SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Draft Staff Report
Proposed Rule 1118.1 – Control of Emissions from Non-Refinery Flares

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INTRODUCTION

In March 2017, the South Coast Air Quality Management District (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. Proposed Rule 1118.1– Control of Emissions from Refinery Flares (PR1118.1) will implement, in part, the 2016 AQMP Control Measure CMB-03 – Emission Reductions from Non-Refinery Flares. The proposed rule seeks to reduce oxides of nitrogen (NOx) and volatile organic compounds (VOC) emissions from flaring produced (e.g., process) gas, digester gas, landfill gas, and other combustible gases and vapors and to encourage alternatives to flaring. The proposed rule also contains a carbon monoxide (CO) limit, which is included to ensure proper combustion and both pollutants are maintained at a lower level. PR1118.1 does not apply to flares at petroleum refineries, sulfur recovery plants, and hydrogen production plants subject to SCAQMD Rule 1118 – Control of Emissions from Refinery Flares (1118), or flares subject to Proposed Rule 1109.1 – Refinery Equipment (PR1109.1) that were previously subject to the Regional Clean Air Incentives Market (RECLAIM) program

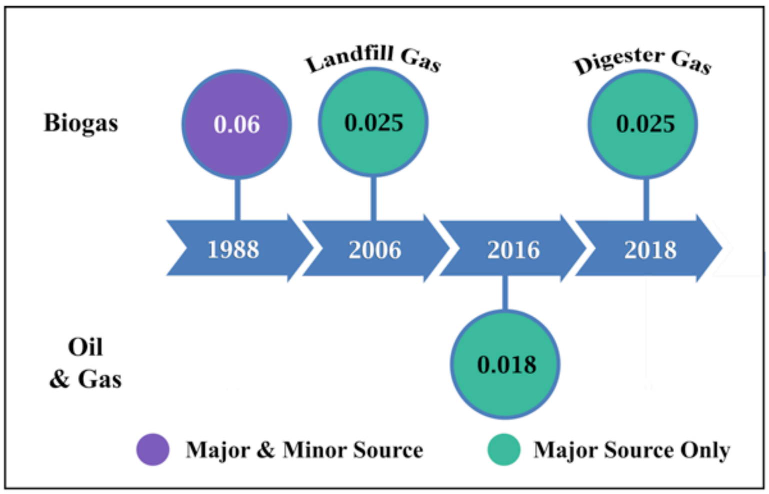
In addition to CMB-03, the adoption resolution of the Final 2016 AQMP directed staff to transition the Regional Clean Air Incentives Market (RECLAIM) program to a command-and-control regulatory structure requiring Best Available Retrofit Control Technology (BARCT) as soon as practicable. California State Assembly Bill 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 subject to a market-based compliance program. PR1118.1 applies to RECLAIM and non-RECLAIM facilities that operate non-refinery flares.

The objective of the proposed rule is to maximize emission reductions and to encourage beneficial use by providing a reasonable timeframe for affected facilities to make feasible, long-range decisions. The proposed rule includes NOx, VOC and CO emission limits that reflect BARCT standards and a capacity threshold that seeks to identify routine flaring. Flares that surpass the capacity threshold will be required to find alternative means (e.g. beneficial use) for excess flaring or reduce flare throughput, or replace with a flare with lower emissions. The capacity threshold varies depending on the type of gas being flared (landfill, digester, produced) and the type of flare equipment (open flare versus a shrouded flare). PR1118.1 provides exemption for low-use and low-emitting flares. Additionally, PR1118.1 establishes provisions for source testing, monitoring, reporting, and recordkeeping. PR1118.1 is expected to reduce 0.23 tons of NOx per day by 2024 from flares located at landfills, wastewater treatment plants, oil and gas production facilities, organic liquid loading stations, and tank farms based on flare replacement. Potential reduction could be greater based on facilities' pursuit of beneficial use instead of flaring. In addition, potential reductions could be achieved sooner as there is typically a shorter compliance schedule for modifying or replacing flares.

BACKGROUND

A survey of SCAQMD permits for non-refinery flares indicate NOx emission rates from many facilities exceed current Best Available Control Technology (BACT) limits. Non-refinery flare emissions are currently regulated through the BACT limits as determined in SCAQMD Rules 1303 and 1701, but there are currently no source-specific rules regulating NOx emissions from non-refinery flares. The first SCAQMD BACT NOx standard for flares was established in 1988 at 0.06 pounds per million British thermal unit (MMBtu). In 2016, advancements in flare technology allowed the NOx standard to be reduced to 0.018 pounds/MMBtu for oil and gas production. Similar flare technology advances for biogas combustion at landfill and wastewater treatment plants lead to the 2018 update to 0.025 pounds/MMBtu. For major polluting facilities, these new BACT determinations serve as requirement pursuant to the United States Environmental Protection Agency (USEPA) Lowest Achievable Emission Rate (LAER) Policy. A facility is defined as a "major polluting facility" if it emits, or has the potential to emit, a criteria air pollutant at a level that equals or exceeds the emission thresholds specified in the federal Clean Air Act. BACT/LAER determinations are based on a permit-by-permit analysis of what is achieved in practice. For non-major polluting facilities, state law requires a more detailed analysis, including cost effectiveness. The non-major source BACT standard for biogas went into effect in 2000 and is 0.06 pounds/MMBtu. There is no non-major source standard for the oil and gas industry. Figure 1 outlines these standards in pounds/MMBtu on a timeline graph.

Figure 1: Flares BACT Requirements



As a region in extreme non-attainment for ozone, SCAQMD is required by USEPA to adopt all reasonably available control measures (RACM) or reasonably available control technologies (RACT), particularly when adopted by other air agencies. In this case, two California air districts, San Joaquin Valley Air Pollution Control District (SJVAPCD) and Santa Barbara County Air Pollution Control District (SBCAPCD) have adopted rules for non-refinery flares. PR1118.1 also address the USEPA requirements for RACM/Best Available Control Measure (BACM) as (SJVAPCD) Rule 4311 – Flares includes emission limits for non-refinery flares and SBCAPCD Rule 359 – Flares and Thermal Oxidizers regulates the use of flares and thermal oxidizers for petroleum and transportation facilities. In addition, PR1118.1 is being developed to facilitate the transition of the NOx RECLAIM program to a command-and-control regulatory structure.

Rule Development

Staff initiated the rule development process in June 2017 with site visits to numerous facilities to better understand the need for flaring and the strides the affected industries have already made to reduce flaring. The initial rule language was distributed in March 2018 and the initial concept was to require flare replacement of older flares (20 years and older) unless they comply with the proposed beneficial use compliance targets (e.g., percent gas handling with beneficial use by a certain date). The beneficial use compliance option was modeled after the Bureau of Land Management (BLM) "Methane and Waste Prevention Rule"[1], which requires between 85 – 98 percent of gas that would have been directed to a flare to be used beneficially. Stakeholders argued that they could not commit to the beneficial use targets, wanted to keep existing flares needed for backup and was not cost-effective to replace, so suggested the rule target routine flaring.

In response to the comments, staff presented a different rule concept that would establish some type of a threshold, and if a flare surpasses the capacity threshold, action would be required. Staff evaluated different threshold options, such as throughput, NOx emission, and percent capacity of the flare (e.g. the amount of gas that was directed to the flare versus how much gas the flare is designed to combust) as possible surrogates to demonstrate routine flaring. Pursuant to working group input, staff subsequently proposed a capacity threshold concept and established different thresholds for each source category that would ultimately be applied to the type of gas being flared. The thresholds were determined by evaluating different percent capacity (e.g. usage compared to rated capacity), in each source category, and at what capacity the cost to replace the flare was feasible. Cost effectiveness is based on the capital costs, maintenance costs, and useful life and emission reduction achieved. The thresholds varied considerably due to:

- Cost of the flares
    - Flare costs were significantly higher for landfills and wastewater treatment plant than oil and gas production, and
- NOx emission reductions
    - The majority of PR1118.1 NOx emissions are from landfills.

Thus, the threshold to determine routine flaring and at what point a replacement is cost effective are different for each affected industry. The oil and gas threshold was calculated to be quite low (5%) due to lower replacement costs and the typical practice using of flares with a high rated capacity. Landfills also were determined to be able to replace flares with a relatively low threshold (20%) due to the larger amounts of potential emission reductions to be achieved. Wastewater flares have a high threshold (70%) due to both the high costs and the low potential for emission reductions. The stakeholders maintained concern with the timeline for the requirements, particularly when a majority of facilities require approval from municipal bodies to take any proposed actions. However, it was mutually agreed that the gas should be handled to benefit the operations and business. Staff worked to include longer timelines and more flexibility in the preliminary draft rule. Further details on the proposed rule language can be found in Chapter 3.

[1] https://www.regulations.gov/document?D=BLM-2016-0001-9126

CHALLENGES AND OPPORTUNITIES FOR INDUSTRIES SUBJECT TO PR1118.1

The main source categories subject to PR1118.1 are landfills, wastewater treatment plants, oil and gas production, organic liquid loading and tank degassing. Table I shows the number of flares at the different source categories, based on the flare gas combusted.

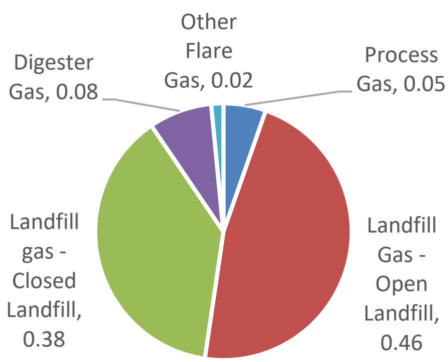
Table 1: Flares subject to PR1118.1

Flare Gas	Number of Flares
Digester gas	65
Landfill Gas	
Closed Landfills	103
Open Landfills	52
Oil and Gas Production	49
Other Flaring	19
TOTAL	288

Landfills

Landfills generate the largest throughput of flared gas and highest NOx emission of the PR1118.1 universe, and generate landfill gas for many decades, even when closed and inactive. The breakdown of waste in landfills produces gases and contaminants including methane, carbon dioxide (CO2), sulfides, siloxane and VOCs. These gases are produced by natural decomposition and predominantly produces methane, in addition to other contaminants. Federal, state and local regulations require the capture of landfill gas, which can generate several million cubic feet of landfill gas per landfill per day, which is primarily composed of methane and carbon dioxide, two potent greenhouse gases. These gases are pulled from beneath a landfill and are collected and combusted through a flare or used beneficially, such as power generation. The quality of landfill gas varies at each landfill, and can decompose at different rates, depending on pressure and temperature. Closed landfills experience decreasing quantity and quality (Btu per standard cubic foot (Btu/scf)) content over time and eventually, flaring is not feasible. In these situations, activated carbon may be used to replace flares. Potential beneficial uses of landfill gas includes the generation of electricity through micro-turbines, steam turbines, internal combustion engines (ICE), fuel cells, transportation fuel, or pipeline injection. The challenges associated with landfill gas includes the low Btu content and the expense to remove siloxane contamination, which can damage equipment or poison the catalyst used to control NOx emissions.

Figure 2 - NOx Emissions (tpd) - three-year average 2015 - 2017



Some landfills also have private or municipal electricity generating facilities that beneficially utilizes the landfill gas. These facilities may also have small flares used during the cleaning of regenerative catalysts. The catalysts are used to clean the landfill gas, and they typically have two catalysts that cycle between cleaning the landfill gas and regenerating the catalyst. The flares are used to combust the regeneration gas needed to purge the catalyst. Figure 2 provides a breakdown of NOx emissions (over 3 yr. period) for each affected source category highlighting the highest emissions from landfills compared to the other non-refinery industries flaring.

Wastewater treatment plants and digester gas

Wastewater treatment plants and gas produced through anaerobic decomposition in a digester generate the second highest volume of gas flared and the volume could increase due to organic waste diversion, as the State strives to meet the seventy-five (75) percent recycling, composting, or source reduction of waste goal by 2020 under Assembly Bill 341 (AB 341, Chesbro, Chapter 476, Statutes of 2011). These waste diversion efforts may eventually decrease landfill gas, but will lead to additional biogas at wastewater treatment plants and other digesters receiving the organic waste. An example is SB 1383 (Chapter 395, Statutes of 2016) Short-lived climate pollutants: methane emissions: dairy and livestock: organic waste: landfills, for organic waste methane emission reductions. These reductions would divert food wastes, currently disposed of at landfill, to anaerobic digesters or composting facilities.

Figure 3 – Flare Throughput (MMscf/year) - three-year average 2015 - 2017

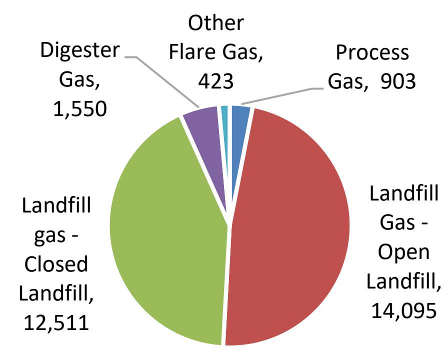
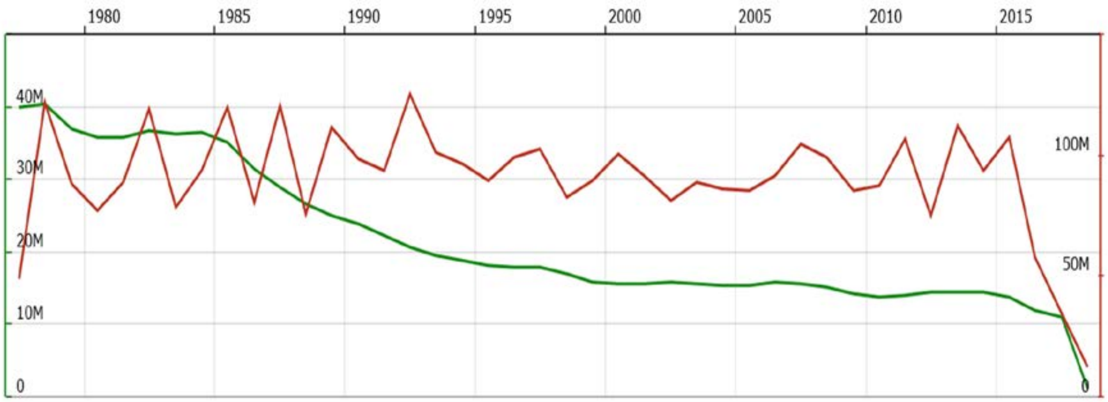


Figure 3 breaks down the affected industry per annual throughput demonstrating the same trend as NOx emissions. Anaerobic decomposition produces a flammable gas composed of methane, hydrogen sulfide, CO2 and siloxane. As with landfill gas, the siloxane contaminate is the most challenging and costly to remove. Digester gas is relatively low Btu, ranging from 500 to 600 Btu/scf. Wastewater treatment facilities have a high energy demand; therefore, many facilities utilize the digester gas for power generation using turbines, ICE, or boilers to make steam for heating digesters.

Oil and gas extraction

The third largest volume of gas is generated from oil and gas extraction. This source category has seen significant declines since 2015, reflecting the decrease in the cost of a barrel of oil (see Figure 4). The oil industry is cyclical and world oil prices are currently increasing. An increase in demand will lead to an increase in drilling and produced gas, ultimately leading to increased flaring and NOx emissions.

Figure 4: Los Angeles County Oil and Gas Production by Year[2]



Oil extraction produces oil, produced gas, water, and other contaminants. The produced gas is naturally occurring and of relatively high Btu, around 900 Btu/scf. The produced gas requires gas treatment to remove sulfides, water, CO2 and other contaminants. Some facilities beneficially use the produced gas to generate energy or inject the gas into a pipeline. Pipeline injection is cost effective for companies that have connections nearby, or can inter-connect to another company's pipeline or through a municipal connection. Produced gas in not considered Renewable Natural Gas (RNG) so incentives are not available to assist in conversion or capture; however, the Southern California Gas Company has a tariff program to assist companies generating produced gas to install skid-mounted units for gas clean-up and develop connection to existing natural gas pipelines. Similar to landfills, there are opportunities to use the gas to generate energy through fuel cells and micro-turbines as well as to fuel transportation. There are some companies that operate portable equipment designed to clean up the gas on-site and sell to third party customers.

Other Flaring

The smallest category of flaring is a default category referred to as "Other Flaring". Other flaring includes, but is not limited to, facilities handing organic liquids, such as bulk terminal loading and unloading, or tank farm degassing. The volume of gas flared and the NOx emissions are low for this source category. Some of these facilities will be subject to proposed Rule 1109.1 if related to refinery activity and not PR1118.1. The majority of flares in this source category are air pollution control devices required to destruct the fugitive emissions from tanks, railcars, and bulk terminals for loading and off-loading organic liquids. Some of the vapors sent to the flare have a low heating value; therefore, may require the use of assist gas to facilitate combustion. Challenges with this source category includes the less opportunities for beneficial use and no market incentives.

MARKET BASED INCENTIVES

Market based incentives are available to encourage the beneficial use of biogas, which includes digester gas from wastewater treatment plants and landfill gas. Wastewater treatment plants and landfills have a constant supply of gas, but produce low-quality gas, often about half the heating value of pipeline quality natural gas, and with significant contamination. The most problematic contaminants are siloxanes, which are used in a variety of personal care products, such as deodorants, shampoos, skin creams, and hair styling products. Siloxanes get washed down the

[2] http://www.drillingedge.com/california/los-angeles-county

drain to end up at wastewater treatment plants and are usually found in product containers that get sent to landfills. Siloxanes are costly to remove from the gas stream and are harmful to combustion equipment and post combustion control equipment used to control NOx emissions, such as catalyst. Federal and State market based programs provide revenue sources from selling biogas as a transportation fuel. These programs include the Low Carbon Fuel Standard (LCFS) in California and the federal Renewable Fuel Standard (RFS) Program. Under these programs, credits are generated for the sale of renewable transportation fuels and, depending on market prices, have provided funding for equipment and lower fuel costs. In addition, future legislation may change the minimum higher heating value and/or maximum siloxane requirements making it easier for pipeline injection and for facilities to use biogas for transportation fuels.

BENEFICIAL USE OPPORTUNITIES

PR1118.1 seeks to encourage alternatives to flaring, while at the same time, allowing an existing flare to be maintained if the flare throughput is reduced below capacity thresholds established in the rule. Flare throughput reduction can be achieved by harnessing and conditioning the waste gas for a variety of uses. Alternatives to flaring include utilizing fuel cells to create electricity and hydrogen; using micro-turbines and boilers to create power for the facility; using boilers for heat in anaerobic digesters; selling the gas to be used in transportation; converting the gas to liquids for transportation; and/ or natural gas pipeline injection. Sites such as oil and gas facilities that do not produce enough gas or are not located near appropriate pipelines for injection could route the gas towards power generation, such as micro-turbines, and/or capture for use in transportation. The flare gas has value and most facilities strive to maximize the use of the gas, the following sections highlight some of the beneficial use options.

Fuel Cells

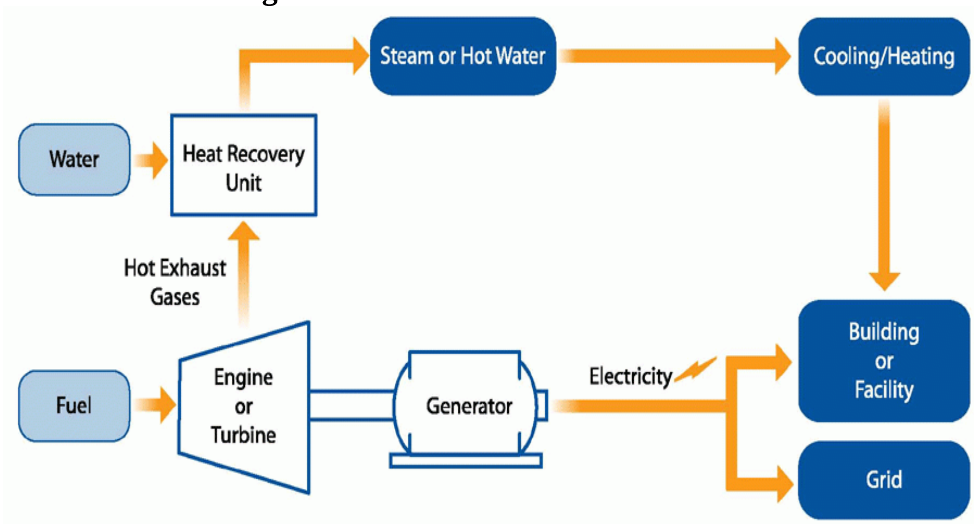
Fuel cells[3] use a chemical reaction, rather than combustion, to generate electricity. They are very efficient and the fuel cells do not produce NOx emissions, though a small amount of NOx can be produced from associated fuel burners. Fuel cells can utilize biogas or produced gas as the fuel, but the contaminants, especially the siloxanes in biogas, must be removed as they will poison the catalyst. Fuel cells represent a great opportunity for beneficial use and NOx emissions but the technology, and the associated gas clean-up, is costly.

[3] Source: https://www.epa.gov/sites/production/files/2016-05/documents/03_devlinkeller.pdf

Combined Heat and Power

Combined heat and power (CHP) is an efficient technology that generates electricity and captures the heat that would otherwise be wasted to provide useful thermal energy, such as steam or hot water (see Figure 5). Nearly two-thirds of the energy used by conventional electricity generation is wasted in the form of heat discharged to the environment.

Figure 5: Combined Heat and Power[4]



Boilers

New power producing technologies, such as the organic Rankine cycle (ORC), has shown the ability to consume the gas that would otherwise be flared and provide a co-benefit by producing power. This technology utilizes heat recovery from gas combustion to operate the ORC loop to make power. For an oil and gas facility, for example, this is accomplished by installing a skid-mounted boiler on site to combust the gas and provide hot water for the ORC. The amount of power generated is not a high enough quantity to sell to the grid, but will be able to meet some of the facility's power needs and/or heat needs. These boilers emit either 9 ppm (at 3 percent oxygen) or 5 ppm (at 3 percent oxygen with selective catalytic reduction), depending on the size, which will result in 40 to 67 percent less NOx emissions than a low-NOx flare. For a wastewater treatment facility that currently utilizes boilers for providing heat to the anaerobic digesters, the same boiler can be utilized to process any excess gas that would otherwise be flared. In addition, a landfill can potentially utilize this technology to generate electricity from landfill gas that would otherwise be flared.

[4] "Combined Heat and Power (CHP) Partnership", United States Environmental Protection Agency, available at https://www.epa.gov/chp/what-chp

Micro-turbines and Turbines

Micro-turbines and turbines can be powered by gas that would otherwise be flared to generate power. Most systems require gas cleanup but there are with regenerative thermal oxidation that can be used to produce power without the necessity of biogas cleanup. These technologies can be used at each of the source categories and are especially useful at landfills with low methane gas.

Calabasas Landfill Micro Turbines

Gas Recovery, Compression, and Transportation

Another alternative to flaring is to compress the gas that would otherwise be flared and either use it on-site or transport the gas for sale or use at another location. The gas can be cleaned up prior to compression and used to create a transportation fueling station or the compressed gas can be transported and injected into the pipeline. This type of system is useful when a natural gas pipeline is not readily accessible.

Gas-to-liquids

Flare gas can also be converted to liquid fuels and sold as transportation fuel or energy generation. This is a way to reduce or eliminate flaring while making a profit of the gas that would otherwise be flared.

PUBLIC PROCESS

The development of PR1118.1 – Control of Emissions from Non-Refinery Flares was conducted through a public process. SCAQMD held eight working group meetings at the Headquarters in Diamond Bar on August 25, 2017, October 24, 2017, January 10, 2018, March 8, 2018, April 4, 2018, June 12, 2018, July 25, 2018 and September 11, 2018. The Working Group is composed of representatives from potentially affected businesses, environmental groups, public agencies, and consultants with expertise in this field. 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 is scheduled for October 17, 2018.

Chapter 2

BARCT ASSESSMENT

Staff conducted an assessment of BARCT for non-refinery flares. 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 emission limits take into consideration environmental impacts, energy impacts, and economic impacts. In addition to NOx reductions sought in the proposed 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.

The RECLAIM Working Group raised a concern as to 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 §40440(b)(1). The use of the word "retrofit" is believed to preclude the SCAQMD from requiring an emissions limit that can only be cost-effectively met by replacing the basic equipment with new equipment. Staff disagrees with this position and views the use of the term "retrofit" does not preclude replacement technology. A review of on-line dictionaries supports this view.

The on-line Merriam-Webster Dictionary defines "retrofit" in a manner that does not preclude replacing equipment. That dictionary establishes the following definition for retrofit: "1) to furnish (something, such as a computer, airplane, or building) with new or modified parts or equipment not available or considered necessary at the time of manufacture, 2) to install (new or modified parts or equipment) in something previously manufactured or constructed, 3) to adapt to a new purpose or need: modify."[1]. This definition does not preclude the use of replacement parts as a retrofit.

The on-line Dictionary.com is more explicit in allowing replacement parts. It includes the following definitions for retrofit as a verb: "1) To modify equipment (in airplanes, automobiles, a factory, etc.) that is already in service using parts developed or made available after the time of original manufacture, 2) To install, fit, or adapt (a device or system) or use with something older; to retrofit solar heating to a poorly insulated house, 3) (of new or modified parts, equipment, etc.) to fit into or onto existing equipment, 4) To replace existing parts, equipment, etc., with updated parts or systems."[2]. This definition clearly includes replacement of existing equipment within the concept of "retrofit." Accordingly, the use of the term "retrofit" can include the concept of replacing existing equipment.

Moreover, the statutory definition of "best available retrofit control technology" does not preclude replacing existing equipment with new cleaner equipment. Section 40406 provides: "As used in

[1] https://www.merriam-webster.com/dictionary/retrofit
[2] http://www.dictionary.com/browse/retrofit

this chapter, 'best available retrofit control technology' means an emission limitation that is based on the maximum degree of emission reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source." Thus, it is clear that BARCT is an emissions *limitation*, and is not limited to a particular technology, whether add-on or replacement. Thus, retrofit technology does not preclude replacement technologies.

Staff also notes that the argument precluding replacement equipment would have an effect contrary to the purposes of BARCT. For example, staff has proposed a BARCT that may be more cost-effectively be met for diesel fueled engines by replacing the engine with a new Tier IV diesel engine rather than installing additional add-on controls on the current engine which may be many decades old. If the SCAQMD were precluded from setting BARCT for these sources, the oldest and dirtiest equipment could continue operating for possibly many more years, even though it would be cost-effective and otherwise reasonable to replace those engines. There is no policy reason for insisting that replacement equipment cannot be an element of BARCT as long as it meets the requirements of the statute including cost-effectiveness.

The case law supports an expansive reading of BARCT. In explaining the meaning of BARCT, the California Supreme Court held that BARCT is a "technology-forcing standard designed to compel the development of new technologies to meet public health goals." *American Coatings Association v. South Coast Air Quality Mgt. Dist.,* 54 Cal. 4th 446, 465 (2012). In fact, the BARCT requirement was placed in state law for the SCAQMD in order to "encourage more aggressive improvements in air quality" and was designed to augment rather than restrain the SCAQMD's regulatory power. *American Coatings, supra*, 54 Cal. 4th 446, 466. Accordingly, BARCT may actually be more stringent than BACT, because BACT must be implemented today by a source receiving a permit today, whereas BARCT may, if so specified by the SCAQMD, be implemented a number of years in the future after technology has been further developed. *American Coatings, supra,* 54 Cal. 4th 446, 467.

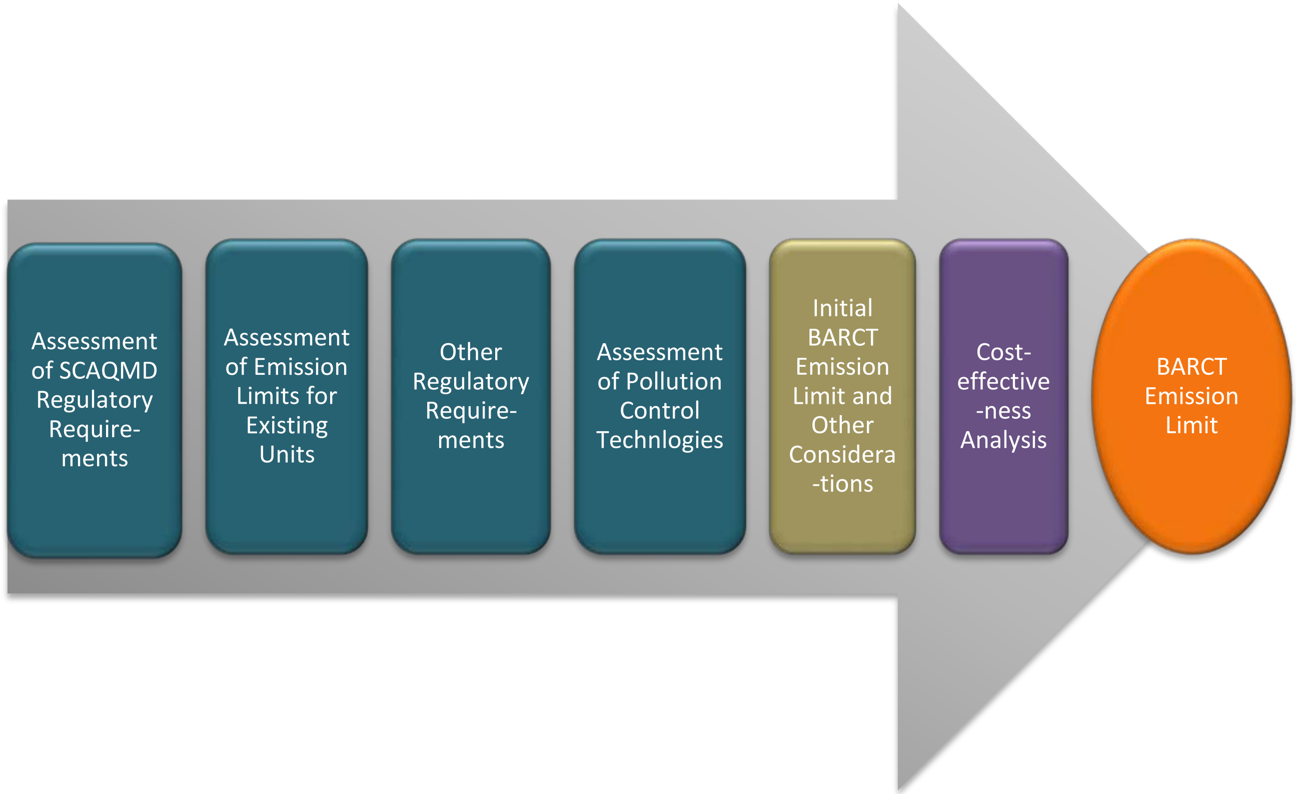
The Supreme Court further held that when challenging the SCAQMD's determination of the scope of a "class or category of source" to which a BARCT standard applies, the challenger must show that the SCAQMD's determination is "arbitrary, capricious, or irrational." *American Coatings, supra,* 54 Cal. 4th 446, 474. Therefore, the SCAQMD may consider a variety of factors in determining which sources must meet any particular BARCT emissions level. If, for example, some sources could not cost-effectively reduce their emissions further because their emissions are already low, these sources can be excluded from the category of sources that must meet a particular BACT. Therefore, the SCAQMD may establish a BARCT emissions level that can cost-effectively be met by replacing existing equipment rather than installing add-on controls, and the SCAQMD's definition of the category of sources which must meet a particular BARCT is within the SCAQMD's discretion as long as it is not arbitrary or irrational.

The steps for a BARCT analysis (see Figure 6) consist of:

- Assessment of SCAQMD Regulatory Requirements
- Assessment of Emission 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

Figure 6: BARCT Assessment



Assessment of SCAQMD Regulatory Requirements

As part of the BARCT assessment, staff reviewed existing SCAQMD regulatory requirements that affect NOx emissions at non-refinery flare facilities. SCAQMD Rule 1147 – NOx Reductions from Miscellaneous Sources (Rule 1147) applies to gaseous and liquid fuel fired combustion equipment and includes incinerators, afterburners, thermal oxidizers, and other combustion equipment, including flares. The NOx emission limits in Rule 1147 is the following:

Table 2: Rule 1147 NOx Emission Limits

Equipment Category	NOx Emission Limit ppm @ 3% O2 dry, or Pound/MMBtu		
	Process Temperature		
	≤ 800°F	> 800°F and >1200°F	≥1200°F
Other Unit	30 ppm or 0.036 lb/MMBtu	30 ppm or 0.036 lb/MMBtu	60 ppm or 0.008 lb/MMBtu

Rule 1147 indicates the emission limits only apply to burners in units fueled by 100 percent natural gas. The flares subject to PR1118.1 are typically not 100 percent natural gas, but rather biogas or produced gas, although the facilities may use natural gas as assist gas (additional gas needed to allow for combustion). Affected facilities primarily use their flares to destruct combustible vapors or gases in the waste stream; therefore, the Rule 1147 emission limits do not apply.

Other Regulatory Requirements

As part of the BARCT assessment, staff examined NOx limits (see Table 3) for non-refinery flares promulgated by other regulatory agencies. Staff reviewed Santa Barbara County Air Pollution Control District (SBCAPCD) Rule 359 – Flares and Thermal Oxidizers and San Joaquin Valley Air Pollution Control District (SJVAPCD) Rule 4311 – Flares. The SJVAPCD rule is applicable to both refinery and non-refinery flares. SBCAPCD is applicable to oil and gas production, non-emergency refining and transportation industries, excludes emergency flares, and includes thermal oxidizers.

In contrast, PR1118.1 is only applicable to *non-refinery* flares. SCAQMD Rule 1118 applies to flares at refineries, hydrogen plants, and sulfur recovery units flares used for emergencies and uncontrolled release of gases and vapors from process upsets or planned turn-around and start-ups.

Table 3 – Other Jurisdiction Flare Emission Limits

Heat Release Rate (MMBtu/hr)	SBCAPCD Effective June 1994		SJVAPCD Effective June 2009	
	NOx (lb/MMBtu)	VOC (lb/MMBtu)	NOx (lb/MMBtu)	VOC (lb/MMBtu)
<10	0.0952	0.0051	0.0952	0.0051
10-100	0.1330	0.0027	0.1330	0.0027
>100	0.5240	0.0013	0.5240	0.0013

Assessment of Pollution Control Technologies

As part of the BARCT assessment staff conducted a technology assessment to evaluate NOx pollution control technologies for non-refinery flares. Staff reviewed scientific literature, vendor information, and strategies utilized in practice. The technologies are presented below and the applicability for use with various types of flare gas from industries generating combustible gases or vapors.

Flare Technology

Open Flare

Open Flares

A flare is a control device that is utilized to control a VOC stream by piping them to a burner that combusts the VOC containing gases. Early flares were designed as elevated, candlestick-type flares that have an open flame with a specially designed burner tip, and auxiliary fuel to achieve nearly 98 percent VOC destruction. The destruction efficiency is driven by flame temperature, residence time in the combustion zone, and turbulent mixing of the components. Complete combustion results in the conversion of all the VOCs to carbon dioxide and water but also results in the emission of NOx, sulfur oxides, and carbon monoxide. Open flares have a high rated capacity and long service life. They are low-cost, simple to use, and reliable but they are also noisy, emit smoke, heat radiation and light. There are few open flares remaining in

Table 4: Non-refinery open flares in the SCAQMD

Number of Open Flares	Estimated NOx Emissions (tpd)	Annual Throughput (MMscf)
11	0.02	418

the SCAQMD. Table 4 shows the number of open flares and estimated emissions. Open flares cannot be source tested due to the open flame and absence of a stack. Unless there was a specified NOx permit limit, a default emission factor was used to estimate the emissions. Both the USEPA's AP-42[3] Compilation of Air Pollutant Emission Factors and Rule 1118 use 0.068 pounds/MMBtu as the default emission factor for an open flare.

To mitigate the noise and the visible pollution of the open flame, most non-refinery flares in operation today are enclosed ground flares. In an enclosed flare, the burners are shrouded in a stack that is internally insulated. This stack provides wind protection and reduces noise, luminosity, and heat radiation. Enclosed flares generally have less capacity than open flares, but they are reliable and straightforward to operate. The majority of non-refinery flares subject to PR1118.1 are enclosed ground flares, while their NOx emissions can be higher, most meet the 1988 BACT NOx limit of 0.06 pounds/MMBtu.

Enclosed Ground Flare

The new generation of low-NOx flare utilizes a pre-mixed gas stream with air-assist combustion and is designed with ultra-low NOx burners resulting in decreased NOx and VOC emissions. These low-NOx flares can achieve NOx emissions of less than 0.025 pounds per Million Btu and they have been available for almost a decade (see Table 5). There are two major manufactures of these low-NOx flares. John Zink Hamworthy Combustion (John Zink) produces Zink Ultra Low Emissions (ZULE®) flare, which electronically control air-to-fuel ratio within the enclosed flare to provide more efficient destruction and less NOx emissions without an increase of carbon monoxide. The other low-NOx flare is the Certified Ultra-Low Emissions Burner (CEB®) produced by the Aereon Corporation. It incorporates the premixing of gases and patented wire mesh technology that allows for more efficient combustion and retention of heat, with a decrease of NOx emissions. Due to the added complexity in the design of the low-NOx flares, some stakeholders have experienced reliability issues. This is especially true of the early generation flares installed that do not combust a constant gas flow.

Low-NOx Flare

[3] USEPA AP-42 - Compilation of Air Pollutant Emission Factors, available at https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emissions-factors

For the Other flaring category, John Zink produces a NOxSTAR Vapor Combustion System capable of reducing emissions for marine terminal loading and unloading by meeting a stringent 99.99 percent destruction efficiency and a 0.036 pound/MMBtu NOx emission. CEB® flares have also been permitted and installed for use for organic liquid handling.

Table 5 – NOx Emissions for Currently Available Control Technology

Manufacturer	Flare	Manufacturer Guaranteed NOx Emissions (lb/MMBtu)
Aereon	CEB®	0.018
John Zink	ZULE®	<0.02
John Zink	NOxSTAR	<0.02

Cost-effectiveness Analysis

Cost-effectiveness was examined for flares in each source category. 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 feasible cost effectiveness, then the control method is considered to be cost effective. The 2016 AQMP establishes a cost-effectiveness threshold of $50,000 per ton of NOx reduced.

The discounted cash flow method (DCF) was 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 percent, 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.

To estimate the cost of a low-NOx flare, staff consulted a variety of vendors and input from stakeholders. Flare installation costs are site specific application and staff received a wide variety of estimates, which varied significantly by source category. To account for the variety of data and establish a consistent threshold per source category, staff averaged the capitol cost (equipment plus installation) and operation and maintenance cost per industry, to estimate the cost of flare replacement, as seen in Table 6.

Table 6: Cost estimates for low-NOx flares

Flare Gas	Size (MMBtu/hr)	Flare Type	Capital Cost	Annual Cost
Digester Gas	27 x 3 Flares	CEB® 800	$654,767	$100,000
	42.6 x 3 Flares	ZULE®	$603,933	$100,000
	39.33	ZULE®	$1,520,000	$100,000
	12	CEB® 350	$298,800	$28,290
	40	CEB® 1200	$448,200	$42,435
Average:			**$769,375**	**$74,145**

Flare Gas	Size (MMBtu/hr)	Flare Type	Capital Cost	Annual Cost
Landfill Gas	75.6	ZULE®	$758,339	$121,867
	167	ZULE®	$1,386,400	$219,850
	120	ZULE®	$2,573,208	$305,515
	12	CEB® 350	$622,910	$35,362
Average:			**$1,335,214**	**$170,649**
Produced Gas	40	CEB® 1200	$410,000	$30,000
	17	CEB® 500	$420,000	$19,000
			$1,000,000	$50,000
	27	CEB® 800-CA	$350,000	$30,000
Average:			**$545,000**	**$32,250**

Averaging these costs provide a fair and balanced value to account for the wide range of data provided. PR1118.1 seeks to reduce routine flaring and staff used the percent of the total flare capacity used by each flare as a surrogate to determine what would be considered routine use. For this analysis, staff evaluated the cost effectiveness at different thresholds to determine the most appropriate threshold. When determining the number of flare that would be impacted, staff did not include flares already meeting proposed limits or eligible for the proposed exemptions. The emission reductions were calculated using a three-year average throughput (2015 – 2017) and the difference between the flare's current NOx permit concentration limit and the proposed emission limit.

Table 7: Capacity Threshold Ranges with Cost Effectiveness

	Capacity Threshold	# flares	Emission Reductions (tpd)	Estimated Cost Effectiveness
Oil and Gas	3%	7	0.014	$57,061.57
	5%	**6**	**0.014**	**$50,337.95**
	10%	5	0.011	$54,732.53
	20%	3	0.008	$43,647.46
Landfills	10%	21	0.21	$43,702.00
	20%	**21**	**0.21**	**$43,702.00**
	30%	17	0.17	$43,062.41
	40%	16	0.17	$41,512.59
Wastewater and Digester Gas	30%	9	0.02	$95,063.38
	40 or 50%	3	0.009	$70,417.32
	60%	2	0.008	$52,812.99
	70%	**1**	**0.007**	**$30,178.85**

Table 7 provides the analysis of each source category, at different percent capacities, with the corresponding emission reductions and the estimated cost per ton of NOx reduced. To achieve the rule objectives, staff chose the threshold based on maximum reduced emissions at a feasible cost effectiveness. PR1118.1 does not contain a capacity threshold for other flaring, such as organic liquid handling (bulk loading and unloading marine terminals, railcars, or truck racks, tank degassing, etc.), as there are not as many feasible opportunities for beneficial use. The cost effectiveness calculation for other flaring used the average cost for the produced gas flares, as that source category is the most similar. Staff estimated the NOx reduction for replacing a flare that emits 60 ppm, which is consistent with the current NOx limit in Rule 1147, to a flare at 30 ppm, based on recently permitted flares. If the flare is used at 20 percent capacity, the cost effectiveness is $32,250 per ton of NOx reduced. The metric used to regulate the other flaring is also different than the other source categories. Most other flaring is conducted to destruct VOCs and the Btu of the vapors can vary significantly. PR1118.1 will set NOx and CO based on parts per million volume (ppmv) at 3 percent Oxygen (O_2) and 99% destruction efficiency of VOC, which has been achieved in similar applications. Table 8 lists the BARCT emission limit recommendations.

BARCT Emission Limit Recommendation

Table 8: Recommended BARCT Emission Limits

Flare Gas	pounds/MMBtu		
	NOx	**CO**	**VOC**
Digester gas[1]	0.025	0.06	0.038
Landfill gas[1]	0.025	0.06	0.038
Produced gas	0.018	0.06	0.008
	Parts per million @ 3% O_2		**Destruction Efficiency**
Other flare gas	30	10	99%

1. Compliance with emission limits shall be demonstrated when combusting 100% biogas (e.g. with no regeneration gas).

The emission limits for flaring regeneration gas is slightly different than the other source categories. Regeneration gas is produced when impurities are being removed from landfill or digester gas. The gas clean up system usually employs two catalyst beds to clean the gas, one catalyst bed is actively cleaning the biogas while the other catalyst bed is being regenerated. The gas used to clean/regenerate the catalyst cannot be used beneficially and is directed to a small flare. The NOx emissions of that flare will vary during this process, the NOx will increase during the initial regeneration process at a time when the gas has a high concentration of impurities. As the impurities are removed from the catalyst, the NOx emissions drop. To address this, the emission limits will only apply (e.g. be determined during the source test) when the flare is combusting 100% biogas.

Chapter 3

PROPOSED RULE 1118.1

Purpose (Subdivision (a))

Purpose (subdivision (a)) of this rule is to reduce NOx and VOC emissions from flaring produced gas, digester gas, landfill gas, and other combustible gases or vapors and encourage alternatives to flaring.

Applicability (Subdivision (b))

PR1118.1 applies to owners and operators of flares that require a SCAQMD permit at facilities, including, but not limited to, oil and gas production, wastewater treatment facilities, landfills, organic liquid loading stations, and tank farms. The proposed rule does not apply to flares subject to SCAQMD Rule 1118, flares that burn 100% natural gas through the burner that are subject to Rule 1147, or flares subject to PR1109.1.

Definitions (Subdivision (c))

PR1118.1 adds the following definitions to clarify and explain key concepts. Please refer to PR1118.1 for each definition.

Proposed Definitions:

- Annual Throughput
- Assist Gas
- Biogas
- Capacity
- Capacity Threshold
- Digester Gas
- Facility
- Flare
- Flare Station
- Heat Input
- Landfill Gas
- Open Flare
- Organic Liquid
- Other Flare Gas
- Oxides of Nitrogen (NOx)
- Produced gas
- Protocol
- Regenerative Adsorption System
- Regeneration Gas
- Relocate
- Statement of Intent
- Various Locations Flare
- Volatile Organic Compound (VOC)

Flare definition (paragraph (c)(10))

PR1118.1 defines the term flare as a combustion device that oxidizes combustible gases or vapors, where the combustible gases or vapors being destroyed are routed directly into the burner without energy recovery. Prior to the development of the flare definition in PR1118.1, there was no established definition of a flare. During the rule process, it became clear that there was no consensus between the following control devices: afterburner, flare, incinerator, or thermal oxidizer. The primary challenge was flares (under this proposed rule definition) might have been permitted as an afterburner or thermal oxidizer in the past because equipment descriptions on permits varied depending on use and the application submitted by the facility. The proposed definition also includes a clarification that flares do not recover energy. This is to distinguish a flare from a burner installed in a device that generates electricity or uses heat to generate steam, etc. A notice was sent to all potentially affected permit holders to make them aware of the rule making. In addition, permitting staff has committed to address the permitting discrepancies with the facilities. For clarification purposes, the following is a brief summary of typical attributes of the different control devices:

Flares

- Primary application: to burn gases capable of sustaining combustion (>300 Btu/scf)
- Waste stream routed directly to the burner
- Open or enclosed
- Enclosed flares feature vertical stack open to the atmosphere
- Low-NOx flares include:
  - Fuel pre-mixing
  - Combustion blowers
  - Temperature controls provided by actuated dampers

Thermal Oxidizers

- Primary application: to burn gases that cannot sustain combustion (<300 Btu/scf)
- Typical thermal oxidizer configurations include:
  - Horizontal combustion chamber followed by vertical stack
  - Combustion chamber not open to the atmosphere, need to maintain temperature
  - Combustion blowers
  - Temperature controls
  - Heat recovery

Afterburners

- Primary application: to burn gases that cannot sustain combustion (<300 Btu/scf)
- Fuel gas routed to burner, waste stream fed into chamber above the flame
- Typical afterburners include:
  - Enclosed vertical stack open to the atmosphere
  - Ground level

Incinerators

- Primary application: to combust organic substances contained in waste materials
- Waste material converted into ash, flue gas, and heat

Requirements (Subdivision (d))
PR1118.1 requires owners or operators that install a new flare or replaces or relocates an existing flare to meet the emission limits listed in Table 1 of the proposed rule (see Table 9). The emission limits are based on staff's BARCT assessment, which is consistent with the current BACT limits.

Table 9: PR1118.1's Table 1 Emission Limits

Flare Gas	pounds/MMBtu		
	NOx	CO	VOC
Digester gas[1]	0.025	0.06	0.038
Landfill gas[1]	0.025	0.06	0.038
Produced gas	0.018	0.06	0.008
	Parts per million @ 3% O_2		**Destruction Efficiency**
Other flare gas	30	10	99%

1. Compliance with emission limits shall be demonstrated when combusting 100% biogas (e.g. with no regeneration gas).

For existing flares that already meet the Table 1 emission limits, the owner or operator must demonstrate compliance with the emission limits. This can be achieved through performing a source test or submitting a prior source test and source test protocol to the Executive Officer for approval. For existing flares that do not meet the Table 1 emission limits, PR1118.1 establishes capacity thresholds (see Table 10) to identify routine flaring. Facilities must begin monitoring the throughput to their flare at least once a month upon rule adoption in the next calendar year. At the end of each calendar year, the facility must determine if their percent capacity surpasses the PR1118.1 Table 2 capacity thresholds. Upon two consecutive years a flare exceeds the capacity threshold, the facility must decide to reduce their throughput to be below the capacity thresholds, e.g. through a beneficial use project, or replace the flare to meet PR1118.1 Table 1 emission limits.

Table 10: PR1118.1's Table 2- Capacity Thresholds by Gas Flared

Flare Gas	Threshold
Any gas combusted in an open flare	5%
Digester gas	70%
Landfill gas	20%
Produced gas	5%

Subdivision (d) also contains the compliance schedule for flares that surpass the capacity threshold. The schedule allows additional time for flare throughput reduction as one objective of the rule is to encourage alternatives to flaring. Each year, the facility has to notify the SCAQMD within 30 days if the annual percent capacity of the flare surpass the capacity threshold. The notification should be submitted via e-mail and the SCAQMD will set up a specific email address that will alert staff in Planning, Engineering and Enforcement. It will be a violation if the facility surpasses the capacity threshold and does not submit the notification. After two consecutive years that a flare surpass the capacity threshold, the facility has 60 days to submit a Statement of Intent to inform the SCAQMD if the facility will pursue flare throughput reduction or flare replacement. A template of the Statement of Intent will be provided and made available on the SCAQMD website.

If pursuing flare replacement, the facility must submit a flare permit application within 6 months of the flare surpassing the capacity threshold for two consecutive years, following standard SCAQMD permit application submittal requirements (e.g. fees). The facility has 18 months to install the flare after the SCAQMD permit was issued, with potential 12 month extensions upon Executive Officer approval.

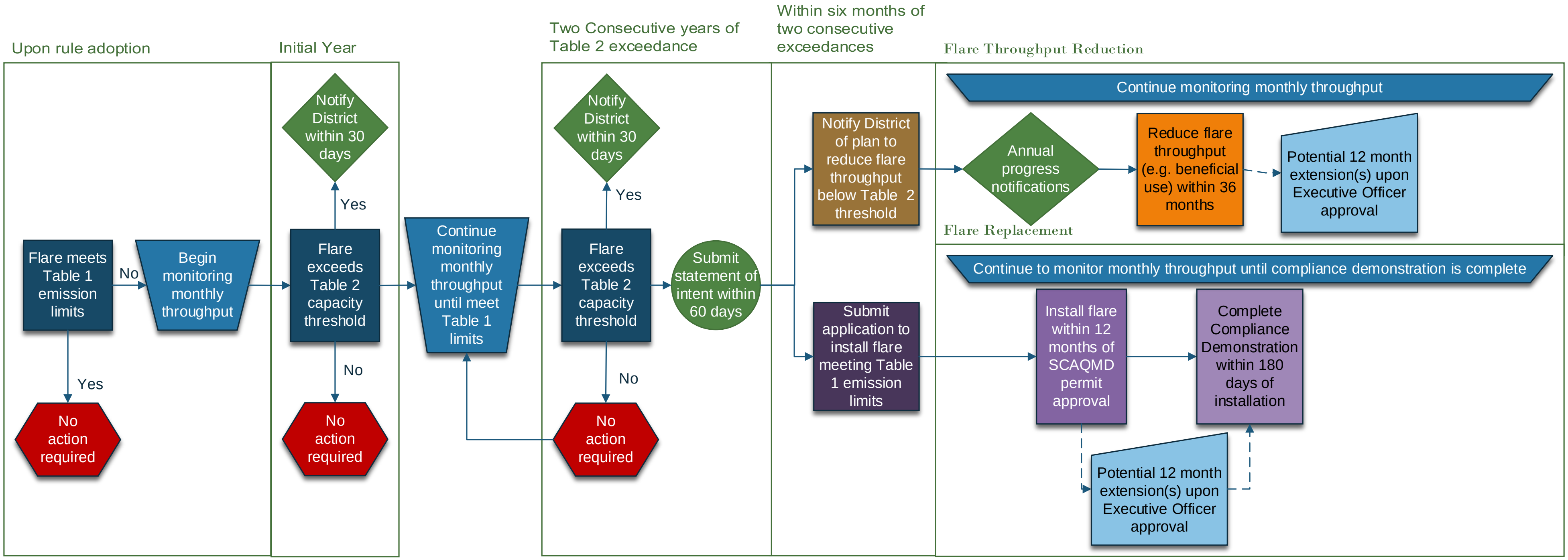
If pursuing flare throughput reduction, the facility must submit the following within 6 months of the flare surpassing the capacity threshold for two consecutive years via another form the SCAQMD will generate and make available on the website:

- Alternative method(s) to reduce flaring below threshold and timetable to implement. This should include a detailed description of the beneficial use project including flare gas recovery, such as energy production, transportation fuels or production of Renewable Natural Gas.
- Annually the facility shall report to the SCAQMD on the progress achieving the flare reduction.

The facility has 36 months from the second consecutive year the flare surpassed the capacity threshold to reduce flare throughput below the threshold, with potential 12 month extensions upon Executive Officer approval.

The following flowcharts demonstrate the rule requirements:

Figure 7: PR1118.1 Requirements



Extension Provision (Subdivision (e))

An owner or operator may submit a request to the Executive Officer at least 60 days prior to the scheduled deadline to complete either the flare throughput reduction or flare replacement. The Executive Office will review the requests and approve or reject based on information included in the request. The owner or operator can request more than one 12-month extension.

Source tests (Subdivision (f))

PR1118.1 contains source test requirements to ensure flares meet emission or exemption limits and must be conducted using SCAQMD test protocols and standardized methodology. Source tests are only required in PR1118.1 for flares complying with the emission limits in Table 1 or are demonstrating they meet the 30 pound NOx emissions per month exemption in subparagraph (h)(2)(A). Source tests are required to be conducted at least once every five years. Source testing protocols must be approved by the SCAQMD at least 90 days prior to the source test. Approved source test protocols do not have to be resubmitted once approved. Source tests conducted prior to rule adoption may be allowed to satisfy the source test requirements upon SCAQMD approval.

The following test methods must be used to determine the NOx, VOC, and CO concentrations:

- SCAQMD Method 100.1 – Instrumental Analyzer Procedures for Continuous Gaseous Emission Sampling for NOx and CO concentrations, and
- SCAQMD Method 25.1 or 25.3 – Determination of VOC Emissions from Stationary Sources for VOC concentration.

The gas composition shall be determined according to the following methods:

- ASTM Method D-3588 – Standard Practice for Calculating Heat Value, Compressibility Factor, and Relative Density of Gaseous Fuels;
- ASTM D1945 – Standard Test Method for Analysis of Natural Gas by Gas Chromatography; or
- ASTM D7833 – Standard Test Method for Determination of Hydrocarbons and Non-Hydrocarbon Gases in Gaseous Mixtures by Gas Chromatography.

Monitoring, Recordkeeping, and Reporting Requirements (Subdivision (g))

The Monitoring, Recordkeeping and Reporting Requirements (MRR) of subdivision (g) is divided into two sections, the first section addresses how facilities must comply with the capacity threshold provision and the second section contains general MRR requirements. For the percent capacity determination, facilities must install non-resettable totalizing fuel meters and monitor the throughput to the flare or flare stations monthly. Monthly throughput records must be maintained and can be recorded in either units of volume (MMscf/hr.) or heat input (MMBtu/hr). Either metric, not both, can be used for monthly throughput determinations, but the same metric must be used throughout the calendar year. The following shows the percent capacity calculations by both volume and heat input:

Figure 8: Percent Capacity Calculations

By volume:

$$Percent\ Capacity_{MMscf} = \frac{Total\ Annual\ Throughput\ \left(\frac{MMscf}{year}\right) \Big/ 8760\ \frac{hour}{year}}{\text{Capacity (MMscf/hour)}}\ x\ 100\%$$

By heat input:

$$Percent\ Capacity_{MMBtu} = \frac{Total\ Annual\ Heat\ Input\ \left(\frac{MMBtu}{year}\right) \Big/ 8760\ \frac{hour}{year}}{\text{Capacity (MMBtu/hour)}}\ x\ 100\%$$

Exemptions (Subdivision (h))

PR1118.1 exempts flares subject to other SCAQMD rules including:

- Rule 1118 – Control of Emissions from Refinery Flares, which applies to refineries, hydrogen plants, and sulfur recovery plants,
- Rule 1147 where 100% natural gas is routed directly to the burner, and
- Proposed Rule 1109.1 – Refinery Equipment.

PR1118.1 also has low-use exemptions, including flares:

- At landfills that have ceased accepting waste that generate less than 2,000 MMscf/year. These landfills have declining gas quality and quantity, so installing a new flare is not reasonable.
- That emit less than 30 pounds of NOx each calendar month, or
- That are used less than 200 hours a calendar year.

PR1118.1 also includes the following exemptions:

- Various locations flares as these flares can serve as temporary solution to new operation not producing the quantity or quality to meet the proposed emission limits.
- Open flares are exempt from the source test requirements since they cannot be source tested.
- The throughput, heat input, NOx emission, and time accrued during source testing does not have to be included in the percent capacity, the 30 pounds/month, or 200 hour calculations.

POTENTIALLY IMPACTED FACILITIES

There are 146 facilities and 288 flares that are potentially applicable to Proposed Rule 1118.1. Of the 146 facilities, 19 are currently in the NOx RECLAIM program. Staff identified 19 facilities and 28 flares that will potentially be required to take action as their current flare activity surpasses the applicable capacity threshold. Of those 19 facilities, one is currently in the NOx RECLAIM program. The following is the list of potentially impacted flares:

Table 11: Existing Flares that Surpass the Proposed Capacity Threshold Based on 2015 – 2017 Throughput

	Facility ID	Facility Name	Gas Flared	Number of Flares Impacted
1	173846	AZUSA LAND RECLAMATION, INC	Landfill Gas	1
2	150400	BREITBURN OPERATING L.P.	Produced gas	1
3	150209	BREITBURN OPERATING L.P.	Produced gas	1
4	150201	BREITBURN OPERATING L.P.	Produced gas	1
5	172872	BREITBURN OPERATING L.P.	Produced gas	1
6	119219	CHIQUITA CANYON LLC	Landfill Gas	1
7	139865	CITY OF BURBANK WATER AND POWER	Landfill Gas	1
8	13662	CITY OF WHITTIER LANDFILL	Landfill Gas	1
9	11245	HOAG HOSPITAL	Produced gas	1
10	9163	INLAND EMPIRE UTILITIES AGENCY	Digester Gas	1
11	45262	LA COUNTY SANITATION DISTRICT - SCHOLL CANYON	Landfill Gas	4
12	69646	ORANGE COUNTY WASTE & RECYCLING - FRANK R. BOWERMAN	Landfill Gas	5
13	52753	ORANGE COUNTY WASTE & RECYCLING - PRIMA DESHECHA	Landfill Gas	1
14	74413	REDLANDS CITY - CALIFORNIA STREET LANDFILL	Landfill Gas	1
15	6979	RIVERSIDE COUNTY WASTE MANAGEMENT - BADLANDS LANDFILL	Landfill Gas	1
16	156312	ROSECRANS ENERGY	Produced gas	1
17	7068	SAN BERNARDINO COUNTY SOLID WASTE MANAGEMENT	Landfill Gas	2
18	50299	SAN BERNARDINO COUNTY SOLID WASTE MANAGEMENT - MID VALLEY	Landfill Gas	2
19	49111	SUNSHINE CANYON LANDFILL	Landfill Gas	1
			Total Flares	28

The following is the list of facilities identified as having non-refinery flares in the SCAQMD.

Table 12: Facilities with Non-Refinery Flares in the SCAQMD

	Facility ID	Facility Name	# of Flares	Gas Flared
1	16642	ANHEUSER-BUSCH LLC., (LA BREWERY)	1	Digester Gas
2	89186	COCA-COLA	1	Digester Gas
3	13596	COLTON CITY WASTEWATER	1	Digester Gas

	Facility ID	Facility Name	# of Flares	Gas Flared
4	2537	CORONA CITY, DEPT OF WATER & POWER	1	Digester Gas
5	109608	CR & R INC	1	Digester Gas
6	7417	EASTERN MUNICIPAL WATER DIST	1	Digester Gas
7	19159	EASTERN MUNICIPAL WATER DIST	1	Digester Gas
8	10983	EASTERN MUNICIPAL WATER DIST.	1	Digester Gas
9	1703	EASTERN MUNICIPAL WATER DISTRICT	1	Digester Gas
10	13088	EASTERN MUNICIPAL WATER DISTRICT	2	Digester Gas
11	147371	INLAND EMPIRE UTILITIES AGENCY	1	Digester Gas
12	9163	INLAND EMPIRE UTL AGEN, A MUN WATER DIS	1	Digester Gas
13	1179	INLAND EMPIRE UTL AGEN, A MUN WATER DIS	1	Digester Gas
14	22674	L.A. COUNTY SANITATION DIST VALENCIA PLT	3	Digester Gas
15	800214	LA CITY, SANITATION BUREAU (HTP)	6	Digester Gas
16	10245	LA CITY, TERMINAL ISLAND TREATMENT PLANT	2	Digester Gas
17	800236	LA CO. SANITATION DIST	12	Digester Gas
18	94009	LAS VIRGENES WATER DIST.	3	Digester Gas
19	155877	MILLERCOORS, LLC	1	Digester Gas
20	17301	ORANGE COUNTY SANITATION DISTRICT	3	Digester Gas
21	29110	ORANGE COUNTY SANITATION DISTRICT	3	Digester Gas
22	14898	PALM SPRINGS WASTEWATER	1	Digester Gas
23	20604	RALPHS GROCERY CO	1	Digester Gas
24	12923	RIALTO CITY	1	Digester Gas
25	9961	RIVERSIDE CITY, WATER QUALITY CONTROL	3	Digester Gas
26	11301	SAN BERNARDINO CITY MUN WATER DEPT (WRP)	1	Digester Gas
27	20237	SAN CLEMENTE CITY, WASTEWATER DIV	1	Digester Gas
28	51304	SANTA MARGARITA WATER DIST	1	Digester Gas
29	181040	SANTA MARGARITA WATER DIST	1	Digester Gas
30	13433	SO ORANGE CO WASTEWATER AUTHORITY-RTP	2	Digester Gas
31	3866	SO ORANGE CO. WASTEWATER AUTHORITY	1	Digester Gas
32	10198	VALLEY SANITARY DIST	1	Digester Gas
33	150667	VENTURA FOODS	1	Digester Gas
34	20561	WATSON LAND COMPANY	1	Digester Gas
35	118526	WESTERN MUNICIPAL WATER DIST.	1	Digester Gas
36	50402	YUCAIPA VALLEY WATER DISTRICT	1	Digester Gas
37	140373	AMERESCO CHIQUITA ENERGY LLC	1	Landfill Gas
38	173846	AZUSA LAND RECLAMATION,INC	1	Landfill Gas
39	113518	BREA PARENT 2007,LLC	1	Landfill Gas
40	119219	CHIQUITA CANYON LLC	2	Landfill Gas
41	139865	CITY OF BURBANK/WATER AND POWER	1	Landfill Gas
42	42086	CITY OF UPLAND LANDFILL	1	Landfill Gas
43	13662	CITY OF WHITTIER LANDFILL	1	Landfill Gas

	Facility ID	Facility Name	# of Flares	Gas Flared
44	45262	LA COUNTY SANITATION DIST SCHOLL CANYON	12	Landfill Gas
45	42514	LA COUNTY SANITATION DIST (CALABASAS)	9	Landfill Gas
46	50418	O C WASTE & RECYCLING, OLINDA ALPHA	2	Landfill Gas
47	69646	OC WASTE & RECYCLING, FRB	5	Landfill Gas
48	52753	OC WASTE & RECYCLING, PRIMA DESHECHA	1	Landfill Gas
49	74413	REDLANDS CITY (CALIFORNIA ST LANDFILL)	1	Landfill Gas
50	15793	RIV CO, WASTE RESOURCES MGMT DIST, LAMB	1	Landfill Gas
51	6979	RIV CO., WASTE MGMT, BADLANDS LANDFILL	2	Landfill Gas
52	7068	SAN BER CNTY SOLID WASTE MGMT	2	Landfill Gas
53	50299	SAN BER CNTY SOLID WASTE MGMT MID VALLEY	3	Landfill Gas
54	49111	SUNSHINE CANYON LANDFILL	4	Landfill Gas
55	139938	SUNSHINE GAS PRODUCERS LLC	1	Landfill Gas
56	113674	U S A WASTE OF CAL(EL SOBRANTE LANDFILL)	1	Landfill Gas
57	800209	BKK CORP (EIS USE)	10	Landfill Gas (closed)
58	3530	CALMAT PROPERTIES CO (HEWITT PIT LANDFIL	1	Landfill Gas (closed)
59	183607	CARSON RECLAM. -TETRATECH	2	Landfill Gas (closed)
60	181904	CHANDLER'S RECYCLING	1	Landfill Gas (closed)
61	57769	CITY OF RIVERSIDE (TEQUESQUITE LANDFILL)	2	Landfill Gas (closed)
62	135369	CORONA DWP LANDFILL	1	Landfill Gas (closed)
63	176967	COYOTE CANYON ENERGY LLC	2	Landfill Gas (closed)
64	145144	ENI OIL & GAS	1	Landfill Gas (closed)
65	79324	HIGHGROVE LANDFILL	1	Landfill Gas (closed)
66	77033	INDUSTRY CITY,CIVIC RECREATIONAL IND AUT	1	Landfill Gas (closed)
67	49805	LA CITY, BUREAU OF SANIT(LOPEZ CANYON)	7	Landfill Gas (closed)
68	42949	LA CITY, PUB WKS DEPT, SANITATION BUREAU	2	Landfill Gas (closed)
69	95566	LA CITY, TOYON CANYON LANDFILL	1	Landfill Gas (closed)
70	24520	LA CNTY SANITATION DISTRICT-PALOS VERDES	8	Landfill Gas (closed)
71	25070	LA CNTY SANITATION DISTRICT-PUENTE HILLS	26	Landfill Gas (closed)
72	42633	LA COUNTY SANITATION DISTRICTS (SPADRA)	6	Landfill Gas (closed)
73	21189	LACO SAN DISTRICT - MISSION CYN	2	Landfill Gas (closed)
74	60384	LOS ANGELES BY-PRODUCTS	2	Landfill Gas (closed)
75	104086	MM LOPEZ ENERGY LLC	1	Landfill Gas (closed)
76	84157	MONTEBELLO CITY	1	Landfill Gas (closed)
77	35102	MOUNTAIN GATE COUNTRY CLUB	1	Landfill Gas (closed)
78	106164	OC WASTE - VILLA PARK	1	Landfill Gas (closed)
79	181426	OC WASTE & RECYCLING, COYOTE	3	Landfill Gas (closed)
80	52743	OC WASTE & RECYCLING, SANTIAGO	3	Landfill Gas (closed)
81	53860	PICK YOUR PART AUTO WRECKING	1	Landfill Gas (closed)
82	68609	PICK YOUR PART AUTO WRECKING	1	Landfill Gas (closed)
83	60302	RIV CO WASTE MGMT (EDOM HILL)	1	Landfill Gas (closed)

	Facility ID	Facility Name	# of Flares	Gas Flared
84	11434	RIV. CO. WASTE RES. MGR. DBL BUT.	1	Landfill Gas (closed)
85	60315	RIVERSIDE CO - COACHELLA	1	Landfill Gas (closed)
86	5112	RIVERSIDE CO. - MEAD VALLEY	1	Landfill Gas (closed)
87	73884	RIVERSIDE CO. WASTE - ELSINORE	1	Landfill Gas (closed)
88	135173	RIVERSIDE CO. WASTE MGT.	1	Landfill Gas (closed)
89	50297	RIVERSIDE COUNTY WASTE MANAGEMENT	1	Landfill Gas (closed)
90	165241	RIVERSIDE COUNTY, CORONA	1	Landfill Gas (closed)
91	58044	SAN BER CNTY SOLID WASTE MGMT - COLTON	2	Landfill Gas (closed)
92	7371	SAN BER CNTY SOLID WASTE MGMT- MILLIKEN	2	Landfill Gas (closed)
93	7699	SYUFY ENT.	1	Landfill Gas (closed)
94	50310	WASTE MGMT DISP &RECY SERVS INC (BRADLEY	2	Landfill Gas (closed)
95	14914	CAL CARBON	1	Other Flaring
96	11245	HOAG HOSPITAL	1	Other Flaring
97	42630	PRAXAIR	1	Other Flaring
98	108742	REMO INC	1	Other Flaring
99	176823	RIALTO BIOENERGY FACILITY, LLC	1	Other Flaring
100	5973	SO CAL GAS CO	1	Other Flaring
101	8582	SO CAL GAS CO	1	Other Flaring
102	800127	SO CAL GAS CO	2	Other Flaring
103	800128	SO CAL GAS CO	2	Other Flaring
104	169754	SO CAL HOLDING, LLC	1	Other Flaring
105	176377	TESORO LOGISTICS MARINE TERMINAL 2	1	Other Flaring
106	137722	VOPAK TERMINAL LONG BEACH INC,A DELAWARE	1	Other Flaring
107	158910	RANCHO LPG HOLDINGS, LLC	1	Other Flaring - Butane
108	44454	STRUCTURAL COMPOSITES IND	1	Other Flaring - Butane
109	12332	GATX CORPORATION	2	Other Flaring - Propane
110	11998	GOODRICH CORPORATION	1	Other Flaring - Propane
111	88359	ALAMITOS COMPANY	1	Produced Gas
112	54349	ANGUS PETROLEUM	1	Produced Gas
113	166073	BETA OFFSHORE	2	Produced Gas
114	107551	BOLSA LEASE	1	Produced Gas
115	120098	BREITBURN ENERGY CO.	1	Produced Gas
116	150209	BREITBURN OPERATING L.P.	1	Produced Gas
117	150400	BREITBURN OPERATING L.P.	1	Produced Gas
118	150201	BREITBURN OPERATING LP	3	Produced Gas
119	151539	BREITBURN OPERATING LP	1	Produced Gas
120	172872	BREITBURN OPERATING LP	1	Produced Gas
121	174544	BREITBURN OPERATING LP	2	Produced Gas
122	185578	BRIDGE ENERGY, LLC	1	Produced Gas

	Facility ID	Facility Name	# of Flares	Gas Flared
123	103480	BRIDGEMARK CORPORATION	1	Produced Gas
124	148894	CALIFORNIA RESOURCES PRODUCTION CORP	1	Produced gas
125	151899	CALIFORNIA RESOURCES PRODUCTION CORP	1	Produced gas
126	109719	COOK ENERGY, INC. KERN LEASE	1	Produced gas
127	143741	DCOR LLC	1	Produced gas
128	175154	FREEPORT-MCMORAN OIL & GAS	1	Produced gas
129	175191	FREEPORT-MCMORAN OIL & GAS	2	Produced gas
130	124723	GREKA OIL & GAS	1	Produced gas
131	13627	HILLCREST BEVERLY	1	Produced gas
132	151532	LINN OPERATING, INC	4	Produced gas
133	131425	MATRIX OIL CORPORATION - RIDEOUT HEIGHTS	2	Produced gas
134	165900	PROS INCORPORATED	2	Produced gas
135	156312	ROSECRANS ENERGY	1	Produced gas
136	184301	SENTINEL PEAK RESOURCES LLC	2	Produced gas
137	45086	SIGNAL HILL PETROLEUM INC	1	Produced gas
138	166595	SO CAL HOLDING, LLC	1	Produced gas
139	83509	THE TERMO CO	1	Produced gas
140	800330	THUMS LONG BEACH	1	Produced gas
141	800325	TIDELANDS OIL PRODUCTION CO	1	Produced gas
142	68112	TIDELANDS OIL PRODUCTION COMPANY, ETAL	1	Produced gas
143	106844	VINTAGE PRODUCTION CALIFORNIA	1	Produced gas
144	144681	WARREN E & P, INC.	2	Produced gas
145	149027	WARREN E & P, INC.	2	Produced gas
146	86463	WEAVER & MOLA DEVELOPMENT (BRINDLE AND THOMAS	1	Produced gas
		Total	288	

EMISSION INVENTORY AND EMISSION REDUCTIONS

Staff estimates the current NOx emission inventory for non-refinery flares to be approximately one ton per day. The emission inventory was estimated using a three-year average flare throughput and the NOx permit limit. The three-year average throughput was to address year-to-year variations and staff used 2015 – 2017 as it is the most recent and complete verifiable dataset available. The throughput was obtained through data reported by the facilities in their Annual Emission Reports (AER). If AER data was not available, staff relied on Rule 1150.1 Annual Reports which contained throughput data for landfills. Staff also conducted outreach to the flare owners to obtain missing data points. For some flares, throughput information was not available so staff did not include any emissions from those facilities in the inventory; thus, the inventory is likely under estimated. In addition, as discussed earlier, the emissions from oil and gas production have been much higher in the past due to production levels and price of barrel. Further, some old permits did not include NOx limits for flares. In those cases, staff defaulted shrouded flares to 0.06 pounds/MMBtu, the BACT limit from 1988, and open flares to 0.068 pounds/MMBtu, based on the default limit in Rule 1118. To convert the throughput, reported in Million Standard Cubic Feet (MMscf), to MMBtu, staff used the following default heating values:

Table 13: Default Heating Values

Flare Gas	Heating Value (Btu/scf)
Digester gas	600
Produced gas	900
Landfill Gas	500
Open Landfill	
Closed Landfill	400
Other Flaring	900
Other Flaring - Propane	91
Other Flaring - Butane	91

To determine the potential emission reductions, staff determined which flares surpass the PR1118.1 Table 2 proposed capacity thresholds in. For each flare, staff determined:

- Maximum rated capacity based on permit descriptions (scf/minute or MMBtu/hr),
- Throughput or heat capacity based on the three-year throughput data and default Btu values, and
- Percent capacity.

For flares that surpass the proposed capacity thresholds, staff calculated the emission reduction if the flare was replaced with a low-NOx flare meeting the PR118.1. Table 1 emission limits. Staff excluded flares that already meet the emission limits and flares eligible for the exemptions (e.g. flares at closed landfills generating less than 2,000 MMscf/year, low-use flares or low-emitting flares). Staff estimates there will be 28 affected flares that will need to take action generating approximately 0.23 tons of NOx reduced per day. These reductions are an underestimation, since it assumes the continuance of flaring, however, more reductions are achieved if all the gas is handled beneficially and without NOx emissions. The following table estimates the emissions reductions per source category:

Table 14: Emission Reductions by Source Category

Gas Flared	Number of Affected Flares	NOx Reductions (tpd)
Produced gas	6	0.014
Landfill gas	21	0.21
Digester Gas	1	0.007
Other Flare Gas	0	0
TOTAL	**28**	**0.23**

INCREMENTAL COST-EFFECTIVENESS

Health and Safety Code Section 40920.6 requires an incremental cost effectiveness analysis for 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, CO, sulfur oxides, oxides of nitrogen, and their precursors. The incremental cost effectiveness analysis will be conducted and released in the draft staff report at least 30 days prior to the SCAQMD Governing Board Hearing on Proposed Rule 1118.1, which is anticipated to take place on December 7, 2018.

Chapter 4

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 Rule 1118.1 implements Control Measure CMB-03 and CMB-05. The 2016 AQMP ranked Control Measure CMB-03 ninth and CMB-05 sixth in cost-effectiveness. Further, proposed PR1118.1 has been designed to consider the cost effectiveness triggering action on behalf of the affected facility.

SOCIOECONOMIC ASSESSMENT

A socioeconomic impact assessment will be prepared and released for public review and comment at least 30 days prior to the SCAQMD Governing Board Hearing of Proposed Rule 1118.1, which is anticipated for December 7, 2018.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

PAR 1118.1 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 an Environmental Assessment (EA) will be required for PAR 1118.1. The Draft EA to be prepared will analyze the potential effects that the project may cause on the environment. In the event that the proposed project may have statewide, regional, or area-wide significance, a CEQA scoping meeting is required pursuant to Public Resources Code Section 21083.9(a)(2) and will be held concurrently with the Public Workshop for PAR 1118.1. As part of the CEQA Scoping Meeting, SCAQMD staff will solicit input from the public on the CEQA evaluation. The Draft EA, upon its release, will be available for a public review and comment period and will contain responses to the comments made at the CEQA Scoping Meeting.

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 Rule 11118.1 is needed to comply with USEPA RACM/BACM requirements and to establish BARCT requirements for non-refinery flares, 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 Rule 1118.1 pursuant to the California Health and Safety Code Sections 39002, 40000, 40001, 40440, 40702, 40725 through 40728, 41508, and 41508.

Clarity

Proposed Rule 1118.1 is written or displayed so that its meaning can be easily understood by the persons directly affected by it.

Consistency

Proposed Rule 1118.1 is in harmony with and not in conflict with or contradictory to, existing statutes, court decisions, or state or federal regulations.

Non-Duplication

Proposed Rule 1118.1 will not impose the same requirements as any existing state or federal regulations. The proposed amended rule is necessary and proper to execute the powers and duties granted to, and imposed upon, the SCAQMD.

Reference

In amending Rule 1118.1, 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 will be prepared and released for public review and comment at least 30 days prior to the SCAQMD Governing Board Hearing of PR1118.1, which is anticipated to take place on December 7, 2018.

Chapter 5

REFERENCES

"Final 2016 Air Quality Management Plan", South Coast Air Quality Management District, March 2017

"Santa Barbara County Air Pollution Control District Rule 359 – Flares and Thermal Oxidizers", Adopted June 28, 1994

"San Joaquin Valley Air Pollution Control District (SJVAPCD) Rule 4311 – Flares", Adopted June 20, 2002; (Amended June 15, 2006; June 18, 2009

"South Coast Air Quality Management District – Best Available Control Technology Guidelines" Adopted August 17, 2000 (Revised June 6, 2003; December 5, 2003; July 9, 2004; July 14, 2006; December 2, 2016; February 2, 2018)

"Bureau of Land Management Waste Prevention, Production Subject to Royalties, and Resource Conservation", 43 CFR Parts 3100, 3160 and 3170