SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Draft Staff Report

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

September 2022

Deputy Executive Officer
Planning, Rule Development, and Implementation
Sarah L. Rees, Ph.D.

Assistant Deputy Executive Officer
Planning, Rule Development, and Implementation
Michael Krause

Planning and Rules Manager
Planning, Rule Development, and Implementation
Heather Farr

Authors: Sarady Ka – Program Supervisor
Zoya Banan, Ph.D. – Air Quality Specialist

Contributors: Barbara Radlein – Program Supervisor
Dipankar Sarkar – Program Supervisor
Brian Vlasich – Air Quality Specialist
Kevin Ni – Air Quality Specialist
Farzaneh Khalaj, Ph.D. – Assistant Air Quality Specialist

Reviewed By: Barbara Baird – Chief Deputy Counsel
Mary Reichert – Senior Deputy District Counsel

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
GOVERNING BOARD

Chair: BEN J. BENOIT
Mayor Pro Tem, Wildomar
Cities of Riverside County

Vice Chair: VANESSA DELGADO
Senator (Ret.)
Senate Rules Committee Appointee

MEMBERS:

MICHAEL A. CACCIOTTI
Mayor, South Pasadena
Cities of Los Angeles County/Eastern Region

ANDREW DO
Supervisor, First District
County of Orange

GIDEON KRACOV
Governor's Appointee

SHEILA KUEHL
Supervisor, Third District
County of Los Angeles

LARRY MCCALLON
Mayor, Highland
Cities of San Bernardino County

VERONICA PADILLA-CAMPOS
Speaker of the Assembly Appointee

V. MANUEL PEREZ
Supervisor, Fourth District
County of Riverside

NITHYA RAMAN
Council Member, Fourth District
City of Los Angeles Representative

REX RICHARDSON
Vice Mayor, City of Long Beach
Cities of Los Angeles County/Western Region

CARLOS RODRIGUEZ
Mayor, Yorba Linda
Cities of Orange County

JANICE RUTHERFORD
Supervisor, Second District
County of San Bernardino

EXECUTIVE OFFICER:

WAYNE NASTRI

TABLE OF CONTENTS

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.

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 of 30 ppmv regardless of process temperature. In addition, PAR 1153.1 proposes a lower NOx limit of 15 ppmv for tortilla ovens firing infrared burners which are currently achieving 15 ppmv. The public process for PAR 1153.1 consisted of five working group meetings, a public workshop, and multiple meetings with industry stakeholders and technology vendors to obtain feedback.

The compliance schedule for PAR 1153.1 takes into account potential stranded assets as some facilities have just recently come into compliance with the latest NOx limits adopted in 2014. Therefore, PAR 1153.1 will require facilities to meet the lower NOx limits upon replacement of burners or combustion system. Units will be required to submit a permit application to meet the proposed lower emission limits by July 1 of the year after the burner(s) becomes 22 years old. 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 0.017 tons tpd at full implementation by 2047.

CHAPTER 1: BACKGROUND

INTRODUCTION

REGULATORY BACKGROUND

AFFECTED INDUSTRIES

AFFECTED EQUIPMENT

PROPOSED AMENDED RULE 1153.1

PUBLIC PROCESS

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.

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.

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.

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 of ovens, roasters, and smokehouses that produce food and beverage products (NAICS 311 and 312). Staff identified 97 facilities with a total of 224 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 179 units located at non-RECLAIM facilities. A breakdown of unit categories is shown in Figure below.

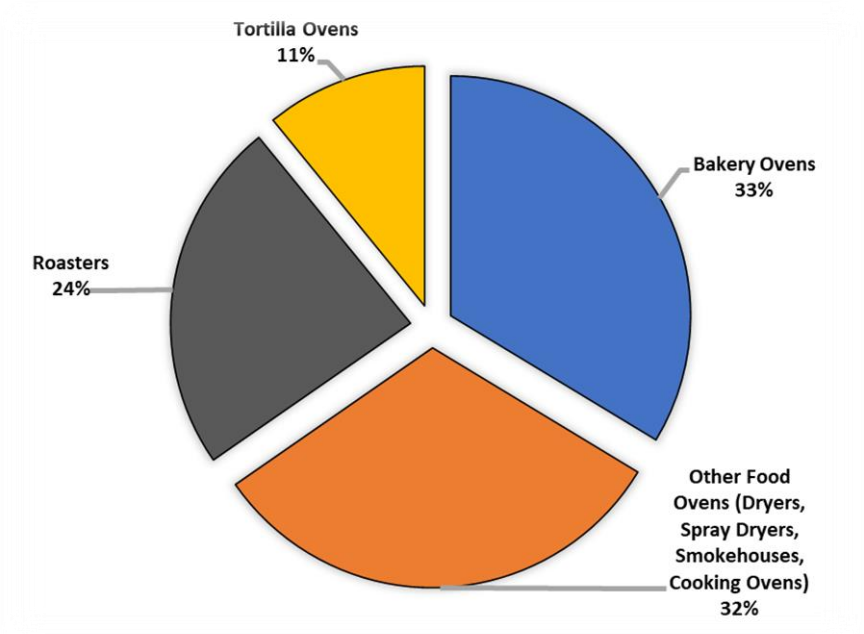

Figure 1-1. Commercial Food Oven Categories Subject to PAR 1153.1

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 four Working Group Meetings and has scheduled a fifth Working Group Meeting 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 Error! No text of specified style in document.**-1. 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
November 4, 2022		Set 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.

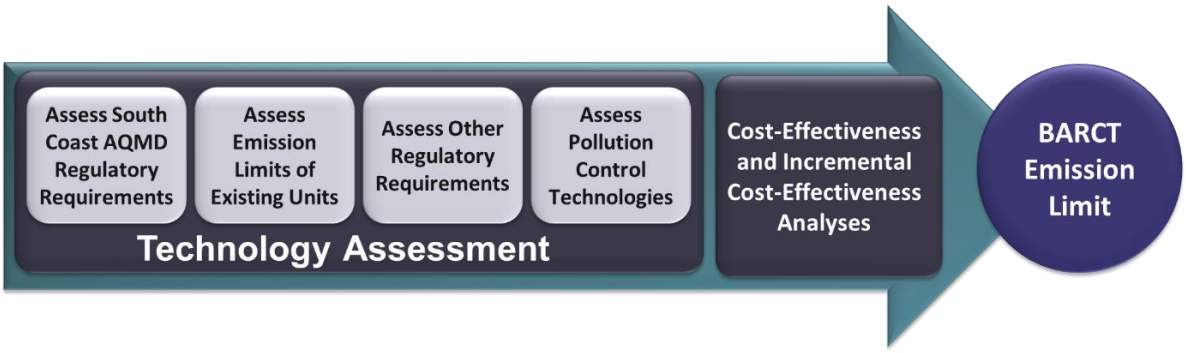

Figure 2-1. BARCT Assessment Approach

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, and 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, and other unique operational features of the units. Figure 2-1 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 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.

EQUIPMENT CATEGORIES AND PROCESSES

There are two main types of commercial food ovens – conveyor and batch ovens. Conveyor ovens continually take in food items, cook them, and deliver the cooked product to an area where it cools prior to packaging. Batch ovens take in food items and remove them 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 four categories as follows.

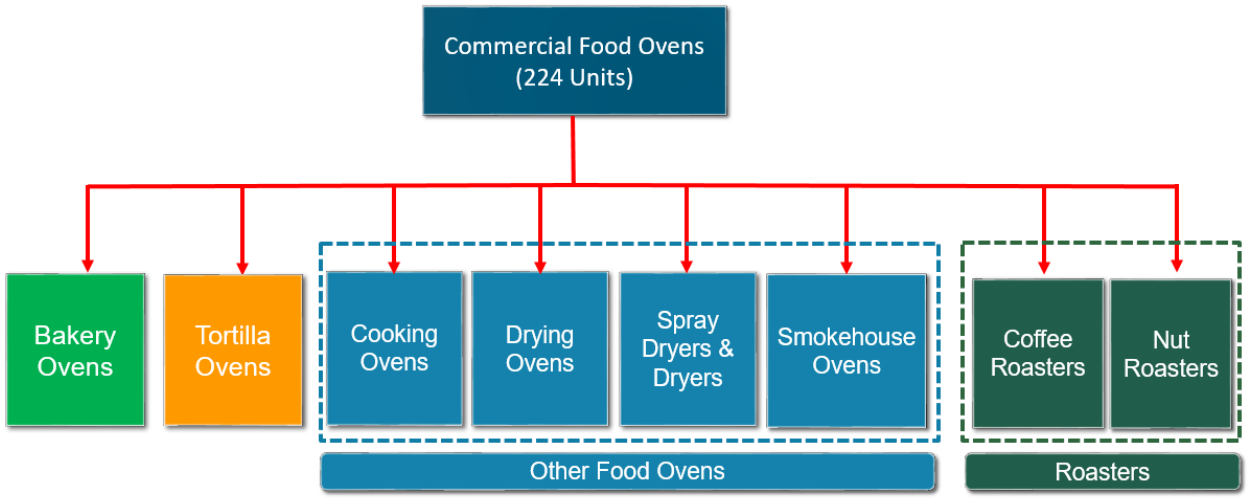

Figure 2-2. Commercial Food Oven Categories

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 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 segregated 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

BARCT ASSESSMENT

Assessment of South Coast AQMD Regulatory Requirements and Emission Limits of Existing Units

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 Error! No text of specified style in document.**-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

Source Test

In addition, staff also 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 224 food ovens were already performing below 30 ppmv level; 14 of these units were unit replacements at BACT and most units have an existing permit limit of 30 ppmv or less. 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 less than 15 ppmv 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.

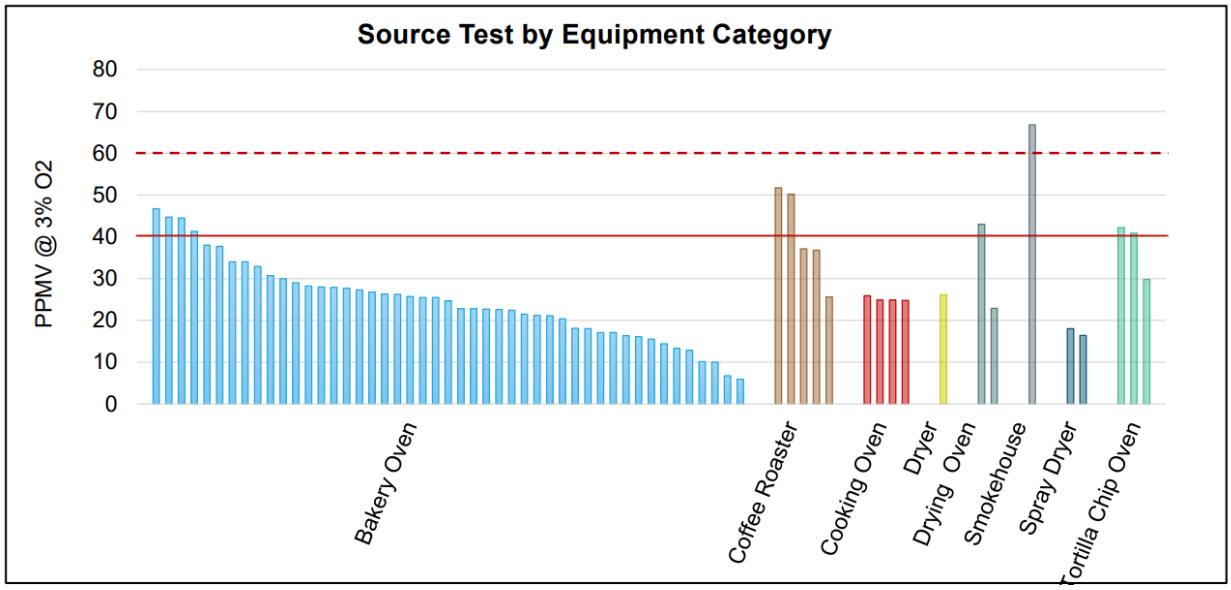

Figure 2-3. Source Test Data for Commercial Food Oven Categories

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 Error! No text of specified style in document.**-3. 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 a potentially transferable to commercial food oven applications.

Staff assessed different pollution control technologies as part of the BARCT assessment. Staff presented and discussed the pollution control technology assessment in Working Group Meeting

#3 which was held on July 27, 2022. 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
- Burner retrofit
- Unit replacement
- Emerging and zero-emission emission technology

There are several options for reducing NOx emissions from combustion equipment subject to PAR 1153.1. Some ovens can potentially change or alter their process, so heat is generated by electricity. There are currently a few examples of this with smokehouse ovens where currently four smokehouse ovens use electricity as the method of supplying heat to the process. Another option is to use heat generated by a steam boiler or thermal fluid heater which can be an efficient and cost-effective method to heat a process. The heat is transfer process requires the use of a heat exchanging system to warm and heat the incoming air that enters the process chamber and heats the food product. For most commercial food ovens, the preferred option is to reduce NOx emissions by replacing the burner system with newer low-NOx burners. In some situations, burners installed within the last 10 years may be tuned and optimized to reduce NOx formation rather than undergoing a complete burner replacement. This will result in cost savings for the facilities. NOx control techniques or combustion control can be divided into two control techniques: (1) combustion control and (2) post-combustion control. Combustion controls are techniques that reduce NOx by modifying the combustion zone through installation of 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. 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.

Burner Technology for Food Ovens

PAR 1153.1 requires food ovens, roasters, dryers, spray dryers, and smokehouses equipment to meet a NOx emission limit of 30 ppmv regardless of process temperature. Based on meetings with combustion system manufacturers, most considered food ovens as relatively low process temperature applications and will guarantee NOx below 30 ppmv up to 1,600 °F. Most commercial food ovens regardless of type operate from 130 to 700 °F which are relatively low temperatures when compared to other industrial processes requiring heat. For this reason, staff believes that the temperature threshold of 500 °F is no longer necessary and will be proposing to remove it from PAR 1153.1. Based on discussions with vendors and provide guarantees of 9 ppmv or less on industrial processes that operate ≥1,200 °F, the proposed lower BARCT limits are achievable regardless of process temperature of commercial food ovens and all operate well below 1,200 °F.

Based on discussion with vendors, in some instances, to meet the proposed BARCT emission limits, some ovens with ribbon burners or other types LNBs will only require tuning and regular maintenance to meet the proposed BARCT concentration limits. In other cases, compliance with the propose BARCT limits will require replacement with newer design lower NOx emitting burners and/or upgrades to the burner control system. 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 other air heating type burners.

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 insert type insert along the length of the pipe that allows for better control of the flame. These ribbon inserts 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. The latest ribbon burners incorporate a metal fiber mesh across the length of the burner where overall flame temperature is reduced which can achieve low 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.

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. The latest low-NOx versions of these types of burners 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.

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. Based on source test data of existing food ovens, IR burners can achieve 9 ppmv or less.

Post-Combustion Control Technology for Food Ovens

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 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) as well as the BELCO® regenerative LABSORB™ process.[1] LoTOx™ is a low temperature operating system in a range of 140°–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:

- 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.

Post combustion control requires significant capital investment and has a high annual operating cost for commercial food oven applications.

Emerging technology and Zero Emission technology

Other options for controlling NOx emissions can potentially include zero-emission technology. Three potential technologies were explored as part of the BARCT assessment were:

- 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.
- 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.
- 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.

One of the concerns with zero-emission technology was the electrical requirements necessary to operate an electrical bakery oven. Working with an industry stakeholder who owns and operate two large commercial bakery facility 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 2-4. 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 (percent)
Facility One	37.3 thousand/day	51.4 thousand/day (for 3 ovens)	140% (for 3 ovens)
Facility Two	9.51 thousand/day	34.3 thousand/day (for 2 ovens)	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. As a result, it was concluded that zero-emission technology is not feasible at this time for these commercial applications and would require a future technology assessment to determine the progress in applying zero-emission technologies in these electricity intensive operations.

Vendor Discussion

The following vendors and manufacturers were contacted requesting information regarding burner control technologies, post-combustion control technologies, zero-emission technologies. Each vendor representative has over 25 years of experience with combustion systems. 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
- Flynn Burners
- Honeywell/Maxon
- Micron Fiber-Tech
- Peerless
- Umicore

A summary of the discussion and conclusions are below, and Table 2-5 was also presented at Working Group Meeting #2:

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. Most consider commercial food oven low temperature applications and have guarantees below 30 ppmv up to 1,600 °F. They believe that the process temperature threshold is not necessary. A few of the vendors have achieved sub-15 ppmv in certain applications and acknowledge a lower NOx could have been achieved if the burner was tuned properly. In some instances, an existing burner may only require tuning to optimize combustion for low NOx levels. One vendor even provided a case study for a ribbon burner retrofit in a commercial bakery where their ribbon burners achieved sub-9 ppmv based on a handheld meter (e.g., diagnostic check) but not demonstrated in a source test conducted by a third-party. In addition, they provided a guarantee letter of 9 ppmv for an air heater LNB in an industrial application but not for specific operating parameters typically found in food oven applications. 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.

Selective Catalytic Reduction (SCR) Systems and LoTOx with wet Scrubber

Exiting limits in Rule 1153.1 can feasibly be achieved with burner control only technologies. SCRs and LoTOx systems can achieve NOx levels of 5 ppmv or less. Both systems are typically employed in large that are 30 MMBtu/hr or greater due to cost versus overall NOx emissions. All

commercial food ovens are less than 10 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.

Table Error! No text of specified style in document.**-5. 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

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 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 are the most feasible option and for reducing NOx for commercial food oven applications and achieve the NOx concentration limits proposed.

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. Burner control technologies are still the main technologies that can achieve the NOx concentration limits proposed in the rule. 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

	Rule 1153.1	Existing Units	Other Regulatory Agencies	Technology Assessment	Initial BARCT NOx Limit	Proposed BARCT NOx Limit
Bakery Ovens	40 and 60 ppm	13 - 47 ppm	40 and 60 ppm	0* to 30 ppm	30 ppm	*Need to conduct cost-effectiveness and incremental cost-effectiveness*
Tortilla Ovens	40 and 60 ppm	8.4 – 52 ppm	40 and 60 ppm	5 to 30ppm	30 ppm and 15 ppm	*Need to conduct cost-effectiveness and incremental cost-effectiveness*
Other Food Ovens	40 and 60 ppm	16 - 67 ppm	40 and 60 ppm	0** to 30 ppm	30 ppm	*Need to conduct cost-effectiveness and incremental cost-effectiveness*
Roasters	40 and 60 ppm	25 – 66 ppm	40 and 60 ppm	9 to 30 ppm	30 ppm	*Need to conduct cost-effectiveness and incremental cost-effectiveness*

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. There ae two methods used to calculate cost-effectiveness, discounted cash flow method and levelized cash flow method. The cost-effectiveness for PAR 1153.1 were completed using the discounted cash flow method. The two methods are 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.

Levelized Cash Flow (LCF)

The LCF method annualizes the present value of total costs as if all costs, including the initial capital investments, would be paid off in the future with an equal annual installment over the equipment life. What is less clear, however, is how to deal with non-constant emission reductions when using the LCF method. The LCF method is designed to compare the annualized cost with the annual emission reduction that can be potentially achieved by a project; thus implicitly, emission reductions are constant when the LCF method is applied. The LCF equation is below:

$$LCF = \left(\frac{Annualized\ Present\ Value\ of\ Total\ Costs}{Average\ Annual\ Emission\ Reductions}\right)$$

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-Effectiveness Analysis and Incremental Cost-Effectiveness Analysis

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, vendors, distributors, and stakeholders to gather cost data and estimates for various types of burners and sizes. In addition, staff also sent out a survey to the facilities to gather equipment data and cost information for recent NOx control projects. As discussed earlier in the technology assessment, staff identified three main types of burners utilized in commercial food ovens: (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.

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.

One 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 MMBt/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:

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

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.

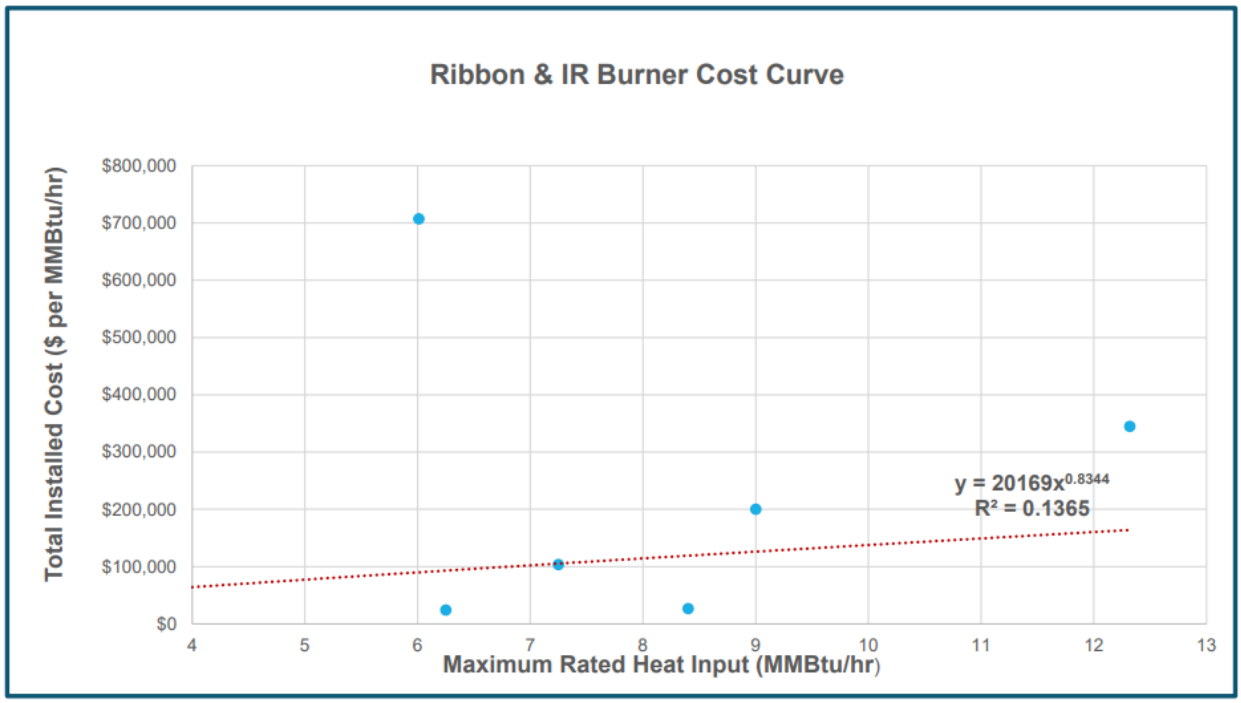

Fig 2-4. Ribbon and IR Burner Cost Curve

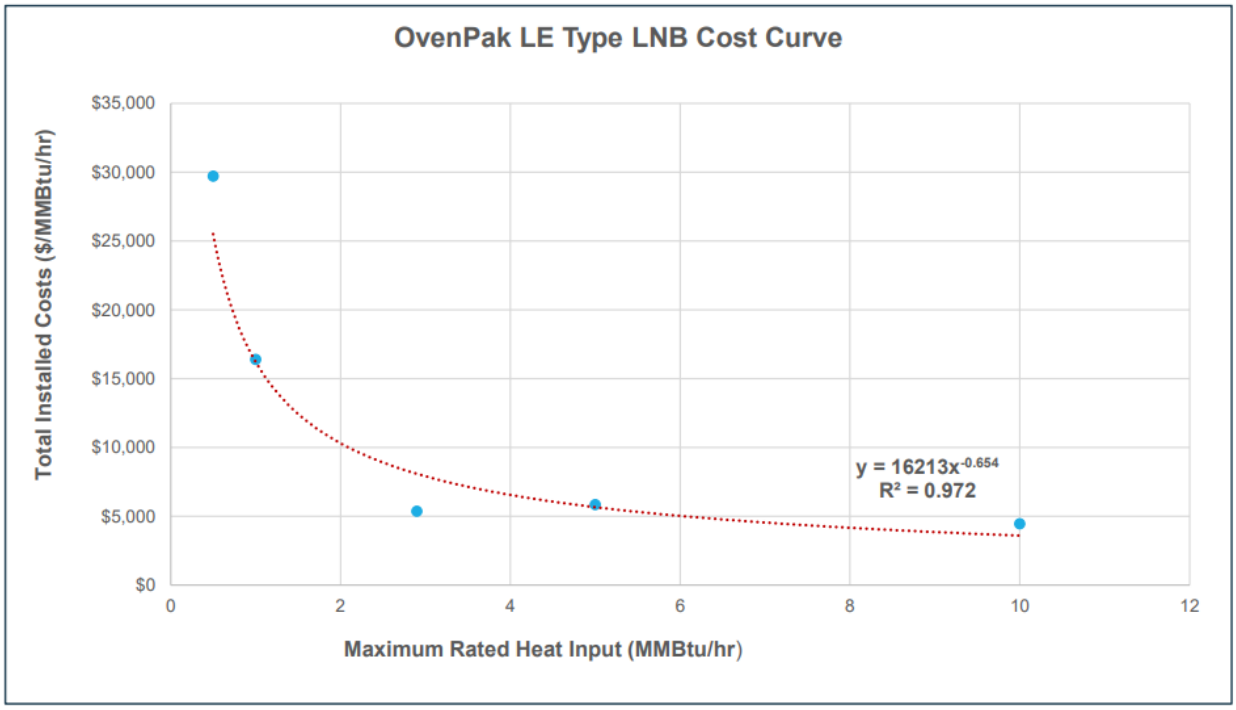

Fig 2-5. Ribbon and IR Burner Cost Curve

After cost information was obtained for all units that require burner control technology, 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. For annual operating and maintenance costs 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 $50,000/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.

Table 2-7. Cost-Effectiveness for PAR 1153.1 Categories

Cost-Effectiveness		
Bakery Ovens	30 ppm	Emission Reductions
Cost-Effectiveness	$46,000	0.0076
Tortilla Ovens	**30 ppm** *(Ribbon and IR burners)*	**15 ppm** *(IR burners only)*
Cost-Effectiveness	$22,000	No Additional Cost
Emission Reductions (tpd)	0.0067	0
Other Food Ovens	**30 ppm**	**Reductions (tpd)**
Cost-Effectiveness	$19,000	0.0023
Roasters	**30 ppm**	**Reductions (tpd)**
Cost-Effectiveness	$49,000	0.00032

Cost-Effectiveness for all commercial food oven categories in PAR 1153.1 were below $50,000 per ton of NOx and considered cost-effective for 30 ppmv. Staff did not include the cost of the one commercial bakery oven that they estimate would cost $4,200,000 to meet the proposed NOx limit of 30 ppmv from their current NOx emission levels at less than 35 ppmv. This bakery oven is already performing near the BARCT limit so staff is proposing a near limit of 35 ppmv to address this one oven that would not be incrementally cost-effective to retrofit to meet a 30 ppmv limit. Pursuant to determining BARCT for class and category, it was cost effective for the remaining units to meet the 30 ppmv.

As discussed earlier in the section, staff identified two control options for controlling NOx; burner control technology and post-combustion. However due to challenges of high capital cost and additional requirements such as temperature and waste effluent treatment, post-combustion control was determined as not feasible for commercial oven applications, so an incremental cost-effectiveness analysis was not calculated.

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, and the proposed averaging times for each class and category.

Table 2-8. Proposed BARCT NOx and CO Emission Limits for Commercial Food Ovens

Equipment Categories	NOx Emission Limit	CO Emission Limit
	ppmv @ 3% O_2, dry or lbs/MMBtu	
Bakery Ovens	30 ppmv or 0.036 lbs/MMBtu	800 ppmv
Tortilla Ovens	30 ppmv or 0.036 lbs/MMBtu	
Tortilla Ovens (heated solely by infrared burners)	15 ppmv or 0.018 lbs/MMBtu	
Other Food Ovens (Dryers, spray dryers, cooking ovens, drying ovens, and smokehouses)	30 ppmv or 0.036 lbs/MMBtu	
Roasters	30 ppmv or 0.036 lbs/MMBtu	

As part of BARCT assessment, staff determined that the temperature threshold of 500 °F is no longer necessary since most vendor and manufacturers consider food oven applications low temperature and will guarantee 30 ppmv or less all the way up to 1,600 °F. Most vendors also have combustion control options that will meet the proposed BARCT limit of 30 ppmv. 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 BARCT limit upon burner replacement or no longer than a 25-year burner life based on burner age. PAR 1153.1 will also address a bakery oven unit that is currently performing near the proposed BARCT limit of 30 ppmv by providing a near limit of 35 ppmv. This unit has a high cost-effectiveness due to high control equipment cost and low emission reductions.

As facilities transition from RECLAIM into PAR 1153.1, an interim limit would put in place until required to meet the proposed NOx limits. Non-RECLAIM facilities will be subject to limits of existing Rule 1153.1 limits while RECLAIM facilities without existing permit limits for NOx will be subject to an interim limit of 102 ppmv NOx which is based on the existing RECLAIM default

emission factor of 130 pounds of NOx per million standard cubic feet of natural gas (lbs/MMcf). Once the unit meets the NOx limits in PAR 1153.1, the interim limit would no longer be applicable.

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, and reorganizing the rule structure to be consistent with recently amended or adopted rules. The proposed revised rule structure and key provisions are discussed below.

PROPOSED AMENDED RULE STRUCTURE

(a) Purpose
(b) Applicability
(c) Definitions
(d) Requirements
(e) Compliance Schedule
(f) Burner Age
(g) Source Test Requirements
(h) Compliance by Certification
(i) Demonstration of One Pound or Less of NOx Per Day
(j) Monitoring, Recordkeeping, and Reporting Requirements
(k) Exemptions

Proposed Amended Rule 1153.1

The proposed amended rule separates the purpose and applicability to be consistent with recently adopted and amended rules.

Rule 1153.1 Purpose [Subdivision(a)]

The purpose of this rule is to reduce emissions Oxides of Nitrogen (NOx) and Carbon Monoxide (CO) from gaseous and liquid-fired combustion equipment as defined in this rule.

Rule 1153.1 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 require South Coast AQMD permits and 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.

Rule 1153.1 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.

BAKERY OVEN in paragraph (c)(1), which means:

> *"an oven used to heat, cook, or prepare baked products which includes tunnel ovens, conveyor ovens, tray ovens, and griddle ovens."*

DECOMMISSION in paragraph (c)(3), 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."*

DRYER in paragraph (c)(4), which means:

> *"a heated convection oven or chamber used to remove water or moisture to dry food products, or process where liquids are atomized and dried into powder form by spraying the liquid feed into a heated chamber."*

FORMER RECLAIM FACILITY in paragraph (c)(6), 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."*

NON-RECLAIM FACILITY in paragraph (c)(11), which means:

> *"a facility, or any of its successors, that was not in the Regional Clean Air Incentives Market program as of January 5, 2018, as established in Regulation XX."*

OTHER FOOD OVENS in paragraph (c)(12), which means:

> *"any food oven that is used to cook or dry food products not including bakery ovens, tortilla ovens, and roasters."*

OXIDES OF NITROGEN (NOx) EMISSIONS in paragraph (c)(13), 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)(14), 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."*

RECLAIM FACILITY in paragraph (c)(16), 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."*

SMOKEHOUSE in paragraph (c)(19), which means:

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

SOURCE TEST PROTOCOL in paragraph (c)(20), which means:

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

STANDARD CONDITIONS in paragraph (c)(21), which means:

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

TORTILLA OVEN in paragraph (c)(23), which means:

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

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

> *"any Food Oven, Dryer, Smokehouse, or Roaster requiring a South Coast AQMD permit and used to prepare food or products for making beverages for human consumption."*

Rule 1153.1 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. An owner or operator of a unit subject to PAR 1153.1 shall not operate the unit in a manner that exceeds the NOx and CO limits of PAR 11153.1 in accordance with the compliance schedule in subdivision (e).

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

Equipment Categories	NOx Emission Limits	CO Emissions Limits
Bakery Ovens	30 ppmv or 0.036 lbs/MMBtu	800 ppmv
Tortilla Ovens	30 ppmv or 0.036 lbs/MMBtu	
Tortilla Ovens (heated solely by Infrared Burners)	15 ppmv or 0.018 lbs/MMBtu	
Other Food Ovens	30 ppmv or 0.036 lbs/MMBtu	
Roasters	30 ppmv or 0.036 lbs/MMBtu	

Paragraph (d)(2) - 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 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)(3) –NOx Emission Limit of One Pound Per Day or Less

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)(9) through (j)(12).

Paragraph (d)(4) – Compliance by Decommissioning the Unit

Paragraph (d)(4) provides the option for an owner or operator of a unit subject to PAR 1153.1 to decommission the unit instead of complying with the applicable emission limits in Table 1.

Paragraph (d)(5) – Combustion System Maintenance

Paragraph (d)(5) requires a unit to conduct combustion system maintenance in accordance with manufacturers schedule and specifications. Recordkeeping requirement that was originally included in this paragraph in Rule 1153.1 has been moved to subdivision (i) in PAR 1153.1

Paragraph (d)(6) – Compliance with Pounds Per Million Btu Requirement Prior to Compliance Demonstration

Paragraph (d)(6) requires an owner or operator of a unit electing to comply with Table 1 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)(7) – Compliance with Pounds Per Million Btu Fuel and Time Meter Requirement

Paragraph (d)(7) requires an owner or operator of a unit electing to comply with Table 1 expressed as pounds per million Btu to install and maintain a non-resettable totalizing time or fuel meter pursuant to subparagraph (j)(7) and (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

Paragraph (e)(1) provides the compliance schedule for Units that are required to meet the NOx and CO emission limits in Table 1 pursuant to paragraph (d). Units subject to this paragraph need to submit permit applications to demonstrate compliance with the emission limits of PAR 1153.1 Table 1 on or before January 1, 2024, or January 1 of the year for any unit where the burner age reaches 22 years as determined by subdivision (f). In addition, paragraph (e)(1) establishes dates when the unit shall be in compliance with the Table 1 limits. The dates established are 12 months after a permit is issued, when the permit expires, or when the burner age reaches 25 years, whichever is sooner.

Paragraph (e)(2) – Compliance Schedule for Units That Fail to Demonstrate Compliance with NOx Emissions of One pound per day or less

Paragraph (e)(2) provides the compliance schedule for Units electing to comply with the one pound per day and fail 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)(3) – Compliance Schedule for Decommissioning of the Unit

Paragraph (e)(3) establishes the compliance schedule for an owner or operator of a unit subject to electing to decommission a unit instead of complying with the applicable emission limits in Table 1. An owner or operator that elects to decommission the unit in lieu of complying with the emission limits in Table 1 must decommission the unit within 30 months following the permit application submittal deadline pursuant to subdivision (e) and inactivate the Unit's permit. The owner or operator must disconnect and blind all fuel and remove all air and electricity to the unit

Paragraph (e)(4) – Compliance Schedule for Units Exempt from Table 1

Paragraph (e)(4) An owner or operator of a bakery oven electing to comply with the exemption from Table 1 pursuant to paragraph (k)(2). The owner or operator is required to submit a complete permit application on or before July 1, 2023 and establishes a date when the facility must meet the limit.

Paragraph (e)(5) – Units Exempt from Table 1 that Exceed Exemption Limits

An owner or operator of a bakery oven electing to comply with the exemption pursuant to paragraph (k)(2) that exceeds the NOx or CO emission limits is required to submit a complete permit application within six months of the exceedance date for the applicable NOx and CO limits in Table 1 and meet the emission limits in Table 1 within 12 months after permit issuance or the expiration date of the issued permit.

Paragraph (e)(6) – Failure to Meet the Compliance by Manufacturer Certification Requirements

Paragraph (e)(6) 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)(7) – Failure to Operate Unit as specified by Manufacturer Certification

Paragraph (e)(7) outlines that if an owner or operator fails to operate 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.

Rule 1153.1 Burner Age Determination [Subdivision(f)]

Subdivision (f) provides guidance to determine burner age of applicable equipment. Owners or operators of unit(s) subject to PAR 1153.1 may choose any of the available options listed in paragraph (f)(2) to determine burner 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 that can be substantiated through sufficient written information as approved by the Executive Officer.

Unit(s) without the information outlined in paragraph (f)(2) will be deemed 22 years old as of January 1, 2024.

Rule 1153.1 Source Test Requirements [Subdivision(g)]

Paragraph (g)(1) – Source Test Provisions

Units subject to the NOx and CO emission limits of PAR 1153.1 must conduct simultaneous source tests for NOx and CO to demonstrate compliance with the applicable emission limits pursuant to subdivision (d). Specifies the period in which a source test must be conducted.

Paragraph (g)(2)to (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 Procedure and Methods to Demonstrate Compliance

Paragraph (g)(4) 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)(5) – Pounds Per Million Btu per hour of Heat Input Compliance

Paragraph (g)(4) 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)(6) – Source Test Compliance for Multiple Unit in Series

Paragraph (g)(6) 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)(7) – Periodic Source Test Requirements

Paragraph (g)(7) outlines periodic source test schedule for units subject to PAR 1153.1. Any unit subject to PAR 1153.1 with emissions greater than one pound per day shall conduct periodic source testing every five calendar years and qualify periodic source testing may not be conducted earlier than 48 months after the previous source test. Rule 1153.1 did not previously require periodic source testing for applicable units.

Rule 1153.1 Compliance by Certification [Subdivision(h)]

Subdivision (h) outlines the procedure and requirements an owner or operator of a unit with a rated heat input capacity of 2MMBtu/hr or less must follow in order 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.

Rule 1153.1 Demonstration of Alternative Emission Limit of One Pound or Less Per Day [Subdivision(i)]

Subdivision (h) establishes demonstration methods in which an owner or operator can demonstrate NOx emissions of one pound per pursuant to paragraph (d)(3). 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 (i)(9) through (i)(12).

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 (h)(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 3-1. 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.

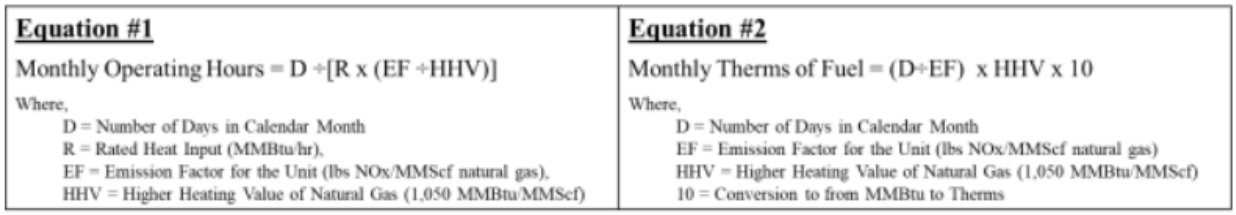

Fig. 3-1. PAR 1153.1 Equation 1 and Equation 2

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 (h)(2) and can either demonstrate compliance one of three ways.

(1) The unit must have a rated heat input capacity of less than 325,000 Btu per hour

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

Table 3-2. 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

(3) 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.

Rule 1153.1 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) – Rated Heat Input Capacity Labeling and Documentation Requirements

Paragraph (j)(2) outlines unit labeling and documentation requirements of the units rated heat input capacity.

Paragraph (j)(3) and (j)(4) – Labeling Requirements

Paragraph (j)(3), and (j)(4) outlines unit labeling requirements including units that have been modified from the original burner configuration or specifications.

Paragraph (j)(5) – Recordkeeping Requirements for Maintenance and Source Test

Paragraph (j)(5) outlines the recordkeeping requirements of maintenance and source test for the unit.

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

Paragraph (j)(6) specifies the recordkeeping requirements that the source test must be maintained on site for five years and made available to South Coast AQMD upon request and any exceedance is a violation of the rule.

Paragraph (j)(7) – Non-Resettable Totalizing Fuel Meter Requirements

Paragraph (j)(7) specifies the requirements an owner or operator must comply with when required to install and operate a non-resettable totalizing fuel meter.

Paragraph (j)(8) – 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 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)(9) and (j)(10) 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)(11) – RECLAIM Facility Reporting Requirements

Paragraph (j)(11) specifies a RECLAIM facility must continue to comply with the reporting requirements until the facility officially exits the RECLAIM program

Rule 1153.1 Exemptions [Subdivision(k)]

Paragraph (k)(1) – Exemptions

Paragraph (k)(1) has been updated to include equipment regulated under Rule 1147 - NOx Reductions from Miscellaneous Sources and clarified the exemption for units regulated under RECLAIM until they become a former RECLAIM facility. 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 (k)(2) – Exemption for Bakery Ovens

Paragraph (k)(2) provides an exemption from the NOx and CO limits in Table 1 for an owner and operator of a bakery oven installed prior to rule adoption and submits a permit application for a permit condition that limits the NOx emissions to 35 ppmv and the CO emissions to 800 ppmv according to paragraph (e)(5) and meets the following conditions:

(1) Does not have an exiting permit limit condition limiting the NOx emissions to 30 ppmv or less;
(2) Is currently not operating at or below 30 ppmv; and
(3) Is not operating above 40 ppmv NOx.

CHAPTER 4: IMPACT ASSESSMENT

INTRODUCTION

Proposed Amended Rule 1153.1 (PAR 1153.1) is expected to impact 224 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 AND EMISSIONS REDUCTIONS

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.

Baseline Emissions

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
* One smokehouse oven is steam heated, did not include in emissions estimates					RECLAIM	0.028
					Rule Total	0.192

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. The estimated emission reductions is 0.017 tons per day at full implementation by 2047.

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. DCF is calculated as follows:

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

Where:

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

Where

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

The present-value factor (PVF) converts a constant stream of payments made for N years into its single present-value equivalent.

Staff will also present Levelized Cash Flow (LCF) method which annualizes the present value of total costs as if all costs, including the initial capital investments, would be paid off in the future with an equal annual installment over the equipment life. LCF is

$$LCF = \left(\frac{Annualized\ Present\ Value\ of\ Total\ Costs}{Average\ Annual\ Emission\ Reductions}\right)$$

In general, DCF cost-effectiveness estimates are lower given the same interest rate and equipment life. The current DCF threshold was established in 2010 SOx RECLAIM BARCT assessment as $50,000 per ton reduced. A LCF threshold has not been established. Incremental cost-effectiveness was not calculated since post-combustion control was considered not feasible for commercial food oven applications due to the unit's having a rated heat input capacities of 12.3 MMBtu/hr or less and low operating temperature of the units.

Control Equipment Cost Estimates

As described in Chapter 2, staff conducted a survey of the affected facilities seeking total install and O&M for past or recent NOx burner projects. Staff used the facility supplied cost data when it was provided. In addition, staff held meeting with several vendors to gather cost information which included budgetary. Staff used the facility cost data to generate cost curves to estimate the cost for units in each of the four categories. The cost-effectiveness is based on 25 years which is the presumed life of the burners or combustion system.

The proposed BARCT emission limits will take effect at the end of the presumed useful life of the equipment that is currently be used; therefore, the majority if the cost impacts are at the natural turnover of the burner or combustion system. The equipment meeting the existing limits of the current rule will submit a permit application to meet the new proposed limits by January 1 of the year after the burner becomes 22 years old. The facilities will incur some cost to upgrade the burners, but most of the cost will already be incurred due to end of useful life replacement.

SOCIOECONOMIC ASSESSMENT

A socioeconomic impact assessment will be conducted and, if applicable, released for public review and comments at least 30 days prior to the South Coast AQMD Governing Board Hearing, which is anticipated to be on November 4, 2022.

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 December 2, 2022.