning of the Unit

Paragraph (e)(6) establishes the compliance schedule for an owner or operator of a unit electing to decommission a unit instead of complying with the applicable emission limits in Table 1. An owner or operator must decommission the unit within 30 months following the permit application submittal deadline pursuant to subdivision (e).

Paragraph (e)(7) – Failure to Meet the Compliance by Manufacturer Certification Requirements

Paragraph (e)(7) outlines that if an owner or operator fails to meet the manufacturer's certification requirements for a unit pursuant to subparagraph (h)(1), an owner or operator must demonstrate compliance with the applicable emission limits through source test pursuant to subdivision (g) and establishes a schedule when to submit and conduct the source test protocol and any subsequent source test.

Paragraph (e)(8) – Failure to Operate Unit as specified by Manufacturer Certification

Paragraph (e)(8) outlines that if an owner or operator fails to operate or if a certification expires and the manufacturer does not re-certify the unit in accordance with manufacturers certification an owner or operator must demonstrate compliance with the applicable emission limits through source test pursuant to subdivision (g) and establishes a schedule when to submit and conduct the source test protocol and any subsequent source test.

Equipment Age [Subdivision(f)]

Subdivision (f) provides guidance to determine original burner age and unit age of applicable equipment. Paragraph (f)(1) provides options for determining original burner's age and Paragraph (f)(2) provides options for determining a unit's age. Owners or operators of unit(s) subject to PAR 1153.1 may choose any of the available options listed in paragraph (f)(1) and (f)(2) to determine original burner age and unit age, including the invoice related to the installation from equipment manufacturer, original manufacturer's identification plate, information submitted to the South Cast AQMD with permit applications, or any other method of determining burner age or unit age that can be substantiated through sufficient written information as approved by the Executive Officer. Burner's without the information outlined in subparagraph (f)(1)(C) will be deemed 22 years old

as of January 1, 2024. Similarly, Unit's without the information outlined in subparagraph (f)(2)(C) will be deemed 25 years old as of July 1, 2026.

Source Test Requirements For Units Subject to Combustion Based Emission Limits [Subdivision(g)]

Paragraph (g)(1) – Source Test Provisions

Units subject to the Combustion Based NOx and CO emission limits of PAR 1153.1 or South Coast AQMD permit concentration limit must conduct simultaneous source tests for NOx and CO to demonstrate compliance with the applicable emission limits. Paragraph (g)(1) also specifies the that a source test must be conducted every five calendar years, but no earlier than 48 calendar months after the previous source test.

Paragraph (g)(2) – Initial Source Test Requirements

Units subject to the NOx and CO emission limits of PAR 1153.1 shall conduct a source test no rather than 24 months after rule adoption or 24 months after a facility the unit becomes a former RECLAIM facility whichever is later. This initial source test will the schedule for the subsequent source testing. For new units installed after date of rule adoption, a source test must be conducted six months after the Unit's initial startup which will establish the subsequent source testing schedule. Furthermore, the source testing must be representative of the current operation of the equipment or a new source test protocol will be required.

Paragraph (g)(3) – Source Test Protocol Submission for Approval

Units subject to the NOx and CO emission limits of PAR 1153.1 shall submit a source test protocol for approval 60 days prior to conducting the source test and must conduct the source test 90 days after a written approval. Source test protocols for subsequent testing would not need to be re-evaluated provided the burner or combustion system tested was not altered to require a new permit.

Paragraph (g)(4) – Source Test Protocol Re-Submittal

Paragraph (g)(4) specifies when the owner or operator must resubmit a source test protocol after the approval of the initial protocol.

Paragraph (g)(5) – Source Test Procedure and Methods to Demonstrate Compliance

Paragraph (g)(5) specifies the procedure how a source test shall be conducted to demonstrate compliance with the limits in PAR 1153.1 and list of approved methods for conducting a source test. Subparagraph (g)(4)(D) and (g)(4)(E) specifies the operating parameters a unit must operate at when conducting a source test. A unit's compliance determination source test shall be conducted using two source tests: (1) source test where the unit is operated at the maximum rated heat input that the unit normally operates at and (2) second source test at less than 35% of the rated heat input of the unit.

Paragraph (g)(6) – Pounds Per Million Btu per hour of Heat Input Compliance

Paragraph (g)(6) specifies the procedure and test methods for an owner or operator electing to comply with the Table 1 NOx emission limit in pounds per million Btu.

Paragraph (g)(7) – Source Test Compliance for Multiple Unit in Series

Paragraph (g)(7) outlines a method for determining compliance for multiple units in series. Since some commercial food ovens subjected PAR 1153.1 are also equipped with afterburners, thermal oxidizers, or vapor incinerators downstream of the unit and are subject to Rule 1147. The provision was expanded to include those downstream units and provide an option for demonstrating compliance since the emission limits for units subject to Rule 1147 have a different emission limit from units from units subject to PAR 1153.1.

Paragraph (g)(8) – Emissions determined to Exceed an Emission Limit

Paragraph (g)(8) states that any source test that determines a unit exceeds an established emission limit constitutes a violation of the rule.

Compliance by Certification For Units Subject to Phase I Emission Limits [Subdivision(h)]

Subdivision (h) outlines the procedure and requirements an owner or operator of a unit subject to the Phase I Emission Limits with a rated heat input capacity of 2MMBtu/hr or less must follow to demonstrate compliance with an applicable emission limit through burner manufacturer's emission certification in lieu of conducting a source test pursuant to subdivision (g).

Paragraph (h)(1) – Demonstrate Compliance with Manufacturer Certification

Paragraph (h)(1) establishes the requirements and procedure to obtain emission's certification for a unit in lieu of compliance demonstration through source testing pursuant to subdivision (g). The emissions certification must be signed by the burner manufacturer or distributor's responsible official that guarantees the burner(s), fuel and combustion air system, and combustion control system identified in the submitted South Coast AQMD application. The following submissions are required when an owner or operator is electing to comply with subdivision (h):

(1) A guarantee showing that it complies with the applicable NOx emission limit in Table 1 when used for the specified process, operating conditions, and within a specified range.
(2) A separate signed emission certification addressing owner or operator of the unit and the designee at the facility.
(3) Supporting documentation which must include emission test reports of at least five South Coast AQMD approved emission tests using South Coast AQMD approved test protocol and methods for five different units operating the same process, burner, fuel and combustion air system, combustion control system, and temperature range.
(4) The emissions test results specified in in subparagraph (h)(1)(C) must be approved by South Coast AQMD prior to submittal of a permit application.
(5) A contract or purchase order, signed by the responsible official of the owner or operator of the unit as identified in the permit application and signed letter or bid from burner manufacturer to the owner or operator of the unit.

Paragraph (h)(2) – Failure to Demonstrate Manufacturer Certification Requirements

Paragraph (h)(2) establishes that any compliance determination conducted by the South Coast AQMD on a unit complying with subdivision (h) that is in excess of those in the rule shall be a considered a violation.

Demonstration of Alternative Emission Limit of One Pound or Less Per Day [Subdivision(i)]
Subdivision (i) establishes demonstration methods in which an owner or operator can demonstrate NOx emissions of one pound per pursuant to paragraph (d)(5). The demonstration methods require the owner or operator to install and maintain a unit specific non-resettable totalizing time meter for hourly limit, or a unit specific non-resettable totalizing fuel meter for fuel or therm limit and maintain records pursuant to paragraph (j)(8).

Paragraph (i)(1) – One Pound Per Day Demonstration Averaged Over a Calendar Month

Facilities electing to comply with the one pound per day averaged over a calendar month shall demonstrate compliance in accordance with paragraph (i)(1) and can either demonstrate compliance with the maximum monthly hourly operating limits specified in Table 3 (Table 3-1 of staff report). The maximum monthly operating hours in Table 3 are based on the operating hours specified in Table 4 (Table 3-2 of staff report) which is the daily operating hours and calculated assuming a five day per week operation multiplied by four weeks. The provision is to provide operating flexibility for some units.

Table 3-2. Less than One Pound per Day Monthly Operating Limits

Unit Rated Heat Input (Btu/hr)	Monthly Operating Limit (Hours)
≤ 400,000	320
>400,000 to ≤ 800,000	160
> 800,000 to ≤ 1,200,000	100

Facilities may also choose to monitor by calculating monthly operating hours with a unit specific factor in lb NOx/MMscf of natural gas in accordance with equation 1 or calculate monthly fuel usage expressed in therms with a unit specific emission factor in lb NOx/MMscf natural gas in accordance with equation 2.

Equation #1

Monthly Operating Hours = D ÷[R x (EF ÷HHV)]

Where,
D = Number of Days in Calendar Month
R = Rated Heat Input (MMBtu/hr),
EF = Emission Factor for the Unit (lbs NOx/MMScf natural gas),
HHV = Higher Heating Value of Natural Gas (1,050 MMBtu/MMScf)

Equation #2

Monthly Therms of Fuel = (D÷EF) x HHV x 10

Where,
D = Number of Days in Calendar Month
EF = Emission Factor for the Unit (lbs NOx/MMScf natural gas)
HHV = Higher Heating Value of Natural Gas (1,050 MMBtu/MMScf)
10 = Conversion to from MMBtu to Therms

Figure 3-2. PAR 1153.1 Equation 1 and Equation 2

An owner or operator of a unit electing to comply with the one pound per day or less calculating monthly maximum usage with equations 1 or 2 in PAR 1153.1 shall determine the emission factor with a South Coast AQMD approved method (e.g., source test) or use the default unit emission factor of 130 lb/MMscf of natural gas.

Paragraph (i)(2) –One Pound Per Day or Less Daily Demonstration

Facilities electing to comply with the one pound or less per daily or per day shall demonstrate compliance in accordance with paragraph (i)(2) and can either demonstrate compliance one of two ways.

(1) A permit condition limiting the operating hour based on rated heat input in Btu/hr

Table 3-3. Less than One Pound per Day Daily Operating Limits

Unit Rated Heat Input (Btu/hr)	Monthly Operating Limit (Hours)
≤ 400,000	16
>400,000 to ≤ 800,000	8
> 800,000 to ≤ 1,200,000	5

(2) A permit condition limiting the daily natural gas usage to 7,692 cubic feet per day or less. In addition, the unit will be required to install and monitor the unit with a unit specific non-resettable totalizing time meter or unit specific non-resettable totalizing fuel meter depending on the exemption chosen.

Monitoring, Recordkeeping, and Reporting [Subdivision(j)]

Subdivision (j) outlines the reporting monitoring, reporting, and recordkeeping requirements including source tests, maintenance, and records for one pound per day or less determination. Records must be kept for a minimum of five years and made available to the Executive Office upon request.

Paragraph (j)(1) –Compliance by Manufacturer Certification Recordkeeping

Paragraph (j)(1) requires an owner or operator that elects to comply with compliance by manufacturer's certification to maintain records and documentation for the unit. Also Requires the owner or operator to conduct tests to ensure compliance with PAR 1153. If the owner or operator fails to conduct testing of the certified unit, any compliance test that has to be conducted by South Coast AQMD shall be considered a violation.

Paragraph (j)(2) – Phase II Emission Limit Reporting Requirements Prior to Effective Date

Paragraph (j)(2) requires an owner or operator with units subject to the Phase II Emission Limits to report to the Executive Officer the age of the unit and anticipated date of replacement. Furthermore, the provision also requires the owner or operator to reach out to the utility provider when the unit's age reaches 17 years of age pursuant to paragraph (f)(2) and submit a document with an explanation of the service upgrades and timeframe to complete the service upgrades. This is to ensure that there are no delays and prevent any issues with complying with the Phase II Emission Limits. The documents submitted to the Executive Office must also be maintained on site for at least five years which will ensure the information is available due to potential staff turnover at the facility.

Paragraph (j)(3) – Rated Heat Input Capacity Labeling and Documentation Requirements

Paragraph (j)(3) outlines unit labeling and documentation requirements of the units rated heat input capacity.

Paragraph (j)(4) and (j)(5) – Labeling Requirements

Paragraph (j)(4), and (j)(5) outlines unit labeling requirements including units that have been modified from the original burner configuration or specifications.

Paragraph (j)(6) – Recordkeeping Requirements for Maintenance and Source Test

Paragraph (j)(6) outlines the recordkeeping requirements of maintenance and source test for the unit.

Paragraph (j)(7) – Recordkeeping Requirements for Source Test and Phase II Emission Limits Documentation Requirements in (j)(2)

Paragraph (j)(7) specifies the recordkeeping requirements that the source test and documentation Phase II Emission Limits documentation in (j)(2) must be maintained on site for five years and made available to South Coast AQMD upon request. Any source test exceedance is a violation of the rule.

Paragraph (j)(8) – Non-Resettable Totalizing Fuel Meter Requirements and Non-Resettable Totalizing Time Meter

Paragraph (j)(8) specifies the requirements an owner or operator must comply with when required to install and operate a non-resettable totalizing fuel meter and non-resettable totalizing time meter.

Paragraph (j)(9) and (j)(10) – Non-Resettable Totalizing Time Meter and Non-Resettable Totalizing Fuel Meter Recordkeeping Requirements for one pound or less per day

Paragraph (j)(10) and (j)(11) specifies the recordkeeping requirements an owner or operator electing to comply with one pound per day requirements or compliance by certification requirements which requires non-resettable totalizing meters.

Paragraph (j)(12) – RECLAIM Facility Reporting Requirements

Paragraph (j)(13) specifies a RECLAIM facility must continue to comply with the reporting requirements until the facility officially exits the RECLAIM program

Alternative Compliance Schedule Plan Requirements [Subdivision(k)]

Subdivision (k) outlines and specifies the requirements, submittal date, review process, approval process, plan modification process, and plan fees for an owner or operator that qualifies for an Alternative Compliance Schedule Plan.

Paragraph (k)(1) – Alternative Compliance Schedule Plan Requirements

Paragraph (k)(1) specifies the timeframe an owner or operator with a Unit(s) subject to Phase II Emission Limits must submit an Alternative Compliance Schedule Plan. The provision also specifies the required documents and information that must be submitted as part of submittal.

Paragraph (k)(2) – Alternative Compliance Schedule Plan Review and Approval Process

Paragraph (k)(2) specifies the Alternative Compliance Schedule Plan review and approval process and the criteria that must be met in order for the plan to be approved by the Executive Officer.

Paragraph (k)(3) – Upon Receiving Approval

Paragraph (k)(3) specifies actions an owner or operator must take once an Alternative Compliance Schedule Plan is approved and schedule for decommissioning of the unit(s).

Paragraph (k)(4) – Alternative Compliance Schedule Plan Disapproval

Paragraph (k)(4) specifies the timeframe when an owner or operator must correct deficiencies to the plan once a written notification of disapproval from the Executive Officer is received.

Paragraph (k)(5)– Alternative Compliance Schedule Plan Second Disapproval

Paragraph (k)(5) specifies the schedule and actions an owner or operator of a Unit(s) must take when a second plan disapproval is received. The facility must decommission the unit pursuant to the compliance schedule in paragraph (e)(2) or submit permit application for the Phase II Emission Limit within 60 days of receiving the disapproval.

Paragraph (k)(6) – Modifications to an Approved Alternative Compliance Schedule Plan

Paragraph (k)(6) specifies requirements necessary for an owner or operator that is requesting to modify an approved Alternative Compliance Schedule Plan.

Paragraph (k)(7) – Modifications to an Approved Alternative Compliance Schedule Plan Review
Paragraph (k)(7) specifies that the Executive Officer will review any modifications to an approved Alternative Compliance Schedule Plan in accordance to paragraph (k)(2).

Paragraph (k)(8) – Plan Fees

Paragraph (k)(8) states that an owner or operator of a Facility that submits an Alternative Compliance Schedule Plan or requests to modify an approved Alternative Compliance Schedule Plan will be subject to applicable plan fees pursuant to Rule 306.

Exemptions [Subdivision(l)]

Paragraph (l)(1) – Exemptions

Paragraph (l)(1) has been updated to include equipment regulated under Rule 1147 - NOx Reductions from Miscellaneous Sources and units with a rated heat input capacity less than 325,000 MMBtu/hr. The definition of afterburner was expanded to include thermal oxidizers, and vapor incinerators as defined by Rule 1147. In addition, the exemption of not requiring units heated solely with infrared burners to demonstrate compliance with Table 1 limits by an approved Source Test protocol was removed. Finally, the demonstration of one pound or less per day was moved to subdivision(i) as a separate subdivision.

Paragraph (l)(2) – Exemption for Units that Do Not Exceed the Phase II and Phase III Emission Limits

Paragraph (l)(2) provides an exemption for an owner and operator from permitting requirements for a new unit with NOx and CO emission that do not exceed the Phase II Emission Limits upon date of rule adoption.

CHAPTER 4 : IMPACT ASSESSMENT

INTRODUCTION

Proposed Amended Rule 1153.1 (PAR 1153.1) is expected to impact 202 units located at approximately 97 facilities. Of the estimated 97 facilities, 6 facilities are identified as participants in the RECLAIM program. Rule 1153.1 was initially adopted on November 7, 2014, and established NOx emission limits for commercial food oven located at non-RECLAIM facilities. It is expected that most of the equipment subject to PAR 1153.1 at non-RECLAIM facilities is already in compliance with emission limits of PAR 1153.1. Approximately 131 units that are currently subject to the exiting limits currently have a limit of 30 ppmv, so it is expected that approximately 93 units will be subject to the requirement to submit permit applications once the burner age reaches 22 years and comply with the lower limits when the burner reaches 25 years of age, which staff has identified as the end of the burner's useful life.

EMISSIONS INVENTORY

The total NOx inventory for the RECLAIM and non-RECLAIM units affected by PAR 1153.1 is estimated to be 0.2 tons per day based on South Coast AQMD annual emissions report (AER) inventory database for compliance year 2019 for permitted units or audited RECLAIM reported emission data. The South Coast AQMD AER program was developed to track emissions of air contaminants from permitted facilities. Facilities with annual emissions exceeding 4 or more tons of NOx, sulfur oxides, volatile organic compounds, specific organics, particulate matter, or emissions of 100 tons per year or more of CO are required to submit an annual emissions report. Facilities could also be required to submit AER if the facility receives a notification from South Coast AQMD or is subject to the AB2588 Program for reporting quadrennial updates to its toxics inventory. For each piece of RECLAIM equipment, the annual activity is estimated using facility's reported emissions for the compliance year of 2019 and fuel usage is calculated using an emission factor represented by the permit limit specific for each unit.

PAR 1153.1 will impact 97 facilities with commercial food ovens and staff will use 2019 NOx emissions as the baseline. Six facilities are currently subject to RECLAIM and 91 facilities are non-RECLAIM facilities. The emissions from the six RECLAIM facilities emissions are measured and reported to AER – the emissions are 0.028 tpd. For the 91 non-RECLAIM facilities, only 9 facilities submitted AER NOx emissions which totaled 0.047 tpd. Only 9 facilities have the criteria pollutants potential to emit (PTE) greater than the AER thresholds of 4 tons per year. In addition, most the non-RECLAIM facilities have small roasters that qualify for the exempt and emit less than one pound per day of NOx emissions. To estimate emissions for the other 82 facilities, staff evaluated the following information:

- Equipment types and number of food ovens located at facility
- Operational days per week
- Burner size or rated heat input

Staff compared the information to similar equipment categories in the information survey that was sent out to facilities. Staff averaged the emissions information for similar equipment to estimate pounds per day of NOx emissions. The following table was presented in Working Group Meeting #3:

Table 4-1. Non-RECLAIM Facility Baseline Emission Estimates

Non-RECLAIM Facility 2019 Emission Estimates						
Equipment	Burner Size (MMBtu/ hr)	Number of Facilities *	Operational Days per Week	NOx Emissions Assumption (lbs/day)	NOx Emissions (tons/year)	NOx Emissions Estimate (tons/day)
Roasters	3 or less	38	5	0.9	4.4	0.012
Dryers/ Spray Dryers	3.2 or less	5	7	4.5	4.1	0.011
Smokehouses/ Drying Ovens	5 or less	4	7	4.5	3.3	0.009
Baking & Cooking Ovens	7.2 or less	33	7	5.2	31.2	0.085
Non-RECLAIM with AER	9 Facilities					0.047
				RECLAIM		0.028
				Rule Total		0.192

* One smokehouse oven is electric and another is electric and steam heated, did not include in emissions estimates

After the table was presented in Working Group Meeting#3, staff identified several more units at the non-RECLAIM facilities with a total estimated NOx emissions of 0.008 tons per day and as a result, the baseline NOx emissions increased from to 0.192 to 0.2 tons per day. The change in estimated baseline NOx emissions was reflected in Working Group Meeting#4 discussions. Emission reductions were calculated by first summing the total 2019 baseline NOx emissions for all units subject to the rule. Then using the existing concentration limit in ppmv or emission factor (converted to ppmv) found in equipment permits, the difference between existing permit limits to the proposed concentration limits in PAR 1153.1 was calculated. This difference was then applied to the total 2019 baseline emissions for all units.

COST-EFFECTIVENESS

California Health and Safety Code Section 40920.6 requires a cost-effectiveness analysis when establishing BARCT requirements. The cost-effectiveness of a control technology is measured in terms of the control cost in dollars per ton of air pollutant reduced is measured in terms of the control cost in dollars per ton of air pollutant reduced for each class and category of equipment. The costs for the control technology include purchasing, installation, operating, and maintaining the control technology.

The South Coast AQMD typically relies on the Discounted Cash Flow (DCF) method which converts all costs, including initial capital investments and costs expected in the present and all future years of equipment life, to a present value. Conceptually, it is as if calculating the amount of funds that would be needed at the beginning of the initial year to finance the initial capital investments but also funds to be set aside to pay off the annual costs as they occur in the future. The fund that is set aside is assumed to be invested and generates a rate of return at the discount

rate chosen. The final cost-effectiveness measure is derived by dividing the present value of total costs by the total emissions reduced over the equipment life of 25 years.

The current DCF threshold was established in the South Coast AQMD 2022 Air Quality Management Plan (AQMP) as $325,000 per ton reduced for each equipment category that staff proposed to transition to zero emission technology. Incremental cost-effectiveness was calculated for the transition from 30 ppm NOx control technology to zero emission technology for four categories of commercial food ovens. Below is a table summarizing the cost-effective. incremental cost-effectiveness, and emission reductions for each category in the BARCT Assessment.

Table 4-2. Cost-Effectiveness and Incremental Cost-Effectiveness

Equipment Categories	Cost-Effectiveness at 30 ppmv	Cost-Effectiveness at 0 ppmv	Incremental Cost-Effectiveness (30 ppmv to 0 ppmv)
Indirect-Fired Bakery Ovens	$0	$38,000	N/A
Direct-Fired Bakery Ovens (>3 MMBtu/hr)	$34,000	$111,000	$119,000
Direct-Fired Bakery Ovens (≤ 3MMBtu/hr)	$27,000	$57,000	$61,000
Tortilla Ovens	$19,000/ $0 @15 ppmv	N/A	N/A
Cooking Ovens	$0	$38,000	$38,000
Drying Ovens	$36,000	$40,000	$38,000
Spray Dryers	$12,000	N/A	N/A
Smokehouses	$20,000	$9,000	$8,000
Roasters	$41,000	N/A	N/A

The cost-effectiveness for all equipment categories is well below the $325,000 cost-effectiveness threshold established in the 2022 AQMP.

EMISSION REDUCTIONS

The following table summarizes the estimated emission reductions for PAR 1153.1 by category.

Table 4-3. Emission Reductions by Commercial Food Oven Category

Equipment Categories	NOx Emission Reductions at 30 ppmv (tpd)	NOx Emission Reductions at 0 ppmv (tpd)	NOx Emission Reduction at Full Implementation
Indirect-Fired Bakery Ovens	0	0.005	0.005
Direct-Fired Bakery Ovens (> 3 MMBtu/hr)	0.008	0.08	0.08
Direct-Fired Bakery Ovens (> 3 MMBtu/hr)	0.006	0.05	0.05
Tortilla Ovens	0.007	N/A	0.007
Cooking Ovens	0	0.02	0.02
Drying Ovens	0.00002	0.009	0.009
Spray Dryers	0.0006	N/A	0.006
Smokehouses	0.0010	0.011	0.011
Roasters	0.00032	N/A	0.00032
Total			**0.19**

The estimated emission reductions are 0.19 tons per day at full implementation by 2047 which includes emission reductions for units where zero-emission is applicable. Emission limits in PAR 1153.1 are based on burner or unit replacement at end of useful life.

SOCIOECONOMIC IMPACT ASSESSMENT

A socioeconomic impact assessment will be conducted and released for public review and comment at least 30 days prior to the South Coast AQMD Governing Board Hearing on PAR 1153.1, which is anticipated to be heard on June 2, 2023 (subject to change).

CALIFORNIA ENVIRONMENTAL QUALITY ACT ANALYSIS

Pursuant to the California Environmental Quality Act (CEQA) and South Coast AQMD's certified regulatory program (Public Resources Code Section 21080.5, CEQA Guidelines Section 15251(l) and South Coast AQMD Rule 110), the South Coast AQMD, as lead agency, is reviewing the proposed project (PAR 1153.1) to determine if it will result in any potential adverse environmental impacts. Appropriate CEQA documentation will be prepared based on the analysis.

DRAFT FINDINGS UNDER CALIFORNIA HEALTH AND SAFETY CODE SECTION 40727

Requirements to Make Findings

California Health and Safety Code Section 40727 requires that prior to adopting, amending, or repealing a rule or regulation, the South Coast AQMD Governing Board shall make findings of necessity, authority, clarity, consistency, non-duplication, and reference based on relevant information presented at the public hearing, and in the staff report.

Necessity

Proposed Amended Rule 1153.1 is needed to establish BARCT requirements for facilities that will be transitioning from RECLAIM to a command-and-control regulatory structure.

Authority

The South Coast AQMD Governing Board has authority to adopt amendments to Rule 1153.1 pursuant to the California Health and Safety Code Sections 39002, 40000, 40001, 40440, 40702, 40725 through 40728, and 41508.

Clarity

Proposed Rule 1153.1 is written or displayed so that its meaning can be easily understood by the persons directly affected by it.

Consistency

Proposed Rule 1153.1 is in harmony with and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations.

Non-Duplication

Proposed Rule 1153.1 will not impose the same requirements as any existing state or federal regulations. The proposed amended rule is necessary and proper to execute the powers and duties granted to, and imposed upon, the South Coast AQMD.

REFERENCE

In drafting Proposed Rule 1153.1, the following statutes which the South Coast AQMD hereby implements, interprets or makes specific are referenced: Health and Safety Code Sections 39002, 40000, 40001, 40702, 40440(a), 40440(b), 40440(c), 40725 through 40728.5, and 41508.

COMPARATIVE ANALYSIS

Under Health and Safety Code Section 40727.2, the South Coast AQMD is required to perform a comparative analysis when adopting, amending, or repealing a rule or regulation. The comparative analysis is relative to existing federal requirements, existing or proposed South Coast AQMD rules and air pollution control requirements and guidelines which are applicable to combustion equipment subject to PAR 1153.1. A comparative analysis will be prepared and released in the Draft Staff Report at least 30 days prior to the South Coast AQMD Governing Board Hearing on PAR 1153.1, which is anticipated to be considered for approval on June 2,2023.