SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Draft Staff Report
Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines

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TABLE OF CONTENTS

CHAPTER 1: BACKGROUND

INTRODUCTION

BACKGROUND

REGULATORY BACKGROUND

PUBLIC PROCESS

INTRODUCTION

In March 2017, the SCAQMD adopted the Final 2016 Air Quality Management Plan (2016 AQMP) which includes a series of control measures to achieve the National Ambient Air Quality Standards for ozone. The adoption resolution of the 2016 AQMP directed staff to achieve additional NOx emission reductions and to transition the Regional Clean Air Incentives Market (RECLAIM) program to a command-and-control regulatory structure requiring Best Available Retrofit Control Technology (BARCT) as soon as practicable. Additionally, California State Assembly Bill (AB) 617, approved by the Governor on July 26, 2017, requires air districts to develop, by January 1, 2019, an expedited schedule for the implementation of BARCT no later than December 31, 2023 for facilities that are in the state greenhouse gas cap-and-trade program.

Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (Rule 1134) was adopted in 1989. Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (PAR 1134) is being amended to facilitate the transition of the NOx RECLAIM program to a command-and-control regulatory structure and to implement Control Measure CMB-05 – Further NOx Reductions from RECLAIM Assessment (Control Measure CMB-05) of the 2016 AQMP. PAR 1134 applies to RECLAIM and non-RECLAIM stationary gas turbines that are not subject to Rule 1135 - Emissions of Oxides of Nitrogen from Electricity Generating Facilities (Rule 1135) or located at landfills, petroleum refineries, or publicly owned treatment works.

BACKGROUND

The SCAQMD Governing Board adopted the RECLAIM program in October 1993. The purpose of RECLAIM is to reduce NOx and SOx emissions through a market-based approach. The program replaced a series of existing and future command-and-control rules and was designed to provide facilities with the flexibility to seek the most cost-effective solution to reduce their emissions. It also was designed to provide equivalent emission reductions, in the aggregate, for the facilities in the program compared to what would occur under a command-and-control approach. 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.

Various rules within Regulation XX have been amended throughout the years. On December 4, 2015, Regulation XX was amended to achieve programmatic NOx emission reductions through an overall reduction in RECLAIM trading credits (RTC) of 12 tons per day from compliance years 2016 through 2022. Regulation XX was amended on October 7, 2016 to incorporate provisions that limited use of RTCs from facility shutdowns. The most recent amendments to Regulation XX on January 5, 2018 was to amend Rules 2001 – Applicability and 2002 – Allocations for Oxides of Nitrogen (NOx) and Oxides of Sulfur (SOx) to commence the initial steps to transition RECLAIM facilities to a command-and-control regulatory approach.

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 in order to achieve further NOx emission reductions of five tons per day, including actions to sunset the program and ensure future equivalency to command-and-control

regulations. During the adoption of the 2016 AQMP, the 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. Staff provided a report on transitioning the NOx RECLAIM program to a command-and-control regulatory structure at the May 5, 2017 Governing Board meeting and provides quarterly updates to the Stationary Source Committee, with the first quarterly report provided on October 20, 2017.

On July 26, 2017, AB 617 was approved by the Governor, which addresses non-vehicular air pollution (criteria pollutants and toxic air contaminants). It is a companion legislation to AB 398, which was also approved, and extends California's cap-and-trade program for reducing greenhouse gas emissions from stationary industrial sources. Electricity generating facilities are not classified as stationary industrial sources. RECLAIM facilities that are in the cap-and-trade program are subject to the requirements of AB 617. Among the requirements of this bill is an expedited schedule for implementing BARCT for cap-and-trade facilities. Air Districts are to develop by January 1, 2019, an expedited schedule for the implementation of BARCT no later than December 31, 2023. The highest priority would be given to older, higher polluting units that will need to install retrofit controls.

In 2015, staff conducted a programmatic analysis of the RECLAIM equipment at each facility to determine if there are appropriate and up to date BARCT NOx limits within existing SCAQMD command-and-control rules for all RECLAIM equipment. It was determined that command-and-control rules would need to be adopted and/or amended to update emission limits to reflect current BARCT and to provide implementation timeframes for achieving BARCT compliance limits for certain RECLAIM equipment.

Rule 1134 is being amended to facilitate the transition of the NOx RECLAIM program to a command-and-control regulatory structure and to implement Control Measure CMB-05, of the 2016 AQMP. PAR 1134 applies to RECLAIM and non-RECLAIM stationary gas turbines that are not subject to Rule 1135. The proposed amended rule will update emission limits to reflect current BARCT and to provide implementation timeframes. The provisions in PAR 1134 establish NOx and ammonia (NH3) emission limits, provisions for monitoring, reporting, and recordkeeping, and establishes exemptions from specific provisions.

REGULATORY BACKGROUND

Rule 1134 was adopted in 1989. The rule applies to stationary gas turbines rated at 0.3 MW and larger that were issued a permit to operate by the SCAQMD prior to August 4, 1989. The origin of the rule can be traced to a 1979 United States Environmental Protection Agency (EPA) New Source Performance Standard for Stationary Gas Turbines. In 1981, the California Air Resources Board (CARB) adopted a Suggested Control Measure for this same equipment. Rule 1134 was subsequently three times; each to provide regulatory flexibility. In December 1995, Rule 1134 was amended to exempt gas turbines located on San Clemente Island and the South East Desert Air Basin. In April 1997, Rule 1134 was amended to increase the NOx concentration limit for turbines utilizing sewage digester gas. In August 1997, Rule 1134 was amended to clarify the need for continuous emission monitoring systems (CEMS) on turbines with a power output of 2.9 MW or larger. EPA approved Rule 1134 into the SIP on August 1, 2000.

Stationary Gas Turbines and RECLAIM

Beginning in 1994, a large number of utilities and third-party-owned cogenerators were included in the RECLAIM program and as such were not required to meet the NOX concentration limits imposed by Rule 1134. However, gas turbines permitted prior to August 4, 1989 and used at publicly-owned treatment works (POTWs), landfills, hospitals and other public facilities, and sources which were not covered under RECLAIM, were still required to meet the concentration limits in Rule 1134 through application of various control technologies. New turbines installed at non-RECLAIM facilities after August 4, 1989 are not subject to Rule 1134. PAR 1134 will apply to all stationary gas turbines located at non-RECLAIM and RECLAIM facilities (excluding those subject to Rule 1135 or located at a petroleum refinery, landfill, or sewage treatment facility), regardless of the date they were permitted.

PUBLIC PROCESS

Development of Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines was conducted through a public process. SCAQMD has held four working group meetings at the SCAQMD Headquarters in Diamond Bar on February 22, 2018, April 26, 2018, June 13, 2018, and August 10, 2018. The Working Group is composed of representatives from businesses, environmental groups, public agencies, and consultants. The purpose of the working group meetings is to discuss proposed concepts and work through the details of staff's proposal. Additionally, a Public Workshop will be held at the SCAQMD Headquarters in Diamond Bar on December 18, 2018.

CHAPTER 2: BARCT ASSESSMENT

INTRODUCTION

BARCT – RETROFIT VERSUS REPLACEMENT

BARCT ANALYSIS APPROACH

INTRODUCTION

Staff conducted an assessment of Best Available Retrofit Control Technology (BARCT) for stationary gas turbines. BARCT is defined in the California Health and Safety Code section 40406 as "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." Consistent with state law, BARCT emissions limits take into consideration environmental impacts, energy impacts, and economic impacts. In addition to NOx reductions sought in the proposed amended rule, SCAQMD, through the California Environmental Quality Act (CEQA) process, identified potential environmental and energy effects of the proposed rule. Economic impacts are assessed at the equipment category level by a review of cost-effectiveness and incremental cost-effectives contained in this report and at the macro level as part of the socio-economic assessment contained in a separate report.

BARCT – RETROFIT VERSUS REPLACEMENT

A question was raised in the Regional Clean Air Incentives Market (RECLAIM) Working Group concerning the scope of "best available retrofit control technology," which the SCAQMD must impose for all existing stationary sources, including sources that exit RECLAIM or that exist after RECLAIM has ended pursuant to Health & Safety Code section 40440(b)(1). A commenter stated that the use of the word "retrofit" precludes the SCAQMD from requiring emissions limits that can only be cost-effectively met by replacing the basic equipment with new equipment.

As explained in detail below, BARCT may certainly include the replacement of equipment. In summary, we explain the particular instance in which SCAQMD has sought to specify a level equivalent to equipment replacement as BARCT for internal combustion engines on Santa Catalina Island. This demonstrates how public policy supports SCAQMD's interpretation. Moreover, as we explained in the Preliminary Draft Staff Report, the statutory definition of BARCT supports a broad interpretation. And applicable dictionary definitions do not preclude the view that BARCT can include equipment replacement. Finally, even if a court were to conclude that BARCT cannot encompass equipment replacement, BARCT is not a limitation on SCAQMD authority. The SCAQMD retains broad statutory authority to adopt emission-control requirements for stationary sources, and that authority may require equipment replacement, as long as the requirement is not arbitrary and capricious.

Public Policy Supports the SCAQMD's Interpretation

As noted in the staff report for PAR 1135, staff has proposed a BARCT for diesel fueled engines that appears to be more cost-effectively met by replacing the engine rather than trying to install additional add-on controls. If SCAQMD were precluded from requiring the replacement of these engines, the oldest and dirtiest power-producing equipment would continue to operate for possibly many years, even though it would be cost-effective and otherwise reasonable to replace those engines. As long as an emissions limit meets the requirements of the definition set forth in section 40406, there is no policy reason why replacement equipment cannot be an element of BARCT. And there is no policy reason why BARCT – if it does not include replacements – would somehow limit the SCAQMD from requiring equipment replacement where that requirement is reasonable and feasible. "If the statutory language permits more than one reasonable interpretation, courts may consider other aids, such as the statute's purpose, legislative history, and public policy." *Jones*

v. Lodge at Torrey Pines Partnership, 42 Cal. 3d. 1158, 1163 (2008). In this case, the statue permits two reasonable interpretations, since the statutory definition in 40406 does not preclude requiring equipment replacement if it is reasonable considering economic and other factors. The legislative history and public policy both support the SCAQMD's interpretation, and a narrow interpretation is inconsistent with the broad language of the statutory definition.

The BARCT proposed for internal combustion engine power producers (replacement with Tier IV engines) is economically and practically reasonable and therefore does not "go beyond" BARCT if we look strictly at the statutory definition. As stated by the Supreme Court, the "statutes that provide the districts with regulatory authority serve a public purpose of the highest order-protection of the public health." *W. Oil & Gas Assn. v. Monterey Bay Unified Air Pollution Control Dist.*, 49 Cal. 3d 408, 419 (1989) ("WOGA"). Therefore, courts should not find that any statute causes an "implied repeal" of the districts' authority. *Id.*

The proposal to require replacement of five out of the six internal combustion engines at Santa Catalina Island is supported by overwhelming policy justifications. There are six internal combustion engines at the facility, of which three are at least 50 years old. The other three were installed in 1974, 1985, and 1995. The 1995 engine was installed with SCR; the other five had SCR installed in 2003. Staff concludes that it would be more cost-effective to replace the five oldest of these engines with new Tier IV engines rather than to install additional add-on controls. (The sixth engine was found not to be cost-effective to replace). These engines account for 0.06% of the electric utility power produced in the District (Draft Staff Report, Table 4-1, 9 MWhr divided by 15,904 MWhr). But they account for 5.7% of the emissions inventory from electricity generating facilities (Draft Staff Report, Table 4-2, 0.2 tpd divided by 3.5 tpd). If the SCAQMD could not require replacement of these engines, then paradoxically the oldest, highest-emitting equipment would escape control.

The SCAQMD has in the past required replacement of old equipment in appropriate cases. The SCAQMD has required replacement, for example, in its dry-cleaning rule, adopted in 2002, which required all perchloroethylene dry-cleaning machines to be phased out by 2020, with other specific requirements implemented starting shortly after rule adoption. Rule 1421(d)(1)(F). Thus, a perchloroethylene machine that was installed in 2001 would be required to be replaced with a non-perchloroethylene machine when it is 19 years old. While this is a rule relating to toxic air contaminants, we do not believe the SCAQMD's authority is any less for criteria pollutants.

Dictionary Definitions Support SCAQMD's Interpretation

We do not agree that the term "retrofit" excludes replacement, such as replacement of an engine. We do not find that limitation in the dictionary definitions for the term "retrofit" including those cited in the SCAQMD staff report for Rule 1135. Instead, at least one definition provides that "retrofit" can mean "to replace existing parts, equipment, etc., with updated parts or systems." http://www.dictionary.com/browse/retrofit. Nothing in this definition requires that only part of a piece of equipment can be replaced. Indeed, according to this definition, a retrofit can include the replacement of an entire system. In our view, at least one dictionary definition of the term "retrofit" encompasses "replacement of equipment or systems." *See* definition cited above. This definition is broad enough to include replacing the entire piece of equipment or system. Therefore,

the key question is what did the legislature mean when it imposed the BARCT requirement on SCAQMD?

Statutory Definition of BARCT Supports SCAQMD's Interpretation

The statutory definition of BARCT, as found in Health & Safety Code section 40406, does not contain any language precluding replacement technology. Section 40406 defines BARCT as "an emissions 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." Thus, BARCT is an emissions limitation. Nothing in the statutory definition specifies the type of technology that may be used. The California Supreme Court has made it clear that it is the definition of BARCT that controls, not implications from the language used in the term itself. Thus, the Supreme Court rejected the argument that "best available retrofit control technology" is limited to that which is readily available at the time when the regulation is enacted, and instead concluded that it encompasses technology that is "achievable," i.e. expected to become available at a future date. *American Coatings Ass'n. v. South Coast Air Quality Mgt. Dist.*, 54 Cal. 4th 446, 462 (2012). The Court focused on the actual statutory definition, which provides that BARCT is "an emissions 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." *American Coatings,* 54 Cal. 4th at 463. The Court concluded that in common usage, "achievable" means "capable of being achieved," which in turn includes "a potentiality to be fulfilled or a goal to be achieved at some future date." *Id.*

Thus, an emissions reduction was "achievable" when the rule was adopted in 1999 if it was "capable of being achieved" by the rule deadline of 2006. *American Coatings,* 54 Cal. 4th at 464. This was so even if that reduction was not "readily available" in 1999, notwithstanding the use of the word "available" in the term being defined. The Supreme Court held that the statutory definition controls, and in this case the statutory definition does not preclude replacement technology.

When the Legislature has defined a term, courts must follow that definition. *People v. Ward,* 62 Cal. App. 4th 122, 126 (1998). Following the California Supreme Court's analysis in *American Coatings,* the test of whether an emission limit constitutes BARCT is whether it meets the definition found in the statute, section 40406. If so, then it is within the statutory definition of BARCT, whether or not it is within the most common understanding of "retrofit." This does not mean that the word "retrofit" is surplusage. The use of the word "retrofit" serves to distinguish an emission limit that is imposed on existing sources, and which under the statutory definition must consider economic and other factors, from the emissions limit imposed on new sources. The limit for new sources must be met if it has been achieved in practice, regardless of cost. *See* definition of "best available control technology" [BACT] in section 40405, which includes "the most stringent emission limitation that is achieved in practice by that class or category of source." We do not argue that a replacement can be BARCT if it does not meet the definition of BARCT. Instead, if a limit meets that definition, it can be BARCT even if it can most cost-effectively be met by replacing the equipment with new equipment, as recognized in the dictionary definition discussed above.

The *American Coatings* ruling is not irrelevant just because it dealt with a rule for architectural coatings, requiring coating reformulation, which "does not typically involve the manufacture of modified production equipment or new add-on controls," whereas control technologies that require physical modification of existing equipment or installation of add-on controls may require "significant disruption to the operation of the facility." We do not know whether the claim regarding architectural coatings is correct, but even if it is, we do not understand how this relates to the question at issue since *both* retrofit add-on controls and replacements would involve the disruption of facility operations for some time.

Other Statutory References to "Retrofit" Are Inapplicable

The legislature has used the term replacement as well as retrofit in certain sections of the Health and Safety Code. §§ 43021(a), 44281(a). Furthermore, the legislature defined retrofit in sections 44275(a)(19) and 44299.80(o), and the definition does not mention replacement but rather making modifications to the engine and fuel system. Finally, these same code sections define "repower" as replacing an engine with a different engine. §§ 44275(a)(18), 44299.80(n). However, all of these code sections were adopted long after 1987, when the legislature mandated SCAQMD to require BARCT for existing sources. They do not shed any light on what the legislature meant by "retrofit" in 1987 when section 40406 was adopted. All of the sections cited (except section 43021(a)) deal with incentive programs, and the definitions are specifically stated to be only "as used in this chapter"; i.e. for the specific incentive program. §§ 44275(a); 44299.80(a). These definitions facilitate the administering agency in implementing the programs, which generally provide different amounts of funding for different types of projects, including "repowering" or "retrofitting." *See e.g.*

https://www.arb.ca.gov/msprog/moyer/source_categories/moyer_sc_on_road_hdv_2.htm

Therefore, the legislature had a specific purpose in distinguishing between replacements and retrofits in these particular chapters, whereas no one has identified a policy reason that the legislature would have wanted to exclude replacement projects from BARCT, as long as they met the statutory definition.

Section 43021(a), enacted in 2017 as Part of SB1, prohibits Air Resources Board rules that require the "retirement, replacement, retrofit, or repower" of a commercial motor vehicle for a period of time. An argument can be made that this language means that a replacement must be different than a retrofit, under that theory it must also mean that a replacement is different from a repower, whereas under the sections cited above, a repower IS a replacement. Presumably, the legislature wanted to make very sure it covered all possibilities. And to add to the confusion, the Carl Moyer statutes appear to distinguish "retrofit" (an eligible project under §44282(a)(2)) from "use of emission-reducing add-on equipment" (an eligible project under §44281(a)(3)). Normally installing add-on controls is considered a type of retrofit.

Statute Discussing Best Available Control Technology Determinations Does Not Circumscribe BARCT Definition

Section 40920.6 states that in establishing the best available control technology, (BACT), the District shall consider only "control options or emission limits to be applied to the basic production or process equipment." BACT is frequently applied to replacement of an entire source (such as repowers of electric generating units) as well as to new and modified sources. Obviously, in the

case of a new source, there is no existing equipment to which to apply the technology. We interpret this statutory language to mean that in establishing BACT, the SCAQMD is not to fundamentally change the nature of the underlying process. For example, if an applicant seeks approval of a simple cycle turbine, the SCAQMD cannot require it to instead construct a combined cycle turbine, since they have different operational characteristics and needs to fill. This would be consistent with EPA's Draft NSR Workshop Manual, p. B-13, that specifies that in determining BACT, states need not redefine the design of the source, although they retain discretion to do so where warranted (i.e. to require consideration of inherently cleaner technology). https://www.epa.gov/nsr/nsr-workshop-manual-draft-october-1990. Similarly, SCAQMD does not propose to require a facility subject to BARCT to "redefine" the nature of its source but merely to replace old diesel internal combustion engines with diesel internal combustion engines meeting EPA's Tier IV standards. Therefore, section 40920.6 does not speak to the question at hand: whether BARCT precludes replacing old equipment with new equipment of the same type.

SCAQMD Has Authority to Require Equipment Replacement Which is Not Limited by the BARCT Definition

Finally, even if BARCT by itself did not include replacement equipment, the SCAQMD could still require the equipment to be replaced. We disagree that section 40440(a)(1) grants the authority to require BARCT (i.e., that without that section, the district would have no authority to require BARCT). We also disagree with the proposition that Section 40440(a)(1) limits the District's authority.

State law has explicitly granted air districts primary authority over the control of pollution from all sources except motor vehicles since at least 1975, when the air pollution regulation provisions were recodified. See § 40000, enacted Stats. 1975, ch. 957, §12; see also § 39002, containing similar language and adopted in that same section. As held by the California Supreme Court, these two sections (and their predecessors dating back to 1947) confirm that the air districts had plenary authority to regulate non-vehicular sources "for many years." WOGA, 49 Cal. 3d. at 418-19. And the Supreme Court had previously recognized the air districts' authority to adopt local regulations for non-vehicular sources under the predecessor statutes. Orange County Air Pollution Control Dist. v. Public Util. Comm., 4 Cal. 3d 945, 948 (1971). Under these broad statutes, the districts could have adopted BARCT requirements for non-vehicular sources. Section 40440(a)(1), therefore, was not a statute granting authority, since the districts already had authority, but a statute imposing a mandate to adopt BARCT.

We also disagree with the claim that section 40440(a)(1) requiring the SCAQMD to impose BARCT on existing sources was a "limitation" of district authority. State law expressly provides that districts "may establish additional, stricter standards than those set forth by law" unless the Legislature has specifically provided otherwise §§ 39002; 41508. Nothing in Section 40440(a)(1) specifically limits the District's authority. In fact, the legislative history of the bill requiring SCAQMD to impose BARCT – among other requirements – states that "this bill is intended to encourage more aggressive improvements in air quality and to give the District new authority to implement such improvements." American Coatings, 54 Cal. 4th at 466 (emphasis added). As stated by the Supreme Court, "[t]the BARCT standard was therefore part of a legislative enactment designed to augment rather than restrain the District's regulatory power." Id. As explained by the

legislative history, BARCT is a "minimum" requirement, and the legislature did not intend it to preclude the District from adopting requirements that go beyond BARCT.

Among the new authorities granted were section 40447.5, authorizing fleet rules and limits on heavy duty truck traffic and section 40447.6, authorizing the SCAQMD to adopt sulfur limits for motor vehicle diesel fuel. We do not believe that section 40440(a)(1) granted "new" authority to require BARCT, as the districts already had authority over non-vehicular sources.

Moreover, when the Legislature extended the BARCT requirement to other districts with significant air pollution, section 40919(a)(3) (districts with serious pollution and worse) the legislature expressly stated that the bill "is intended to establish minimum requirements for air pollution control districts and quality management districts" and that "[n]othing in this act is intended to limit or otherwise discourage those district from adopting rules and regulations which exceed those requirements." Stats. 1992, ch. 945 § 18. Thus it is clear that BARCT is not intended to be a limitation or restriction on existing authority.

Although the California Supreme Court found it unnecessary to decide whether the SCAQMD could adopt rules going beyond BARCT, because it held that BARCT could include technology-forcing measures, it did state that BARCT was not designed to restrain the District's regulatory power. American Coatings, 54 Cal 4th at 466, 469.

In an earlier case, the California Supreme Court made it clear that new legislation does not impliedly repeal an air district's existing authority unless it "gives undebatable evidence of an intent to supersede" the earlier law. WOGA, 49 Cal. 3d. at 420 (internal citation omitted; emphasis by Supreme Court). There the court noted that the present statutes and their predecessors giving air districts authority over non-vehicular sources, including the authority to regulate air toxics, had been in effect before the allegedly preempting law was enacted (in 1983; Stats 1983 Ch. 1047), and had been generally understood and acted upon. WOGA, 49 Cal 3d at 419. The court concluded there was no "undebatable evidence of a legislative intent to repeal the districts' statutory authority to protect the health of their citizens by controlling air pollution." WOGA, 49 Cal 3d at 420. By the same token here, there is no undebatable evidence of an intent to limit air districts' existing authority by imposing a mandate to adopt BARCT requirements. Instead, BARCT was a minimum requirement that SCAQMD must impose, not a limit on its ability to impose additional, including more stringent, requirements. Indeed, the argument that BARCT limits SCAQMD's authority is illogical. It would make no sense for the Legislature in 1987 to limit only the district with the worst air pollution (SCAQMD) while leaving untouched the authority of other districts with lesser levels of pollution.

Nor does this conclusion leave the SCAQMD with unlimited regulatory power. In going beyond the statutory minimum of BARCT for existing sources, the District would still be limited by the requirement that its rules may not be arbitrary and capricious, or without reasonable or rational basis, or entirely lacking in evidentiary support. American Coatings, 54 Cal. 4th at 460. And of course, the SCAQMD's rulemaking authority is limited by applicable constitutional principles. Therefore, stakeholders need not rely on an argument that BARCT restricts the SCAQMD's authority in order to ensure the SCAQMD does not implement any arbitrary action.

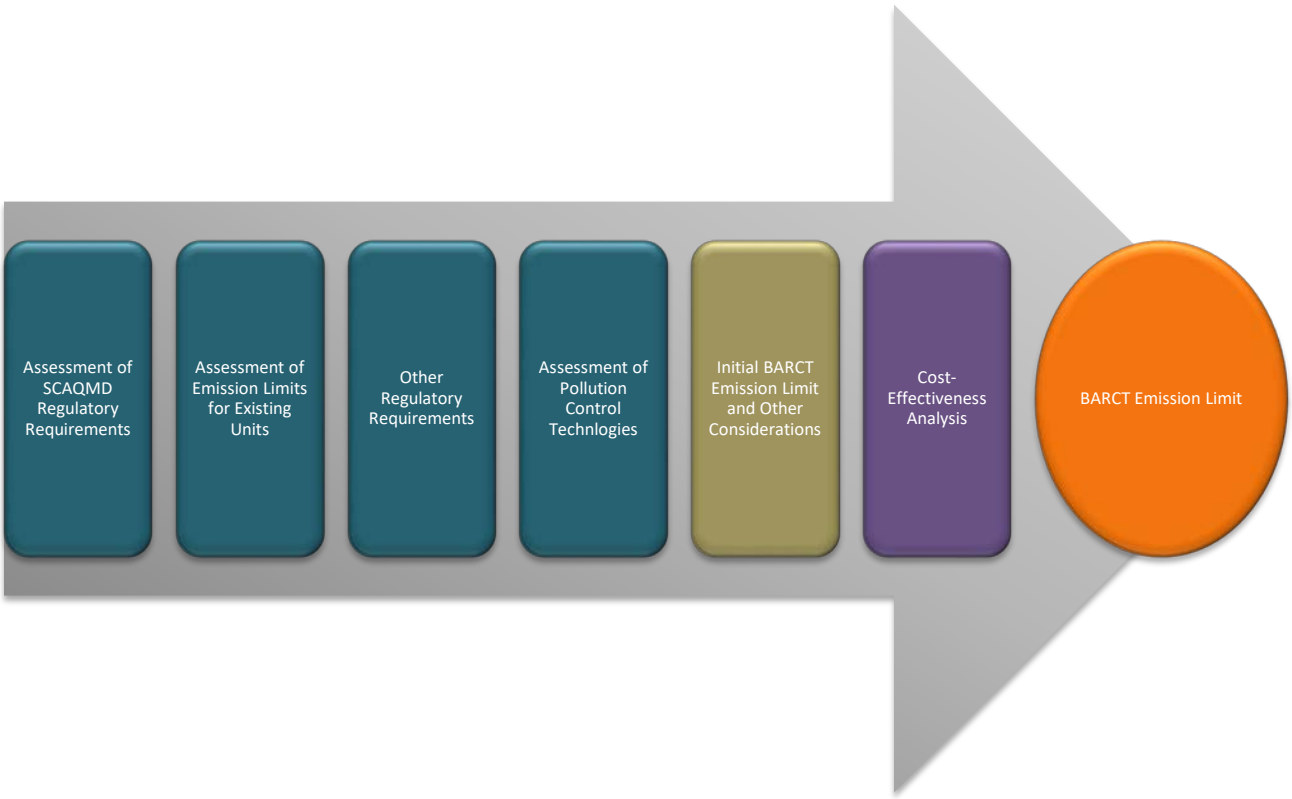
Conclusion
SCAQMD has the authority to require equipment replacement as a BARCT requirement as long as the requirement meets the statutory definition of BARCT. But even if BARCT were to exclude equipment replacement, the SCAQMD would still have the authority to require replacement, as long as the replacement is not arbitrary and capricious. The proposed BARCT for internal combustion engines on Santa Catalina island is reasonable and feasible, and no one has argued to the contrary.

BARCT ANALYSIS APPROACH

The BARCT analysis approach follows a series of steps conducted for each equipment category and fuel type. For Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (PAR 1134), stationary gas turbines were analyzed by process and fuel type.

The steps for BARCT analysis consist of:

- Assessment of SCAQMD Regulatory Requirements
- Assessment of Emissions Limits for Existing Units
- Other Regulatory Requirements
- Assessment of Pollution Control Technologies
- Initial BARCT Emission Limit and Other Considerations
- Cost-Effectiveness Analysis
- Final BARCT Emission Limit



Assessment of SCAQMD Regulatory Requirements

As part of the BARCT assessment, staff reviewed existing SCAQMD regulatory requirements that affect NOx emissions from stationary gas turbines. NOx emissions from stationary gas turbines permitted prior to August 4, 1989 located at non-RECLAIM facilities are regulated under Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (Rule 1134). Under Rule 1134, the NOx emission concentration limits are as follows in Table 2-1 below.

Table 2-1 – Current Rule 1134 NOx Concentration Limits

Unit Size (MW)	NOx Reference Limit (ppmv at 15% oxygen, dry)
No Selective Catalytic Reduction	
0.3 to < 2.9	25
2.9 to < 10	15
2.9 to < 10 (Sewage Digester Gas)	25
10 and Over	12
60 and Over (Combined Cycle)	15
With Selective Catalytic Reductions	
2.9 to < 10	9
10 and Over	9
60 and Over (Combined Cycle)	9

The RECLAIM program limits NOx emissions from facilities that operate stationary gas turbines, but does not limit emissions or establish concentration limits by equipment category or fuel type. However, emissions limits are established at the time of permitting, and permits include concentration limits for NOx and emissions limits for non-RECLAIM pollutants such as particulate matter. A facility's NOx allocations are diminished over time, requiring facilities to lower emissions or to purchase credits from other facilities that have lowered emissions below their allocations. Stationary gas turbines installed after August 4, 1989 and not located at a RECLAIM facility only have emissions limits established at the time of permitting.

Assessment of Emission Limit for Existing Units

Staff examined all of the current non-emergency stationary gas turbines, excluding those subject to Rule 1135 or located at a petroleum refinery, to assess the emission rate of equipment located in SCAQMD. Permit limits for NOx concentrations were identified for all equipment to identify what is already being done in practice. Currently, there are approximately 96 turbines at 44 facilities: 42 natural gas turbines at 27 facilities; 10 produced gas turbines at three facilities; 16 landfill gas turbines at five facilities; six sewage digester gas turbines at two facilities; and 20 emergency gas turbines at seven facilities.

Natural Gas Combined Cycle Gas Turbines

For natural gas combined cycle gas turbines, one of 16 units are permitted at 2 ppmv NOx and six at 2.5 ppmv NOx at 15% oxygen on a dry basis. These six units were replacement units installed in 2009 or later. Units that were permitted at 2 ppmv or 2.5 ppmv NOx at 15% oxygen on a dry basis also had ammonia permit limits of 5 ppmv at 15% oxygen on a dry basis. The lowest permitted NOx limit for a natural gas combined cycle gas turbines in SCAQMD is 2 ppmv at 15%

oxygen on a dry basis. Table 2-2 lists the information regarding natural gas combined cycle gas turbines.

Table 2-2 – Natural Gas Combined Cycle Gas Turbines

Unit	Size (MMBTU/HR)	MW Rating	Install	Control[1]	NOx Permit Limit[2] (ppmv @ 15% oxygen, dry)	Ammonia Permit Limit (ppmv @ 15% oxygen, dry)	2015 NOx Emissions (tons)
NG CS10[3]	410	60	1996	SCR	102[4]	5	192.7
NG CS3	16	1.1	1989	Water injection	41	None	2.4
NG CS1	59	2.89	1989	Water injection	25	None	10.8
NG CS2	59	2.89	1989	Water injection	25	None	4
NG CS8[3]	59	6	1993	Water injection; Low NOx duct burner	21	None	26.2
NG CS9[3]	59	6	1993	Water injection; Low NOx duct burner	21	None	24.1
NG CS4	234	23.6	1989	Steam or water injection; SCR & vaporization system	12	None	33.3
NG CS6[3]	46	2.8	1992	Water injection	9	None	5.3
NG CS7	49	2.9	1992	Water injection	9	None	5.6
NG CS5	259	24	1990	SCR/Water Injection	2.5	5	1.1
NG CS18	350	30	2010	SCR/Water Injection	2.5	5	1.0
NG CS11[3]	57	5	2009	SCR	2.5	5	0.6
NG CS12[3]	57	5	2009	SCR	2.5	5	0.2
NG CS13	162	13.4	2010	SCR	2.5	5	3.5
NG CS15	114	5.6	2015	SCR	2.5	5	0.4
NG CS16	114	5.6	2015	SCR	2.5	5	0.4
NG CS14	173	13.5	2013	SCR	2	5	0.9

[1] – SCR: Selective Catalytic Reduction
[2] – Actual NOx concentrations emitted are generally lower than the NOx permit limit
[3] – Natural Gas Combined Cycle Gas Turbine with Associated Duct Burner
[4] – Actual NOx concentration emitted are much lower than NOx permit limit

Natural Gas Simple Cycle Gas Turbines

For natural gas simple cycle gas turbines, 2 of 19 units are permitted at or below 2.5 ppmv NOx at 15% oxygen on a dry basis. Both of the low concentration natural gas simple cycle turbines were new installations commissioned after 2008. Some simple cycle gas turbines have permitted ammonia concentrations of 5 ppmv at 15% oxygen on a dry basis. However, many have no limits whatsoever. Table 2-3 lists the information regarding natural gas simple cycle turbines.

Table 2-3 – Natural Gas Simple Cycle Gas Turbines

Unit	Size (MMBTU/HR)	Output (MW)	Install Year	Control[1]	NOx Permit Limit[2] (ppmv at 15% oxygen, dry)	Ammonia (ppmv at 15% oxygen, dry)	2015 NOx Emissions (tons)
NG SS1	150	11	1980	None	81	None	58.1
NG SS2	150	11	1980	None	81	None	54.3
NG SS3	150	11	1980	None	81	None	52.4
NG SS4[3]	13.11	0.9	1980	None	68	None	3.7
NG SS6[3]	13.11	0.9	1990	None	68	None	3.9
NG SS5[3]	13.11	0.9	2002	None	67	None	4.3
NG SS7[3]	13.11	0.9	1987	None	64	None	3.7
NG SS13	246	23	1987	Steam injection	42	None	26.1
NG SS14	466	42	1987	Steam injection	42	None	279.2
NG SS8	50	4	1988	Steam injection	40	None	29.3
NG SS9	50	4	1989	Steam injection	40	None	29.3
NG SS10	229	22.4		Steam injection	9	20	32.4
NG SS11	250.6	23.1	2002	Steam injection	9	20	27.3
NG SS12	1080	158	2009	Steam injection	7.5	None	4.9
NG SS19	530.2	43.8	2008	Steam injection	7	20	0
NG SS15	472.5	39		Steam injection	5	5	4.8
NG SS17	43.8	4.6	1980	Lean pre-mix combustor	5	None	3.2
NG SS20	136.5	10.5	2001	SCR	5	5	0
NG SS21	136.5	10.5	2001	SCR	5	5	0
NG SS22	136.5	10.5	2001	SCR	5	5	0
NG SS23	136.5	10.5	2001	SCR	5	5	0
NG SS24	136.5	10.5	2001	SCR	5	5	0.1
NG SS25	136.5	10.5	2001	SCR	5	5	0
NG SS26	136.5	10.5	2001	SCR	5	5	0
NG SS27	136.5	10.5	2001	SCR	5	5	0
NG SS16	126	10	1980	SCR	2.5	None	8.7
NG SS18	407.7	39	1980	SCR	2.5	10	1.7

[1] – SCR: Selective Catalytic Reductions
[2] – Actual NOx concentration emitted are generally lower than the NOx permit limit
[3] – Pipeline gas turbines

Produced Gas Turbines

Currently there are five non-Outer Continental Shelf (OCS) produced gas turbine subject to PAR 1134. One produced gas turbine is permitted at 5 ppmv NOx and 5 ppmv ammonia at 15% oxygen on a dry basis. Table 2-4 lists the information regarding the non-OCS produced gas turbines.

Table 2-4 – Produced Gas Turbines (Non-OCS)

Unit	Size (MMBTU/HR)	Output (MW)	Install Year	Control[1]	NOx Permit Limit[2] (ppmv at 15% oxygen, dry)	Ammonia (ppmv at 15% oxygen, dry)	2016 NOx Emissions (tons)
PGT1	221	21.8	1989	SCR	9	20	19.0
PGT2	49	4.8	2001	SCR	9	10	4.0
PGT3	49	4.8	2001	SCR	9	10	1.5
PGT4	221	21.8	1989	SCR	9	20	23.1
PGT5	63	5.7	2003	SCR	5	5	4.6

[1] – SCR: Selective Catalytic Reduction
[2] – Actual NOx concentration emitted are generally lower than the NOx permit limit

Outer Continental Shelf Produced Gas and Liquid Fueled Turbines

Currently there are six OCS produced gas turbine subject to PAR 1134. They also have the capability to burn liquid fuel when produced gas is not available. The turbines are permitted between 65 and 140 ppmv NOx at 15% oxygen on a dry basis. Table 2-5 lists the information regarding the OCS produced gas turbines.

Table 2-5 – Outer Continental Shelf Produced Gas Turbines

Unit	Size (MMBTU/HR)	Output (MW)	Install Year	Control	NOx Permit Limit[1] (ppmv at 15% oxygen, dry)	Ammonia (ppmv at 15% oxygen, dry)	2016 NOx Emissions (tons)
PGOCST1	29	2.5	1984	N/A	140	N/A	47.7
PGOCST2	29	2.5	1984	N/A	140	N/A	42.3
PGOCST3	29	2.5	1984	N/A	130	N/A	40.1
PGOCST4	42	2.5	1984	N/A	65	N/A	7.2
PGOCST5	42	2.5	1984	N/A	65	N/A	3.0
PGOCST6	42	2.5	1984	N/A	65	N/A	8.9

[1] – Actual NOx concentration emitted are generally lower than the NOx permit limit

Summary

A summary of permitted limits in SCAQMD for the four types of stationary gas turbines is provided in Table 2-6.

Table 2-6 – Assessment of NOx Concentration Levels for Existing Units

Equipment	Initial Recommendation for NOx Concentration Limit Based on Existing Units	Number of Units Meeting Retrofit Concentration Limit	Pollution Control Technology
Natural Gas Combined Cycle Gas Turbine	2 ppmv at 15% oxygen, dry	1 units	Selective Catalytic Reduction (Replacement)
Natural Gas Simple Cycle Gas Turbine	2.5 ppmv at 15% oxygen, dry	2 units	Selective Catalytic Reduction (Replacement)
Produced Gas Turbines	5 ppmv at 15% oxygen, dry	1 units	Selective Catalytic Reduction (Replacement)
Outer Continental Shelf Produced Gas Turbines	65 ppmv at 15% oxygen, dry	3 units	None

Other Regulatory Requirements

As part of the BARCT assessment, staff examined NOx limits for electric generating units promulgated by Bay Area Air Quality Management District (BAAQMD) and San Joaquin Valley Air Pollution Control District (SJVAPCD). BAAQMD Regulation 9, Rule 9 – Nitrogen Oxides and Carbon Monoxide from Stationary Gas Turbines and SJVAPCD Rule 4703 – Stationary Gas Turbines were reviewed. Table 2-7 below notes the NOx limits in the two air districts for stationary gas turbines.

Table 2-7 – Turbines (Natural Gas)

Agency	Rule Adoption Date	Rule Effective Date	Capacity (MMBTU/HR)	Output (MW)	NOx Limit (ppmv @ 15% oxygen, dry)
BAAQMD[1]	December 2006	January 2010	5 - 50	N/A	42
			>50 - 150	N/A	25-42
			>150 - 250	N/A	15
			>250 - 500	N/A	9
			>500	N/A	5
SJVAPCD	September 2007	January 2012	<35[2]	<3	25
			>35 – 130[2]	>3 – 10	25
			>35 – 130[2]	>3 – 10	8 steady and 12 transition (Pipeline)
			>130[2]	>10	25-42

[1] – Currently under review

[2] – Non-regulatory, converted for comparison purposes only

For natural gas turbines, the NOx concentration limits in other Air District regulations were higher than existing units located in SCAQMD. The exception is the SJVAPCD pipeline gas turbine limit.

Assessment of Pollution Control Technologies

As part of the BARCT assessment, staff conducted a technology assessment to evaluate NOx pollution control technologies for electric generating units. Staff reviewed scientific literature, vendor information, and strategies utilized in practice. The technologies are presented below and the applicability for use with various electric power generating units is noted. In most cases, post-combustion technologies may be utilized in conjunction with pre-combustion technologies.

Pre-Combustion Technologies

Dry Low-NOx or Lean Premix Emission Combustors (Natural Gas, Landfill Gas, Produced Gas Turbines)

Prior to combustion, gaseous fuel and compressed air are pre-mixed, minimizing localized hot spots that produce elevated combustion temperatures and therefore, less NOx is formed. Atmospheric nitrogen from the combustion air is mixed with air upstream of the combustor at deliberately fuel-lean conditions. Approximately twice as much air is supplied as is actually needed to burn the fuel. This excess air is a key to limiting NOx formation, as very lean conditions cannot produce the high temperatures that create thermal NOx. Using this technology, NOx emissions, without further controls, have been demonstrated at single digits (< 9 ppmv at 15% oxygen, dry). The technology is engineered into the combustor that becomes an intrinsic part of the turbine design. Fuel staging or air staging is utilized to keep the flame within its operating boundaries. It is not available as a "retrofit" technology and must be designed for each turbine application.

Water or Steam Injection (Natural Gas, Landfill Gas, Sewage Digester Gas, Produced Gas Turbines)

Demineralized water is injected into the combustor through the fuel nozzles to lower flame temperature and reduce NOx emissions. Water or steam provides a heat sink that lowers flame temperature. Imprecise application leads to some hot zones so NOx is still created. NOx levels in natural gas turbines can be lowered by 80% to 25 ppmv at 15% oxygen on a dry basis. Addition of water or steam increases mass flow through the turbine and creates a small amount of additional power. The addition of water increases carbon monoxide emissions and there is added cost to demineralize the water. Turbines using water or steam injection have increased maintenance due to erosion and wear.

Catalytic Combustion (Natural Gas, Produced Gas Turbines)

A catalytic process is used instead of a flame to combust the natural gas. Flameless combustion lowers combustion temperature resulting in reduced NOx formation. The overriding constraints are operating efficiency over a wide operating range of the turbine. Initial engine demonstrations have shown that catalytic combustion reduces NOx emissions. In its first commercial installation, NOx concentrations were lowered from approximately 20 ppmv to below 3 ppmv at 15% oxygen on a dry basis without post-combustion controls. Several turbine manufacturers are in the development stage to incorporate this technology.

Post-Combustion Technologies

Selective Catalytic Reduction (Natural Gas, Landfill Gas, Sewage Digester Gas, Produced Gas Turbines)

Selective Catalytic Reduction is the primary post-combustion technology for NOx reduction and is widely used in turbines. The technology can reduce NOx emissions 95% or greater. In many cases the NOx reduction is limited by the release of other pollutants (ammonia and carbon monoxide), space constraints, or reaches the practical limit of the NOx measuring device. Many stationary gas turbines already utilize selective catalytic reduction. Further reductions could be possible by adding catalyst modules. From observations made during site visits, space is not readily available to add catalyst modules and would require construction.

Ammonia is injected into the flue gas and reacts with NOx to form nitrogen and water. Catalysts are made from ceramic materials and active catalytic components of base metals, zeolites, or precious metals. The catalyst may be configured into plates but many new systems are configured into honeycombs to ensure uniform dispersion and reduce ammonia emissions to below 5 ppmv. The reductant, ammonia, is available as anhydrous ammonia, aqueous ammonia, or urea. Anhydrous ammonia is toxic and SCAQMD does not permit new installations of anhydrous ammonia storage tanks. Urea is an alternative but requires conversion to ammonia to be used. Most new selective catalytic reduction installations utilize aqueous ammonia in a 19 percent solution.

To perform optimally, the gas temperature in the control device should be between 400°F and 800°F. During start-up and shutdown, the temperature will be below optimal range greatly reducing the effectiveness. Thus, NOx concentration limits are generally not applicable during start-up or shutdown. Newer stationary gas turbines reduce the low temperature periods where emissions are out of control.

The catalyst is susceptible to "poisoning" if the flue gas contains contaminants including sulfur compounds, particulates, reagent salts, or siloxanes. These contaminants are readily found in landfill gas, sewage digester gas, and other biogas. Poisoned catalysts require cleaning or replacement resulting in additional costs and extended periods of non-operation for the stationary gas turbine. In those cases, filtering may be used to reduce the impacts on the catalyst.

Catalytic Absorption Systems (Natural Gas Turbines)

Catalytic absorption is based on an integration of catalytic oxidation and absorption technology resulting in similar control efficiency as selective catalytic reduction without the use of ammonia. Carbon monoxide and nitrogen oxide catalytically oxidize to carbon dioxide and nitrogen dioxide, then the nitrogen dioxide molecules are absorbed onto the catalyst. The catalyst is a platinum-based substrate with a potassium carbonate coating. The catalyst appears to be very sensitive to sulfur, even the small amounts in pipeline natural gas. Initial issues regarding catalyst failures have been addressed by conducting more frequent and extensive catalyst washing. At one facility, they have determined that emission levels are best met when all three layers of catalyst are washed about every four months. During the wash process, the turbine is non-operational for about three days.

The NOx concentration levels achieved by the various technologies assessed were consistent with the NOx concentration levels found in existing stationary gas turbines located in SCAQMD.

Initial BARCT Emission Limit and Other Considerations

The recommendation for the NOx BARCT emission limits are established using information gathered from existing SCAQMD regulations, existing units permitted in SCAQMD, regulatory requirements for other air districts, and the technology assessment. Both retrofit and new installations are considered. Once the initial limits are established, a cost-effectiveness determination is made at that initial limit. If the initial limit is not cost-effective, an alternative limit may be recommended. Unique circumstances are taken under consideration to distinguish alternative limits or to create provisions in the rule to address equipment that would otherwise not be cost-effective.

Natural Gas Combined Cycle Gas Turbines

Natural gas combined cycle gas turbines have been new installations. The lowest NOx concentration limit for new installations in SCAQMD is 2 ppmv at 15% oxygen on a dry basis. Other air districts limit NOx emissions to between 5-25 ppmv at 15% oxygen on a dry basis for existing units and 2-25 ppmv at 15% oxygen on a dry basis for new installations. The technology assessment found that a for natural gas combined cycle turbines, a combination of pre-combustion technology and post-combustion control can meet a concentration of 2 ppmv NOx at 15% oxygen on a dry basis. The initial BARCT recommendation for both new installations and retrofits of natural gas combined cycle gas turbines is 2 ppmv NOx at 15% oxygen on a dry basis.

Table 2-8 – Initial BARCT Recommendation for Natural Gas Combined Cycle Gas Turbines

	Existing Units (ppmv @ 15% oxygen, dry)	Other Regulatory Requirements (ppmv @ 15% oxygen, dry)	Technology Assessment (ppmv @ 15% oxygen, dry)	Initial BARCT Recommendation (ppmv @ 15% oxygen,dry)
Retrofit	5	5-25	2	2
New Install	2	2-25	2	2

Natural Gas Simple Cycle Gas Turbines

For new installations, numerous natural gas simple cycle gas turbines have a NOx concentration limit of 2.5 ppmv at 15% oxygen on a dry basis. Other air districts limit NOx emissions to between 5 and 25 ppmv at 15% oxygen on a dry basis for existing units and 2.5-25 ppmv at 15% oxygen on a dry basis for new installations. The technology assessment found that a combination of pre-combustion technology and post-combustion control can meet a concentration of 2.5 ppmv NOx at 15% oxygen on a dry basis for natural gas simple cycle gas turbines. The initial BARCT recommendation for both new installations and retrofits of natural gas simple cycle gas turbines is 2.5 ppmv NOx at 15% oxygen on a dry basis.

Table 2-9 – Initial BARCT Recommendation for Natural Gas Simple Cycle Gas Turbines

	Existing Units (ppmv @ 15% oxygen, dry)	Other Regulatory Requirements (ppmv @ 15% oxygen, dry)	Technology Assessment (ppmv @ 15% oxygen, dry)	Initial BARCT Recommendation (ppmv @ 15% oxygen, dry)
Retrofit	9	5-25	2.5	2.5
New Install	2.5	2.5-25	2.5	2.5

Produced Gas Turbines

The single produced gas turbines has a NOx concentration limit of 5 ppmv at 15% oxygen on a dry basis. Other air districts do not have specific limits for produced gas turbine NOx emissions. They default to natural gas limits based on the size of the turbine. In this case the limit is 50 ppmv at 15% oxygen on a dry basis. The technology assessment found that a combination of pre-combustion technology and post-combustion control can meet a concentration of 5 ppmv NOx at 15% oxygen on a dry basis. The initial BARCT recommendation for both new installations and retrofits of produced gas turbines is 5 ppmv NOx at 15% oxygen on a dry basis.

Table 2-10 – Initial BARCT Recommendation for Produce Gas Turbines

	Existing Units (ppmv @ 15% oxygen, dry)	Other Regulatory Requirements (ppmv @ 15% oxygen, dry)	Technology Assessment (ppmv @ 15% oxygen, dry)	Initial BARCT Recommendation (ppmv @ 15% oxygen, dry)
Retrofit	5	50	5	5
New Install	5	50	5	5

Outer Continental Shelf Produced Gas and Liquid Turbines

Three OCS produced gas turbines have a NOx concentration limit of 65 ppmv at 15% oxygen on a dry basis. Other air districts do not have specific limits for produced gas turbine NOx emissions. They default to natural gas limits based on the size of the turbine. In this case the limit is 50 ppmv at 15% oxygen on a dry basis. The technology assessment found that pre-combustion technology can meet a concentration of 15 ppmv NOx at 15% oxygen on a dry basis. When firing on liquid fuel, the technology assessment found that pre-combustion technology can meet a concentration of 30 ppmv NOx at 15% oxygen on a dry basis. The initial BARCT recommendation for both new installations and retrofits of produced gas turbines is 15 ppmv NOx at 15% oxygen on a dry basis.

Table 2-11 – Initial BARCT Recommendation for Produce Gas Turbines

	Existing Units (ppmv @ 15% oxygen, dry)	Other Regulatory Requirements (ppmv @ 15% oxygen, dry)	Technology Assessment (ppmv @ 15% oxygen, dry)	Initial BARCT Recommendation (ppmv @ 15% oxygen, dry)
Retrofit	65	50	15	15
New Install	65	50	15	15

Other Gas Turbines

The BARCT assessment provided above analyzed existing gas turbines. However, the rule may apply to gas turbines using a fuel besides those listed above. The most likely alternative fuel is

biogas that will have the same contaminant issues as sewage digester gas and landfill gas. Other gas turbines will be limited to a NOx concentration limit of 12.5 ppmv at 15% oxygen on a dry basis; the same limit as landfill gas turbines.

In summary, the initial BARCT recommendations are presented in Table 2-12 below:

Table 2-12 – Summary of Initial BARCT Recommendation

Equipment	Initial BARCT Recommendation
Natural Gas Combined Cycle Gas Turbine	2 ppmv @ 15% oxygen, dry
Natural Gas Simple Cycle Gas Turbine	2.5 ppmv @ 15% oxygen, dry
Natural Gas Simple Cycle Pipeline Gas Turbine	8 ppmv @ 15% oxygen, dry
Produced Gas Turbine	5 ppmv @ 15% oxygen, dry
Outer Continental Shelf Produced Gas Turbine	15 ppmv @ 15% oxygen, dry
Outer Continental Shelf Liquid Fuel Turbine	30 ppmv @ 15% oxygen, dry
Other Gas Turbine	12.5 ppmv @ 15% oxygen, dry

Cost-Effectiveness Analysis

Cost-effectiveness is examined for each equipment category type. Cost-effectiveness is measured in terms of control costs (dollars) per air emissions reduced (tons). If the cost per ton of emissions reduced is less than the maximum required cost-effectiveness, then the control method is considered to be cost-effective. The 2016 Air Quality Management Plan (AQMP) establishes a cost-effectiveness threshold of $50,000 per ton of NOx reduced.

The discounted cash flow method (DCF) is used in to determine cost-effectiveness. The DCF method calculates the present value of the control costs over the life of the equipment by adding the capital cost to the present value of all annual costs and other periodic costs over the life of the equipment. A real interest rate of four per cent and a 25-year equipment life is used. The cost-effectiveness is determined by dividing the total present value of the control costs by the total emission reductions in tons over the same 25-year equipment life.

Baseline emissions are determined by using reported fuel consumption and the permit NOx concentration limit corrected to 15% oxygen on a dry basis except for natural gas boilers where it is corrected to 3% oxygen on a dry basis. Proposed Amended 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (PAR 1134) emissions are determined by using reported fuel consumption and the proposed emission limit. Emission reductions are the difference between baseline emissions and PAR 1134 emissions.

Costs for retrofitting stationary gas turbines were determined using U.S. EPA's Air Pollution Control Cost Estimation Spreadsheet for Selective Catalytic Reduction. The methodology used in the spreadsheet is based on U.S. EPA Clean Air Markets Division Integrated Planning Model. Size and costs of selective catalytic reduction control equipment and operational costs are based on size, fuel burned, NOx removal efficiency, reagent consumption rate, and catalyst costs. Fuel consumption is based on 2015 reported fuel usage. Values are reported in 2015 dollars. Cost-

effectiveness is not reported for turbines that are already meet the proposed BARCT emission limits.

Natural Gas Combined Cycle Gas Turbines

All but one of the 16 natural gas combined cycle gas turbines currently have NOx permit limits greater than the proposed NOx concentration limit of 2 ppmv at 15% oxygen on a dry basis. Six units are permitted at 2.5 ppmv NOx at 15% oxygen on a dry basis. The remaining nine units are permitted at 9 ppmv NOx at 15% oxygen on a dry basis or above. The cost-effectiveness for natural gas combined cycle gas turbines is presented below in Table 2-13 below.

Table 2-13 – Natural Gas Combined Cycle Gas Turbine Cost-Effectiveness

Unit	Input (MMBTU/HR)	Output (MW)	2016 Annual NOx Emissions (tons)	Estimated MWh/yr	% Capacity	NOx Permit Limit (ppmv @ 15% oxygen, dry)	Capital Cost (Millions)	Operating Cost (millions)	Emission Reductions (tons)	Cost-Effectiveness ($/ton reduced)	Annual Capacity Factor (%) at $50,000 per ton of NOx Reduced
NG CS10	410	60	192.7	7500	1.4%	102	$7.21	$0.49	188.9	$3,229	0.1%
NG CS3	16	1	2.4	4800	49.8%	41	$0.54	$0.04	2.3	$21,064	21.0%
NG CS1	59	3	10.8	22800	90.1%	25	$1.00	$0.09	9.9	$9,802	17.7%
NG CS2	59	3	4	22800	90.1%	25	$1.00	$0.09	3.7	$26,465	47.7%
NG CS8	59	6	26.2	47000	89.4%	21	$1.61	$0.14	23.7	$6,477	11.6%
NG CS9	59	6	24.1	44000	83.7%	21	$1.61	$0.14	21.8	$7,042	11.8%
NG CS4	234	24	33.3	75000	36.3%	12	$3.93	$0.29	27.8	$12,516	9.1%
NG CS6	46	3	5.3	18000	68.4%	9	$0.98	$0.07	4.1	$42,269	57.8%
NG CS7	49	3	5.6	19000	72.3%	9	$0.98	$0.07	4.4	$40,256	58.2%
NG CS5	350	30	1	6000	2.3%	2.5	$4.59	$0.33	0.2	$1,826,656	84.0%
NG CS11	57	5	0.6	20000	45.7%	2.5	$1.43	$0.11	0.1	$1,094,878	999.9%
NG CS12	57	5	0.2	10000	22.8%	2.5	$1.43	$0.11	0.0	$3,284,635	1499.8%
NG CS13	162	13	3.5	100000	85.2%	2.5	$2.72	$0.22	0.6	$422,044	719.1%
NG CS15	114	6	0.4	44000	89.7%	2.5	$1.54	$0.11	0.1	$1,668,033	2992.2%
NG CS16	114	6	0.4	44000	89.7%	2.5	$1.54	$0.11	0.1	$1,668,033	2992.2%

Average Cost-Effectiveness (Excluding Near-Limit Turbines): $5,900

1 – Natural Gas Combined Cycle Gas Turbine with Associated Duct Burner

For the natural gas combined cycle gas turbines as a class permitted at 2.5 ppmv NOx at 15% oxygen on a dry basis, the cost-effectiveness threshold of $50,000 per ton reduced is never reached,

even when used at 100% annual capacity factor. Those six units will not be required to retrofit to the proposed BARCT limit. For the remaining units, a low-use provision is included in the proposed rule allowing the units to operate at current permitted levels if their annual capacity factor remains below 25% in any one year and 10% averaged over three consecutive years. Otherwise, it is cost-effective for the combined cycle natural gas turbines to meet the proposed 2 ppmv NOx at 15% oxygen on a dry basis.

Natural Gas Simple Cycle Gas Turbines

Twenty-five of 27 natural gas simple cycle gas turbines have permitted NOx limits greater than the proposed BARCT limit of 2.5 ppmv at 15% oxygen on a dry basis. Nine of the natural gas simple cycle gas turbines that are permitted at NOx concentration levels above the proposed limit are used sporadically to support renewable power generation or are no longer in use. The cost-effectiveness for natural gas simple cycle gas turbines is presented below in Table 2-14 below.

Table 2-14 – Natural Gas Simple Cycle Gas Turbine Cost-Effectiveness

Unit	Input (MMBTU/HR)	Output (MW)	2016 Annual NOx Emissions (tons)	Estimated MWh/yr	%Capacity	NOx Permit Limit (ppmv @ 15% oxygen, dry)	Capital Cost (Millions)	Operating Cost (millions)	Emission Reductions (tons)	Cost-Effectiveness ($/ton reduced)	Annual Capacity Factor (%) at $50,000 per ton of NOx Reduced
NG SS1	150	11	60.0	48,000	49.8%	81	$2.39	$0.24	56.3	$4,438	4.4%
NG SS2	150	11	61.7	44,000	45.7%	81	$2.39	$0.24	52.6	$4,748	4.3%
NG SS3	150	11	62.1	42,000	43.6%	81	$2.39	$0.24	50.8	$4,920	4.3%
NG SS4	13.11	0.9	3.7	2,500	31.7%	68	$0.47	$0.04	3.6	$4,205	7.6%
NG SS6	13.11	0.9	3.9	1,800	22.8%	68	$0.47	$0.04	3.8	$2,950	5.1%
NG SS5	13.11	0.9	4.3	1,800	22.8%	67	$0.47	$0.04	4.1	$2,950	4.6%
NG SS7	13.11	0.9	3.7	1,700	21.6%	64	$0.47	$0.04	3.6	$2,820	5.1%
NG SS13	246	23	26.1	22,000	10.9%	42	$3.87	$0.33	24.5	$15,067	3.3%
NG SS14	466	42	279.2	250,000	67.9%	42	$5.72	$0.69	262.4	$2,586	3.5%
NG SS8	50	4	29.3	31,500	89.9%	40	$1.24	$0.12	27.5	$4,675	8.4%
NG SS9	50	4	29.3	31,500	89.9%	40	$1.24	$0.12	27.5	$4,675	8.4%
NG SS10	229	22.4	32.4	75,000	38.2%	9	$3.80	$0.34	23.4	$15,927	12.2%
NG SS11	250.6	23.1	27.3	190,000	94.1	9	$3.88	$0.32	19.7	$18,352	34.5%
NG SS12	1080	158	4.9	20,000	1.4%	8	$13.53	$1.02	3.3	$376,566	10.5%
NG SS19	530.2	43.8	0.0	0	0.0%	7	$5.88	$0.43	0.0	N/A	17.1%
NG SS15	472.5	39	32.6	340000	99.5%	5	$12.70	$0.45	16.3	$49,026	99.0%
NG SS17	43.8	4.6	7.0	4000	9.9%	5	$1.36	$0.11	1.6	$78,135	15.5%
NG SS20	136.5	10.5	0.0	0	0%	5	$2.3	$0.15	0	N/A	34.0%
NG SS21	136.5	10.5	0.0	0	0%	5	$2.3	$0.15	0	N/A	34.0%
NG SS22	136.5	10.5	0.0	0	0%	5	$2.3	$0.15	0	N/A	34.0%
NG SS23	136.5	10.5	0.0	0	0%	5	$2.3	$0.15	0	N/A	34.0%
NG SS24	136.5	10.5	0.1	100	0.1%	5	$2.3	$0.15	0	N/A	34.0%
NG SS25	136.5	10.5	0.0	0	0%	5	$2.3	$0.15	0	N/A	34.0%
NG SS26	136.5	10.5	0.0	0	0%	5	$2.3	$0.15	0	N/A	34.0%
NG SS27	136.5	10.5	0.0	0	0%	5	$2.3	$0.15	0	N/A	34.0%

Average Cost-Effectiveness (Excluding Low-Use Turbines): $6,100

A low-use provision is included in the proposed rule allowing the units to operate at current permitted levels if their annual capacity factor remains below 25% in any one year and 10% averaged over three consecutive years. Otherwise, it is cost-effective for the simple cycle natural gas turbines to meet the proposed 2.5 ppmv NOx at 15% oxygen on a dry basis.

Produced Gas Turbines

There are 11 produced gas turbines employed in oil and gas production. These do not include turbines used for refining of oil or gas which will be subject to Proposed Rule 1109.1 when it is adopted. Produced gas turbines use the gas released from oil fields. Because the flow of gas from oil fields is inconsistent, there is significant variation in the operating load level of the turbines. In some cases, the gas may be supplemented with natural gas. In the case of outer continental shelf turbines, natural gas is unavailable and the produced gas may be supplemented with diesel fuel. One of the five produced gas turbines currently meets the proposed BARCT limit of 5 ppmv at 15% oxygen on a dry basis.

Table 2-15 – Produced Gas Turbine Cost-Effectiveness

Unit	Input (MMBTU/HR)	Output (MW)	2016 Annual NOx Emissions (tons)	Estimated MWh/yr	%Capacity	NOx Permit Limit (ppmv @ 15% oxygen, dry)	Capital Cost (Millions)	Operating Cost (millions)	Emission Reductions (tons)	Cost-Effectiveness ($/ton reduced)	Annual Capacity Factor (%) at $50,000 per ton of NOx Reduced
PGT1	221	21.8	19.0	140,000	73.3%	9	$3.72	$0.29	7.6	$44,847	65.7%
PGT2	49	4.8	4.0	30,000	71.4%	9	$1.24	$0.09	1.8	$47,213	67.4%
PGT3	49	4.8	1.5	15,000	35.7%	9	$1.24	$0.07	0.7	$136,500	97.5%
PGT4	221	21.8	23.1	160,000	83.7%	9	$3.72	$0.30	10.2	$33,147	55.5%

Average Cost-Effectiveness (Excluding Low-Use Turbines): $43,600

As a class, produced gas turbines can cost-effectively meet the proposed BARCT limit of 5 ppmv at 15% oxygen on a dry basis.

Table 2-16 – Outer Continental Shelf Produced Gas Turbine Cost-Effectiveness

Unit	Input (MMBTU/HR)	Output (MW)	2016 Annual NOx Emissions (tons)	Estimated MWh/yr	%Capacity	NOx Permit Limit (ppmv @ 15% oxygen, dry)	Capital Cost (Millions)	Operating Cost (millions)	Emission Reductions (tons)	Cost-Effectiveness ($/ton reduced)	Annual Capacity Factor (%) at $50,000 per ton of NOx Reduced
PGOCST1	29	2.5	53.8	20,000	91.3%	65	$0.91	$0.09	46.3	$2,012	3.7%
PGOCST2	29	2.5	47.8	20,000	91.3%	65	$0.91	$0.09	41.1	$2,267	4.1%
PGOCST3	29	2.5	45.2	20,000	91.3%	65	$0.91	$0.09	38.9	$2,395	4.4%
PGOCST4	42	2.5	8.0	3,500	16.0%	140	$0.91	$0.07	7	$11,481	3.7%
PGOCST5	42	2.5	3.4	1,500	6.8%	140	$0.91	$0.07	2.9	$27,351	3.7%
PGOCST6	42	2.5	9.2	4,300	19.6%	130	$0.91	$0.07	8.6	$9,804	3.8%

Average Cost-Effectiveness (Excluding Low-Use Turbines): $3,600

As a class, outer continental shelf produced gas turbines can cost-effectively meet the proposed BARCT limit of 5 ppmv at 15% oxygen on a dry basis. Cost-effectiveness is not calculated for liquid fuel use on outer continental shelf produced gas turbines because the emissions concentration that can be met is twice the value of the produced gas limit.

BARCT Emission Limit Recommendation

In all categories, the technology is available to meet the Initial BARCT NOx concentration limits. Low-use and near-limit provisions are included in the rule to address units that are not cost-effective. The provision allows low-use equipment to continue operating without retrofit provided that they do not exceed an annual capacity factor limit and that they include an annual capacity factor in their Permit to Operate. This ensures that turbines that increase use to the point where the cost-effectiveness threshold is reached, that they will be required to retrofit the units to meet the proposed BARCT concentration limits.

The BARCT emission limits for the proposed rule are listed below in Table 2-17.

Table 2-17 – Summary of BARCT Recommendation

Equipment	Initial BARCT Recommendation
Natural Gas Combined Cycle Gas Turbine	2 ppmv @ 15% oxygen, dry
Natural Gas Simple Cycle Gas Turbine	2.5 ppmv @ 15% oxygen, dry
Natural Gas Simple Cycle Pipeline Gas Turbine	8 ppmv @ 15% oxygen, dry
Produced Gas Turbine	5 ppmv @ 15% oxygen, dry
Outer Continental Shelf Produced Gas Turbine	15 ppmv @ 15% oxygen, dry
Outer Continental Shelf Liquid Fuel Turbine	30 ppmv @ 15% oxygen, dry
Other Gas Turbine	12.5 ppmv @ 15% oxygen, dry

CHAPTER 3: SUMMARY OF PROPOSALS

INTRODUCTION

PURPOSE (Subdivision (a))

APPLICABILITY (Subdivision (b))

DEFINITIONS (Subdivision (c))

EMISSIONS LIMITATIONS (Subdivision (d))

MONITORING AND SOURCE TESTING (Subdivision (e))

TEST METHODS (Subdivision (f))

RECORDKEEPING (Subdivision (g))

EXEMPTIONS (Subdivision (h))

INTRODUCTION

Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (PAR 1134) establishes NOx and ammonia emission limits gas turbines. Additionally, PAR 1134 establishes provisions for monitoring, reporting, and recordkeeping, and establishes exemptions from specific provisions.

PURPOSE (Subdivision (a))

Purpose (subdivision (a)) is added to PAR 1134 to be consistent with the structure of current SCAQMD rules. The purpose of PAR 1134 is to reduce emissions of oxides of nitrogen from stationary gas turbines.

APPLICABILITY (Subdivision (b))

While there is no specific language excluding RECLAIM facilities from current Rule 1134, a few turbines are currently subject to Rule 1135. Many turbines are included in the RECLAIM program and as such are not required to meet the NOx concentration limits imposed by Rule 1134. However, gas turbines permitted prior to August 4, 1989 and used at publicly-owned treatment works (POTWs), landfills, hospitals and other public facilities, and sources which were not covered under RECLAIM, were still required to meet the concentration limits in Rule 1134 through application of various control technologies. New turbines installed at non-RECLAIM facilities after August 4, 1989 are not subject to Rule 1134. PAR 1134 will apply to all stationary gas turbines located at non-RECLAIM and RECLAIM facilities (excluding those subject to Rule 1135 or located at a landfill, petroleum refinery, or publicly owned treatment works), regardless of the date they were permitted. NOx generating equipment located at petroleum refineries and refinery associated facilities will be subject to forthcoming Proposed Rule 1109.1 – Refinery Equipment.

DEFINITIONS (Subdivision (c))

PAR 1135 adds and modifies definition to clarify and explain key concepts and removes obsolete definitions. Please refer to PAR 1135 for each definition.

Proposed Deleted Definitions:	Chemical Processing Gas Turbine
	Emission Control Plan
	HHV
	LHV
	Peaking Gas Turbine Unit
	Southeast Desert Air Basin (SEDAB)
Proposed Modified Definitions:	Cogeneration Turbine
	Combined Cycle Gas Turbine
	Emergency Standby Gas Turbine
	Existing Gas Turbine
	Stationary Gas Turbine

Proposed Added Definitions:
Annual Capacity Factor
Duct Burner
Former RECLAIM NOx Source
Landfill
Natural Gas
Non-RECLAIM NOx Source
Oxides of Nitrogen (NO_x) Emissions
Outer Continental Shelf
Petroleum Refinery
Produced Gas
Publicly Owned Treatment Works
RECLAIM NOx Source
Shutdown
Simple Cycle Gas Turbine
Start-up
Tuning

EMISSIONS LIMITATIONS (Subdivision (d))

The emissions limits in paragraph (d)(1) will be applicable to existing turbines currently subject to Rule 1134. The limits are applicable in the interim until the turbine can comply with limits in Table 1 of paragraph (d)(3) or January 1, 2024, whichever comes first. Turbines that are a RECLAIM NOx source or a former RECLAIM NOx source are not subject to (d)(1).

The emission limits in Tables 1 of PAR 1134 are based on the BARCT assessment presented in Chapter 2 – BARCT Assessment.

PAR 1134, Table 1: Emissions Limits for Stationary Gas Turbines

Fuel Type	NO_x[1] (ppmv)	Ammonia (ppmv)	Oxygen Correction (%, dry)
Liquid – Outer Continental Shelf	30	5	15
Natural Gas – Combined Cycle	2	5	15
Natural Gas – Pipeline Gas Turbine	8	5	15
Natural Gas – Simple Cycle	2.5	5	15
Produced Gas	5	5	15
Produced Gas – Outer Continental Shelf	15	5	15
Other	12.5	5	15

[1] – The NOx emission limits in Table 1 shall not apply during start-up, shutdown, and tuning.

To help achieve the emission reduction goals of the 2016 AQMP and AB 617 requirement of BARCT implementation, PAR 1134 subparagraphs (d)(1) and (d)(2) set the compliance date for electric generating units as January 1, 2024.

Subparagraph (d)(4) states that requirements for start-up, shutdown, and tuning periods will be put in each stationary gas turbine's permit. The requirements will specify duration, mass emissions, and number of start-ups, shutdowns, and, if applicable, tunings. Requirements for start-up, shutdown, and tuning of existing electric generating units are currently in the permits for that equipment. Additionally, start-up, shutdown, and tuning are unique to each unit and evaluated during the permitting process. Therefore, PAR 1134 does not specify specific start-up, shutdown, and tuning requirements, but instead states that the requirements will be put in each stationary gas turbine's permit.

Subparagraph (d)(5)(B) requires the emissions limits of turbines that are installed after [*Date of* Adoption] to be averaged over a 60-minute rolling average. For stationary gas turbines installed before [*Date of Adoption*], subparagraph (d)(5)(A) allows turbines to retain their current averaging time, not to exceed three hours. The averaging times for these units were evaluated during the permitting process and may be maintained.

Paragraph (d)(6) prohibits the use of liquid fuel in a stationary gas turbine except for Outer Continental Shelf gas turbines which do not have access to natural gas. Outer Continental Shelf gas turbines burning 10 percent or less liquid fuel will be subject to the produced gas limit.

Paragraph (d)(7) requires that by July 1, 2022 facilities submit applications to reconcile their permits with Rule 1134. As facilities transition out of RECLAIM to Rule 1134, their permits will need to be revised to remove references to RECLAIM rules and include references to Rule 1134.

MONITORING AND SOURCE TESTING (Subdivision (e))

Staff is currently working on adopting Rule 113 – Monitoring, Reporting, and Recordkeeping (MRR) Requirements for NOx and SOx Sources. Once Rule 113 is adopted, all Rule 1134 equipment will transition to Rule 113 for MRR. For the interim period, the intention of the PAR 1134 MRR is to maintain current MRR for all facilities and minimize the RECLAIM reporting requirements. Turbines that are non-RECLAIM NOx sources already comply with Rule 218 – Continuous Emission Monitoring (Rule 218) in addition to other MRR requirements. Therefore, requiring compliance with Rule 218 will not affect these units.

Paragraph (e)(1) requires that turbines 2.9 MW and larger retain their CEMS.

Subparagraph (e)(2)(A) requires turbines smaller than 2.9MW and located at a non-RECLAIM NOx source to conduct a source test to demonstrate compliance with NOx and carbon monoxide concentrations and demonstrated percent efficiency (EFF) if applicable.

Subparagraph (e)(2)(B) requires stationary gas turbines operating with a catalytic control device to conduct source testing to determine compliance with the ammonia concentration emission limit. Alternatively, a certified ammonia CEMS may be used to determine compliance in lieu of source testing. At this time, SCAQMD is in the process of finding a host site for an ammonia CEMS

demonstration project. Upon successful demonstration, SCAQMD will develop an ammonia CEMS protocol. Once an ammonia CEMS protocol is developed then SCAQMD intends to require ammonia CEMS instead of source testing to demonstrate compliance with the ammonia limits. At this time, an ammonia CEMS is approximately $60,000. The provision that allows for ammonia CEMS instead of source testing allows facilities to transition to ammonia CEMS once a protocol is ready, but is not specifically required by Rule 1134.

Source tests to determine compliance with NOx concentration limits for turbines not equipped with NOx CEMS shall be conducted every calendar year according to clause (e)(2)(C)(i). Clause (e)(2)(C)(ii) states that turbines emitting less than 25 tons per year of NOx may source test at least once every three calendar years. Additionally, clause (e)(2)(C)(iii) requires turbines not equipped with ammonia CEMS to source test quarterly when initially installed and after an annual test is failed. After four consecutive compliant ammonia source tests, source testing of ammonia may be conducted every calendar year. Turbines currently testing for ammonia annually may retain that schedule until an annual test is failed.

Paragraph (e)(3) applies to RECLAIM facilities and requires that current MRR be maintained until the facility leaves RECLAIM.

Paragraph (e)(4) applies to former RECLAIM facilities. To demonstrate compliance with the NOx emissions limits, these facilities will be required to comply with SCAQMD Rule 2012 with the exception of the following provisions that reference reporting requirements or that do not apply to electric power generating units:

- (c)(3) – facility permit holder of a major NOx source
- (c)(4) – Super Compliant Facilities
- (c)(5) – facility Permit holder of a facility which is provisionally approved for NOx Super Compliant status
- (c)(6) – after final approval of Super Compliant status
- (c)(7) – facility designated as a NOx Super Compliant Facility
- (c)(8) – super Compliant Facility exceeds its adjusted allocations
- (d)(2)(B) – install, maintain and operate a modem
- (d)(2)(C) – equipment-specific emission rate or concentration limit
- (d)(2)(D) – monitor one or more measured variables as specified in Appendix A
- (d)(2)(E) – comply with all applicable provisions of subdivision (f)
- (e) – NOx Process Unit
- (g)(5) – system is inadequate to accurately determine mass emissions
- (g)(6) – sharing of totalizing fuel meters
- (g)(7) – equipment which is exempt from permit requirements pursuant to Rule 219 - Equipment Not Requiring A Written Permit Pursuant to Regulation II
- (g)(8) – rule 2012 and Appendix A
- (h)(1) – facilities with existing CEMS and fuel meters as of October 15, 1993
- (h)(2) – interim emission reports
- (h)(4) – installation of all required or elected monitoring and reporting systems
- (h)(5) – existing or new facility which elects to enter RECLAIM or a facility which is required to enter RECLAIM

- (h)(6) – new major NOx source at an existing facility
- (k) – Exemption
- (l) – Appeals
- Reported Data and Transmitting/Reporting Frequency requirements from Appendix A – "Protocol for Monitoring, Reporting and Recordkeeping for Oxides of Nitrogen (NOx) Emissions"

TEST METHODS (Subdivision (f))

SCAQMD Method 207.1 is included to determine ammonia concentration during source testing.

RECORDKEEPING (Subdivision (g))

The recordkeeping provisions in subdivision (g) are maintained with one change. Paragraph (g)(3) will require the use of a data acquisition system as a replacement for monthly reporting.

EXEMPTIONS (Subdivision (h))

The current exemption for chemical processing gas turbine units in subparagraph (h)(1)(C) has been removed and those units must comply with applicable limits in Proposed Rule 1109.1 – Refinery Equipment when it is adopted. The current exemptions in subparagraph (h)(1)(D) and (h)(2)(B), Southeast Desert Air Basin are no longer necessary because the locations are outside the SCAQMD. There are no turbines located on San Clemente Island and therefore the exemption in subparagraph (h)(2)(C) is unnecessary.

Rule 1134 will be amended to include several new exemptions. The first new exemption, subparagraph (h)(3), exempts existing combined cycle gas turbines at 2.5 ppmv NOx at 15% oxygen on a dry basis from the emissions limitations in paragraph (d)(3), with the condition that the units keep their NOx and ammonia limits, start-up, shutdown, and tuning requirements, and averaging times on the current permit. According to the BARCT assessment, it is not cost-effective for combined cycle gas turbines at 2.5 ppmv NOx at 15% oxygen on a dry basis to reduce their limits to 2 ppmv at 15% oxygen on a dry basis.

To address low-use stationary gas turbines, a low-use provision, paragraph (h)(4) is included in PAR 1134. The provision allows low-use equipment to continue operating without retrofit provided that they: do not exceed annual capacity factor limits; include annual capacity factor limits in their permit; and keep the NOx and ammonia limits, start-up, shutdown, and tuning requirements, and averaging times on the current permit. The NOx limit may not exceed 9 ppmv at 15% oxygen on a dry basis. The annual capacity factor, paragraph (c)(1), is defined as the ratio between the actual annual input and the annual maximum heat input if operated continuous over one year. The annual capacity factor limits for gas turbines in subparagraph (g)(4)(A) is less than twenty-five percent in one calendar year and less than ten percent averaged over three years. In order to obtain the low-use exemption, subparagraph (g)(4)(B) requires that an application for the low-use exemption be submitted by July 1, 2022. Subparagraph (g)(4)(C) requires that annual capacity factor to be determined annually and submitted to the Executive Officer no later than March 1 following the reporting year. If a unit exceeds the annual capacity factor, subparagraph (g)(4)(D) states the owner or operator is subject to a notice of violation for each year of exceedance and for each annual and/or three-year exceedance. Clause (g)(4)(D)(iii) requires that after two

years of the date of reported exceedance, the unit must come into compliance with the emissions limits in Table 1. There are also interim milestone requirements in clauses (g)(4)(D)(i) and (g)(4)(D)(ii): submitting a permit application within six months from the date of reported exceedance and a CEMS plan within six months from the date of permit application submittal.

If a stationary gas turbine is not using selective catalytic reduction or other processes that add ammonia into the exhaust gas, then paragraph (h)(5) exempts those turbines from ammonia concentration limits and source testing requirements.

CHAPTER 4: IMPACT ASSESSMENT

POTENTIALLY IMPACTED FACILITIES

There are 34 facilities that are potentially impacted by Proposed Amended Rule 1134 – Emissions of Oxides of Nitrogen from Stationary Gas Turbines (PAR 1134). Of these 34 facilities, 18 are currently in the NOx RECLAIM program. The remaining facilities are not in the RECLAIM program; 8 are currently subject to SCAQMD Rule 1134. Eight facilities are not subject to RECLAIM or Rule 1134 because of applicability requirement of RECLAIM and the turbines were built after 1989.

There are approximately 74 turbines at these 34 facilities: 4 are at the proposed emissions limits, 27 are exempt, and 13 qualify for the low-use provisions. The remaining 30 turbines will need to be replaced, repowered, or retrofitted to come into compliance with PAR 1134.

The seven exempt units are exempt from emissions limits in Table 1 because of the exemption in paragraph (h)(3) and listed in Table 4-1 below.

Table 4-1 – Combined Cycle Turbines Exempt Due to PAR 1134 Paragraphs (h)(3)

Facility	SCAQMD Permit	Current NOx Permit Limit (ppmv at 15% oxygen, dry)
City of Riverside, Public Utilities Department	Turbine D1	2.5
MillerCoors USA	F99403	2.5
MillerCoors USA	F99402	2.5
Kimberly-Clark Worldwide	G33192	2.5
Orange County, Central Utility Facility	G35244	2.5
Orange County, Central Utility Facility	G35245	2.5
University of California at Irvine	G46888	2.5

Assuming similar usage as in 2015, 13 turbines would qualify for the low-use provisions, as summarized in Table 4-2.

Table 4-2 – Units Potentially Utilizing Low-Use Provisions in Paragraph (h)(4)

Facility	SCAQMD Permit	Current NOx Permit Limit (ppmv at 15% oxygen, dry)
Altagas Pomona Energy	G32224	102
City of Riverside, Public Utilities Department	Turbine D1	2.5
Harbor Cogeneration	G48131	8
CES Placerita	F96765	7
California State University, Fullerton	G20025	5
Colton Power (SCAQMD ID 182561)	Turbine D1	5
Colton Power (SCAQMD ID 182561)	Turbine D8	5
Colton Power (SCAQMD ID 182561)	Turbine D15	5
Colton Power (SCAQMD ID 182561)	Turbine D22	5
Colton Power (SCAQMD ID 182563)	Turbine D1	5
Colton Power (SCAQMD ID 182563)	Turbine D8	5
Colton Power (SCAQMD ID 182563)	Turbine D15	5
Colton Power (SCAQMD ID 182563)	Turbine D22	5

EMISSION INVENTORY AND EMISSION REDUCTIONS

The NOx emission inventory for turbines subject to PAR 1134 is 3.3 tons per day in 2015 as seen in Table 4-3 below.

Table 4-3 – NOx Emission Inventory and MWh Capacity

Equipment Type	2015 NOx Emission Inventory (tons per day)	MWh Capacity
Combined Cycle Turbines	0.9	210
Simple Cycle Turbines	1.7	534
Produced Gas Turbines	0.2	60
Outer Continental Shelf Gas Turbines	0.5	15
Total	3.3	819

After the implementation of the BARCT limits, 1.9 tons per day of NOx emission reductions will be realized as seen in Table 4-4 below.

Table 4-4 – NOx Emission Reductions

Equipment Type	2015 NOx Emission Inventory (tons per year)	2015 NOx Emissions Reductions (tons per year)
Combined Cycle Turbines	0.9	0.8
Simple Cycle Turbines	1.7	1.5
Produced Gas Turbines	0.2	0.1
Outer Continental Shelf Gas Turbines	0.5	0.4
Total	3.3	2.8

The use of ammonia in the selective catalytic reduction (SCR) process results in an increase of particulate matter emissions. There are 7 turbines that already utilize SCR but will increase their ammonia usage by an estimated 30% to meet the proposed emissions limits. The particulate matter increase is 8,400 pounds annually or 0.01 tons per day. Twenty-three turbines do not currently utilize SCR. The particulate increase from incorporating SCR into their process is expected to increase particulate matter emissions by 112,322 pounds annually or 0.15 tons per day.

INCREMENTAL COST-EFFECTIVENESS

Health and Safety Code section 40920.6 requires an incremental cost-effectiveness analysis for Best Available Retrofit Control Technology (BARCT) rules or emission reduction strategies when there is more than one control option which would achieve the emission reduction objective of the proposed amendments relative to ozone, carbon monoxide, sulfur oxides, oxides of nitrogen, and their precursors. Incremental cost-effectiveness is the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option. An incremental cost-effectiveness analysis will be conducted at least 30 days prior to the public hearing.

RULE ADOPTION RELATIVE TO COST-EFFECTIVENESS

On October 14, 1994, the Governing Board adopted a resolution that requires staff to address whether rules being proposed for amendment are considered in the order of cost-effectiveness. The 2016 Air Quality Management Plan (AQMP) ranked, in the order of cost-effectiveness, all of the control measures for which costs were quantified. It is generally recommended that the most cost-effective actions be taken first. Proposed Amended Rule 1134 implements Control Measure CMB-05. The 2016 AQMP ranked Control Measure CMB-05 sixth in cost-effectiveness.

SOCIOECONOMIC ASSESSMENT

A Draft Socioeconomic Impact Assessment will be prepared and released at least 30 days prior to the SCAQMD Governing Board Hearing on PAR 1134, which is anticipated to be heard on April 5, 2019.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

PAR 1134 is considered a "project" as defined by the California Environmental Quality Act (CEQA), and the SCAQMD is the designated lead agency. Pursuant to CEQA and SCAQMD Rule 110, the SCAQMD, as lead agency for the proposed project, has determined that PAR 1134 contains new information of substantial importance which was not known and could not have been known at the time the March 2017 Final Program Environmental Impact Report (EIR) was certified for the 2016 Air Quality Management Plan (referred to herein as March 2017 Final Program EIR). Because PAR 1134 may create new potentially significant effects that were not analyzed in the March 2017 Final Program EIR, the SCAQMD, as lead agency for the proposed project will prepare a Subsequent Environmental Assessment (SEA) with significant impacts. In addition, PAR 1134 could have statewide, regional or areawide significance such that a CEQA Scoping Meeting is required to be held for the proposed project pursuant to Public Resources Code Section 21083.9(a)(2). The CEQA Scoping Meeting is scheduled to be held in conjunction with the Public Workshop. Upon completion, a Draft SEA will be released for a 45-day public review and comment period. Comments received at the Public Workshop/CEQA Scoping Meeting will be considered when preparing the Draft SEA and the responses to comments will be included in the Draft SEA.

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 SCAQMD Governing Board shall make findings of necessity, authority, clarity, consistency, non-duplication, and reference based on relevant information presented at the public hearing, and in the staff report.

Necessity

Proposed Amended Rule 1134 is needed to establish BARCT requirements for facilities, including facilities that will be transitioning from RECLAIM to a command-and-control regulatory structure.

Authority

The SCAQMD Governing Board has authority to adopt amendments to Proposed Amended Rule 1134 pursuant to the California Health and Safety Code Sections 39002, 40000, 40001, 40440, 40702, 40725 through 40728, 41508, and 41508.

Clarity

Proposed Amended Rule 1134 is written or displayed so that its meaning can be easily understood by the persons directly affected by it.

Consistency

Proposed Amended Rule 1134 is in harmony with and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations.

Non-Duplication

Proposed Amended Rule 1134 will not impose the same requirements as any existing state or federal regulations. The proposed amended rule is necessary and proper to execute the powers and duties granted to, and imposed upon, the SCAQMD.

Reference

In amending Rule 1134, the following statutes which the SCAQMD hereby implements, interprets or makes specific are referenced: Health and Safety Code sections 39002, 40000, 40001, 40702, 40440(a), and 40725 through 40728.5.

COMPARATIVE ANALYSIS

Health and Safety Code Section 40727.2 requires a comparative analysis of the proposed amended rule with any Federal or District rules and regulations applicable to the same source. A comparative analysis is presented below in Table 4-5.

Table 4-5 – PAR 1134 Comparative Analysis

Rule Element	PAR 1134	RECLAIM	40 CFR Part 60 GG	40 CFR Part 60 KKKK
Applicability	Turbines with generating capacity greater than 0.3 MW except those located electric generating facilities, landfills, petroleum refineries, and publicly owned treatment works	Facilities regulated under the NOx RECLAIM program (SCAQMD Reg. XX)	Gas turbines with heat input of ≥ 10 MMBtu/hr constructed or modified before 2/18/2005	Gas turbines with heat input of ≥ 10 MMBtu/hr constructed or modified after 2/18/2005
Requirements	Emission limits: • Combined Cycle Gas Turbine and Associated Duct Burner: NOx 2 ppmv @ 15% O2; Ammonia 5 ppmv @ 15% O2 • Simple Cycle Gas Turbine: NOx 2.5 ppmv @ 15% O2; Ammonia 5 ppmv @ 15% O2 • Produced Gas Turbine: NOx 5 ppmv @ 15% O2; Ammonia 5 ppmv @ 15% O2 • Outer Continental Shelf Produced Gas Turbine: NOx 15 ppmv @ 15% O2; Ammonia 5 ppmv @ 15% O2 • Outer Continental Shelf Produced Gas Turbine (Liquid Fuel): NOx 30 ppmv @ 15% O2; Ammonia 5 ppmv @ 15% O2	None	NOx limit @ 15% O2: 0.0075*(14.4/Y)+F where Y = manufacture's rated heat input and F = NOx emission allowance for fuel-bound nitrogen	NOx limit for electric generating units (@ 15% O2): • ≤ 50 MMBtu/hr – 42 ppm when firing natural gas • 50 MMBtu/hr and ≤ 850 MMBtu/hr – 15 ppm when firing natural gas • >850 MBtu/hr – 15 ppm when firing natural gas • ≤ 50 MMBtu/hr – 96 ppm when firing other fuel • 50 MMBtu/hr and ≤ 850 MMBtu/hr – 74 ppm when firing other fuel • >850 MBtu/hr – 42 ppm when firing natural gas
Reporting	Annual reporting of NOx emissions	• Daily electronic reporting for major sources • Quarterly Certification of Emissions Report and Annual Permit Emissions Program for all units	Excess emissions and CEMS downtime within 30 days	Excess emissions and CEMS downtime within 30 days; annual performance testing within 60 days
Monitoring	• A continuous in-stack NOx monitor for turbines with a capacity of 2.9 MW or greater. Periodic source testing for small turbines.	A continuous in-stack NOx monitor for major sources	A continuous in-stack NOx monitor	A continuous in-stack NOx monitor
Recordkeeping	Performance testing; emission rates; monitoring data; CEMS audits and checks maintained for five years	• < 15-min. data = min. 48 hours; • ≥ 15-min. data = 3 years (5 years if Title V) • Maintenance & emission records, source test reports, RATA reports, audit reports and fuel meter calibration records for Annual Permit Emissions Program = 3 years (5 years if Title V)	Performance testing; emission rates; monitoring data; CEMS audits and checks	Performance testing; emission rates; monitoring data; CEMS audits and checks
Fuel Restrictions	Liquid petroleum fuel limited to Outer Continental Shelf turbines	None	None	None

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