SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Draft Staff Report

Proposed Amended Rule 1147 - NOx Reductions from Miscellaneous Sources

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EXECUTIVE SUMMARY

Proposed Amended Rule (PAR) 1147 – NOx Reductions from Miscellaneous Sources, seeks further emission reductions of oxides of nitrogen (NOx) and is part of a suite of "landing" rules for facilities currently regulated under the Regional Clean Air Incentives Market (RECLAIM) program or under another existing source specific rule. The goal is to conduct an updated Best Available Retrofit Control Technology (BARCT) analysis to ensure affected equipment is feasibly controlled to achieve cost effective maximum emission reductions.

Control Measure CMB-05 of the Final 2016 Air Quality Management Plan (AQMP) directed staff to assess how to transition the RECLAIM program to a command-and-control regulatory structure requiring BARCT as soon as practicable and to achieve a five tons per day NOx emission reduction as soon as feasible but no later than 2025.

PAR 1147 will primarily update NOx emission limits for existing equipment categories, as well as establish new equipment categories based on stakeholder comments. PAR 1147 will include a newly added carbon monoxide (CO) limit for RECLAIM and non-RECLAIM equipment with additional requirements for monitoring and recordkeeping. The proposed NOx emission limits for existing categories and new emission limits for added equipment categories represent BARCT. The proposed amended rule will update compliance dates and new limits for NOx and CO emissions for RECLAIM, non-RECLAIM, and former RECLAIM facilities.

The current Rule 1147 regulates NOx emissions from miscellaneous combustion equipment that range from a wide variety of industries, such as automotive body shops to large industrial manufacturing facilities, at limits ranging between 30 to 60 ppm depending on equipment type and process temperature. PAR 1147 regulates roughly 5,300 units located at approximately 3,000 facilities. After a comprehensive BARCT assessment including analysis of technology feasibility and cost effectiveness, PAR 1147 proposes to lower limits in some equipment categories to 20 to 30 ppm while others remain at the existing Rule 1147 levels of 30 to 60 ppm. In addition, a limit on CO emissions is being proposed. Rulemaking for PAR 1147 spans over 11 working group meetings and additional meetings were held with industry stakeholders to obtain feedback during rule development.

Implementation will primarily take place when the equipment has reached a certain age recognizing typical replacement periods as well as addressing stranded assets from that equipment with controls installed to meet existing Rule 1147 limits. In addition, the applicability has been expanded to include equipment currently under the RECLAIM program as the facility transition to become former RECLAIM facilities. More specifically, the equipment meeting current limits shall submit permit applications to meet proposed emission limits by July 1 of the year after the unit burner becomes 32 years old. Owners or operators of a units that are not in compliance with the existing Rule 1147 NOx limits must submit applications to meet proposed emission limits by July 1, 2023, or July 1 of the year after unit burner becomes 12 years old, whichever is later. The compliance deadlines for PAR 1147 were established by taking into consideration equipment size range, application type, the number of units per facility, and whether facilities had multiple pieces of equipment subject to multiple source-specific command-and-control rules. The total emissions inventory for the PAR 1147 universe is ~3.69 tons per day (tpd). Emission reductions from the facilities expected to submit permit applications by July 1, 2023 is estimated to be ~0.54 tpd by July 1, 2025 and expected total reductions from the Proposed Amended Rule 1147 universe expected to be 1.59 tpd by the full implementation estimate of July1, 2057.

CHAPTER 1: BACKGROUND

Introduction
Regulatory History
Affected Industries
Public Process

Introduction

The Regional Clean Air Incentives Market (RECLAIM) program was adopted in October 1993 under Regulation XX. RECLAIM is a market-based emissions trading program designed to reduce NOx and SOx emissions and includes facilities with NOx or SOx emissions greater than 4 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 ensure the NOx RECLAIM program was achieving equivalency with command-and-control rules that are implementing Best Available Retrofit Control Technology (BARCT) and to generate further NOx emission reductions at RECLAIM facilities. The adoption resolution for the 2016 AQMP directed staff to achieve five tons per day of NOx emission reductions as soon as feasible but no later than 2025, and 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 be needed for all equipment categories. Proposed Amended Rule (PAR) 1147 – NOx Reductions from Miscellaneous Sources is a "landing" rule for RECLAIM facilities with permitted combustion sources that are not subject to another South Coast AQMD Regulation XI rule and will establish NOx and CO emission limits for equipment subject to the rule at RECLAIM, non-RECLAIM, and former RECLAIM facilities.

Background

Rule 1147 – NOx Reductions for Miscellaneous Sources applies to all permitted combustion equipment not subject to another South Coast AQMD Regulation XI rule. Impacted equipment range from a wide range of industries and equipment heat input varies from below 2 million BTU/hr (MMBtu/hr) to over 80 MMBtu/hr. Currently Rule 1147 consists of nine different categories for gaseous fuel-fired combustion equipment and one additional category for liquid fuel-fired combustion equipment. Each equipment category has its own unique challenges and staff has received feedback from stakeholders regarding unique challenges with certain equipment types in existing categories. As a result, PAR 1147 propose to pull equipment from some existing categories into their own equipment categories.

Regulatory History

The South Coast AQMD Governing Board adopted the RECLAIM program in October 1993.Regulation XX – Regional Clean Air Incentives Market (RECLAIM) (Regulation XX) includes a series of rules that specify the applicability and procedures for determining NOx and SOx facility emissions allocations, program requirements, as well as monitoring, reporting, and recordkeeping requirements for RECLAIM facilities. 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 are required to hold RTCs that are equal or greater than their actual annual emissions.

Under RECLAIM, facilities can install pollution controls 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 1147 is needed to transition RECLAIM facilities with miscellaneous sources equipment to a command-and-control regulatory structure. PAR 1147 will apply to facilities while in RECLAIM and after the facility transitions out of RECLAIM and becomes a former RECLAIM facility.

Rule 1147 – NOx Reductions from Miscellaneous Sources

Rule 1147 was initially adopted in December 2008 and establishes NOx limits for a wide variety of miscellaneous combustion sources at non-RECLAIM facilities. Rule 1147 applies to ovens, dryers, dehydrators, heaters, kilns, calciners, furnaces, crematories, incinerators, heated pots, cookers, roasters, fryers, closed and open heated tanks and evaporators, distillation units, afterburners, degassing units, vapor incinerators, catalytic or thermal oxidizers, soil and water remediation units and other combustion equipment with NOx emissions that require a South Coast AQMD permit and are not specifically required to comply with a NOx emission limit designated by other South Coast AQMD Regulation XI rules.

- December 2008 - Rule 1147 was adopted.
- September 2011 - Rule 1147 was amended in order to respond to compliance challenges by delaying compliance dates as well as providing alternative compliance pathways and reducing testing requirements for impacted equipment. The rule amendment also required staff to conduct a technology assessment for small combustion sources impacted by the rule.
- February 2017 - Staff conducted a technology assessment focused on low-use equipment emitting less than one-pound NOx per day. The completed Technology Assessment was reviewed by an independent third-party consultant as well as the Rule 1147 Task Force.
- July 2017 - Rule 1147 was amended to reflect findings and recommendations from the Technology Assessment conducted in February 2017. This amendment provided additional compliance flexibility by including an exemption for equipment with heat input ratings of less than 325,000 BTU/hr. The amendment also removed the in-use requirement for low-use equipment, modified emission limits for various equipment categories in line with findings from the February 2017 Technology Assessment and provided additional compliance options for impacted equipment.

Under Rule 1147, applicable equipment subject to 1147 with total heat input greater than or equal to 325,000 BTU/hr must meet Rule 1147 NOx limit depending on equipment category and process temperature as shown in Table 1-1 - NOx Emission Limit for Unit Heat Ratings ≥ 325,000 BTU/hour.

Table 1-1 – NOx Emission Limit for Unit Heat Ratings ≥ 325,000 BTU/hour

Equipment Category(ies)	NOx Emission Limit PPM @ 3% O_2, dry or Pound/mmBtu heat input		
	Process Temperature		
Gaseous Fuel-Fired Equipment	≤ 800° F	> 800 ° F and < 1200° F	≥ 1200 ° F
Asphalt Manufacturing Operation	40 ppm	40 ppm	
Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator [1]	60 ppm or 0.073 lb/mmBtu	60 ppm or 0.073 lb/mmBtu	60 ppm or 0.073 lb/mmBtu
Burn-off Furnace, Burnout Oven, Incinerator or Crematory with or without Integrated Afterburner	60 ppm or 0.073 lb/mmBtu	60 ppm or 0.073 lb/mmBtu	60 ppm or 0.073 lb/mmBtu
Evaporator, Fryer, Heated Process Tank, or Parts Washer	60 ppm or 0.073 lb/mmBtu	60 ppm or 0.073 lb/mmBtu	
Metal Heat Treating, Metal Melting Furnace, Metal Pot, or Tar Pot	60 ppm or 0.073 lb/mmBtu	60 ppm or 0.073 lb/mmBtu	60 ppm or 0.073 lb/mmBtu
Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank	30 ppm or 0.036 lb/mmBtu	30 ppm or 0.036 lb/mmBtu	60 ppm or 0.073 lb/mmBtu
Make-Up Air Heater or other Air Heater located outside of building with temperature controlled zone inside building	30 ppm or 0.036 lb/mmBtu	30 ppm or 0.036 lb/mmBtu	
Tenter Frame or Fabric or Carpet Dryer	30 ppm or 0.036 lb/mmBtu		
Other Unit or Process Temperature	30 ppm or 0.036 lb/mmBtu	30 ppm or 0.036 lb/mmBtu	60 ppm or 0.073 lb/mmBtu
Liquid Fuel-Fired Equipment	≤ 800° F	> 800 ° F and < 1200° F	≥ 1200 ° F
All liquid fuel-fired Units	40 ppm or 0.053 lb/mmBtu	40 ppm or 0.053 lb/mmBtu	60 ppm or 0.080 lb/mmBtu

1. Emission limit applies to burners in units fueled by 100% natural gas that are used to incinerate air toxics, VOCs, or other vapors; or to heat a unit. The emission limit applies solely when burning 100% fuel and not when the burner is incinerating air toxics, VOCs, or other vapors. The unit shall be tested or certified to meet the emission limit while fueled with natural gas.

All in-use equipment subject to Rule 1147 with total heat input greater than 325,000 BTU/hr and emitting one pound or more of NOx per day must demonstrate compliance with Rule 1147 limits according to the schedule outlined below in Table 1-2 – Rule 1147 Compliance Schedule.

Table 1-2 – Rule 1147 Compliance Schedule (≥1 lb/Day of NOx)

Equipment Category(ies)	Submit Permit Application	Unit Shall Be in Compliance
Specific UNIT		
Remediation UNIT manufactured and installed prior to March 1, 2012	Seven months prior to a combustion system modification, combustion system replacement or unit replacement or a relocation.	Upon combustion system modification, combustion system replacement or unit replacement or relocation beginning March 1, 2012
Evaporator, heated process tank, or parts washer with a District permit issued and operating prior to January 1, 2014	Seven months prior to combustion system modification, combustion system replacement or unit replacement	Upon combustion system modification, combustion system replacement or unit replacement
Tar Pot		All new permit applications beginning January 1, 2013
UNIT with Emissions ≥1 Pound/Day		
Afterburner, degassing unit, catalytic oxidizer, thermal oxidizer, vapor incinerator, fryer, or spray booth make-up air heater manufactured prior to 1998	December 1, 2013	July 1, 2014
Other UNIT manufactured prior to 1986	December 1, 2011	July 1, 2012
Other UNIT manufactured prior to 1992	December 1, 2011	July 1, 2012
Other UNIT manufactured prior to 1998	December 1, 2012	July 1, 2013
Any UNIT manufactured after 1997	December 1 of the year prior to the compliance date	July 1 of the year the unit is 15 years old

All new equipment subject to Rule 1147 is required to demonstrate compliance with the rule limit existing at the time of permitting. Units emitting less than one pound per day of NOx are required to demonstrate compliance with applicable Rule 1147 limits when the unit becomes 35 years old unless opting to demonstrate NOx emissions of less than one pound per day through biennial emissions testing. Rule 1147 does not have periodic monitoring requirements. RECLAIM Rule 2012 requires periodic monitoring and bi-annual tune ups with frequency determined by source categorization of Major, Large or Process sources:

- Major sources are required to install CEMS with daily, monthly, quarterly, and annual reporting with minimum of semi-annual RATA
- Large sources are required to conduct source testing every 3 years with requirement for bi-annual tune up
- Process sources are required to conduct source testing every 5 years with requirement for bi-annual tune up

Rule 1147 itself does not have a CO emission limit requirement in the rule itself.CO requirements of Rule 1147 are based on a limit of 2000 ppm corrected to 3% oxygen from South Coast AQMD *Rule 407 – Liquid and Gaseous Air Contaminants.*

AB 617

On July 26, 2017, Governor Brown signed AB 617 (Cynthia Garcia): Nonvehicular air pollution: criteria air pollutants and toxic air contaminants. AB 617 was companion legislation to AB 398 which extended California's cap and trade program for reducing greenhouse gas emissions from stationary sources. RECLAIM facilities that are part of the cap-and-trade program are now also subject to the requirements of AB 617. AB 617 requires an expedited schedule for implementing BARCT for cap-and-trade facilities. Under AB 617, the State's air districts were to develop a schedule by January 1, 2019 for the implementation of BARCT no later than December 31, 2023. The schedule must give highest priority to those permitted units that have not modified emissions-related permit conditions for the greatest period and does not apply to an emissions unit that has implemented BARCT due to a permit revision or a new permit issuance since 2007.

Affected Industries

PAR 1147 will affect RECLAIM and non-RECLAIM facilities that own or operate permitted gaseous fuel-fired equipment that are not subject to another South Coast AQMD Regulation XI rule. Based on South Coast AQMD permitting data, staff identified approximately 5,300 pieces of equipment located at approximately 3,000 facilities that are subject to PAR 1147. Of the estimated 3,000 facilities, 85 are identified to be participants of the RECLAIM program. Breakdown of impacted industries for RECLAIM equipment is shown in Figure 1-1 and shown for non-RECLAIM equipment in Figure 1-2. Based on equipment data, RECLAIM facilities show higher representation in the Manufacturing sector while non-RECLAIM facilities show higher representation in the Services sector.

Figure 1-1 –Industry Breakdown for RECLAIM Facilities Subject to PAR 1147

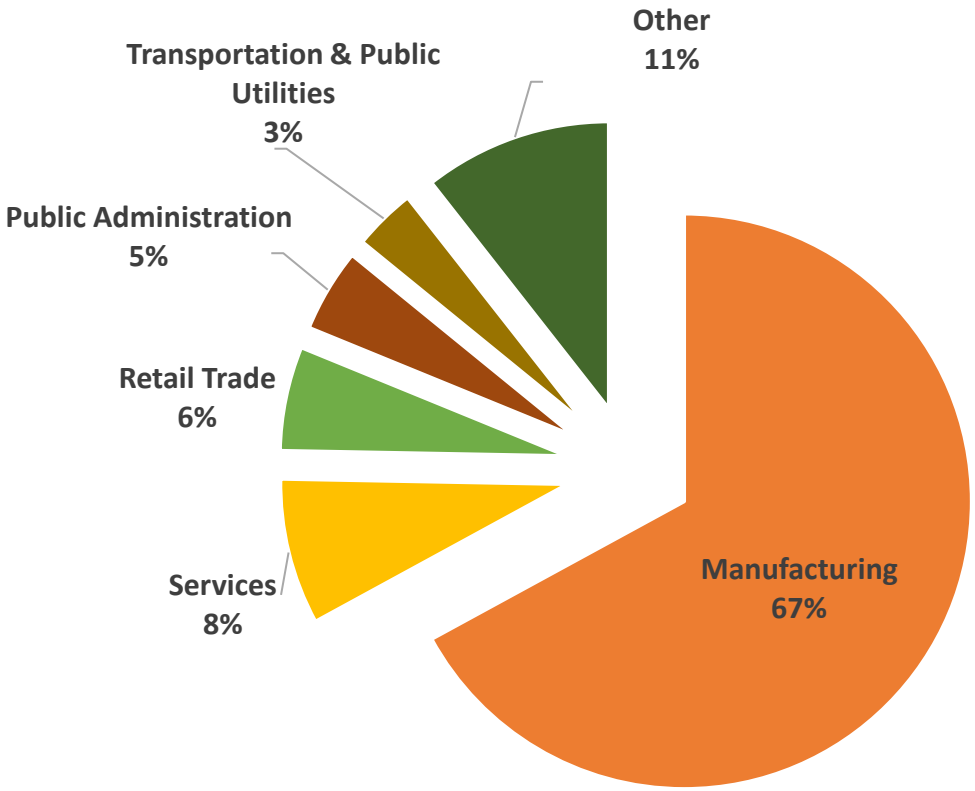
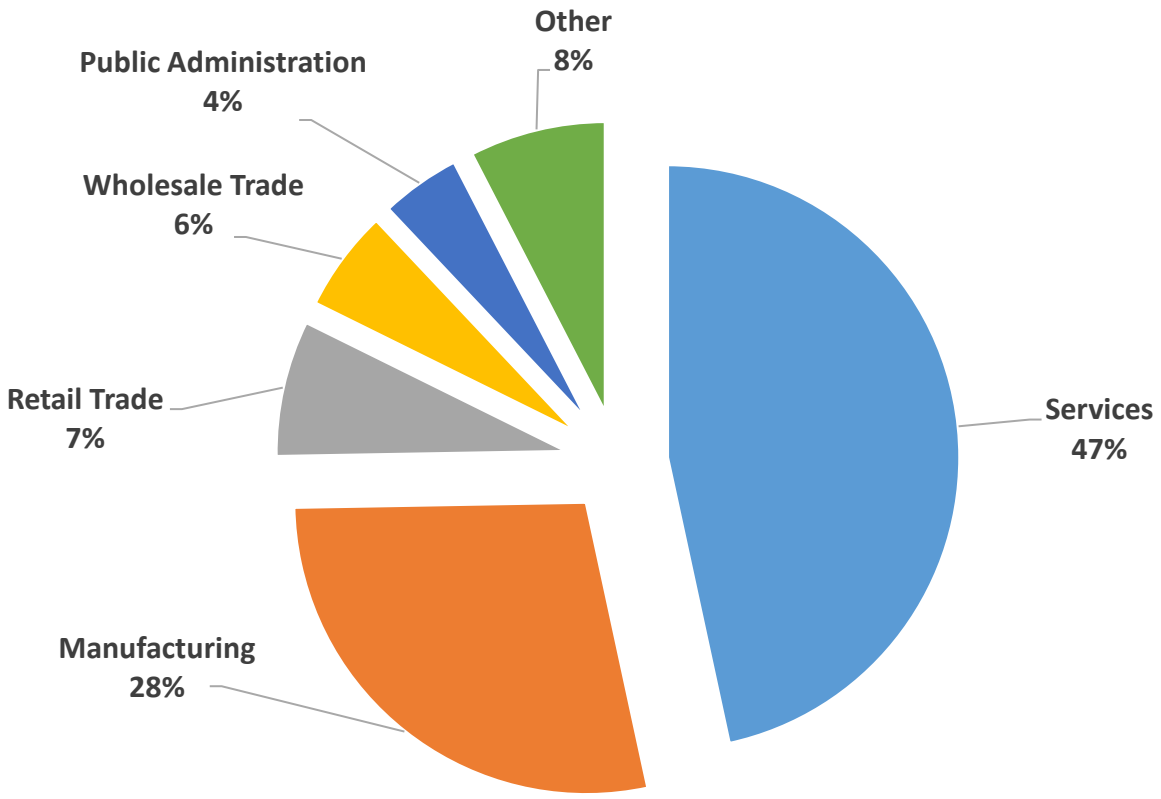


Figure 1-2 –Industry Breakdown for Non-RECLAIM Facilities Subject to PAR 1147



Public Process

Development of PAR 1147 was conducted through a public process. South Coast AQMD staff has held eleven Working Group Meetings. Staff recognized the challenges businesses and other stakeholders have experienced with the global COVID-19 pandemic and have conducted Working Group Meetings remotely via Zoom consistent with Governor Newsom's Executive Order N-29-20 dated March 17, 2020. In person Working Group Meetings were held February 28, 2019, April 17, 2019, May 30, 2019, October 23, 2019, and February 11, 2020. Remote Working Group Meetings were held on May 14, 2020, November 12, 2020, March 10, 2021, July 14, 2021, September 8, 2021, January 5, 2022. The Working Group is composed of representatives from the equipment manufacturers, trade organizations, permit stakeholders, businesses, environmental groups, public agencies, consultants, and other interested parties. The purpose of the Working Group Meetings was to discuss proposed concepts and to work through the details of staff's proposal. A Public Workshop is to be held on January 27, 2022. Staff has also had numerous individual meetings with stakeholders who will be impacted by this rulemaking.

CHAPTER 2: BARCT ASSESSMENT

BARCT Assessment
Monitoring, Reporting, and Recordkeeping

BARCT Assessment

Health & Safety Code §40406 defines BARCT as follows:

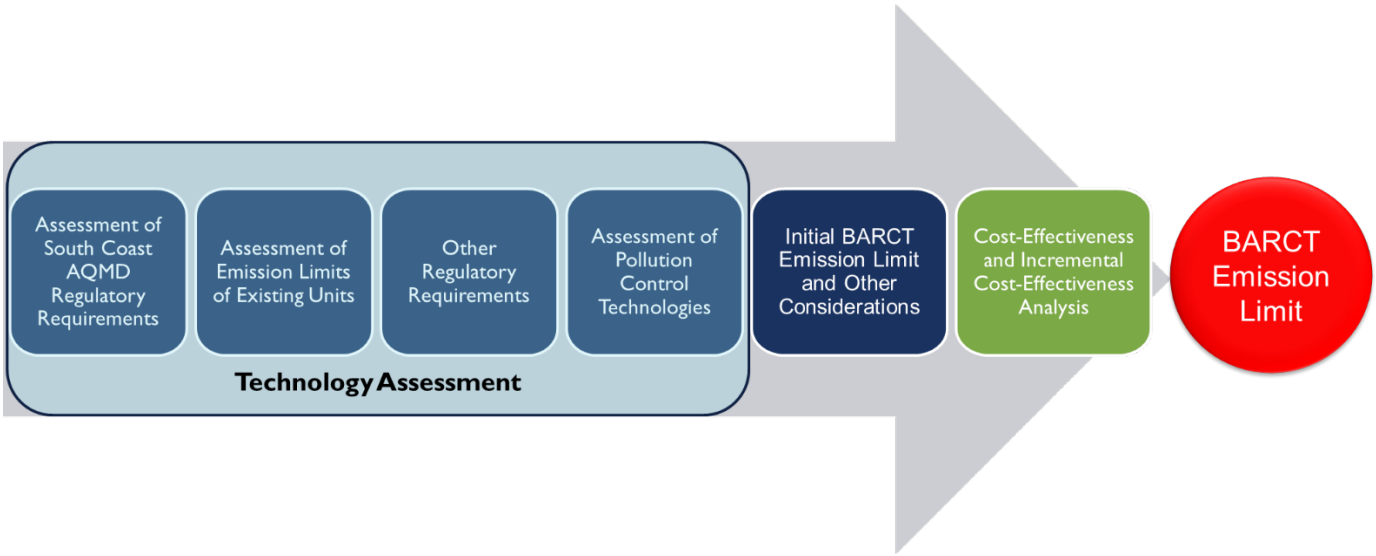
> *Best Available Retrofit Control Technology means an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source.*

The California Health and Safety Code Section 40920.6 establishes requirements prior to adopting rules or regulations regarding retrofit control technologies. Some of these requirements include:

- Identifying one or more potential control options which achieves the emission reduction objective for the regulation.
- Reviewing the information developed to assess the cost-effectiveness of the potential control option, where cost-effectiveness is defined as the cost, in dollars, of the potential control option divided by emission reduction potential, in tons (i.e., the amount of dollars per ton of NOx reduced).
- Calculating the incremental cost-effectiveness for the potential control options is defined as the difference in the costs divided by the difference in the emission reduction potential between each progressively more stringent potential control option as compared to the next less expensive control option.

The BARCT technology assessment for applicable PAR 1147 equipment included a technology assessment that included assessment of existing regulatory requirements, existing NOx limits that have been achieved, and review of commercially available NOx emission reduction technologies. After staff conducts the technology assessment identifies potential control options. Before the proposed BARCT limit is established staff will evaluate the cost-effectiveness and incremental cost-effectiveness. A summary of the BARCT assessment is provided below in Figure 2-1.

Figure 2-1 – Summary of BARCT Assessment



Assessment of South Coast AQMD Regulatory Requirements

As part of the BARCT assessment, staff reviewed NOx limits in Rule 1147 which regulates NOx emissions from ovens, dryers, dehydrators, heaters, kilns, calciners, furnaces, crematories, incinerators, heated pots, cookers, roasters, fryers, closed and open heated tanks and evaporators,

distillation units, afterburners, degassing units, vapor incinerators, catalytic or thermal oxidizers, soil and water remediation units and other combustion equipment with nitrogen oxide emissions that require a South Coast AQMD permit and are not specifically required to comply with a nitrogen oxide emission limit by other South Coast AQMD Regulation XI rules. Current rule emission limits were adopted on July 7, 2017. All NOx concentration limits specified in Rule 1147 are referenced at 3 percent volume stack gas oxygen on a dry basis.

Under Rule 1147, applicable equipment subject to 1147 with total heat input greater than or equal to 325,000 BTU/hr must meet Rule 1147 NOx limit depending on equipment category and process temperature as shown in Table 1-1 - NOx Emission Limit for Unit Heat Ratings ≥ 325,000 BTU/hour. Based on stakeholder feedback, staff propose to shift equipment currently subject to the oven, dehydrator, dryer, heater, kiln, calciner, cooker, roaster, furnace, or heated storage tank category into additional equipment categories for tunnel kilns, absorption chillers, and autoclaves. Based on assessment of equipment located in RECLAIM facilities, PAR 1147 will also include a new equipment category for stationary gas turbines below 0.3 megawatt.

Assessment of NOx Emission Limits for Existing Units

As part of the BARCT analysis for PAR 1147, permit limits were reviewed for all applicable categories. In addition to the assessment of permit limits, additional assessment was conducted from available source test results for each new and existing equipment category. The objective of this part of the technology assessment is to ascertain current permitted emission limits and source tested results are at lower than the NOx limit established in Rule 1147. The analysis also identified other control technologies implemented by permitted equipment to achieve designated permit limits or better. Due to the wide variety of equipment found in certain equipment categories, additional considerations were made regarding application and equipment configuration. The equipment category impacting make-up air heater or other air heater was evaluated previously during the 2017 Technology Assessment[1] for Rule 1147 equipment and staff assessment was in line with the 2017 technology assessment; therefore, equipment category was not re-evaluated during this rulemaking.

Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator

The category for afterburner degassing unit, remediation unit, thermal oxidizer, catalytic oxidizer or vapor incinerator consists of 327 total units with 267 units located at non-RECLAIM facilities and 62 units located at RECLAIM facilities. Units in this category are used as control equipment for volatile organic compounds and other air toxics. Total heat input for equipment found in this category ranges between less than 1 MMBtu/hr to 189 MMBtu/hr. Emission limits for this category apply to burners in units fueled by 100% natural gas that are used to heat a uit or to incinerate air toxics, VOCs, or other vapors. The emission limit applies solely when burning 100% fuel and not when the burner is incinerating air toxics, VOCs, or other vapors. Units in this category demonstrate compliance by being tested or certified to meet the emission limit while fueled with natural gas.

Permit Limits

Permit limits of existing permitted equipment in this category range between 12 ppm to 135 ppm. While existing Rule 1147 limit for this category is 60 ppm for all process temperatures, the BACT

[1] July 7, 2021 South Coast AQMD Governing Board Meeting Agenda Item 36 – Certify the Final Subsequent Environmental Assessment and Amend Rule 1147 – NOx Reductions from Miscellaneous Sources: 36. Certify the Final Subsequent Environmental Assessment and Amend Rule 1147 - NOx Reductions from Miscellaneous Sources (aqmd.gov)

requirement for all new equipment is 30 ppm for all process categories. Rule 1147 was amended in 2017 to reflect findings from the February 2017 Final Technology Assessment that was reviewed by ETS Inc. BACT revisions from February 2019 revised the BACT guidance from this category to 30 ppm. As a result of the difference in BACT and Rule 1147 limits, new units permitted after 2019 are limited to 30 ppm while older equipment permitted between 2017 to 2019 is assigned the permit limit of 60 ppm.

Source Test

Facility-submitted source test results from 80 units were analyzed to assess NOx concentration levels being achieved. From the evaluated source tests, 13 source test results were obtained from RECLAIM units and 67 source test results were obtained from non-RECLAIM units. Source test results ranged from <1 ppm to 126 ppm. Seven of the 13 units source tested in RECLAIM demonstrated source tested emissions of below 20 ppm while 47 of the 67 units in non-RECLAIM demonstrated source tested emissions of below 20 ppm. Summary of technology assessment is shown in Figure 2-2.

Figure 2-2 – Summary of Technology Assessment for Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator

Operating Temp	South Coast AQMD Limit	Existing Units: ST Recommended Limit	Existing Units: Units Meeting Recommendation	Technology Assessment
All	60 ppm (30 ppm BACT)	20 ppm	7 of 13 RECLAIM 47 of 67 Non-RECLAIM	20 ppm

Burn-off Furnace, Burnout Oven, Incinerator or Crematory with or without Integrated Afterburner

The category for burn-off furnace, burnout oven, incinerator or crematory with or without integrated afterburner consists of 314 total units with 303 units located at non-RECLAIM facilities and 13 units located at RECLAIM facilities. Total heat input for equipment found in this category range between less than 1 MMBtu/hr to 9 MMBtu/hr. These units may be called burn-off or burn-out ovens, kilns or furnaces and incinerators; however, all units perform and operate in a similar fashion. They are built with a primary chamber for melting, vaporizing or pyrolyzing some material on a part or piece of equipment to recycle the material or component. Some units are used for incinerating material that cannot be reclaimed or must be incinerated prior to disposal. The primary chamber leads to an integrated secondary afterburner chamber that destroys particulate matter, carbon monoxide, VOCs and any other organic material that enter this afterburner section. The incinerated material is reduced to carbon dioxide and water vapor.

Permit Limits

Permit limits of existing permitted equipment in this category range between 30 ppm to 102 ppm (equivalent to RECLAIM default emission factor of 130 lb/mmscf). Equipment permit limits are based on existing and previous Rule 1147 limit of between 30 to 60 ppm for all process temperatures. While current Rule 1147 limit for this category is 60 ppm for all process temperatures, Rule 1147 was amended in 2017 to reflect findings from the February 2017 Final

Technology Assessment by increasing emission limits for this category from 30 ppm to 60 ppm. Because of the rule amendment, new units permitted after 2017 are limited to 60 ppm while older equipment are still limited to 30 ppm.

Source Test

Facility-submitted source test results from 69 units were analyzed to assess NOx concentration levels being achieved. From the evaluated source tests, one source test result was obtained from a RECLAIM unit and 68 source test results were obtained from non-RECLAIM units. Source test results ranged from 4 ppm to 60 ppm. Nine of the 68 units in non-RECLAIM demonstrated source tested emissions of below 30 ppm while no units were identified to have source tested below 30 ppm in RECLAIM. Summary of technology assessment is shown in Figure 2-3.

Figure 2-3 – Summary of Technology Assessment for Burn-off Furnace, Burnout Oven, Incinerator or Crematory with or without Integrated Afterburner

Operating Temp	South Coast AQMD Limit	Existing Units: ST Recommended Limit	Existing Units: Units Meeting Recommendation	Technology Assessment
All	60 ppm	30 ppm	0 of 1 RECLAIM 9 of 68 Non-RECLAIM	30 ppm

Evaporator, Fryer, Heated Process Tank, or Parts Washer

The category for evaporator, fryer, heated process tank, or parts washer consists of 51 total units with 49 units located at non-RECLAIM facilities and 2 units located at RECLAIM facilities. Units in this category are used to heat containers of process fluid for various applications. Total heat input for equipment found in this category range between less than 1 MMBtu/hr to 14 MMBtu/hr. There are different types of heating systems including immersion tube heating in conveyor units and external oil heating systems. While most equipment in this category is equipped with small burners (<2 MMBtu/hr) that would generally be exempt from permitting per Rule 219, the associated process has emissions other than the products of combustion such as VOC, PM or toxic air contaminants which necessitates permitting of the process equipment, including any small burners.

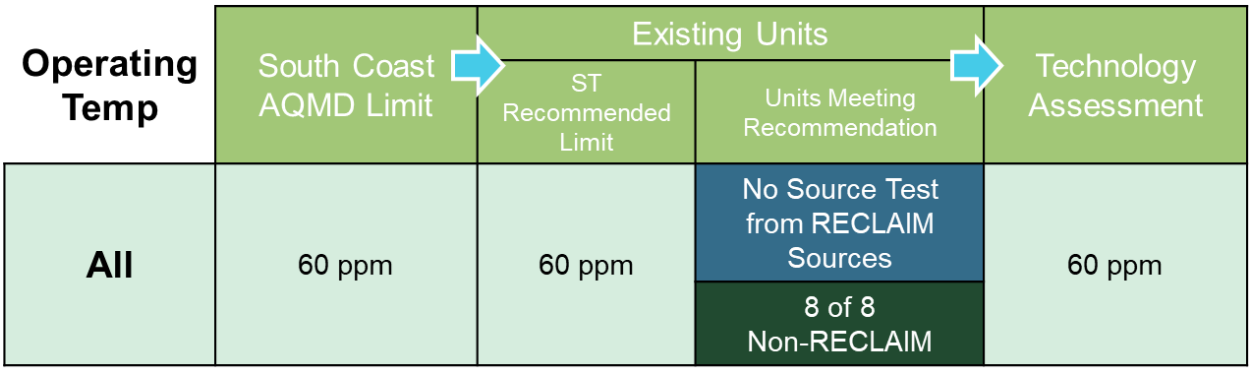
Permit Limits

Permit limits of existing permitted equipment in this category range between 60 ppm to 102 ppm (equivalent to RECLAIM default emission factor of 130 lb/mmscf). Equipment permit limits are based on existing and previous Rule 1147 limit of 60 ppm for all process temperatures. As part of the July 7, 2017 rule amendment, any evaporator, heated process tank and parts washer with a South Coast AQMD permit prior to January 1, 2014 became exempt from applicable Rule 1147 limits until combustion system modification, relocation or unit replacement.

Source Test

Facility-submitted source test results from 8 units were analyzed to assess NOx concentration levels being achieved. From the evaluated source tests, all 8 source test results were obtained from non-RECLAIM units. Source test results ranged from 37 ppm to 56 ppm. Summary of technology assessment is shown in Figure 2-4.

Figure 2-4 – Summary of Technology Assessment for Evaporator, Fryer, Heated Process Tank, or Parts Washer



Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank

The category for oven, dehydrator dryer, heater, kiln, calciner, cooler, roaster, furnace, or heated storage tank is the largest equipment category found in the Rule 1147 universe consisting of approximately 1,509 pieces of non-RECLAIM equipment and 191 pieces of RECLAIM equipment. Total heat input for equipment found in this category ranges between less than 1 MMBtu/hr to 30 MMBtu/hr. Due to the large number of equipment subject to this equipment category, staff sampled a subset of 728 units consisting of 177 units in RECLAIM and 552 units in non-RECLAIM. The subset of equipment was chosen by a random number generator to address potential bias in the evaluation criteria.

Permit Limits

Permit limits of existing permitted equipment in this category range between 30 ppm to 101.4 ppm (equivalent to RECLAIM default emission factor of 130 lb/mmscf). Equipment permit limits are based on existing Rule 1147 limits and divided into either 30 ppm or 60 ppm depending on process temperature. Equipment with process temperature of less than 1,200°F are required to meet 30 ppm NOx while those with process temperature greater than or equal to 1,200°F are required to meet 60 ppm NOx.

Source Test

Facility-submitted source test results from the subset of 728 units were analyzed to assess NOx concentration levels being achieved. From the selected subset, 201 source test results were obtained from 28 RECLAIM units and 173 non-RECLAIM units.

For units with process temperatures less than 1,200°F, source test results from 169 non-RECLAIM units and 27 RECLAIM units were identified to range from 5 to 64 ppm. Out of the source test results from 196 units surveyed, 87 units demonstrated emissions below 20 ppm NOx with 76 units belonging to non-RECLAIM facilities and 11 units belonging to RECLAIM facilities.

For units with process temperatures greater than or equal to 1,200°F, source test results from 4 non-RECLAIM units and one RECLAIM unit were identified ranged from 18 to 59 ppm. Out of the five identified source tests, three units demonstrated result below 30 ppm NOx with all three units belonging to non-RECLAIM facilities. Summary of technology assessment is shown in Figure 2-5.

Figure 2-5 – Summary of Technology Assessment for Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank

Operating Temp	South Coast AQMD Limit	Existing Units		Technology Assessment
		ST Recommended Limit	Units Meeting Recommendation	
<1,200° F	30 ppm	20 ppm	11 of 27 RECLAIM 76 of 169 Non-RECLAIM	20 ppm
≥1,200° F	60 ppm	30 ppm	0 of 1 RECLAIM 3 of 4 Non-RECLAIM	30 ppm

Tenter Frame or Fabric or Carpet Dryer

The category for tenter frame or fabric or carpet dryer consists of 61 total units with 35 units located at non-RECLAIM facilities and 26 units located at RECLAIM facilities. Units in this category are used to hold and dry fabric in a way as to avoid shrinkage. Burners for equipment in this category range between less than 1 MMBtu/hr to 10 MMBtu/hr. Process temperatures are always less than 800°F.

Permit Limits

Permit limits of existing permitted equipment in this category range between 30 ppm to 101.4 ppm (equivalent to RECLAIM default emission factor of 130 lb/mmscf). Equipment originally permitted after Rule 1147 adoption on December 8, 2008 is assigned permit limits based on existing Rule 1147 limits of 30 ppm. Equipment originally permitted before Rule 1147 adoption are limited to permit limits of between 40 to 60 ppm.

Source Test

Facility-submitted source test results from 29 units were analyzed to assess NOx concentration levels being achieved. From the evaluated source tests, 20 source test results were obtained from non-RECLAIM units and 9 source test results were obtained from RECLAIM units Source test results ranged from 18 ppm to 60 ppm. One of 20 units from non-RECLAIM demonstrated source test result of under 20 ppm and no units in RECLAIM demonstrated source test results below 20 ppm. Sixteen of the 20 units source tested in non-RECLAIM demonstrated source tested emissions of below 30 ppm while four of the 9 units in RECLAIM demonstrated source tested emissions of below 30 ppm. Summary of technology assessment is shown in Figure 2-6.

Figure 2-6 – Summary of Technology Assessment for Tenter Frame or Fabric or Carpet Dryer

Operating Temp	South Coast AQMD Limit	Existing Units: ST Recommended Limit	Existing Units: Units Meeting Recommendation	Technology Assessment
All	30 ppm	20 ppm	0 of 9 RECLAIM 1 of 20 Non-RECLAIM	20 ppm

Autoclave

The category for autoclave is a new equipment category in PAR 1147 and consists of 10 total units with all identified units located at RECLAIM facilities. Prior to PAR 1147, autoclaves were categorized in the Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank category. From stakeholder feedback and further assessment, staff proposes to move autoclaves into a separate equipment category due to the unique heating process and pressurized vessel used. Identified units in this category are pressurized vessels heated by natural gas fired burners used to slowly heat and cure composite materials used in the aerospace industry. Burners for equipment in this category range between 5 MMBtu/hr to 25 MMBtu/hr. Process temperatures are generally less than 800°F.

Permit Limits

Permit limits of existing permitted equipment in this category range between 30 ppm to 101.4 ppm (equivalent to RECLAIM default emission factor of 130 lb/mmscf).). Equipment permit limits are based on existing Rule 1147 limits and divided into either 30 ppm or 60 ppm depending on process temperature. Equipment with process temperature of less than 1,200°F are required to meet 30 ppm NOx while those with process temperature greater than or equal to 1,200°F are required to meet 60 ppm NOx.

Source Test

Facility-submitted source test results from 2 RECLAIM units were analyzed to assess NOx concentration levels being achieved. Source test results for both units demonstrated source test results below 30 ppm. Summary of technology assessment is shown in Figure 2-7.

Figure 2-7 – Summary of Technology Assessment for Autoclave

Operating Temp	South Coast AQMD Limit	Existing Units: ST Recommended Limit	Existing Units: Units Meeting Recommendation	Technology Assessment
All	30 ppm	30 ppm	2 of 2 RECLAIM No Source Test from Non-RECLAIM	30 ppm

Tunnel Kiln and Tunnel Dryer

The category for tunnel kiln and tunnel dryer is a new equipment category in PAR 1147 and consists of 6 total units with five identified units located in RECLAIM and one identified unit in non-RECLAIM. Prior to PAR 1147, tunnel dryers were categorized in the Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank category. From stakeholder feedback and further assessment, staff proposes to move tunnel dryers into a separate equipment category due to the unique heating process. Tunnel dryers are used to physically evaporate moisture from a material using heated air. Typically, tunnel dryers operate at temperatures less than 1,200ºF while tunnel kilns operate at temperatures greater than 1,200ºF. Exhaust gases from both tunnel kilns and tunnel dryers exhibit high moisture contents (approximately 30 percent or more) and relatively low temperatures (less than 400 ºF). Additionally, because the combustion gases and the heated process air are combined before discharge, the final exhaust gas has a higher exhaust oxygen concentration. Units in this equipment category consist of multiple burners with total heat input of between 14 MMBtu/hr to 84 MMBtu/hr.

Permit Limits

Permit limits of existing permitted equipment in this category range between 60 ppm to 101.4 ppm (equivalent to RECLAIM default emission factor of 130 lb/mmscf). Staff identified one major source tunnel dryer operated at a RECLAIM facility with no permit limit and monitored by a continuous emissions monitoring system (CEMS). Equipment permit limits for tunnel kilns are based on existing Rule 1147 limits of 60 ppm due to high process temperature greater than or equal to 1,200°F.

Source Test

From the evaluated source tests, source test results were obtained from all six identified units in non-RECLAIM and RECLAIM. Source test results ranged from 20 ppm to 54 ppm. The tunnel dryer major source identified to not have an assigned permit limit in RECLAIM demonstrated source test result demonstrating below 30 ppm NOx. Source test results for four other identified RECLAIM tunnel kilns demonstrated source test results of between 40 ppm to 52 ppm NOx. One tunnel kiln identified in non-RECLAIM demonstrated source test result of 54 ppm NOx. Summary of technology assessment is shown in Figure 2-8.

Figure 2-8 – Summary of Technology Assessment for Tunnel Dryers

Operating Temp	South Coast AQMD Limit	Existing Units: ST Recommended Limit	Existing Units: Units Meeting Recommendation	Technology Assessment
<1,200° F	30 ppm	30 ppm	1 of 1 RECLAIM No Source Test in Non-RECLAIM	30 ppm
≥1,200° F	60 ppm	60 ppm	No Source Test in RECLAIM 5 of 5 Non-RECLAIM	60 ppm

Natural Gas Fired Chillers

The category for natural gas fired chillers is a new equipment category in PAR 1147 and consists of 12 total units with three units located at RECLAIM facilities and nine units located at non-RECLAIM facilities. Prior to PAR 1147, chillers were categorized in the Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank category. From stakeholder feedback and further assessment, staff proposes to move chillers into a separate equipment category due to the unique heating process and ability to reach lower NOx emissions levels due to the process. Burners for equipment in this category range between 2 MMBtu/hr to 13 MMBtu/hr. Process temperatures are generally less than 800°F.

Permit Limits

Permit limits of existing permitted equipment in this category are all currently at 20 ppm compared to the rule limit requirement of 30 ppm. Newly permitted natural gas fired chillers are also permitted to the BACT limit of 20 ppm.

Source Test

Facility-submitted source test results from all 12 identified units were analyzed to assess NOx concentration levels being achieved. Source test results for all units demonstrated source test results below 20 ppm. Summary of technology assessment is shown in Figure 2-9.

Figure 2-9 – Summary of Technology Assessment for Natural Gas Fired Chillers

Operating Temp	South Coast AQMD Limit	Existing Units: ST Recommended Limit	Existing Units: Units Meeting Recommendation	Technology Assessment
All	30 ppm	20 ppm	3 of 3 RECLAIM 9 of 9 Non-RECLAIM	20 ppm

Turbine <0.3 MW (Natural Gas)

The category for natural gas turbines <0.3 MW is a new equipment category in PAR 1147 that impacts natural gas fired turbines smaller than 0.3 MW that are not subject to South Coast AQMD Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines. Natural gas turbines of this size are generally exempt per South Coast AQMD Rule 219 if the units are certified to meet emission levels certified by the California Air Resources Board. For units operating outside their certified configurations, a South Coast AQMD permit is required. For RECLAIM facilities operating these units under a South Coat AQMD permit to exit RECLAIM, a landing rule and BARCT limit must be established. This new equipment category consists of 29 units with 15 units located in non-RECLAIM facilities and 14 units in RECLAIM facilities.

Permit Limits

Permit limits of existing permitted equipment in this category range between 9 ppm to 25 ppm. Equipment permit limits are based on BACT at the time of permitting. New equipment within this category is permitted to a limit of 9 ppm. NOx emissions are corrected to 15% oxygen in turbines in contrast to 3% oxygen for other Rule 1147 equipment categories.

Source Test

Facility-submitted source test results from 17 units were analyzed to assess NOx concentration levels being achieved. Out of the 17 source tested units, 11 units are located at non-RECLAIM facilities and six units are located at RECLAIM facilities. Source test results for all units demonstrated below 9 ppm, including three units with existing permit limits of 25 ppm. Summary of technology assessment is shown in Figure 2-10.

Figure 2-10 – Summary of Technology Assessment for Natural-Gas-Fired Turbines

Operating Temp	South Coast AQMD Limit	Existing Units: ST Recommended Limit	Existing Units: Units Meeting Recommendation	Technology Assessment
All	9 ppm	9 ppm	6 of 6 RECLAIM 11 of 11 Non-RECLAIM	9 ppm

Turbine <0.3 MW (Distillate)

The category for distillate turbines <0.3 MW is a new equipment category in PAR 1147 that impacts natural gas fired turbines smaller than 0.3 MW that are not subject to South Coast AQMD Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines. Natural gas turbines of this size are generally exempt per South Coast AQMD Rule 219 if the units are certified to meet emission levels certified by the California Air Resources Board. For units operating outside their certified configurations, a South Coast AQMD permit is required. For RECLAIM facilities operating these units under a South Coat AQMD permit to exit RECLAIM, a landing rule and BARCT must be established. This new equipment category consists of 3 units located at one RECLAIM facility.

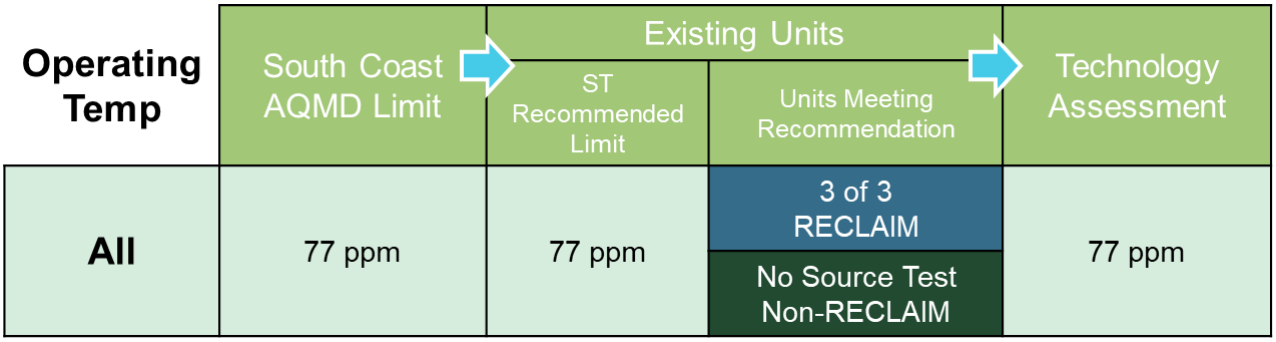
Permit Limits

All three units subject to this equipment category are assigned the permit limit of 77 ppm. Equipment permit limits are based on BACT at the time of permitting. NOx emissions are corrected to 15% oxygen in turbines compared to 3% oxygen in other Rule 1147 equipment categories.

Source Test

Facility-submitted source test results from all three units were analyzed to assess NOx concentration levels being achieved. Source test results for all units demonstrated below 7 ppm. Summary of technology assessment is shown in Figure 2-11.

Figure 2-11 – Summary of Technology Assessment for Distillate Fuel Fired Turbines



Other Regulatory Requirements

Analysis of NOx Concentration Limits for Proposed Rule 1147 Equipment at Other Air Districts

Staff reviewed other air districts' requirements for Proposed Amended Rule 1147 applicable equipment to identify rules and regulations with lower emission limits or limits representing improvements in pollution control technologies. A comparison of the existing requirements in Rule 1147 was made with the analogous rules adopted by two other air districts in California, one in San Joaquin Valley (SJVAPCD) and the other in Ventura.

SJVAPCD Rule 4309

SJVAPCD Rule 4309 (Dryers, Dehydrators, and Ovens) regulates equipment that are greater than or equal to 5 MMBTU/hr with full compliance by December 1, 2009. Rule 4309 limits applicable gaseous fueled equipment to a NOx limit of between 3.5 to 5.3 ppm and a CO limit of 42 ppm both corrected to 19% oxygen which are between 32 to 50 ppm NOx and 395 ppm CO corrected to 3% oxygen. SJVAPCD Rule 4309 does not separate emission limits based on process temperature, so comparable NOx emission limits may be more or less stringent compared to existing South Coast AQMD Rule 1147 depending on the process and temperature. However South Coast AQMD Rule 1147 does not contain any requirements for CO which makes SJVAPCD Rule 4309 definitively more stringent in regard to CO.

Monitoring requirements of Rule 4309 include monthly emissions monitoring or installation of CEMS with source testing required every 24 months. SJVAPCD has more stringent MRR requirements when compared to existing South Coast AQMD Rule 1147. Rule 4309 requires source testing at the frequency of every 24 months and periodic emissions monitoring every month as compared to the Rule 1147 requirement of one source test at the time of compliance determination with no additional requirements for periodic emissions monitoring.

Ventura County Air Pollution Control District (VCAPCD) Rule 74.34

VCAPCD Rule 74.34 –NOx Reductions from Miscellaneous Sources establishes a NOx emission limit of between 30 to 80 ppm and CO limit of 400 ppm both corrected to 3% oxygen for any natural gas fired combustion unit where the unit total heat input is greater than or equal to 5 MMBtu/hr. Similar to South Coast AQMD Rule 1147, VCAPCD Rule 74.34 separates emission limits for oven, dryer, heater, incinerator, furnaces and duct burners depending on process temperature of either above or below 1,200°F. oven, dryer, heater, incinerator, furnaces and duct burners operating below 1,200°F are limited to 30 ppm NOx while those operating above or equal to 1,200°F are limited to 60 ppm NOx. VCAPCD also contains separate limits for kilns of 80 ppm as well as separate limits for paper product manufacturing and aggregate processes limited to 40 ppm NOx with a CO limit of 400 ppm across all applicable equipment. VCAPCD Rule 74.34 NOx

limits are generally equivalent to existing Rule 1147 requirements except for the Kiln category which is less stringent than Rule 1147. VCAPCD Rule 74.34 is more stringent for CO for all equipment categories.

Monitoring requirements of Rule 74.34 includes a NOx and CO source test every 48 months with annual screening of NOx and CO within 30 days of the anniversary date of the previous source test. VCAPCD Rule 74.34 has more stringent MRR requirements when compared to South Coast AQMD Rule 1147. Rule 74.34 requires source testing at the frequency of every 48 months and annual screening of NOx and CO within 30 days of the anniversary date of the previous source test when compared to the Rule 1147 requirement of one source test at the time of compliance determination with no requirements for periodic emissions monitoring.

Assessment of Pollution Control Technologies

Ultra-Low/Low NOx Burners Systems

For gaseous fuels, thermal NOx is generally the largest contributor of NOx emissions. High flame temperatures trigger the disassociation of nitrogen molecules from combustion air and a chain reaction with oxygen follows to form oxides of nitrogen. Factors that minimize the formation of thermal NOx include reduced flame temperature, shortened residence time, and an increased fuel to air ratio. To reduce NOx emissions, combustion parameters can be optimized, control techniques can be applied downstream of the combustion zone, or a combination of the two approaches can be utilized. Common types of combustion modification include: lowered flame temperature; reduced residence time at high combustion temperature; and reduced oxygen concentration in the high temperature zone.

There are a variety of configurations and types of burners for ultra-low NOx burner (ULNB) systems. Often, fuel and air are pre-mixed prior to combustion. This results in a lower and more uniform flame temperature. Some premix burners also use staged combustion with a fuel rich zone to start combustion and stabilize the flame and a fuel lean zone to complete combustion and reduce the peak flame temperature. These burners can also be designed to spread flames over a larger area to reduce hot spots and lower NOx emissions. Radiant premix burners with ceramic, sintered metal or metal fiber heads spread the flame and produce more radiant heat. When a burner produces more radiant heat, it results in less heat escaping through the exhaust gases.

Most premix burners require the aid of a blower to mix the fuel with air before combustion takes place (primary air). A commonly used application in combination with these burners is flue gas recirculation (FGR). FGR recycles a portion of the exhaust stream back into the burner. Increasing the amount of primary air and/or use of FGR can reduce flame temperature, but it also reduces the temperature of combustion gases through dilution and can reduce efficiency. To maintain efficiency a manufacturer may have to add surface area to the heat exchanger. Increasing the primary air may also destabilize the flame. Ultra-low NOx burners require sophisticated controls to maintain emissions levels and efficiency, to stabilize the flame, and to maintain a turndown ratio that is enough for the demands of the operation.

Selective Catalytic Reduction (SCR) Systems

SCR is a post-combustion control technology that is a commercially available and commonly employed to control NOx emissions from wide range of NOx sources. It is considered to be BARCT, if cost-effective, for controlling NOx emissions from existing combustion sources. A typical SCR system design consists of an ammonia storage tank, ammonia vaporization and injection equipment, a booster fan for the flue gas exhaust, an SCR reactor with catalyst, an exhaust stack plus ancillary electronic instrumentation and operations control equipment. The technology

uses a precious metal catalyst that selectively reduces NOx in the presence of ammonia. Ammonia is injected in the flue gas stream where it reacts with NOx and oxygen in the presence of the catalyst to produce nitrogen and water vapor.

For conventional SCRs, the minimum temperature for NOx reduction is 500 degrees F and the maximum operating temperature for the catalyst is 800 degrees F. Depending on the application, the type of fuel combusted, and the presence of sulfur compounds in the exhaust gas, the optimum flue gas temperature of an SCR system is case-by-case and will range between 550 degrees F and 750 degrees F to limit the occurrence of several undesirable side reactions at certain conditions. Depending on the type of combustion equipment utilizing SCR technology, the typical amount of ammonia slip can vary between less than 5 ppm when the catalyst is fresh and 20 ppm at the end of the catalyst life. However, newly permitted SCR systems have an ammonia slip limit of 5 ppm. In addition to the conventional SCR catalysts, there are high temperature SCR catalysts that can withstand temperatures up to 1200 degrees F and low temperature SCR catalysts that can operate below 500 degrees F.

For applications where exhaust temperatures are below the minimum reaction temperature, additional heat in the form of duct burners would need to be installed for proper emission reduction. Doing so would increase mass emissions at the inlet of the SCR and lower total emissions reduction potential of the SCR system.

Vendor Discussions

The following four vendors and manufacturers (in alphabetical order) were contacted requesting information regarding ultra-low/low NOx burners and SCR systems. All four provided technical input and provided cost estimates that has been included in the discussion below and the cost-effectiveness analysis in this staff report.

- Fives North American
- Honeywell Thermal Solutions
- Nationwide Boiler Incorporated
- Tri-Mer Corporation

Ultra-Low/Low NOx Burners Systems

The current NOx limit for categories for Rule 1147, is between 30 to 60 ppm corrected to 3% O_2. Based on the information obtained through vendor discussions, lower NOx emissions with ultra-low/Low NOx burners are feasible for burner replacements and new installations. Based on discussions with one burner manufacturer, achieving 20 ppm NOx ultra-low NOx burner without SCR is feasible in certain applications. Observed source test data also suggests existing equipment and burner technology can feasibly achieve between 20 to 30 ppm NOx and 1,000 ppm CO in existing applications.

Selective Catalytic Reduction (SCR) Systems

Existing Rule 1147 NOx limits can be feasibly achieved with burner only control technologies. The NOx limit for new SCR applications within the South Coast AQMD is 5 ppm with accompanying requirement for 5 ppm ammonia slip. SCR systems are scalable and generally utilized for units greater than 10 MMBtu/hr. From discussions with SCR vendors, system installations PAR 1147 is feasible with some limitations. One limitation for SCR applications in PAR 1147 applicable equipment is the low exhaust temperature for aggregate drying operations. Due to SCR systems requiring minimum exhaust temperatures of about 500 Degrees F, many

applications subject to PAR 1147 would require installations of additional heat input devices such as duct burners to meet a minimum exhaust temperature for proper emission reduction reaction to occur. Installation of duct burners would increase NOx emissions at the inlet of the SCR and decrease total reduction potential of the system. Vendor quotes also indicated that inclusion of duct burners would also increase the overall cost of the control system.

Initial BARCT Recommendations and Additional Considerations

Based on the review of the types of pollution control technologies available to reduce NOx and CO emissions for equipment subject to PAR 1147, burner control technologies are still the main technologies that can achieve the NOx concentration limits specified in these rules.[2]

Natural gas fired units comprise most of the equipment subject to PAR 1147; however, certain equipment use liquid fuels such as existing distillate fueled turbines. Summary of initial staff recommendations based on feasibility is shown in Table 2-1.

Table 2-1 -Initial BARCT Recommendations for Proposed Amended Rule 1147

Equipment Category	Operating Temperature	Current Rule Limit	Proposed NOx Limit[1]	Proposed CO Limit[1]
Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank	<1,200°F	30 ppm	**20 ppmv (0.024 lb/mmBtu)**	**1,000 ppmv**
	≥1,200°F	60 ppm	**30 ppmv (0.036 lb/mmBtu)**	
Tunnel Dryers	<1,200°F	30 ppm	**30 ppmv (0.036 lb/mmBtu)**	
	≥1,200°F	60 ppm	**60 ppmv (0.073 lb/mmBtu)**	
Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator	All	60 ppm	**20 ppmv (0.024 lb/mmBtu)**	
Evaporator, Fryer, Heated Process Tank, and Parts Washer	All	60 ppm	**60 ppmv (0.073 lb/mmBtu)**	
Burn-off Furnace, Burnout Oven, Incinerator, Crematory with or without Integrated Afterburner	All	60 ppm	**30 ppmv (0.036 lb/mmBtu)**	
Tenter Frame, Fabric or Carpet Dryer	All	30 ppm	**20 ppmv (0.024 lb/mmBtu)**	
Other Unit and Process Temperature	<1,200°F	30 ppm	**30 ppmv (0.036 lb/mmBtu)**	
	≥1,200°F	60 ppm	**60 ppmv (0.073 lb/mmBtu)**	
Chillers	All	30 ppm	**20 ppmv (0.024 lb/mmBtu)**	
Micro-Turbines (All Other)	All	N/A	**9 ppmv (0.011 lb/mmBtu)[2]**	
Micro-Turbines (In-Use Distillate Fuel)	All	40 ppm	**77 ppmv (0.094 lb/mmBtu)[2]**	
Auto-Claves	All	30 ppm	**30 ppmv (0.036 lb/mmBtu)**	
All Liquid Fuel-Fired Units	<1,200°F	40 ppm	**40 ppmv (0.053 lb/mmBtu)**	
	≥1,200°F	60 ppm	**60 ppmv (0.073 lb/mmBtu)**	

[1] *Emissions limits are corrected to 3% O_2, unless otherwise specified*
[2] *Emissions limits are corrected to 15% O_2*

[2] In the event that an owner or operator installs a new burner to meet the proposed emission limit, a permit modification would be required. If the owner or operator chooses to increase the unit's rating in the process, the equipment would be subject to the emission limit set by Best Available Control Technology (BACT).

Cost-Effectiveness and Incremental Cost-Effectiveness Analysis

Cost-Effectiveness Methodologies

The South Coast AQMD routinely conducts cost-effective 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 inputs in a cost-effectiveness analysis include capital and installation costs, operating and maintenance costs, emission reductions, discount rate, and equipment life. There are two potential methods to calculate cost-effectiveness for emission reductions, discounted cash flow method and levelized cash flow method. The cost-effectiveness calculations were completed using the discounted cash flow method based on the discussions and comparisons of the two methods 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 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 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-effectiveness measure is derived by dividing the present value of total costs by the total emissions reduced over the equipment life. Below is the equation used for calculating cost-effectiveness with DCF as 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.

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

Levelized Cash Flow (LCF)

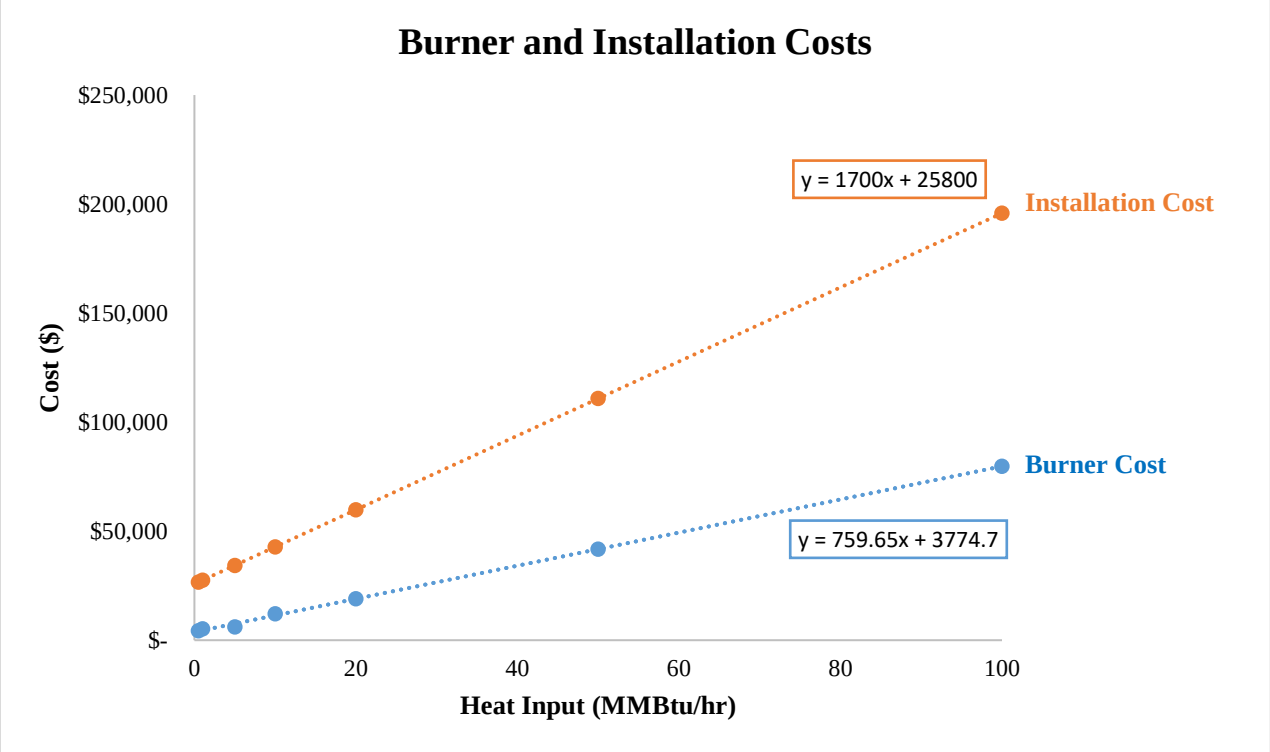
The LCF method annualizes the present value of total costs as if all costs, including the initial capital investments, would be paid off in the future with an equal annual installment over the equipment life. What is less clear, however, is how to deal with non-constant emission reductions when using 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.

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

Summary of Cost-Effectiveness and Incremental Cost-Effectiveness Analysis

To assess the cost-effectiveness for the proposed BARCT limits, cost information about the control equipment was obtained from discussions with manufacturers, vendors, and stakeholders. Additional references were made to the installation cost information obtained during the 2018 rulemaking for the Rule 1146 series. Cost extrapolations were further compared to stakeholder provided vendor quotations which showed staff's estimates were generally more conservative than that of stakeholder quotations. Figure 2-12 shows the linear correlations between equipment and installation cost for natural gas fired units based on size (MMBtu/hr) for burner replacements.

Figure 2-12 – Capital Costs for Equipment and Installation



Burner costs depended on the equipment size. The budget prices obtained for burner retrofits, that indicate there would be no major changes to existing units such as major structural or foundation changes. Additionally, the useful life for the control equipment was assumed to be 15 years for equipment burners. Staff utilized a bottom-up approach which evaluated each equipment subject to PAR 1147 and conducted cost-effectiveness analysis on a per equipment basis. Baseline emissions for each equipment were calculated using latest usage information from facility Annual Emissions Reporting (AER), if available. For equipment without AER information, staff used an operating capacity assumption of 80% based off the average industrial production and capacity utilization released by the United States Federal Reserve printed on February 7, 2011[3]. In addition to the average cost for the equipment and installation, the permitting fees are included as part of the capital cost in the cost-effectiveness analysis. The most current fee rates in *Rule 301 – Permitting and Associated Fees* were used to estimate the permitting cost. Table 2-2 shows average cost-effectiveness for each equipment category subject to PAR 1147. In general, all average cost effectiveness for each equipment category are calculated to be below $50,000/ton with some

[3]Federal Reserve Statistical Release G.17, Industrial Production and Capacity Utilization http://www.federalreserve.gov/releases/g17/cap_notes.htm as printed on February 7, 2011.

categories identified to have a cost effectiveness of "no additional cost" or $0/ton due to BARCT matching existing limits for those equipment categories such as chillers, turbines, and autoclaves.

Table 2-2 –Cost Effectiveness Estimate for PAR 1147 Categories

Equipment Category	Operating Temperature	Average Cost-Effectiveness
Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank	<1,200°F	**$12,700/Ton**
	≥1,200°F	**$5,600/Ton**
Tunnel Dryers	<1,200°F	**$49,200/Ton**
	≥1,200°F	**No Additional Cost**
Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator	All	**$12,300/Ton**
Evaporator, Fryer, Heated Process Tank, and Parts Washer	All	**$31,300/Ton**
Burn-off Furnace, Burnout Oven, Incinerator, Crematory with or without Integrated Afterburner	All	**$25,800/Ton**
Tenter Frame, Fabric or Carpet Dryer	All	**$23,600/Ton**
Other Unit and Process Temperature	<1,200°F	**No Additional Cost**
	≥1,200°F	
Chillers	All	**No Additional Costs**
Micro-Turbines (All Other)	All	**No Additional Costs**
Micro-Turbines (In-Use Distillate Fuel)	All	**No Additional Costs**
Auto-Claves	All	**$49,000**
All Liquid Fuel-Fired Units	<1,200°F	**No Additional Costs**
	≥1,200°F	**No Additional Costs**

Incremental cost-effectiveness evaluates and compares two or more control options available for emission reductions. For equipment subject to PAR 1147, the two identified pollution control technologies are ultra-low NOx burners and selective catalytic reduction (SCR) systems. The general size of applicable equipment in PAR 1147 are below 5 MMBtu/hr and SCR applications are more suited for larger applications that are greater than 10 MMBtu/hr. For the larger equipment impacted by PAR 1147, the processes are generally tunnel dryers with low exhaust temperature (between 300°F and 400°F). SCR systems would require additions of external heat sources, such as duct burners, to bring exhaust temperatures up to temperatures where reduction reactions can efficiently occur (~500°F). External combustion sources of SCR applications increase system cost and lower overall emission reduction potential when compared to SCR applications that do not require external heat input. The average cost-effectiveness for SCR systems including duct burners for all PAR 1147 equipment categories were calculated to be >$50,000/ton. As such post-combustion controls were found to be not cost-effective and incremental cost-effectiveness between combustion control and post-combustion control was not calculated.

Proposed BARCT Emission Limit

Staff evaluated applicable permitted equipment in the RECLAIM and non-RECLAIM universe to assess and develop the proposed NOx BARCT limit for PAR 1147. The proposal outlined in Table 2-3 was developed by considering data collected from vendor discussions as well as the analysis of source test results and cost-effectiveness. Separate compliance schedules will be developed for applicable equipment with South Coast AQMD permits that limit emissions less than or equal to existing limits under Rule 1147 and for equipment without South Coast AQMD permits that limit emissions less than or equal to existing Rule 1147 limits shown in Table 2-4. Permitted equipment with permit limit of daily NOx emissions below one pound per day will be exempt from limits of PAR 1147.

Table 2-3 – Summary of Proposed Amended Rule 1147

Equipment Category	Operating Temperature	Current Rule Limit	Proposed NOx Limit[1]	Proposed CO Limit
Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank	<1,200°F	30 ppm	**20 ppmv (0.024 lb/mmBtu)**	**1,000 ppmv**
	≥1,200°F	60 ppm	**30 ppmv (0.036 lb/mmBtu)**	
Tunnel Dryers	<1,200°F	30 ppm	**30 ppmv (0.036 lb/mmBtu)**	
	≥1,200°F	60 ppm	**60 ppmv (0.073 lb/mmBtu)**	
Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator	All	60 ppm	**20 ppmv (0.024 lb/mmBtu)**	
Evaporator, Fryer, Heated Process Tank, and Parts Washer	All	60 ppm	**60 ppmv (0.073 lb/mmBtu)**	
Burn-off Furnace, Burnout Oven, Incinerator, Crematory with or without Integrated Afterburner	All	60 ppm	**30 ppmv (0.036 lb/mmBtu)**	
Tenter Frame, Fabric or Carpet Dryer	All	30 ppm	**20 ppmv (0.024 lb/mmBtu)**	
Other Unit and Process Temperature	<1,200°F	30 ppm	**30 ppmv (0.036 lb/mmBtu)**	
	≥1,200°F	60 ppm	**60 ppmv (0.073 lb/mmBtu)**	
Chillers	All	30 ppm	**20 ppmv (0.024 lb/mmBtu)**	
Micro-Turbines (All Other)	All	N/A	**9 ppmv (0.011 lb/mmBtu)[2]**	
Micro-Turbines (In-Use Distillate Fuel)	All	40 ppm	**77 ppmv (0.094 lb/mmBtu)[2]**	
Auto-Claves	All	30 ppm	**30 ppmv (0.036 lb/mmBtu)**	
All Liquid Fuel-Fired Units	<1,200°F	40 ppm	**40 ppmv (0.053 lb/mmBtu)**	
	≥1,200°F	60 ppm	**60 ppmv (0.073 lb/mmBtu)**	

Table 2-4 – Summary of Existing Limits in Rule 1147

Equipment Categories	Process Temperature	Emission Limits	
		NOx Limit (ppmv)	CO Limit (ppmv)
Gaseous Fuel-Fired Equipment			
Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator [1]	All	60 ppmv or 0.073 lb/mmBtu	1,000 ppmv
Burn-off Furnace, Burnout Oven, Incinerator or Crematory with or without Integrated Afterburner	All	60 ppmv or 0.073 lb/mmBtu	
Evaporator, Fryer, Heated Process Tank, or Parts Washer	All	60 ppmv or 0.073 lb/mmBtu	
Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank	<1,200°F	30 ppmv or 0.036 lb/mmBtu	
	≥1,200°F	60 ppmv or 0.073 lb/mmBtu	
Equipment Categories	**Process Temperature**	**NOx Limit (ppmv)**	**CO Limit (ppmv)**
Make-Up Air Heater or other Air Heater located outside of building with temperature controlled zone inside building	All	30 ppmv or 0.036 lb/mmBtu	1,000 ppmv
Tenter Frame or Fabric or Carpet Dryer	All	30 ppmv or 0.036 lb/mmBtu	
Other Unit or Process Temperature	<1,200°F	30 ppmv or 0.036 lb/mmBtu	
	≥1,200°F	60 ppmv or 0.073 lb/mmBtu	
Liquid Fuel-Fired Equipment			
All liquid fuel-fired Units	<1,200°F	40 ppm or 0.053 lb/mmBtu	1,000 ppmv

1. Emission limit applies to burners in units fueled by 100% natural gas that are used to incinerate air toxics, VOCs, or other vapors; or to heat a unit. The emission limit applies solely when burning 100% fuel and not when the burner is incinerating air toxics, VOCs, or other vapors. The unit shall be tested or certified to meet the emission limit while fueled with natural gas

As facilities transition from RECLAIM into PAR 1147, interim limits are put in place until required to meet proposed NOx and CO emission limits. Non-RECLAIM facilities will be subject to limits of existing Rule 1147 limits while RECLAIM facilities without existing permit limits on NOx will be subject to an interim limit of 102 ppm NOx based on existing RECLAIM default emission factor of 130 pounds NOx per million standard cubic feet natural gas (lbs/mmscf). Equipment above the current applicable Rule 1147 limit are required to submit permit applications to meet proposed limits when the burner reaches 12 years of age or by July 1, 2023, whichever is later. Equipment at or below the current Rule 1147 limit is required to meet proposed limits when the burner reaches 32 years of age or July 1, 2023, whichever is later. Applicable equipment must meet proposed limits upon burner replacement.

CHAPTER 3: SUMMARY OF PROPOSALS

Introduction
Proposed Amended Rule 1147

Introduction

The primary objective of PAR 1147 is to update NOx and CO emission limits that represent BARCT requirements for applicable equipment and to remove the exclusion of RECLAIM facilities. Proposed Amended Rule 1147 also proposes to include periodic monitoring requirements that are currently not included in Rule 1147. Key provisions included in PAR 1147 are discussed below.

Proposed Amended Rule 1147

Rule 1147 Purpose [Subdivision(a)]

The purpose of this rule is to reduce emissions of nitrogen oxide (NOx) and limiting carbon monoxide (CO) emissions from gaseous and liquid fuel-fired combustion equipment as defined in this rule.

Rule 1147 Applicability [Subdivision(b)]

Proposed amended Rule 1147 applies to manufacturers, distributors, retailers, installers, owners, and operators of combustion equipment with NOx emissions that require a South Coast AQMD permit and is not specifically required to comply with requirements of other South Coast AQMD Regulation XI combustion rules. Equipment with total heat input of below 325,000 btu/hr or equipment with total daily NOx emissions of less than one pound as required by a permit condition will not be subject to the NOx and CO emission limit requirements of Rule 1147.

Rule 1147 Definitions [Subdivision(c)]

The following are key definitions for Proposed Amended Rule 1147 to distinguish the new equipment categories for PAR 1147 as well as additional definitions included to guide RECLAIM facilities into PAR 1147. For all definitions, refer to draft of PAR 1147 released with this report.

AUTOCLAVE in paragraph (c)(3), which means:

> *"a device that uses both heat and pressure (over 15 pounds per square inch) to process materials, employing a heating method that includes an internal heat-transfer coil and an external combustion system which fires gaseous or liquid fuels through the coil.*

CHILLER in paragraph (c)(5), which means:

> "*any natural gas fired unit that captures and uses waste heat to provide cold water for air conditioning and other process requirements."*

CONTINUOUS EMISSIONS MONITORING SYSTEM in paragraph (c)(9), which means:

> "*the total combined equipment and systems required to continuously determine air contaminants and diluent gas concentrations and/or mass emission rate of a source effluent (as applicable). The CEMS consists of three major subsystems: sampling interface, analyzer and data acquisition system."*

DECOMMISSION in paragraph (c)(10), which means:

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

FORMER RECLAIM FACILITY in paragraph (c)(12), 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."*

NEW UNIT in paragraph (c)(19), which means:

> *"a Unit that is installed, relocated, or replaced after [Date of Adoption]"*

NON-RECLAIM FACILITY in paragraph (c)(20), 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."*

RECLAIM FACILITY in paragraph (c)(26), 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."*

TUNNEL KILN in paragraph (c)(32), which means:

> *"any gaseous fired equipment which transfers heat from combusted fuel to air contained in the unit with exhaust moisture content above 30 percent using a continuous moving conveyor or vehicle."*

TURBINE in paragraph (c)(33), which means:

> *"for the purposes of this rule, any gas turbine that is gas and/or liquid fueled with or without power augmentation. This gas turbine is either attached to a foundation at a facility or is portable equipment that will reside at the same location for more than 12 consecutive months. Two or more gas turbines powering one shaft shall be treated as one gas turbine."*

UNIT in paragraph (c)(34), which means:

> *"for the purposes of this rule, any combustion equipment with NOx emissions requiring a South Coast AQMD permit and not specifically required to comply with requirements of other South Coast AQMD Regulation XI combustion rules. Basic equipment with integrated control is considered a single Unit."*

For the purposes of PAR 1147, equipment configurations with multiple burners shall be considered a single unit. Total heat input and gas usage for Units with multiple burners shall be the sum of all burners of the Unit.

Rule 1147 Requirements [Subdivision(d)]

Paragraph (d)(1) – Interim Limit for RECLAIM and Non-RECLAIM Facilities

Units at non-RECLAIM facilities are already subject to existing limits or implementation schedule of existing Rule 1147. As of the date of adoption for PAR 1147, most equipment subject to the rule would have already been required to meet applicable Rule 1147 limits, unless specifically afforded an alternative compliance schedule. PAR 1147 will allow non-RECLAIM facilities to continue to meet compliance limits of existing Rule 1147 until the unit is required to meet the new, lower limits of PAR 1147 in accordance with the implementation schedule in subdivision (d).

As RECLAIM facilities transition out of RECLAIM and to the command-and-control regulatory program, an interim NOx limit is needed until the facility achieves the proposed NOx BARCT limit. This is done to ensure that there is an enforceable regulatory requirement that is representative of federal Reasonable Available Control Technology (RACT) levels. In addition, to make sure RECLAIM sources with compliance dates after a facility becomes a former RECLAIM facility continue to meet RACT in the interim on an aggregate demonstration basis, units at RECLAIM facilities that do not have an existing NOx concentration limit on their permit will be subject to an interim limit of 102 ppmv NOx which is the equivalent of the RECLAIM default emission factor of 130 lb/mmscf natural gas.

Paragraph (d)(2) through (d)(6) – PAR 1147 BARCT Emission Limit

PAR 1147 will establish updated BARCT emission limits for NOx and CO for applicable equipment as shown in PAR 1147 Table 2 (Table 3-2 of this staff report). An owner or operator of a unit subject to PAR 1147 shall not operate the unit in a manner that exceeds the NOx and CO limits of PAR 1147 Table 2 unless the unit have an existing permit condition that complies with the NOx and CO limits of PAR 1147 Table 1 (Table 3-1 of this Staff Report) as of the date of rule adoption. For units without permit conditions that comply with PAR 1147 Table 1 by the date of adoption, the owner or operator may submit a permit application to add a permit condition to the Permit to Operate that requires compliance with the NOx and CO concentration limits in PAR Table 1 by May 1, 2022.

Table 3-2 – PAR 1147 Table 2
(NOx Emission Limits for Unit Permitted Prior to Date of Rule Adoption)

Equipment Categories	Process Temperature	Emission Limits	
		NOx Limit (ppmv)	CO Limit (ppmv)
Gaseous Fuel-Fired Equipment			
Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator [1]	All	60 ppmv or 0.073 lb/mmBtu	1,000 ppmv
Burn-off Furnace, Burnout Oven, Incinerator or Crematory with or without Integrated Afterburner	All	60 ppmv or 0.073 lb/mmBtu	
Evaporator, Fryer, Heated Process Tank, or Parts Washer	All	60 ppmv or 0.073 lb/mmBtu	
Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank	<1,200°F	30 ppmv or 0.036 lb/mmBtu	
	≥1,200°F	60 ppmv or 0.073 lb/mmBtu	
Make-Up Air Heater or other Air Heater located outside of building with temperature controlled zone inside building	All	30 ppmv or 0.036 lb/mmBtu	
Tenter Frame or Fabric or Carpet Dryer	All	30 ppmv or 0.036 lb/mmBtu	
Other Unit or Process Temperature	<1,200°F	30 ppmv or 0.036 lb/mmBtu	
	≥1,200°F	60 ppmv or 0.073 lb/mmBtu	
Liquid Fuel-Fired Equipment			
All liquid fuel-fired Units	<1,200°F	40 ppm or 0.053 lb/mmBtu	1,000 ppmv
	≥1,200°F	60 ppmv or 0.073 lb/mmBtu	

1. Emission limit applies to burners in units fueled by 100% natural gas that are used to incinerate air toxics, VOCs, or other vapors; or to heat a unit. The emission limit applies solely when burning 100% fuel and not when the burner is incinerating air toxics, VOCs, or other vapors. The unit shall be tested or certified to meet the emission limit while fueled with natural gas.

Table 3-2 – PAR 1147 Table 2
(NOx Emission Limit)

Equipment Categories	Process Temperature	Emission Limits	
		NOx Limit (ppmv)	CO Limit (ppmv)
Gaseous Fuel-Fired Equipment			
Afterburner, Degassing Unit, Remediation Unit, Thermal Oxidizer, Catalytic Oxidizer or Vapor Incinerator [1]	All	20 ppmv or 0.024 lb/mmBtu	1,000 ppmv
Burn-off Furnace, Burnout Oven, Incinerator or Crematory with or without Integrated Afterburner	All	30 ppmv or 0.036 lb/mmBtu	
Evaporator, Fryer, Heated Process Tank, or Parts Washer	All	60 ppmv or 0.073 lb/mmBtu	
Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank	<1,200°F	20 ppmv or 0.024 lb/mmBtu	
	≥1,200°F	30 ppmv or 0.036 lb/mmBtu	
Make-Up Air Heater or other Air Heater located outside of building with temperature controlled zone inside building	All	30 ppmv or 0.036 lb/mmBtu	
Tenter Frame or Fabric or Carpet Dryer	All	20 ppmv or 0.024 lb/mmBtu	
Autoclave	All	30 ppmv or 0.036 lb/mmBtu	
Tunnel Kiln	<1,200°F	30 ppmv or 0.036 lb/mmBtu	
	≥1,200°F	60 ppmv or 0.073 lb/mmBtu	
Chiller (Absorption or Adsorption)	All	20 ppm or 0.024 lb/mmBtu	
Turbine <0.3 MW[3]	All	9 ppm or 0.011 lb/mmBtu	

1. Emission limit applies to burners in units fueled by 100% natural gas that are used to incinerate air toxics, VOCs, or other vapors; or to heat a unit. The emission limit applies solely when burning 100% fuel and not when the burner is incinerating air toxics, VOCs, or other vapors. The unit shall be tested or certified to meet the emission limit while fueled with natural gas.
2. Emission limit applies to turbines smaller than 0.3 MW In-Use prior to *date of adoption* with an annual fuel throughput of 13,800 gallons/year.
3. Emission limit for turbines are corrected to 15% O_2, dry

Paragraph (d)(7) and (d)(8) – Emissions of Less Than One Pound Per Day

Paragraph (d)(7) of PAR 1147 will provide the terms for an owner or operator of a Unit with daily NOx emissions of below one pound per day to be exempt from NOx and CO emission limits of PAR 1147. To be exempt, the owner or operator must submit a permit application to add a permit condition limiting daily NOx emissions to less than one pound per day before January 1, 2023 for existing units. An owner or operator of a new unit complying with paragraph (c)(7) must obtain a permit condition that limits NOx emissions to one pound per day at the time of permit issuance.

Paragraph (d)(8) provides the pathway into compliance with Rule 1147 for equipment complying with paragraph (d)(7) that fails to continuously demonstrate NOx emissions of less than 1 pound per day. Per paragraph (d)(8), an owner or operator that fails to demonstrate less than 1 pound per day pursuant to subdivision (g) or maintain recordkeeping pursuant to subdivision (j) shall submit permit application to meet emission limits in PAR 1147 Table 2 within 6 months of failing to demonstrate less than 1 pound NOx per day pursuant to subdivision (g) or failing to satisfy recordkeeping pursuant to subdivision (j). The owner or operator must then comply with the emission limits in Table 2 within 12 months after a Permit to Construct is issued.

Rule 1147 Compliance Schedule [Subdivision(e)]

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

Paragraph (e)(1), (e)(2), and (e)(3) – Compliance Schedules

Paragraph (e)(1) provides the compliance schedule for units that are required to meet the NOx and CO emission limits in Table 2 pursuant to paragraph (d)(2). Units subject to this paragraph need to submit permit applications to demonstrate compliance with emission limits of Table 2 on or before July 1, 2023 or July 1 of the year the unit's burner reaches 12 years of age as determined by subdivision (f), whichever is later.

Paragraph (e)(2) provides the compliance schedule for units that are required to meet the NOx and CO emission limits in Table 2 pursuant to paragraph (d)(3). Units subject to this paragraph need to submit permit applications to demonstrate compliance with emission limits of Table 2 on or before July 1, 2023 or July 1 of the year the unit's burner reaches 32 years of age as determined by subdivision (f), whichever is later.

Paragraph (e)(3) retains the alternative compliance schedules established in Rule 1147 to provide units identified in PAR 1147 Table 3 (Table 3-3 of this Staff Report) the same compliance schedule that was present in Rule 1147. When equipment subject to the compliance schedule in Table 3-3 must comply with PAR 1147 limits, the units must demonstrate compliance with emission limits of PAR Table 2 (Staff Report Table 3-2).

Table 3-3 – PAR 1147 Table 3
(Alternative Compliance Schedule)

Equipment Category(ies)	Submit Permit Application	Unit Shall Be in Compliance
Specific UNIT		
Remediation UNIT manufactured and installed prior to March 1, 2012	Seven months prior to a combustion system modification, combustion system replacement or unit replacement or a relocation.	Upon combustion system modification, combustion system replacement or unit replacement or relocation beginning March 1, 2012
Evaporator, heated process tank, or parts washer with a South Coast AQMD permit issued and operating prior to January 1, 2014	Seven months prior to combustion system modification, combustion system replacement or unit replacement	Upon combustion system modification, combustion system replacement or unit replacement

Paragraph (e)(4)– Compliance via Decommissioning

Paragraph (e)(4) provides the option for an owner or operator of a unit subject to PAR 1147 to decommission the unit instead of complying with applicable emission limits in PAR 1147 Table 2 provided a permit application is submitted on or before applicable permit application submittal dates in paragraphs (e)(1) or (e)(2). An owner or operator that elects to decommission the unit must decommission the unit within 30 months after the application submittal deadline by disconnecting all fuel, air, and electricity to the unit.

Paragraph (e)(5) – Compliance Schedule for Facilities with Five or More Units

Paragraph (e)(6) provides additional time for facilities operating five or more units subject to paragraphs (d)(2) or (d)(3) with a July 1, 2023 permit application submittal date pursuant to paragraphs (e)(1) or (e)(2). The extended schedule is outlined in PAR 1147 Table 4 (Table 3-4 in this Staff Report) and is based on total heat input of all units subject to the multiple unit implementation schedule as of July 1, 2023. Total heat input does not include units complying with the less than one pound per day option of paragraph (d)(7). The minimum percentages listed are rounded up to the nearest whole number of applicable unit(s). An owner or operator must submit permit application by the dates specified in PAR 1147 Table 4 to comply with emission limits of PAR 1147 Table 2. Owner or operators may elect to decommission units to meet permit application submittal requirements provided the owner or operator submits permit application identifying and declaring intent to decommission a unit and decommissions the units within 30 months after application submittal similar with requirements of paragraphs (e)(4).

Table 3-4 – PAR 1147 Table 4
(Multiple Unit Implementation Schedule)

Application Submission Deadline	5 to 9 units (Minimum % of Total Heat Input)	10 to 19 units (Minimum % of Total Heat Input)	20+ units (Minimum % of Total Heat Input)
July 1, 2023	50%		
July 1, 2024	100%	50%	33%
July 1, 2025	Not Applicable		
July 1, 2026		100%	67%
July 1, 2027		Not Applicable	
July 1, 2028			100%

Rule 1147 Burner Age Determination [Subdivision(f)]

Subdivision (f) provides guidance to determine burner age of applicable equipment. Unlike the existing provision in Rule 1147(c)(2), PAR 1147 subdivision (f) does not function as a hierarchy. Owners and operators of unit(s) subject to PAR 1147 may choose any of the available options listed in paragraph (f)(2) to determine burner age, including the invoice related to installation from equipment manufacturer, original manufacturer's identification plate, information submitted to the South Coast 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 by operation of PAR 1147 to be 32 years old as of January 1, 2023.

Rule 1147 Demonstration of Less than One Pound of NOx per Day [Subdivision(g)]

Subdivision (g) establishes methods in which an owner or operator can demonstrate daily NOx emissions of below one pound per day. Two methods are provided to the owner or operator of a unit subject to PAR 1147, monitoring with a unit specific non-resettable totalizing time meter or unit specific non-resettable totalizing fuel meter.

For facilities electing to monitor with a unit specific non-resettable totalizing time meter pursuant to subparagraph (g)(1)(A), options are provided to calculate maximum daily operating hours with unit specific emission factor in lb NOx/mmscf natural gas or operating limits specified in PAR 1147 Table 5 (Table 3-5 in this Staff Report). Owners or operators electing to calculate maximum daily operating minutes with Equation 1 shall determine unit emission factor with a South Coast AQMD approved source test.

Table 3-5 – PAR 1147 Table 5
(Less than One Pound per Day Daily Operating Limits)

Unit Rated Heat Input (Btu/hr)	Daily Operating Limit (minutes)
< 1,000,000	480
≥ 1,000,000 to < 1,500,000	300
≥ 1,500,000 to ≤ 2,000,000	240

Rule 1147 Monitoring and Source Testing [Subdivision(h)]

Background of Current MRR Requirements in RECLAIM and Non-RECLAIM

Under RECLAIM, mass emissions reported by each facility are used to track and demonstrate compliance. To ensure the integrity of reported emissions, RECLAIM includes substantial monitoring and reporting requirements, as specified in *Rule 2012 - Requirements for Monitoring, Reporting and Recordkeeping for Oxides of Nitrogen Emissions*. RECLAIM monitoring, reporting, and recordkeeping (MRR) requirements are developed to accurately determine mass emissions of NOx for each facility, which is necessary for emission reconciliation and compliance demonstration in the cap-and-trade regulatory structure. RECLAIM MRR requirements are segregated by device classifications. The four device classifications are major sources, large sources, process units, and Rule 219 exempt equipment.

In a command-and-control regulatory structure, a device-level emission limit (commonly expressed in concentration such as ppmv in Rule 1147) is used for regulatory and compliance demonstration. Unlike RECLAIM equipment, Rule 1147 does not have periodic source testing requirements such as periodic source testing or emissions monitoring, and generally only an initial source test is required.

Major sources are units with a total heat input rating of greater than or equal to 40 MMBtu/hr with total annual fuel usage of greater than 90 billion Btu. Units that are classified as major sources are required to install a continuous emissions monitoring system (CEMS) or South Coast AQMD approved equivalent monitoring requirement. To ensure the integrity of reported emissions, RECLAIM includes substantial monitoring and reporting requirements for major sources such as annual (or semi-annual) relative accuracy test audit (RATA), daily emissions electronic reporting, quarterly aggregate electronic reporting, quarterly certifications of emissions reports (QCER), and annual permit emissions program (APEP) report.

Large sources are units with a total heat input rating of greater than or equal to 10 MMBtu/hr and less than 40 MMBtu/hr with annual NOx emissions of between 4 and 10 tons. Under the RECLAIM program, units classified as large sources are required to electronically report monthly emissions and quarterly aggregate emissions as well as QCER and APEP requirements. Large sources are also required to conduct source testing every three years and conduct semi-annual tuning.

Process units are units with a total heat input rating of between 2 MMBtu/hr and 10 MMBtu/hr. Process units share similar reporting requirements as Rule 219 exempt equipment which are rated to less than or equal to 2 MMBtu/hr. Both process units and Rule 219 exempt equipment are required to submit quarterly electronic emissions reports as well as QCER and APEP requirements. Process units assigned concentration limits are required to conduct source testing every five years

and all process units are required to conduct semi-annual tuning. Rule 219 exempt equipment is not subject to periodic testing or tuning requirements unless required by permit.

Comparison of MRR Requirements in RECLAIM and Non-RECLAIM

Comparison of MRR requirements between RECLAIM and Rule 1147 are outlined in Table 3-6.

Table 3-6 – Comparison of MRR Requirements Between RECLAIM and Rule 1147

Requirements	RECLAIM	Rule 1147
Source Testing	**Major Source**: Semi-annual RATA which includes reference source test **Super Compliant Major Source:** Semi-annual source testing (Every 12 months after 2 years of consecutive passes)	**Units Emitting ≥1 Pound NOx/Day:** According to schedule found in Rule 1147 Table 2 or at the time of permitting
	Large Source: Source testing every 3 years	**Units Emitting <1 Pound NOx/Day:** At the time when unit is 35 years old*
	Process Source: Source testing every 5 years	
Periodic Monitoring	**Major Source**: Requires installation of CEMS or equivalent	**Units Emitting ≥1 Pound NOx/Day:** Tune up interval according to manufacturer specification
	Super Compliant Major Source: Semi-annual tuning with emissions monitoring	
	Large Source: Semi-annual tuning with emissions monitoring	**Units Emitting <1 Pound NOx/Day:** Tune up interval according to manufacturer specification and maintaining daily usage records to demonstrate low use
	Process Source: Semi-annual tuning with emissions monitoring	
CEMS Provision	Required for all units meeting definition of major source (≥40 MMBtu/hr and ≥90 billion BTU/year; OR ≥500 MMBtu/hr)	Rule 1147 does not contain provisions for CEMS
Reporting	**Major Source**: - Daily electronic reporting - Monthly electronic reporting - Quarterly aggregate reporting - Quarterly certifications of emissions report (QCER) - Annual permit emissions program (APEP) report	Rule 1147 does not contain periodic reporting requirements
	Super Compliant Major Source: - Monthly electronic reporting - Quarterly aggregate reporting - QCER - APEP report	
	Large Source: - Monthly electronic reporting - Quarterly aggregate reporting - QCER - APEP report	
	Process Source: - Quarterly aggregate reporting - QCER - APEP report	

[*]Units subject to Rule 1147 emitting less than 1 pound/day of NOx may continue to operate without complying with rule limits if the facility conducts biennial testing to continuously demonstrate emissions of <1 pound/day.

In general, source testing and reporting requirements under RECLAIM are more stringent than Rule 1147. PAR 1147 aligns MRR requirements for applicable RECLAIM and non-RECLAIM facilities. Title V requires additional periodic monitoring. South Coast AQMD has developed guidelines, outlined in South Coast AQMD Periodic Monitoring Guidelines[4], for periodic monitoring, testing and recordkeeping requirements that may be incorporated in Title V permits. Currently, the monitoring requirements in the RECLAIM program are comprehensive and address the Title V periodic monitoring requirements. On March 5, 2021, the South Coast AQMD Governing Board voted to amend *Rule 218 - Continuous Emission Monitoring* and *adopt Rule 218.2 - Continuous Emission Monitoring System: General Provisions*, and *Rule 218.3 - Continuous Emission Monitoring System: Performance Specifications* which address the additional MRR requirements as required by the Title V program. Considerations of the different monitoring requirements between RECLAIM and non-RECLAIM are considered when developing MRR requirements for PAR 1147.

Paragraphs (h)(1) through (h)(4) –Source Test Provision

Units subject to paragraph (d)(1), (d)(2), (d)(3) or (d)(4) must conduct a source test to demonstrate compliance with applicable emission limits of Table 1 or Table 2 pursuant to subdivision (d) as well as obtain an approved source test protocol prior to conducting the source test. Source test protocols for subsequent testing would not need to be re-evaluated assuming the tested burner or unit was not altered to require a new permit.

Paragraph (h)(5) –Source Test Methods

Paragraph (h)(5) outlines acceptable methods for determining compliance with PAR 1147 emission limits.

Paragraph (h)(11) through (h)(13)–Periodic Source Testing Requirements

Paragraph (h)(11) outlines the following periodic source test schedule for units subject to PAR 1147 based on rated heat input:

- Below 10 MMBtu/hr – Every 5 calendar years and qualifying periodic source test may not take place earlier than 54 calendar months after previous source test
- Between 10 MMBtu/hr and 40 MMBtu/hr – Every 3 calendar years and qualifying periodic source test may not take place earlier than 30 months after the previous source test
- At or above 40 MMBtu/hr – Every calendar year and qualifying periodic source test may not take place earlier than 6 months after the previous source test

Since Rule 1147 did not previously require periodic source testing for applicable units, paragraph (h)(12) provides applicable units an onramp to the periodic monitoring requirement of PAR 1147. Applicable equipment would need to conduct a source test no later than 24 months after date of rule adoption, which will set the schedule for the next required periodic source test. For units below 40 MMBtu/Hr, Owner may choose to use a recent approved source test that shows compliance with applicable PAR 1147 limits as the basis for establishing a recurring schedule. This can in some cases establish a first-required periodic source test that would be more than 24 months after rule adoption.

[4] Periodic Monitoring Guideline. http://www.aqmd.gov/home/permits/title-v/title-v-requirements#pm.

PAR 1147 will not require facilities to install new continuous emissions monitoring systems (CEMS); however, facilities with existing CEMS must maintain the system. Applicable units with installed CEMS are required to conduct periodic relative accuracy test audits (RATA) as required in Rule 218.2 and 218.3. RATA may substitute for one instance of compliance demonstration required in paragraph (h)(11) as specified in paragraph (h)(13).

Rule 1147 Labeling Requirement [Subdivision(i)]

Subdivision (i) outlines unit labeling requirements including units that have been modified from the original burner configuration.

Rule 1147 Reporting and Recordkeeping [Subdivision(j)]

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

Rule 1147 Exemptions [Subdivision(m)]

Paragraphs (m)(13) – Start up and Shutdown Exemption for Tunnel Kilns

Paragraph (m)(13) provides a brief period of exemption from NOx and CO limits of Table 1 and Table 2 during periods of startup and shutdown for tunnel kilns. An owner or operator of a unit relying on exemption must maintain records of startup and shutdown for minimum of five years.

CHAPTER 4: IMPACT ASSESSMENT

Introduction
Emission Reductions
Socioeconomic Assessment
California Environmental Quality Act Analysis
Draft Findings Under California Health and Safety Code Section 40727
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Introduction

Proposed Amended Rule 1147 (PAR 1147) is expected to impact ~4900 units located at approximately 2,900 facilities. Of the estimated 2,900 facilities, 85 facilities are identified to be participants of the RECLAIM program. Rule 1147 was initially adopted on December 5, 2008 and established NOx emission limits for applicable equipment located in non-RECLAIM facilities. It is expected that most of the equipment subject to PAR 1147 located at non-RECLAIM facilities is already in compliance with emission limits of PAR 1147 Table 1 (Staff Report Table 3-1) and will be subject to the requirement to submit permit applications and comply with tightened limits when units reach 32 years of age. RECLAIM equipment without permit limits complying with PAR 1147 Table 1 will be subject to meet tightened limits when units reach 12 years of age.

Emissions Reduction

The total NOx inventory for the RECLAIM and non-RECLAIM units affected by the PAR 1147 is estimated to be 3.69 tons per day. This estimate is taken from South Coast AQMD annual emission report (AER) inventory database for compliance year 2018 for permitted units or audited RECLAIM reported emission data. The South Coast AQMD's AER program was developed to track emissions of air contaminants from permitted facilities. Facilities with annual emissions exceeding 4 or more tons of nitrogen oxides (NOx), sulfur oxides (SOx), volatile organic compounds (VOCs), specific organics (SPOG), particulate matter (PM), or emissions of 100 tons per year or more of carbon monoxide (CO) are required by the South Coast AQMD 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 the facility's reported emissions for the compliance year of 2020 and fuel usage is calculated using an emission factor represented by the permit limit specific for each unit. For units with missing AER data, emissions were calculated assuming 80% utilization capacity based off the average industrial production and capacity utilization released by the United States Federal Reserve printed on February 7, 2011.[5]

Emission reductions were calculated using the difference between the total aggregate emissions calculated using the concentration limit or emissions factor found on equipment permits (RECLAIM default of 130 lb/MMSCF for those without specified limits or factors) and total aggregate emissions using the PAR 1147 proposed NOx concentration limit. Emission reductions from facilities expected to submit permit applications by July 1, 2023 are estimated to be 0.54 tpd by July 1, 2025 with expected total reductions of 1.59 tpd by the estimated full implementation date of July 1, 2057.

Socioeconomic Assessment

A socioeconomic impact assessment will be conducted and released for public review and comment at least 30 days prior to the South Coast AQMD Governing Board Hearing, which is anticipated to be on April 1, 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

[5]Federal Reserve Statistical Release G.17, Industrial Production and Capacity Utilization http://www.federalreserve.gov/releases/g17/cap_notes.htm as printed on February 7, 2011.

proposed project 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

PAR 1147 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 obtains its authority to adopt, amend, or repeal rules and regulations pursuant to California Health and Safety Code Sections 39002, 40000, 40001, 40440, 40702, 40725 through 40728, and 41508.

Clarity

PAR 1147 is written or displayed so that it's meaning can be easily understood by the persons directly affected by it.

Consistency

PAR 1147 is in harmony with and not in conflict with or contradictory to, existing statutes, court decisions or state or federal regulations.

Non-Duplication

PAR 1147 will not impose the same requirements as any existing state or federal regulations. The proposed rule is necessary and proper to execute the powers and duties granted to, and imposed upon, the South Coast AQMD.

Reference

In amending these rules, the following statutes which the South Coast AQMD hereby implements, interprets or makes specific are referenced: Health and Safety Code sections 39002, 40001, 40702, 40440(a), and 40725 through 40728.5.

Comparative Analysis

Under H&SC Section 40727.2, the South Coast AQMD is required to perform a comparative written 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 PAR 1147 equipment.

The South Coast AQMD is not aware of any state or federal requirements regulating air pollution that are applicable to new or in-use PAR 1147 units. Because there are no state or federal requirements for PAR 1147 units, the proposed amendments are not in conflict with and do not duplicate any South Coast AQMD, state or federal requirement