SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Draft Staff Report
Proposed Amended Rule 1117 – Emissions from Glass Melting and Sodium Silicate Furnaces

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EXECUTIVE SUMMARY

The Regional Clean Air Incentives Market (RECLAIM) program was adopted in October 1993 under Regulation XX. RECLAIM is a market-based emissions trading program designed to reduce NOx and SOx emissions and includes facilities with NOx or SOx emissions greater than 4 tons per year. The 2016 Final Air Quality Management Plan (2016 AQMP) included Control Measure CMB-05: Further NOx Reductions from RECLAIM Assessment (CMB-05) to ensure the NOx RECLAIM program was achieving equivalency with command-and-control rules that are implementing Best Available Retrofit Control Technology (BARCT) and to generate further NOx emission reductions at RECLAIM facilities. The adoption resolution for the 2016 AQMP directed staff to achieve five tons per day of NOx emission reductions as soon as feasible but no later than 2025, and to transition the RECLAIM program to a command-and-control regulatory structure requiring BARCT as soon as practicable. On July 26, 2017 the Governor approved California State Assembly Bill 617, which required air districts to develop, by January 1, 2019, an expedited schedule for the implementation of BARCT no later than December 31, 2023 for industrial facilities that are in the State greenhouse gas cap-and-trade program with priority given to older higher polluting sources that need to install BARCT.

As facilities transition out of NOx RECLAIM, a command-and-control rule that includes NOx emission standards that reflect BARCT will be needed for all equipment categories. Rule 1117 – Emissions of Oxides of Nitrogen from Glass Melting and Sodium Silicate Furnaces is a command-and-control rule for facilities that operate furnaces used in the production of glass and sodium silicate. Proposed Amended Rule 1117 – Emissions from Container Glass Melting and Sodium Silicate Furnaces (PAR 1117) will update the existing rule to reflect current technologically-achieved emission levels that represent BACRT for NOx and SOx. PAR 1117 will also address operational concerns related to idling, startup, and shutdown of container glass melting and sodium silicate furnaces by including provisions and limitations for these unique situations. In addition, provisions that are no longer applicable will be removed.

Of the facilities in RECLAIM, two facilities will be affected by PAR 1117: one container glass manufacturer and one sodium silicate manufacturer. There are two furnaces operated at container glass facility and one furnace operated at the sodium silicate facility that will be subject to PAR 1117. In addition, PAR 1117 will also incorporate the auxiliary combustion equipment associated with the container glass manufacturing lines. Initially, Rule 1117 applied to the container glass manufacturing process and it did not apply to the sodium silicate process. However, with the transition of RECLAIM to a command-and-control regulatory structure, sodium silicate manufacturing has been included into PAR 1117 since its manufacturing process is similar to container glass.

In 2017, both container glass and sodium silicate facilities installed new air pollution control devices (APCDs) on each of their furnaces. Although the APCDs were installed prior to the adoption of PAR 1117, their impact on reducing NOx and SOx emissions will be evaluated and included as part of the rule development process to ensure NOx and SOx emission limits are met on an ongoing basis. Based on the success demonstrated in reducing NOx and SOx emission levels, PAR 1117 will reduce the NOx limit from the current rule level of 4.0 lbs of NOx per ton of glass

pulled to 0.25 lbs of NOx per ton of glass pulled for container glass furnaces and 0.50 lbs of NOx per ton of product pulled for sodium silicate furnaces. PAR 1117 will also establish a SOx emission level where no limit had been included previously in the rule. The SOx emission level for container glass furnaces and the sodium silicate furnace will be established at 1.1 lbs of SOx per ton of glass pulled based on current permitted conditions contained in the container glass facility's Permit to Operate and on a level representing Best Available Control Technology limits.

A cost-effectiveness analysis was completed for the NOx reduction associated with the 2017 installation of the APCDs at both the container glass and sodium silicate facilities, as well as future requirements pertaining to container glass associated combustion equipment. The overall NOx reductions are 0.70 tpd and an overall cost-effectiveness of $3,300 per ton of NOx reduced was determined. Although additional benefits from the reduction of other pollutants are expected, these additional reductions were not considered at this time.

CHAPTER 1: BACKGROUND

BACKGROUND

In October 1993, Regulation XX- RECLAIM was adopted. The purpose of the RECLAIM program was to provide industry with a flexible, market-based approach to reduce NOx and SOx emissions. Participants were initially allocated RECLAIM Trading Credits (RTCs) based on emissions from their highest production level from 1989 to 1992. With the adoption of RECLAIM, furnaces that had been regulated under Rule 1117 were exempt from NOx emission standards.

Over the life of RECLAIM, allocations have been reduced twice, requiring businesses to either reduce emissions through installation of pollution controls; replacement if equipment or processes change; or purchase RTCs. 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 transition the program and ensure future equivalency to command-and-control regulations. During the adoption of the 2016 AQMP, the adoption resolution directed staff to modify Control Measure CMB-05 to achieve the five tons per day NOx emission reduction as soon as feasible but no later than 2025, and to transition the RECLAIM program to a command-and-control regulatory structure requiring BARCT-level controls as soon as practicable.

In addition, on July 26, 2017, Governor Brown signed AB 617 which addressed non-vehicular air pollution. AB 617 was companion legislation to AB 398 which extended California's cap-and-trade program for reducing greenhouse gas emissions from stationary sources. RECLAIM facilities that are part of the cap-and-trade program are now also subject to the requirements of AB 617. AB 617 requires an expedited schedule for implementing BARCT for cap-and-trade facilities. Under AB 617, the State's air districts were to develop a schedule by January 1, 2019 for the implementation of BARCT no later than December 31, 2023. The highest priority would be given to older, higher polluting units that would need to install retrofit controls.

The October 5, 2018 amendment to Rule 2001 established procedures for facilities to opt out of RECLAIM provided the equipment at the facility met specified criteria.

Staff has been in discussions with the United States Environmental Protection Agency (USEPA) on all elements of transitioning RECLAIM sources to a command-and-control regulatory structure to ensure that the rules relating to the transition would be approved into the State Implementation Plan (SIP). USEPA expressed concern over facilities exiting RECLAIM before all command-and-control and New Source Review (NSR) requirements had been adopted to clearly demonstrate equivalency to the replaced program. Therefore, USEPA has recommended keeping facilities in RECLAIM until all the rules associated with the transition have been adopted and approved into the SIP.

As a result, on July 12, 2019, the opt-out provision was removed from Rule 2001 in consideration of USEPA's recommendation, and now prohibits facilities from exiting the RECLAIM program. Until facilities exit RECLAIM, they will continue to be subject to all RECLAIM requirements including Rule 2005 – New Source Review for RECLAIM, for permitting of new or modified NOx sources that undergo emission increases. In addition, these facilities will also be required to

comply with all the requirements in adopted and amended command-and-control rules that apply to RECLAIM facilities, including the implementation schedules and any NOx or SOx limitations. Staff will continue to work with USEPA on NSR for former RECLAIM facilities as well as on all the relevant command-and-control rules for the RECLAIM transition.

As facilities transition out of RECLAIM, a command-and-control rule that includes NOx and SOx emission standards that reflect BARCT will be needed. PAR 1117 is a command-and-control "landing" rule for RECLAIM facilities that operate container glass melting and associated combustion equipment, and sodium silicate furnaces. Equipment at existing RECLAIM facilities will be required to comply with the emission standards and with monitoring, reporting, and recordkeeping requirements contained in PAR 1117. In addition, PAR 1117 will address operational concerns related to idling, startup, and shutdown of container glass melting and sodium silicate furnaces by including provisions and limitations for these situations. Existing provisions that are no longer applicable will be removed.

REGULATORY HISTORY

On February 5, 1982, the South Coast AQMD Governing Board adopted Rule 1117 – *Emissions of Oxides of Nitrogen from Glass Melting Furnaces*. The rule was subsequently amended once on January 6, 1984. The rule set a single limit for NOx emissions at 4.0 lbs NOx per ton of glass pulled effective after December 31, 1992. However, the rule exempted furnaces used in the production of glass tableware, flat glass, or fiberglass.

The rule also allowed for the use of an alternative emissions control plan and an energy recovery NOx emissions factor. In addition, compliance determination was made using a three-hour averaging procedure unless a continuous emissions monitoring system was installed for which a 24-hour averaging could then be used.

In December 2015, Regulation XX was amended to implement Control Measure CMB-01 of the 2012 Air Quality Management Plan and to further reduce NOx from RECLAIM facilities. The amendment implemented NOx BARCT for various pieces of equipment. As part of the BARCT assessment, container glass melting and sodium silicate furnaces were evaluated and it was determined to be feasible to reduce NOx emissions by 80%, which was also verified by a third-party consultant. In response to the required NOx allocation reduction, both container glass and sodium silicate facilities installed air pollution control equipment to comply with this requirement.

AFFECTED FACILITIES AND EQUIPMENT

PAR 1117 impacts two facilities: a container glass and sodium silicate manufacturing facility. Both facilities are in the RECLAIM program and upon transitioning out of RECLAIM into a command-and-control regulatory structure, they will become former RECLAIM Facilities. There are no other facilities operating within the jurisdiction of the South Coast AQMD that are equipped with container glass melting or sodium silicate furnaces or similarly purposed equipment that would be subject to this proposed amended rule.

The container glass facility makes containers used in the food and beverage industries. It operates two container glass melting furnaces. Each furnace is rated at 68 MMBTU/hr and is equipped with oxy-fueled burners. The container glass facility also operates two manufacturing lines that each consists of a main melting furnace where molten glass is produced and auxiliary combustion equipment to keep the material flowing to pour stations where the bottles are formed. Once the bottles are formed, they are transported to furnaces for annealing. The annealing step relieves any residual internal stress introduced in the manufacturing process which improves the durability of bottles. Typically, once the facility starts up, the furnaces operate continuously for years at a time.

The sodium silicate facility produces a sodium silicate material in either solid or aqueous solution that is used in a variety of industrial or consumer products. It operates one furnace rated at 56.6 MMBTU/hr and it is equipped with low-NOx burners. The sodium silicate furnace is a cross-fired regenerative furnace that cycles its firing from one side to the other, reversing direction on a periodic basis. The back-and-forth operation of this furnace allows for waste heat to be recovered and used to preheat combustion air, improving efficiency and allowing for higher operating temperatures. Unlike the container glass facility, the sodium silicate facility operates for limited manufacturing runs of up to several months with significant down time where the furnace is not in operation between cycles.

PUBLIC PROCESS

The development of PAR 1117 was conducted through a public process. One Working Group meeting was held on August 1, 2019. Working Group meetings typically include staff and representatives from affected businesses, environmental groups, public agencies, consultants, and other interested parties. The purpose of the Working Group meetings is to discuss details of proposed amendments and to listen to concerns and issues with the objective to build consensus and resolve key issues.

Staff has had meetings with stakeholders and has conducted multiple site visits at both facilities as part of this rulemaking process. Since this rule affects only two facilities, staff decided it would be more beneficial and efficient to address specific issues with the facilities individually in lieu of conducting multiple working group meetings. A public workshop is scheduled for March 19, 2020.

CHAPTER 2: BARCT ASSESSMENT

INTRODUCTION

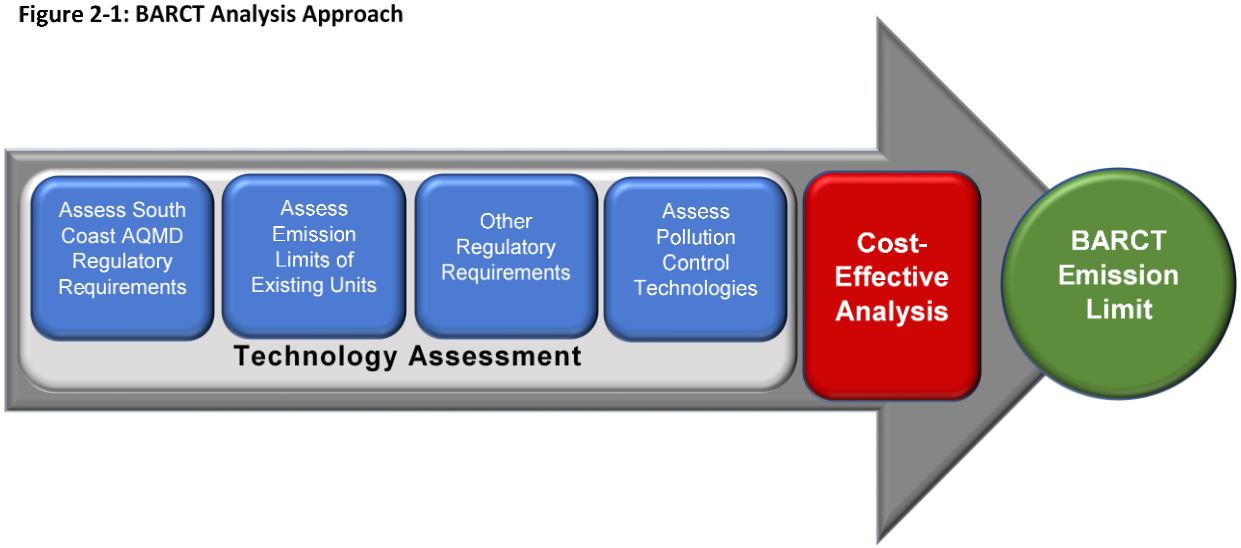
Staff conducted an assessment of the NOx and SOx emission limit under Rule 1117 to determine if it is still representative of BARCT for similar types of combustion equipment. BARCT analyses are periodically performed for equipment categories to assess technological changes that may reflect a lower emission limit. Rule 1117 was adopted in 1982 and last amended in 1984. Since that time, NOx emission limits for similar types of combustion equipment generally have been established lower than the current limit contained in Rule 1117. The lower limits have been due to the evolution of burner design and the addition of emission control systems.

Under California Health and Safety Code § 40406, BARCT is defined 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."

The BARCT assessment for this rule development consisted of a multi-step analysis. The first four steps represent the technology assessment. First, staff evaluated current South Coast AQMD regulatory requirements, then assessed emission limits for existing units and then surveyed other air districts and agencies outside of the South Coast AQMD's jurisdiction to identify emission limits that exist for similar equipment. In the final step of the technology assessment, staff assessed pollution control technologies to determine what degree of reduction could be achievable for the affected sources. A cost-effectiveness analysis is then conducted. Based on the evaluation if the information, initial BARCT emission limits are recommended.

Figure 2-1: BARCT Analysis Approach



BARCT ANALYSIS APPROACH

Assessment of South Coast AQMD Regulatory Requirements

For this first step of the BARCT analysis, staff reviewed both existing South Coast AQMD Rule 1117 and recent permitting activities. Last amended in 1984, Rule 1117 currently limits NOx emissions to 4.0 lbs of NOx per ton of glass pulled and has no SOx emission limits. Although Rule 1117 applies to glass melting furnaces, it exempts emissions from furnaces used to melt glass to produce glass tableware, flat glass, and fiberglass. Rule 1117 specifically does not include, nor does it explicitly preclude, the operation of a sodium silicate furnace. There are currently no glass melting furnaces outside of RECLAIM that are subject to Rule 1117.

Assessment of Emission Limits of Existing Units

The current permit for the container glass facility contains a NOx emission limit of 1.5 lbs NOx per ton of glass pulled. The permit limit was predicated on the addition of a post-combustion control system designed to provide at least an 80% reduction of NOx emissions in the exhaust gas exiting from the furnace. The post-combustion control system that was selected and installed was a ceramic-based catalyst system manufactured by Tri-mer. Additional consideration in selecting the permit limit was also influenced by what other air districts and jurisdictions had determined to be attainable.

The container glass facility's permit also contains a SOx emission limit of 1.1 lbs of NOx per ton of glass pulled. The SOx emission limit was established based on Best Available Control Technology (BACT) limits and by what other air districts and jurisdictions had determined to be attainable.

In contrast to the container glass facility's permit, the sodium silicate facility's Title V permit does not specify either a NOx or a SOx emission limit, but it does contain a throughput limit. Although not subject to a NOx emission limit, the sodium silicate facility installed a Tri-mer system similar to the container glass installation to reduce NOx emissions. Although the sodium silicate facility is included in the SOx RECLAIM program, it was exempt from reporting any SOx emissions because it uses 100% natural gas in its furnace and processes non-sulfate containing materials.

In general, since the installation of the Tri-mer systems, significant reductions in NOx emissions have been observed at both the container glass and sodium silicate facilities. In contrast to NOx emissions, staff has not observed significant SOx reductions, due in part because NOx reduction was the primary driver behind the installation of the emission controls equipment and because there is no SOx data from the sodium silicate facility. These observations and their significance will be discussed further under the section assessing air pollution control technologies.

Other Regulatory Requirements

For this BARCT assessment, staff compared Rule 1117 emission limits to limits for glass melting equipment in other air districts within California and jurisdictions outside of California.

In its initial review, staff noted that some air districts and jurisdictions distinguished between the type of glass manufacturing. For example, San Joaquin Valley Air Pollution Control District (SJVAPCD) Rule 4354 – *Glass Melting Furnaces* established emission limits for the production of either container glass, flat glass, or fiberglass (see Table 2-1). Similarly, State of Pennsylvania Code 25, Section 129 – *Standards for Sources Control of NOx Emissions from Glass Melting Furnaces* also established limits based on different glass production operations, distinguishing between container glass, fiberglass, flat glass, and pressed or blown glass (see Table 2-2).

In contrast to the SJVAPCD and the State of Pennsylvania, Bay Area Air Quality Management District (BAAQMD) Regulation 9, Rule 12, Section 9-12-301 – *Nitrogen Oxides from Glass Melting Furnaces* made no distinction in the type of glass manufacturing for its NOx emission limit. The BAAQMD set a NOx emission limit of 5.5 lbs of NOx per short ton of glass pulled, averaged over any consecutive 3-hour period, making no distinction in the type of glass manufacturing.

Table 2-1: SJVAPCD Rule 4354
NOx Emission Limits
(lbs NOx per ton glass produced)

Container Glass	1.5[B]
Fiberglass	1.3[A,C] 3.0[A,D]
Flat Glass (Standard Option)	3.7[A] 3.2[B]
Flat Glass (Enhanced Option)	3.4[A] 2.9[B]

[A] Block 24-hour average
[B] Rolling 30-day average
[C] Not subject to California Public Resources Code Section 19511
[D] Subject to California Public Resources Code Section 19511

Table 2-2: Pennsylvania Code 25, Section 129
NOx Emission Limits[A]
(lbs NOx per ton glass produced)

Container Glass	4.0
Fiberglass	4.0
Flat Glass	7.0
Pressed or Blown Glass	7.0

All Other Glass	6.0
[A] Rolling 30-day average	

In addition to comparing NOx emission limits set by other air districts and jurisdictions, staff also reviewed permits issued to glass melting facilities across the country to identify NOx emission limits for comparable operations. In one example, staff noted that a furnace operated at the Gallo Glass Company located in Modesto, California is permitted not to exceed 1.4 lbs NOx per ton of glass pulled. At this location, Gallo manufactures container glass and although it is within the jurisdiction of the SJVAPCD, the Gallo NOx emission limit was set lower than what is established in the SJVAPCD Rule 4354.

After reviewing other permits issued to glass melting facilities across the country, staff also evaluated actions taken by USEPA to identify other NOx emission limits established for comparable operations. Staff noted that in a settlement agreement with the Durand Glass Manufacturing Company which operates a tableware glass manufacturing facility in Millville, New Jersey, Durand was required to meet a NOx emission limit of 1.2 lbs of NOx per ton of glass produced on a 30-day rolling average and 1.0 lbs of NOx per ton of glass produced on a 365-day rolling average.

As was noted earlier, the South Coast AQMD permit for the sodium silicate facility does not have a NOx emission limit specifically written into it. However, staff noted that at other domestic Title V-permitted facilities operated by the same corporation that produces sodium silicate, NOx emission limits are included within the respective facility permit. For example, at two sodium silicate facilities, one operating in Baltimore, Maryland and another in Chester, Pennsylvania, the sodium silicate melting furnaces have permitted limits of 5.73 lbs of NOx per ton produced and 6.0 lbs of NOx per ton produced, respectively.

Assessment of Pollution Control Technologies

Current air pollution control technology for glass melting and sodium silicate furnaces can be divided into three commercially available systems. Each one will be described in the following sections:

- Regenerative burners
- Oxy-fueled burner technology
- Selective Catalytic Reduction (SCR), and
- Ceramic Catalyst Filtration (CCF)

- *Regenerative burners*

Glass melting furnaces can be configured in a standard configuration where burners are mounted in a side-port arrangement on both sides, and are fired continuously. Alternatively, a cross-fired

regenerative furnace cycles its firing from one side to the other, reversing direction on a periodic basis. The cyclic operation of this furnace allows for waste heat to be recovered and used to preheat combustion air for the opposing side's burners, improving efficiency and allowing for lower NOx emissions.

- *Oxy-fueled Burner Technology*

Oxy-fueled combustion is a NOx reduction technology that uses oxygen-enriched air to combust fuel, instead of ambient air. By increasing the concentration of oxygen in the combustion air, two benefits are noted. The first is that the amount of fuel used in the combustion process can be reduced. Reducing the amount of fuel used can lead to less NOx emissions. Oxygen combusts with fuel releasing energy to heat the glass making or sodium silicate process. By having more oxygen in a given volume of air, oxy-rich air requires less overall air volume needed in the combustion process compared with ambient air. In the combustion process, some of the energy released is used to also heat the overall volume of gas. Reducing the overall volume of air then in turn reduces the amount of fuel used. The second effect is that by increasing the concentration of oxygen in air, other constituents like nitrogen are displaced. With less nitrogen in air, less NOx from combustion is produced.

Typical NOx conversion efficiencies for oxy-fueled burners varies depending on operation and configuration. Although NOx reduction may be beneficial, costs associated with oxygen enrichment may make this option expensive relative to other technologies because of the additional equipment costs associated with the construction and operation an onsite plant to supply the oxygen.

- *SCR*

SCR is a commercially available air pollution control technology used to reduce NOx emissions from combustion sources. The SCR process works by chemically converting NOx into nitrogen and water vapor. Ammonia (or similarly based reagent such as urea) is injected into the exhaust of a combustion source. The exhaust then passes through a fixed catalyst bed where NOx reacts with ammonia and is converted into nitrogen and water vapor as illustrated by the following equations:

$$6NO + 4NH_3 \rightarrow 5N_2 + 6H_2O \text{ (reduction of NO to } N_2)$$

$$6NO_2 + 8NH_3 \rightarrow 7N_2 + 12H_2O \text{ (reduction of } NO_2 \text{ to } N_2)$$

The catalyst is typically designed in a honey-combed lattice structure embedded with active metal-oxides sites. Catalyst efficiency relies on good dispersion, mixing, optimal temperature range, and catalyst activity. However, catalyst activity can be adversely affected by poisoning of the active sites from contaminants such as sulfur, by thermal sintering due to high temperature, or by plugging from particulate matter (PM) and salts. Typical conversion efficiencies for SCR systems can range between 90 – 95% for NOx. Although NOx conversion can be high using an SCR system, capital investment, operating cost, and increased reagent usage may make this option less cost-effective compared to other emission control technologies Additionally, consideration is

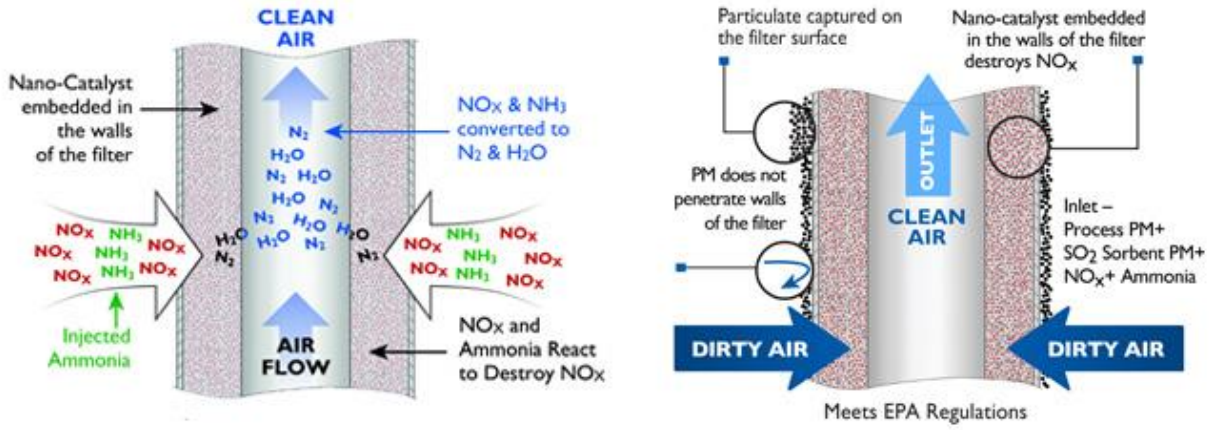
required for the minimization of any excess unreacted ammonia past the SCR catalyst, otherwise known as ammonia slip.

- Ceramic Catalyst Filtration (*CCF)*

CCF is a commercially available air pollution control system used to reduce NOx emissions from combustion sources. It is similar to SCR technology in that a reagent is injected into the exhaust gas from a combustion source. The exhaust then passes through a fixed catalyst bed where NOx reacts with ammonia and is converted into nitrogen and water vapor. Like an SCR, the catalyst bed in impregnated with metal oxides (See Figure 2-2). Unlike an SCR, however, the catalyst bed is configured into a cylindrical, ceramic filter element. Multiple filter elements are then arranged in an enclosed structure where the gas mixture passes through the element walls.

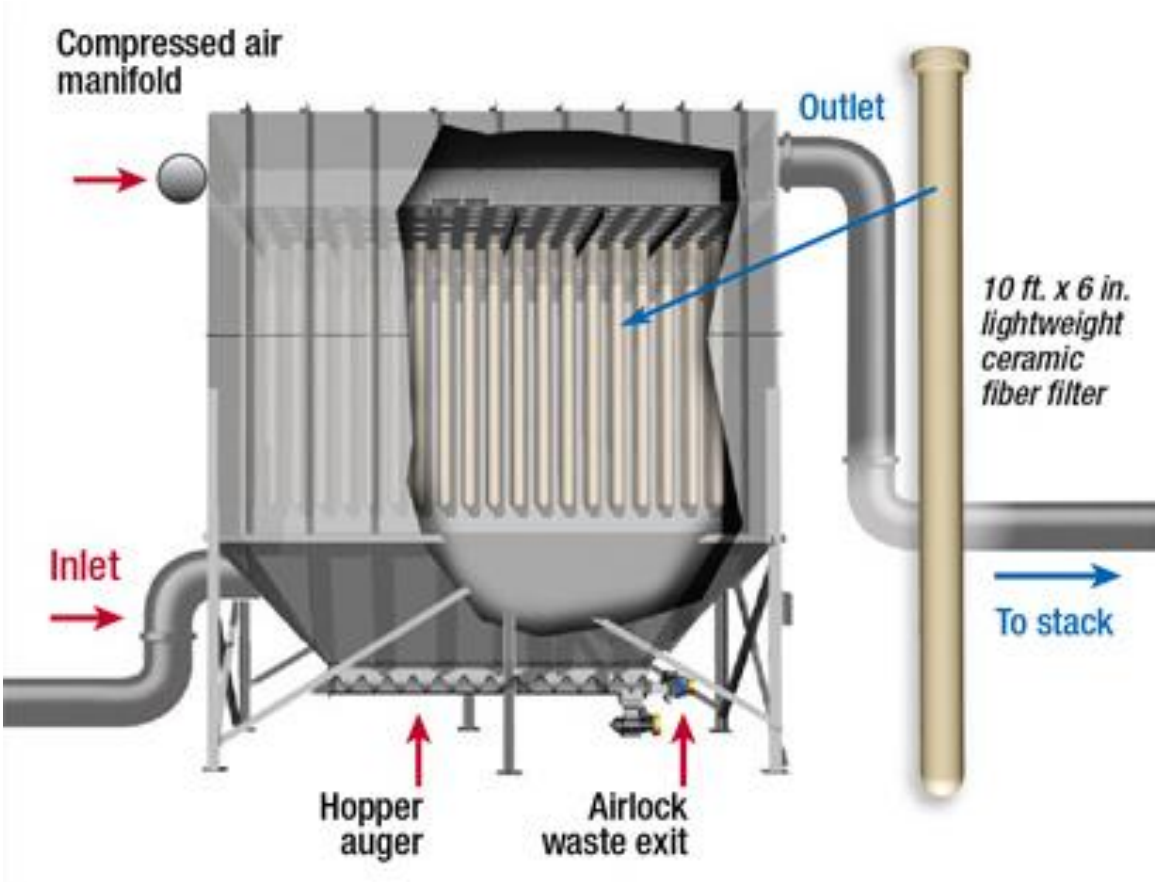
Typical NOx conversion efficiencies for CCF systems are comparable to traditional SCR systems. In addition to NOx reduction, CCF systems can be designed to remove other air pollutants such as SOx and PM. Although NOx conversion can be high using a CCF system, capital investment, operating cost, and increased reagent usage may make this option less cost-effective compared to other emission control technologies. However, the potential to remove pollutants in addition to NOx can make this option attractive to install.

Figure 2-2: Ceramic Filter Control System*



*** Image courtesy of Tri-mer Corporation**

Figure 2-3: Tri-mer Ultracat Control System Baghouse*



*** Image courtesy of Tri-mer Corporation**

CHAPTER 3: PROPOSED AMENDMENTS TO RULE 1117

INTRODUCTION

PROPOSED AMENDMENTS TO RULE 1117

INTRODUCTION

PAR 1117 is a landing rule for facilities in RECLAIM that establishes NOx and SOx emission limits for container glass melting and sodium silicate furnaces. The purpose of the proposed amendments is to establish Best Available Retrofit Control Technology (BARCT) emission limits for glass melting and sodium silicate furnaces.

PROPOSED AMENDMENTS TO RULE 1117

Rule 1117 was adopted on February 5, 1982 and was amended one-time on January 6, 1984. As part of this rulemaking effort, the rule not only will be revised to reflect BARCT NOx and SOx emission levels but it will also be amended to expand the applicability to include sodium silicate furnaces, to include new operational requirements, and address both NOx and SOx emissions. New sections and definitions are also added for clarity. Some provisions will be deleted as they are no longer applicable or relevant. Including a SOx emission limit as part of this rulemaking, helps to address the future transition of the SOx RECLAIM program. The rule title will be revised to: Emissions from Container Glass Melting and Sodium Silicate Furnaces.

New Purpose – Subdivision (a)

Previously, Rule 1117 did not have a subdivision that described the purpose of the rule. Consistent with recent source-specific rules, a purpose was added. PAR 1117 adds the following language for the purpose of the rule.

- The purpose of this rule is to limit emissions of Oxides of Nitrogen (NOx) and Oxides of Sulfur (SOx) from facilities producing container glass and sodium silicate.

New Applicability – Subdivision (b)

Previously, Rule 1117 did not have a subdivision that described the applicability of the rule. Consistent with recent source-specific rules, applicability was added to PAR 1117. It should be noted that auxiliary combustion equipment associated with container glass melting furnaces and sodium silicate furnaces are proposed to be included in this rule. Currently, there are only two facilities operating within the South Coast AQMD jurisdiction that PAR 1117 will apply to. Both are currently in the RECLAIM program. The provisions of PAR 1117 will apply to these facilities while in RECLAIM and after they transition out of RECLAIM.

Although the operations at the two facilities are distinct enough to require different emission limits, it was determined that there was sufficient similarity to consolidate the sodium silicate furnace operation into PAR 1117 with the acknowledgement that there are distinct differences between the equipment, process, operation, and configuration.

PAR 1117 adds the following language to the applicability of the rule for clarity and for consistency with other South Coast AQMD rules.

- The provisions of this rule shall apply to the owner or operator of a RECLAIM facility or Former RECLAIM facility that operates a container glass melting furnace and associated auxiliary combustion equipment or that operates a sodium silicate furnace.

New and Modified Definitions – Subdivision (c)

Subdivision (c) was amended to reflect new and revised definitions and to delete obsolete terms. The definitions were rearranged to be in alphabetical order. The following new and modified definitions reflect the proposed changes.

- *AUXILIARY COMBUSTION EQUIPMENT means any combustion equipment associated with the conveyance system or annealing equipment used in the container glass production process.*

  This definition was added since the container glass facility operates other combustion sources related to the manufacturing process. Their container glass production line also includes heated conveyance systems (forehearths/refiners) and annealing furnaces. It is the intent of staff to have this type of equipment covered in PAR 1117 to streamline simplify compliance under one industry-specific rule.

- *CONTAINER GLASS MELTING FURNACE means any furnace used to melt material in the production of food and beverage type containers manufactured by pressing, blowing in molds, drawing, rolling, or casting glass. Container glass does not include flat glass that is used in windows, windshields, plate glass, etc., and which is produced by the float, sheet, rolled, or plate glass process.*

  The definition for container glass melting furnaces was updated to differentiate this type of furnace from sodium silicate furnaces. It was also was updated to list exclusions to the definition of container glass melting furnaces. By combining references to flat glass and glass tableware operations, this revision allows the removal of these two processes from the exemption portion of the rule. Although other types of glass melting furnace operations were under RECLAIM in the past, these facilities conducting these operations have since shut down.

- *CULLET means scrap glass which is added to the formulation being charged to a* ***container glass*** *melting furnace.*

  This definition was modified slightly to clarify that the addition of scrap glass only applies to the container glass melting process.

- *DAY means the continuous 24-hour period from 12:00 am through 11:59 pm.*

  This definition was added to provide clarity as to what is considered one day of operation. This becomes relevant when following the proposed averaging provisions in PAR 1117.

- *FORMER RECLAIM FACILITY means a facility, or any of its successors, that was in the Regional Clean Air Incentives Market as of January 5, 2018, as established in Regulation XX,*

that has received a final determination notification, and is no longer in the RECLAIM program.

This defines when a facility no longer is referenced as a "RECLAIM facility" which will occur as the facility transitions out of RECLAIM.

- *FURNACE means, for the purpose of this rule, either a container glass melting furnace or sodium silicate furnace.*

  Unless specifically referenced as a "container glass melting furnace" or "sodium silicate furnace" the term furnace will apply to both types of furnaces.

- *IDLING means the operation of a furnace at less than 25 percent of the production capacity as stated on the Permit to Operate* ***and where the furnace is not undergoing startup or shutdown****.*

  Additional language was added to differentiate idling activities from startup and shutdown activities. The rule is being amended to restrict activities associated with idling, startup, and shutdown activities, which is detailed in another subdivision of PAR 1117. Activities that can necessitate a period of idling can include: a product compositional change, a temporary pause in operation known as a "hot hold", or short-term periods of time where a furnace is kept warm while maintenance of pollution control equipment is performed.

- *NOx EMISSIONS means the sum of nitric oxides and nitrogen dioxides emitted, calculated as nitrogen dioxide.*

  This definition was added for clarity.

- *PRODUCTION CAPACITY means a container glass or sodium silicate pull limit found in a Permit to Operate for the applicable furnace*.

  This definition was modified for clarity.

- *PULL or PULLED means the amount of product produced by a furnace, expressed in short tons per day*.

  This definition was modified for clarity.

- *RECLAIM FACILITY means a facility, or any of its successors, that was in the Regional Clean Air Incentives Market as of January 5, 2018, as established in Regulation XX.*

  This defines what facilities are RECLAIM facilities.

- *SHUTDOWN means that period of time during which a furnace is allowed to cool from operating temperatures to a furnace temperature below 200°F.*

This definition was modified to add language to differentiate shutdown activities from idling and startup activities. Previously, the rule considered a shutdown to occur when a furnace was "allowed to cool from operating temperature to a lower temperature". There was no consideration of what cooling to a lower temperature meant. In this revised definition, a shutdown is considered the process of cooling a furnace from an operating temperature with the intent of reaching ambient air temperature. For example, an operator may cut production and furnace temperature, but still keep a furnace hot enough to ramp production back up. This "hot standby" or "hot hold" mode should not be considered a shutdown, but rather an idling activity. In addition, a shutdown period is considered to start when product from the furnace is no longer being pulled.

- *SODIUM SILICATE FURNACE means any furnace used to melt material in the production of various water-soluble substances obtained in the form of crystals, glasses, powders, or aqueous solutions, used in a variety of industrial and consumer products.*

  Previously, there had been no definition for a sodium silicate furnace. This definition was added to differentiate this type of furnace from container glass melting furnaces. The definition is referenced in part from the online Merriam Webster dictionary at: https://www.merriam-webster.com/dictionary/sodium%20silicate.

- *SOx EMISSIONS means sulfur dioxides emitted.*

  This definition was added for clarity.

- *STARTUP means that period of time during which a furnace is heated to operating temperatures from a furnace temperature below 200°F.*

  The definition was modified to add language to differentiate startup activities from idling and shutdown activities. Previously, the rule considered a startup to occur when a furnace was "heated to operating temperature from a lower temperature". There was no consideration of what heating to an operating temperature meant. In this revised definition, a startup is considered the process of heating a furnace with the intent of reaching an operating temperature starting from ambient conditions. As mentioned previously, an operator may cut production but keep a furnace hot enough to ramp production back up. Ramping back up from this "hot standby" mode should not be considered a startup but rather an idling activity. In addition, a startup is considered to end once product is being pulled from the furnace.

- The definition for *ENERGY RECOVERY* was removed as no longer applicable. The definition for *FURNACE REBUILD* was removed as the amended rule no longer required this distinction.

Revised Requirements – Subdivision (d)

- *Previous* (d)(1) – (d)(6)

  The previous subparagraphs were no longer considered applicable and were removed and replaced with the following provisions.

- *New* (d)(1) – NOx and SOx emission limits for container glass melting furnaces

  The current Rule 1117 NOx emission limit for container glass melting furnaces is 4.0 pounds of NOx per ton of glass pulled. The 2015 NOx RECLAIM amendments were a result of a BARCT assessment that also included container glass melting and sodium silicate furnaces. In that evaluation, staff concluded that an 80% NOx emission was feasible and cost effective. Furthermore, staff's conclusion was confirmed by a contracted third-party consultant. The recommended BARCT emission factor for container glass melting furnaces was 0.24 pound of NOx per ton of glass pulled, as stated on Table 6 of Rule 2002 – Allocations for Oxides of Nitrogen (NOx) and Oxides of Sulfur (SOx). Based on this BARCT assessment for PAR 1117, the container glass melting furnace is using a CCF technology that can achieve NOx emissions well below 4.0 pounds of NOx per ton of glass pulled. As a result, the current limit in Rule 1117 is not representative of what has been demonstrated in for glass melting furnaces in the South Coast AQMD.

  Staff analyzed NOx emission data from 2016 through 2019 for container glass melting furnaces at the container glass melting facility. This period covered the time prior to and after the installation of their CCF pollution control equipment. Based on the evaluation of the operational data (see Appendix A), staff is recommending a NOx emission limit of 0.25 pounds of NOx per ton of glass pulled, averaged over a rolling 30-day period. A rolling 30-day averaging period was selected based on the operational variability, which is due to changes in types of glass containers produced. Staff looked at other jurisdictions for guidance. For a majority of instances, staff found that a rolling 30-day averaging was common. In some cases, a rolling 365-day averaging provision was also put in place as a complement to a 30-day rolling averaging provision. For example, the Durand Glass Manufacturing plant in Millville, New Jersey has a NOx permitted limit of 1.2 pounds of NOx per ton of glass pulled on a 30-day rolling average and a limit of 1.0 pounds of NOx per ton of glass pulled on a 365-day rolling average. Proposed Amended Rule 1117 is proposing the following NOx emission limit for container glass melting furnaces:

  > (d)(1)(A) – The owner or operator of a container glass melting furnace shall not operate a furnace, except during periods of idling, startup, or shutdown, in a manner that exceeds:
  >
  > 0.25 pound of NOx per ton of glass pulled, averaged over a rolling 30-day period

  Staff also concluded that the current SOx emission limit as established in the container glass facility permit and in other jurisdictions represents current BARCT. The following SOx limit is included in the proposed provision:

  > (d)(1)(B) – The owner or operator of a container glass melting furnace shall not operate a furnace, except during periods of idling, startup, or shutdown, in a manner that exceeds:
  >
  > 1.1 pounds of SOx per ton of product pulled, averaged over a rolling 30-day period

Changing the emission limit to a concentration-based standard (parts per million by volume, dry) was evaluated by staff. Staff reviewed how emissions are reported and regulated by other jurisdictions and found that the conventional reporting standard is pounds of pollutant per ton of glass pulled. Staff has proposed to keep the emission compliance standard on a pounds of pollutant per ton of glass pulled basis.

- *New* (d)(2) – NOx and SOx emission limits for sodium silicate furnaces

Rule 1117 currently does not include a NOx emission limit for sodium silicate furnaces. The 2015 NOx RECLAIM amendments were a result of a BARCT assessment that also included container glass melting and sodium silicate furnaces. In that evaluation, staff concluded that a 80% NOx emission was feasible and cost effective. Furthermore, staff's conclusion was confirmed by a contracted third-party consultant. The recommended BARCT emission factor for sodium silicate furnaces was 1.28 pounds of NOx per ton of glass pulled, as stated on Table 6 of Rule 2002 – Allocations for Oxides of Nitrogen (NOx) and Oxides of Sulfur (SOx). Based on this BARCT assessment for PAR 1117, staff concluded that technology exists such that NOx emissions can reduced well below the existing NOx emission limit for glass melting furnaces of 4.0 pounds of NOx per ton of glass pulled.

Staff analyzed NOx emission data from 2016 through 2019 for the sodium silicate furnace at the sodium silicate facility. This period covered the time prior to and after the installation of their CCF emissions control equipment. Based on the evaluation of the operational data (see Appendix A), staff is recommending a NOx emission limit of 0.50 pound of NOx per ton of product pulled, averaged over a rolling 30-day period. A 30-day averaging period was selected based on the operational variability which is due to operational configuration of the furnace. Proposed Amended Rule 1117 is proposing the following NOx emission limit for sodium silicate furnaces:

> (d)(2)(A) – The owner or operator of a sodium silicate furnace shall not operate a furnace, except during periods of idling, startup, or shutdown, in a manner that exceeds:
>
> 0.50 pound of NOx per ton of product pulled, averaged over a rolling 30-day period

Staff also concluded that the current SOx emission limit, as established for container glass melting furnaces and based on review of other jurisdictions, is representative of current BARCT. The following SOx limit is included in the proposed provision:

> (d)(2)(B) – The owner or operator of a sodium silicate furnace shall not operate a furnace, except during periods of idling, startup, or shutdown, in a manner that exceeds:
>
> 1.1 pounds of SOx per ton of product pulled, averaged over a rolling 30-day period, if not fired on 100% natural gas

The furnace at the sodium silicate facility is currently permitted in the SOx RECLAIM program, but is no longer a SOx emitting source. Previously, the facility had the ability to supply its furnace with No. 2 fuel oil, but it has since changed its primary fuel to natural gas

and has removed all infrastructure to support fuel oil. The proposed provision places a limit in the event that a fuel other than natural gas is used and that results in SOx emissions.

- *New* (d)(3) – Operational restrictions

  (d)(3)(A) – Idling

  Previously, idling had been exempted from the provisions of the Rule 1117. However, concern that idling may lead to unrestricted emissions with no limitations or cap prompted staff to consider implementing measures to limit emissions from this type of activity. At the same time, staff recognized the need to provide operational flexibility for instances where a facility may require a temporary transitional period where shutting down a furnace may not be warranted. For example, a product change may necessitate a period of time where idling may take place as the manufacturing line transitions from one product to another.

  Facilities idle their furnaces because it is inefficient to shut down and start up again. Furthermore, this shutdown and startup process takes several days to complete. For guidance and comparison, staff reviewed how idling is regulated in other jurisdictions. In general, idling is defined as the operation of a furnace at less than 25% of the permitted glass production capacity. In other jurisdictions, during idling, emissions are not counted towards complying with an emission limit. However, when regulated, idling emissions may be capped for a given operation. For example, SJVAPCD Rule 4354 does not count idling emissions for compliance determination but it does limits idling emissions using the following formula:

  $$E_{i,max} = E_i \times \text{Capacity}$$

  where, $E_{i,max}$ = maximum daily emission of pollutant i during idling
  E_i = applicable emission limit
  Capacity = furnace's permitted glass production rate

  Similarly, in Title V permits issued to the PQ Corporation in Chester, Pennsylvania and the Gallo Glass Company in Modesto, California, NOx emissions are not counted towards compliance determination. However, emissions are limited during idling events such that PQ (Chester) and Gallo have idling NOx emission limits of 1,670 lbs/day and 780 lbs/day, respectively.

  While there are examples of idling emissions being regulated to a specified emission level, staff did not find examples where the length of idling time was regulated. Nonetheless, staff is concerned that a furnace may be at idling conditions for an undetermined length of time. To address this potential unlimited amount of idling time, staff proposes the following provisions.

  - The owner or operator shall not operate a furnace for more than: 240 consecutive hours per event and 960 cumulative hours in any rolling 365-day period during periods of idling.

Based on discussions with the affected facilities, establishing a limit of 240 hours or 10 days of idling was a reasonable expectation for a product transition event as well as scheduled idling events that occur annually. Moreover, setting a limit of 960 hours gives operators flexibility to have multiple idling events during a rolling 365-day period yet at the same time, limiting the emissions from this type of activity. Consistent with other jurisdictions, staff recommends that idling emissions not be counted towards compliance determination.

(d)(3)(B) – Startup

Under Rule 1117, there were no restrictions associated with starting up a furnace. PAR 1117 proposes to define a startup as initiating furnace operation from a temperature below 200°F. A startup period should be considered to end once product is being pulled from the furnace. Concern that unlimited and unregulated startups may lead to unrestricted emissions with no limitations or cap has prompted staff to consider implementing measures to limit emissions from this type of activity. At the same time, staff recognizes the need to provide flexibility to operators during startups.

For guidance and comparison, staff reviewed how a startups are regulated in other jurisdictions. In other jurisdictions, during startups, emissions are not counted towards complying with an emission limit. Under SJVAPCD Rule 4354, startups from a furnace rebuild are regulated on a case-by-case basis to maximum time between 70 – 100 days for a container glass melting furnace. There is, however, no restriction on the amount of time for a startup from a non-furnace rebuild startup event.

Staff is concerned that a furnace may be at startup conditions for an undetermined length of time. To address this unlimited amount of startup time, staff proposes the following similar, but more restrictive provision than SJVAPCD's rule:

(A) A facility shall not operate a furnace for more than: 720 hours per startup period.

Based on discussions with representatives of the container glass facility, setting a limit of 720 hours or 30 days for a startup is appropriate based on normal startup procedures.

(d)(3)(C) – Shutdown

Rule 1117 currently has no restrictions associated with shutting down a furnace. Staff has proposed defining a shutdown as stopping furnace operation and cooling towards a temperature below 200°F. A shutdown period should be considered to be initiated once product from the furnace is no longer pulled. Concern that unlimited and unregulated startups may lead to unrestricted emissions with no limitations or cap has prompted staff to consider implementing measures to limit emissions from this type of activity. At the same time, staff recognizes the need to provide flexibility to operators during shutdowns.

For guidance and comparison, staff reviewed how a shutdown is regulated in other jurisdictions. In other jurisdictions, emissions during shutdowns are not counted towards complying with an emission limit. Under SJVAPCD Rule 4354, shutdowns are limited not to

exceed 20 days once the furnace is below an idling threshold of 25% of the permitted glass production rate.

Using SJVAPCD Rule 4354 as guidance, staff is proposing a similar but more restrictive limitation to the shutdown of a furnace:

- A facility shall not operate a furnace for more than: 240 hours per shutdown period.

Although staff has proposed less time than what is contained in SJVAPCD Rule 4354 (20 days in SJVAPCD Rule 4354 versus 10 days or 240 hours in PAR 1117), this amount of time is a reasonable expectation, pursuant to shutdown procedures based on discussions with the affected facilities.

- *New* (d)(4) – Operation of emission control equipment

  When the rule was last amended in 1984, the glass melting and sodium silicate furnaces did not have any added emission control equipment like a CCF system. Since 2017, both the container glass and sodium silicate facilities installed CCF systems to control NOx emissions. As a result, staff is adding a requirement that states:

  - During operation of a furnace including periods of idling, startup, or shutdown, the owner or operator of a furnace shall maintain in operation any exhaust emission control systems, including the injection of any associated chemical reagent into the exhaust stream to control NOx, if the temperature of the gas to the inlet of the emission control system is greater than or equal to 450 deg F.

  This provision mirrors what has been observed in other jurisdictions. For example, in the SJVAPCD Rule 4354, during idling, startups, or shutdowns, the emission control system shall be in operation whenever technologically feasible.

  Staff notes what is technologically feasible requires further clarification. The CCF system operates as designed within a normal temperature operating window between 450 deg F and 900 deg F. The intent of this provision is to explicitly require the emission control equipment to be in operation and injecting ammonia or similar reagent when the temperature of the exhaust from the furnace to it is above a minimum operational temperature, even if the furnace is idling, in startup, or in the process of a shutdown. If an operator can still inject ammonia while reducing NOx without exceeding an ammonia slip limit, then this activity would be encouraged.

- *New* (d)(5) – Auxiliary combustion equipment

  One of the objectives of PAR 1117 is to provide container glass melting and sodium silicate facility operators with a single industry-specific rule that would encompass relevant combustion sources at their facilities. Staff recognized that the container glass facility's process lines include such auxiliary combustion equipment. This subparagraph limits emissions from

this equipment to emission levels currently established for comparable equipment regulated by South Coast AQMD Rule 1147 – NOx Reductions from Miscellaneous Sources.

The conveyance system burners located along the forehearths and refiners coming out of the glass melting furnace for the production of container glass are numerous. They number in the hundreds and the types of burners are of a standard open flame type that have no viable method for emissions testing because they are not enclosed and vent to the atmosphere. The container glass facility underwent a rebuild on both of their furnace lines in 2017, so the proposed provision would require the replacement of these burners at the time of a subsequent furnace rebuild with burners that are certified by the manufacturer to meet either 30 ppm at 3% O2 dry or 0.036 pound of NOx per million BTU of heat input. Staff proposes at time interval of 15 years from the date of amendment.

Equipment manufacturers have stated that the ability to test and certify these types of burners could be achieved in the near future. Similarly, the container glass facility operates several annealing furnaces (Lehr furnaces) that are natural gas fired. It should be noted that the container glass facility also has installed Lehr ovens that are electric and not natural gas fired. The proposed provision would also require compliance with either NOx limit by 15 years from the date of amendment.

Currently under RECLAIM, these combustion devices are only required to report their mass emissions by using a default emission factor of 130 lbs of NOx per standard cubic foot, roughly equivalent to 101 ppm, corrected to 3% oxygen. This proposed provision would state:

- By [*15 years after Date of Amendment*], the owner or operator of a container glass facility shall not operate the auxiliary combustion equipment used in the manufacture of container glass that exceeds a NOx emission limit of 30 ppmvd at 3% O2, dry or 0.036 lb/MMBTU heat input.

<u>*Revised* Compliance Determination – Subdivision (e)</u>

- *Previous* (e)(1) and (e)(2)

  The previous subparagraphs were no longer considered applicable and were removed and replaced with the following provisions.

- *New* (e)(1) – CEMS requirements

  Staff recognizes that CEMS requirements differ between the RECLAIM program regulated by Rules 2011 and 2012 and a command-and-control regulatory structure regulated by Rules 218 and 218.1. This section is added to facilitate the transition of the applicable monitoring, reporting, and recordkeeping requirements specified in RECLAIM versus a command-and-control system. The provision reads:

  The owner or operator of a container glass melting furnace or sodium silicate furnace shall:

- Determine compliance with the emission limits in paragraphs (d)(1) and (d)(2) on a rolling 30-day average using a Continuous Emissions Monitoring System (CEMS), except if a furnace operates for fewer than 30 days, then compliance for NOx will be determined based on the average for the actual days of operation. A facility owner or operator shall comply with the applicable monitoring, reporting, and recordkeeping requirements specified in:

    (A) Rules 2011 and 2012 for RECLAIM facilities; or

    (B) Rules 218 and 218.1 for former RECLAIM facilities.

The current version of Rule 1117 requires a facility owner or operator to determine compliance with an emission limit averaged over a 3-hour period for a furnace not equipped with a CEMS. For furnaces equipped with a CEMS, averaging may be allowed over a 24-hour period. A 24-hour averaging basis to determine compliance was something that staff further evaluated.

Staff also reviewed emissions data for both the container glass and sodium silicate facilities from 2016 through 2019. In their review, staff had noticed spikes in the data corresponding to transient operational issues. Some of these issues were identified as actions taken to comply with a permitted ammonia limit. When staff applied a rolling 30-day averaging to the data, these transient spikes were not as significant as to affect the compliance determination.

Therefore, to provide the operator with flexibility to respond to transient operational issues, staff has included a provision that requires compliance determination to be made on a 30-day rolling average basis. Moreover, recognizing that the sodium silicate facility operates a batch process where a rolling 30-day period may not be achievable, the provision also allows averaging over the actual days of operation.

Emissions from idling, startups, and shutdowns would not be included in the rolling 30-day average.

- *New* (e)(2) – Auxiliary equipment provision

Included in subparagraph (d)(5), auxiliary combustion equipment will be covered under the provisions of PAR 1117. The proposed limits mirror what is currently contained in Rule 1147 and would have applied to this type of equipment. However, staff recognizes that there are challenges for the verification of the proposed limits. Specifically, there is concern with the configuration of the conveyance system at the container glass facility – it does not allow for accurate and verifiable emissions testing. What staff proposes, in lieu of a source test, is to accept certification from the original equipment manufacturer (OEM) that the burners used in the conveyance system have been tested and can meet the proposed emissions levels. For annealing furnaces that are combustion sources, this equipment can either be source tested to demonstrate compliance or the operator can provide OEM certification.

Once the equipment has met the verification required under this subparagraph, there is no additional testing that will be required.

New Recordkeeping – Subdivision (f)

Staff added a recordkeeping section to this rule so that records to demonstrate the pounds of pollutant per ton of product pulled are maintained. These records include the total hours of operation, the quantity of product pulled from each furnace, and the requirement that the pollutant emission rate be kept on a pounds of pollutant per ton of product pulled, as applicable, on a rolling 30-day average. Here, it should be noted that product refers to either container glass product or sodium silicate product. Currently, NOx and SOx are the pollutants regulated by PAR 1117; however, in the case of the sodium silicate facility, the SOx limit would not apply if it continues to operate on 100% natural gas.

In addition, a provision requiring a facility owner or operator to retain all data, logs, and other information required by this rule for at least five years and be made available for inspection by the Executive Officer is added. For current RECLAIM facilities, any reporting requirements under Regulation XX will still be in effect until the facility exits the RECLAIM program.

Revised Exemptions – Subdivision (g)

- *Revised* (g)(1) – Reduce applicability threshold to provide relief only to small operators

  Currently, subparagraph (f)(1) exempts from the provision of the rule, furnaces which are limited by their permit to operate to 15 lbs of NOx per hour which equates to up to 65.7 tons per year which is unacceptably high.

  Staff proposes to change the exemption to apply to furnaces that are exempt from permits and to furnaces that produce less than 100 tons of product per year. It is in the intention to provide this relief to small shops that may be manufacturing niche or artisan products.

- *Previous* (g)(3) and (g)(4) – Remove glass tableware and flat glass exemptions

  These two exemptions were removed from this section and incorporated in the definition for container glass furnace for exclusion.

- *Revised* (g)(5) – Revision of fiberglass exemption

  Additional description of what is fiberglass was added for clarity.

- *Previous* (f)(6) – Remove idling exemption

  As stated earlier, staff is concerned that idling should not be allowed to occur for an unlimited amount of time. Provisions have been included to regulate what is considered idling and how long idling would be allowed to occur.

CHAPTER 4: IMPACT ASSESSMENTS

INTRODUCTION

In December 2015, Regulation XX was amended to implement Control Measure CMB-01 of the 2012 Air Quality Management Plan and to further reduce NOx from RECLAIM facilities. The amendment implemented NOx BARCT for various pieces of equipment. As part of the BARCT assessment, container glass melting and sodium silicate furnaces were required to reduce NOx emissions by 80%. Subsequently, Control Measure CMB-05 of the 2016 AQMP required the RECLAIM program to achieve further NOx emission reductions of five tons per day and to include actions to transition the program to a command-and-control regulatory structure as soon as feasible but no later than 2025.

In 2017, the container glass and sodium silicate facilities installed air pollution control equipment in response to CMB-01. Since the installation of the control equipment, there has been a NOx reduction of at least 80% from the furnaces at both facilities. The costs of installation and operation of the control equipment from the 2017 installation of pollution control equipment will be used to the calculate the cost-effectiveness of PAR 1117.

EMISSION REDUCTIONS

In 2017, both facilities installed air pollution control equipment for each of their furnaces. At the container glass facility, a combination of oxy-fueled burners and a ceramic catalyst filtration system was installed. At the sodium silicate facility, only a ceramic catalyst filtration system was installed. Since the startups of these furnaces with the installed emissions control equipment, NOx emissions have been reduced by approximately 0.7 tons per day. A comparison of emissions before and after 2017 is shown in Table 4-1 below.

In 2016, the total NOx emissions from the two furnaces at the container glass facility and the one furnace at the sodium silicate facility were reported at 0.79 tons per day (tpd). In 2019, the combined NOx emissions for the three furnaces were 0.088 tpd. This is a significant drop in NOx emissions of 0.70 tpd. It should be noted that the sodium silicate furnace operated 35 days less in 2019 (139 days) compared to the number of days operated in 2016 (174 days).

For the auxiliary combustion equipment, staff also reviewed what NOx reductions are achievable once this equipment meets the NOx emission limits established in subparagraph (d)(5). Currently, the auxiliary combustion equipment is classified as RECLAIM process units and is assigned a NOx emission factor of 130 lb/mmscf of gas fired (or approximately 101 ppmvd). The combined annual NOx emissions from this equipment is 7.5 tons per year or 0.021 tpd. Therefore, the emission reductions for the auxiliary equipment would be 5.3 tons per year or 0.015 tpd.

Table 4-1: Average Daily NOx Emissions per Calendar Year (lb/day)[1]		
	2016	2019
Container Glass Furnace B	0.321	0.0315
Container Glass Furnace C	0.262	0.025
Sodium Silicate	0.205	0.032
Total	0.79	0.088
[1] Based on unaudited RECLAIM data submitted by facilities		

COST-EFFECTIVENESS

Staff conducted a cost-effectiveness analysis for the installation and operation of the control equipment and the reduction in NOx emissions observed after installation. To assist in the analysis, actual cost information was requested and received from the sodium silicate facility. However, cost data was requested but has not been received from the container glass facility at this time. For the container glass facility, staff utilized estimates provided by equipment manufacturers and used during the 2015 BARCT assessment.

Capital costs included cost for the emissions control system, infrastructure, engineering services, and installation costs. Annual operating costs included estimates for electricity, reagent, operation and maintenance, waste disposal, system costs, and filters elements.

The NOx emissions used in the analysis compared 2016 data with 2019 data for both facilities (see Table 4-1).

In the calculation, staff assumed a uniformed series present worth factor (PWF) at a 4% interest rate and a 25-year equipment life expectancy. The uniform series present worth factor for these assumption is 15.622.

$$PWV = TIC + (PWF \times AC)$$

PWV = present worth value ($)
TIC = total installed cost ($)
AC = annual cost ($)
PWF = uniform series present worth factor (15.622)

In addition, staff used the Marshall and Swift cost indexes to scale costs and estimates from 2015 to 2019. The values used were based on the national average for all industrial equipment for 2015 and 2019 or 1593.7 and 1727.8, respectively.

Table 4-2: PAR 1117
Cost Effectiveness Analysis

Operation	TIC ($ MM)	AC ($ MM)	PWV ($ MM)	CE ($/ton)
Glass Melting (Container Glass)	5.57	0.62	15.2	3,200
Sodium Silicate Manufacturing	4.34	0.11	6.03	3,800
Auxiliary Equipment (Container Glass)	N/A	N/A	N/A	N/A
			Total	3,300

Since the auxiliary combustion equipment for container glass is expected to be replaced upon the next furnace rebuild, this is not expected to incur any incremental cost associated with PAR 1117.

Based on the preceding analysis, the overall cost-effectiveness for PAR 1117 is calculated to be approximately $3,300 per ton of NOx reduced.

SOCIOECONOMIC ASSESSMENT

A socioeconomic impact assessment will be conducted and released for public review and comment at least 30 days prior to the South Coast AQMD Governing Board Hearing which is anticipated to be heard on June 5, 2020.

CALIFORNIA ENVIRONMENTAL QUALITY ACT ANALYSIS

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

DRAFT FINDINGS UNDER CALIFORNIA HEALTH AND SAFETY CODE SECTION 40727

Requirements to Make Findings

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

Necessity

PAR 1117 is needed for equipment under the RECLAIM program that will be transitioning to a command-and-control regulatory structure to establish NOx emission limits for furnaces and auxiliary combustion equipment that are representative of BARCT, as well as monitoring, reporting, and recordkeeping requirements.

Authority

The South Coast AQMD obtains its authority to adopt, amend, or repeal rules and regulations pursuant to H&SC Sections 39002, 39616, 40000, 40001, 40440, 40702, 40725 through 40728, 40920.6, and 41508.

Clarity

PAR 1117 is written or displayed so that their meaning can be easily understood by the persons directly affected by them.

Consistency

PAR 1117 is in harmony with and not in conflict with or contradictory to, existing statutes, court decisions or state or federal regulations.

Non-Duplication

PAR 1117 will not impose the same requirements as any existing state or federal regulations. The proposed amended rules are necessary and proper to execute the powers and duties granted to, and imposed upon, the South Coast AQMD.

Reference

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

COMPARATIVE ANALYSIS

Under H&SC Section 40727.2, the South Coast AQMD is required to perform a comparative written analysis when adopting, amending, or repealing a rule or regulation. The comparative analysis is relative to existing federal requirements, existing or proposed South Coast AQMD rules and air pollution control requirements and guidelines which are applicable to container glass melting and sodium silicate furnaces.

Staff reviewed existing federal requirements that regulate glass melting furnaces to compare these requirements with PAR1117. Based on the review, staff determined that PAR 11117 does not conflict with any NOx or SOx emission limits or recordkeeping requirement established in the Code of Federal Regulations (CFRs) for glass manufacturing facilities. In general, the CFRs do not regulate NOx or SOx emissions. See Table 4-3.

Table 4-3: Comparative Analysis of PAR 1117 with the Code of Federal Regulations (CFR)

CFR Title	Part	Subpart	Title of Regulation	Pollutant (s) Regulated
40	60	CC	Standard of Performance for Glass Melting Furnaces	Particulate matter
40	63	SSSSSS	National Emission Standards for Hazardous Air Pollutants for Glass Manufacturing Area Sources	Particulate matter and metal
41	61	N	National Emission Standard for Inorganic Arsenic Emissions from Glass Manufacturing Plants	Arsenic

Staff also reviewed other South Coast AQMD rules relative to PAR 1117. No conflicts were noted between the two.

Table 4-4: Comparative Analysis of PAR 1117 with Existing South Coast AQMD Rules

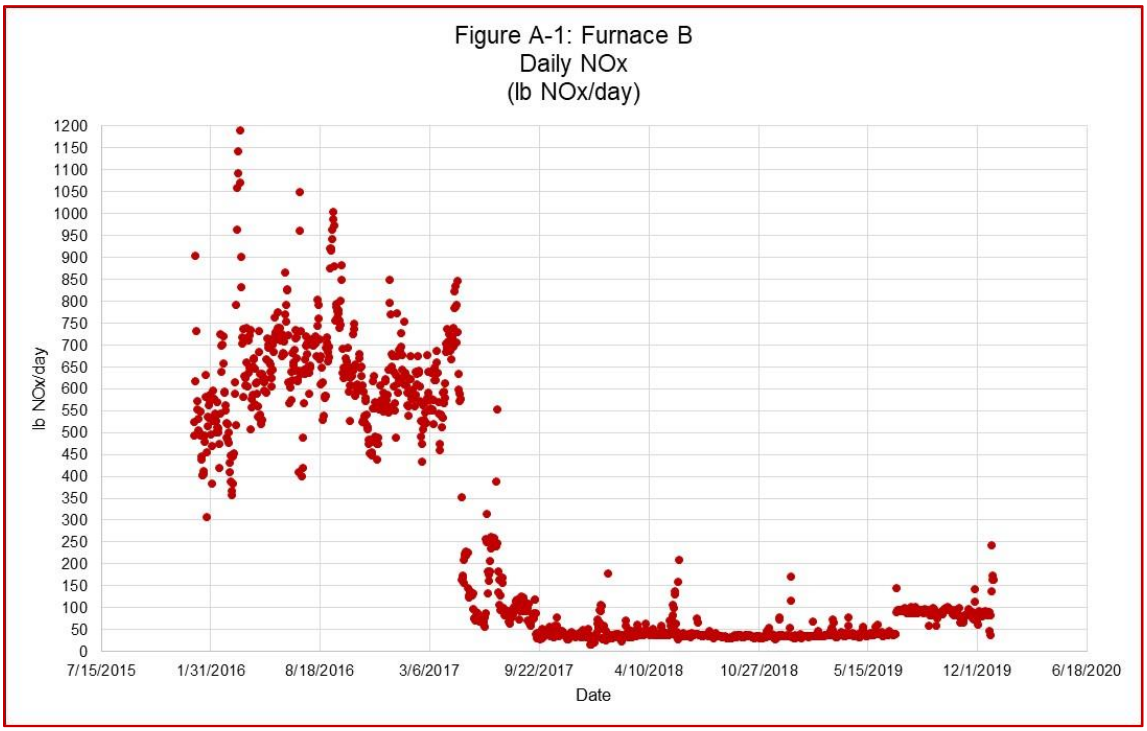
Rule Element	PAR 1117	RECLAIM
Applicability	• Container glass melting furnaces • Container glass auxiliary combustion equipment • Sodium silicate furnaces	Facilities regulated under the NOx and SOx RECLAIM program (SCAQMD Reg. XX)
Requirements	• Container glass melting furnaces NOx: 0.25 lb/ton pulled SOx: 1.1 lb/ton pulled • Container glass auxiliary combustion equipment 30 ppmvd @ 3% O_2 • Sodium silicate furnaces NOx: 0.50 lb/ton pulled SOx: 1.1 lb/ton (if not on 100% natural gas)	• Major Source NOx/SOx: None • Process Unit NOx: 130 lb/mmscf

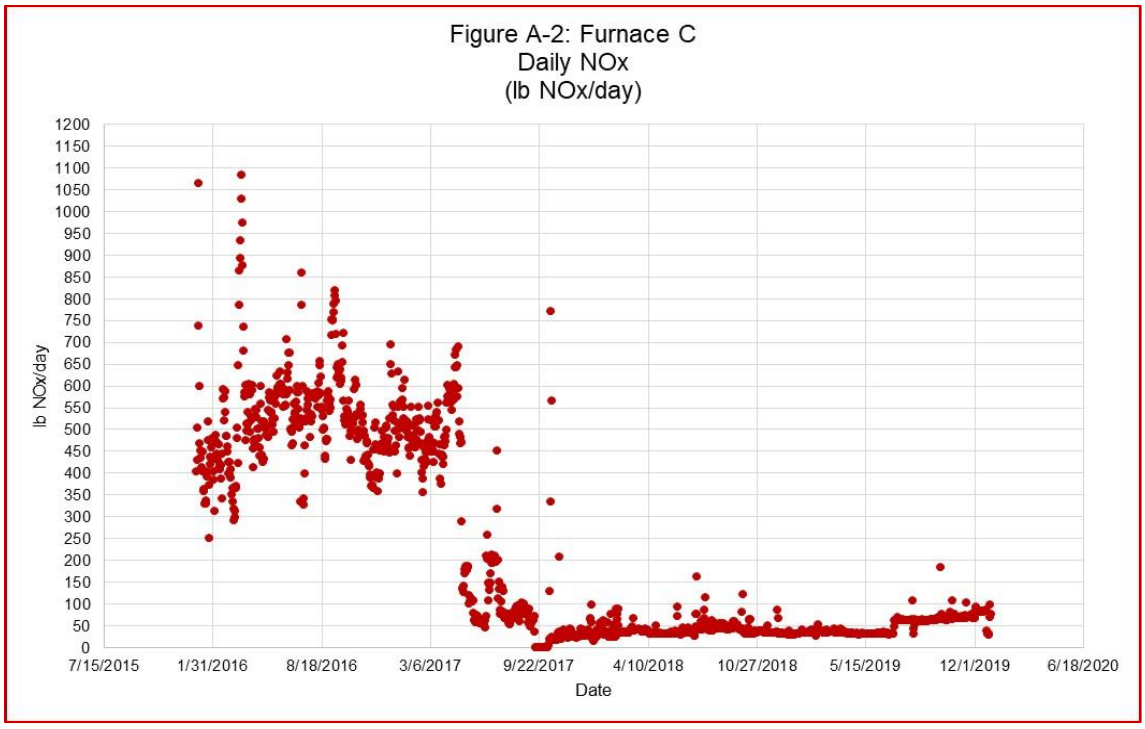
Reporting	• Maintain data to be used for compliance determination	• Daily electronic reporting for major sources • Monthly to quarterly reporting for large sources and process units • Quarterly Certification of Emissions Report and Annual Permit Emissions Program for all units
Monitoring	• A continuous in-stack NOx monitor subject to: ➢ South Coast AQMD Rules 2011 and 2012 for RECLAIM facilities ➢ South Coast AQMD Rules 218 and 218.1 for former RECLAIM facilities	• A continuous in-stack NOx monitor for major sources Source testing once every 5 years for process units
Recordkeeping	• All data required by this rule shall be maintained for at least five years and made available for inspection by the Executive Officer	• Quarterly log for process units • < 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)

APPENDIX A: EMISSION LIMIT DETERMINATION

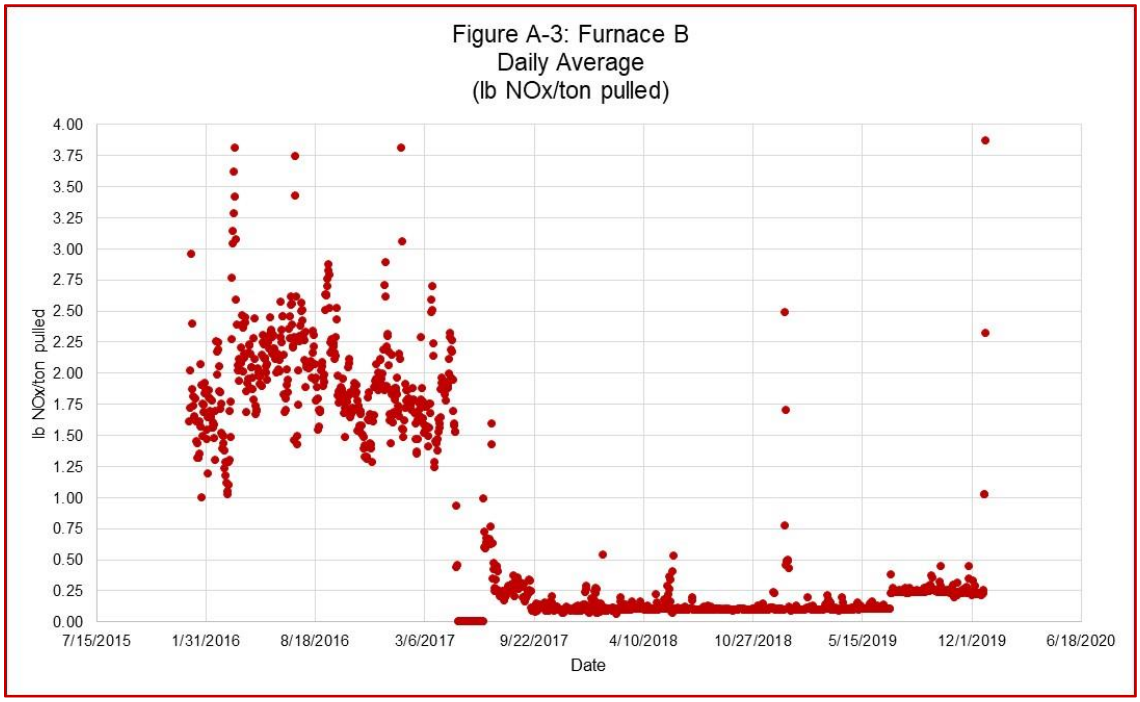
Presentation of NOx Emissions from Furnace Operations

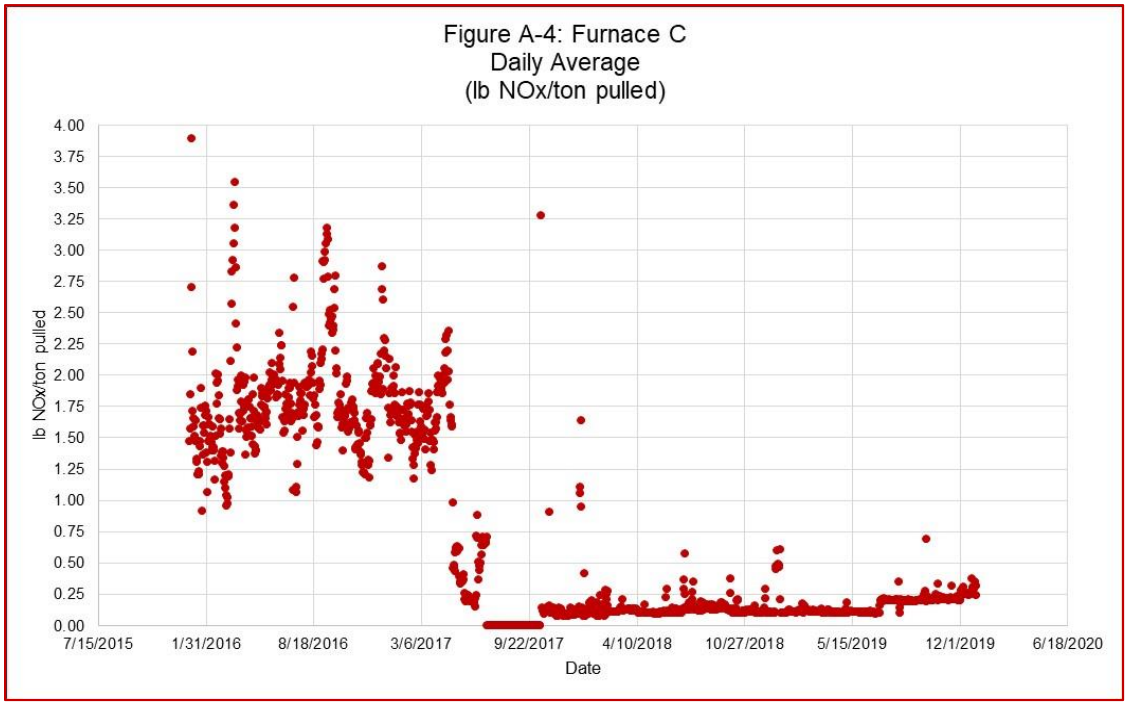
Figures A-1 and A-2 illustrate the NOx emissions on a lbs per day basis reported by the container glass facility for its container glass melting furnaces from CY 2016 to CY 2019.



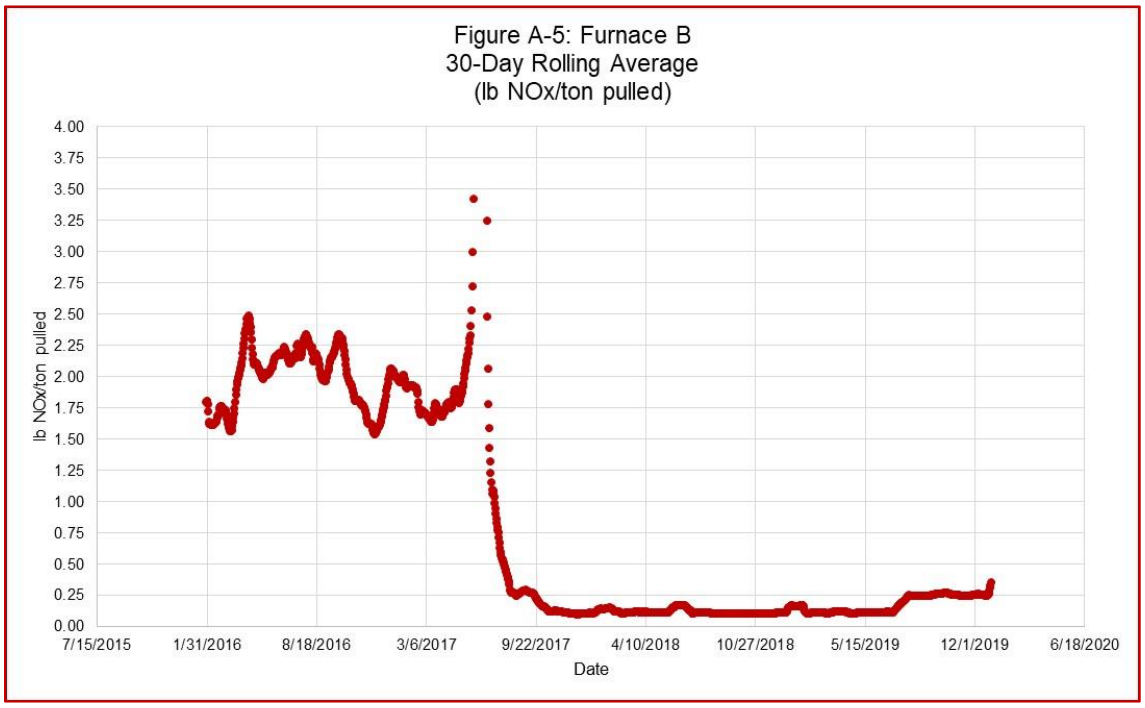


Figures A-3 and A-4 illustrate the NOx emissions per day based on the ratio of emissions to glass pulled for the container glass melting furnaces from CY 2016 to CY 2019.





Figures A-5 and A-6 illustrate the NOx emissions on a rolling 30-day average based on the ratio of emissions to glass pulled for the container glass melting furnaces from CY 2016 to CY 2019.



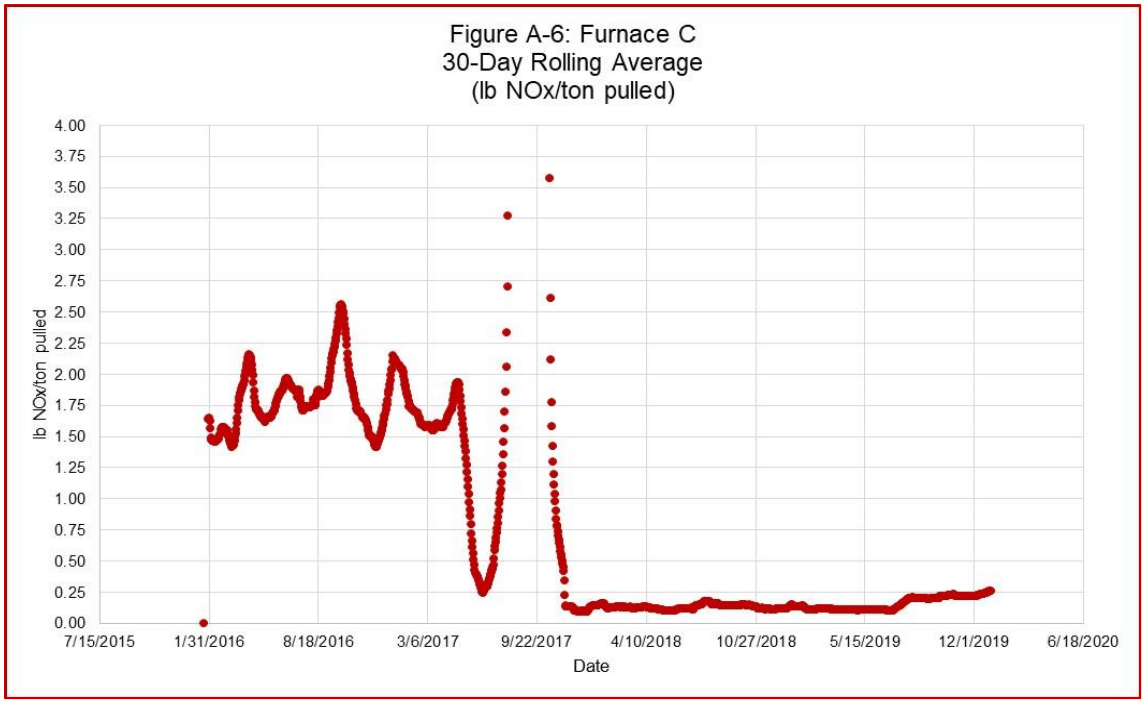
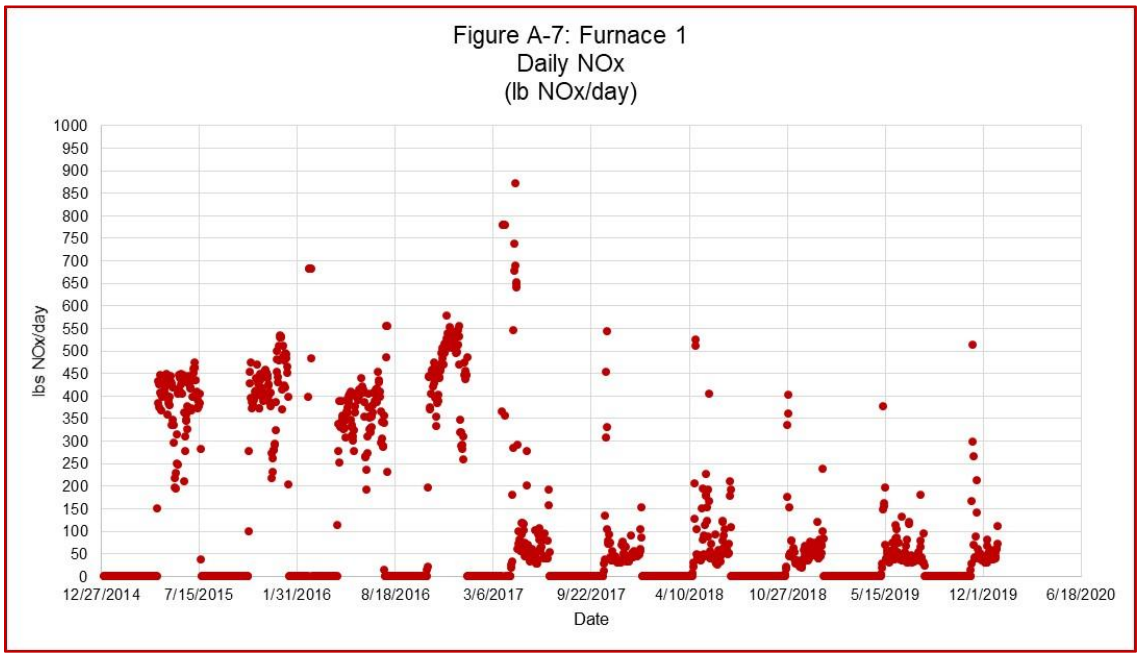
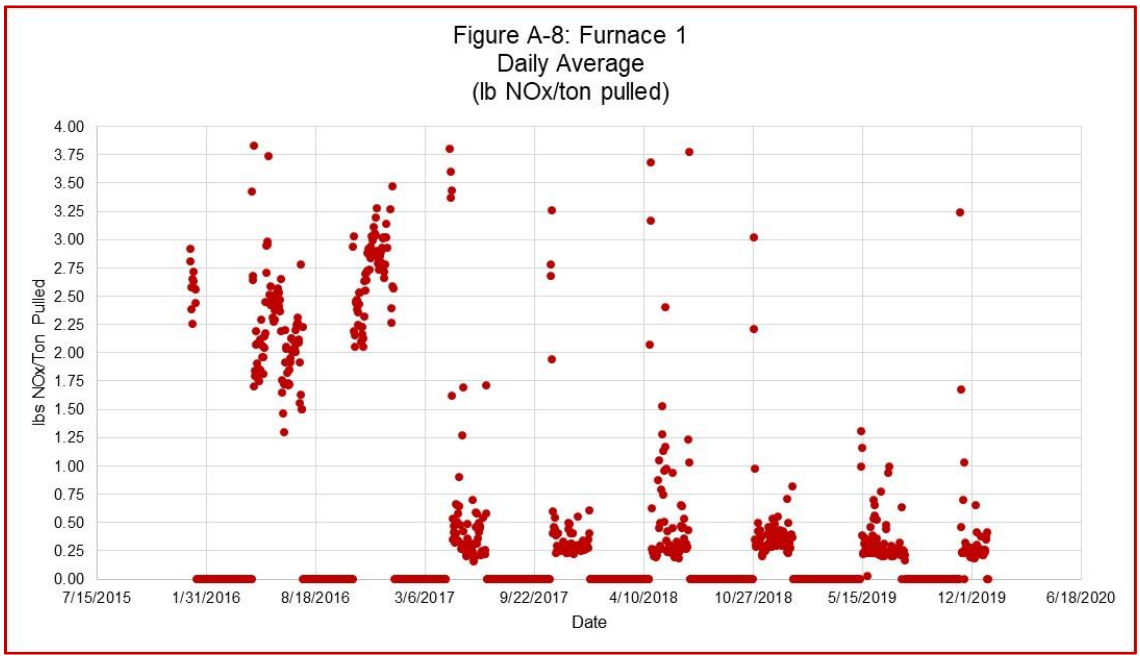


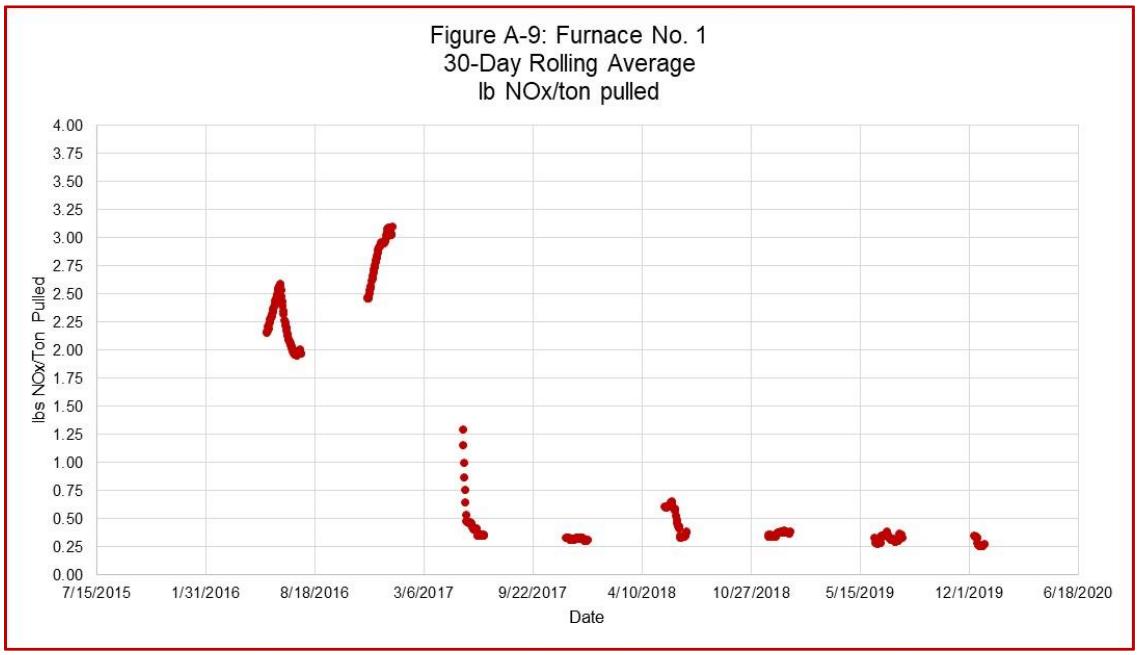
Figure A-7 illustrates the NOx emissions on a lbs per day basis reported by the sodium silicate facility for its sodium silicate furnace from CY 2016 to CY 2019.



Figures A-8 illustrates the NOx emissions per day based on the ratio of emissions to glass pulled for the sodium silicate furnace from CY 2016 to CY 2019.



Figures A-9 illustrates the NOx emissions on a rolling 30-day average based on the ratio of emissions to glass pulled for the sodium silicate furnace from CY 2016 to CY 2019.



NOx Data Analysis

Staff analyzed the NOx emissions data from the container glass furnaces and noted a significant drop in NOx emissions when comparing data from before and after 2017. In 2017, the container glass facility installed a CCF emission control systems on the exhaust gas exiting their container glass melting furnaces. It also should be noted that this facility had previously installed oxy-fueled burners on their container glass melting furnaces. Staff believes that the combination of the CCF and the oxy-fueled burners accounted for the significant drop in NOx emissions.

Through discussions with the container glass facility, staff learned that after the installation of the CCF systems, there was a period of time where they had to learn how to fine tune the operation of the equipment. During this time, they experienced unexpected breakage of filter elements. They also had to experiment with ammonia injection rates to optimize NOx emission reductions versus their permitted ammonia slip limit of 5 ppmvd. Initially after startup of the CCF system, to maximize NOx reductions, the CCF control system was operated to control NOx emissions at a 0.15 lb of NOx per ton of glass pulled ratio. Later as operational issues were resolved, the targeted emission level was adjusted up to 0.22 lb of NOx per glass pulled, as observed around July 2019. Some of this adjustment helped to resolve ammonia slip concerns such that current ammonia slip is less than 1 ppmvd.

Through site visits to the container glass facility, it was noted that the CCF system as installed is a robust system consisting of four units per furnace. According to its permit, the facility is required to run at a minimum of two units per furnace line. However, running three units at a time with a sufficient ammonia injection appears to minimize NOx emissions as well as balance their ammonia

slip concerns. With a fourth unit online, it was reported that there was not much difference observed in the amount of reduction achieved versus three units on line.

When the NOx emission data was analyzed on a 30-day rolling average by staff, many transient data spikes that had been initially observed became less significant.

Staff also analyzed the NOx emissions data from the sodium silicate furnaces and noted a significant drop in NOx emissions when comparing data from before and after 2017. In 2017, the sodium silicate facility installed a CCF emission control system on the exhaust gas exiting their sodium silicate furnace which accounted for their drop in NOx emissions.

As with the container glass facility, the sodium silicate facility also experienced a period of time where the operators had to learn how to fine tune the operation of the equipment. During this time, they too experienced unexpected breakage of filter elements. They also had to experiment with ammonia injection rates to optimize NOx emission reductions versus their permitted ammonia slip limit of 10 ppmvd. In general, the sodium silicate furnace operates at about 0.4 lb of NOx per ton of product pulled and also does not have the same level of redundancy as the container glass facility does by having multiple units.

During site visits to the sodium silicate facility, it was observed that there were frequent transient spikes in ammonia slip. It was also observed that these spikes may be correlated to how the furnace switches its crossflow flow periodically from one side of the furnace to the other. These transients forced ammonia injection adjustments which appeared to affect their overall NOx control. A combination of tuning issues with the ammonia injection and the range of the ammonia analyzer may be adding to this issue.

When the NOx emission data was analyzed on a 30-day rolling average, many transient data spikes that had been initially observed became less significant.

Proposed NOx Emission Limits

Based on the data analysis and observations made by staff, the following NOx emission limits are proposed:

- For the container glass melting furnaces, NOx emissions should not exceed 0.25 lb NOx per ton of glass pulled on a rolling 30-day average.
- For the sodium silicate furnace, NOx emissions shall not exceed 0.50 lb NOx per ton of product pulled.

Presentation of SOx Emissions from Container Glass Melting Furnace Operations

As was previously noted in this staff report, although the sodium silicate facility is in the SOx RECLAIM program, it does not report SOx emissions.

The following SOx information illustrates SOx emissions from the container glass melting furnaces.

Figure A-10 illustrates the SOx emissions on a lbs per day basis reported by the container glass facility for its container glass melting furnaces from CY 2016 to CY 2019.

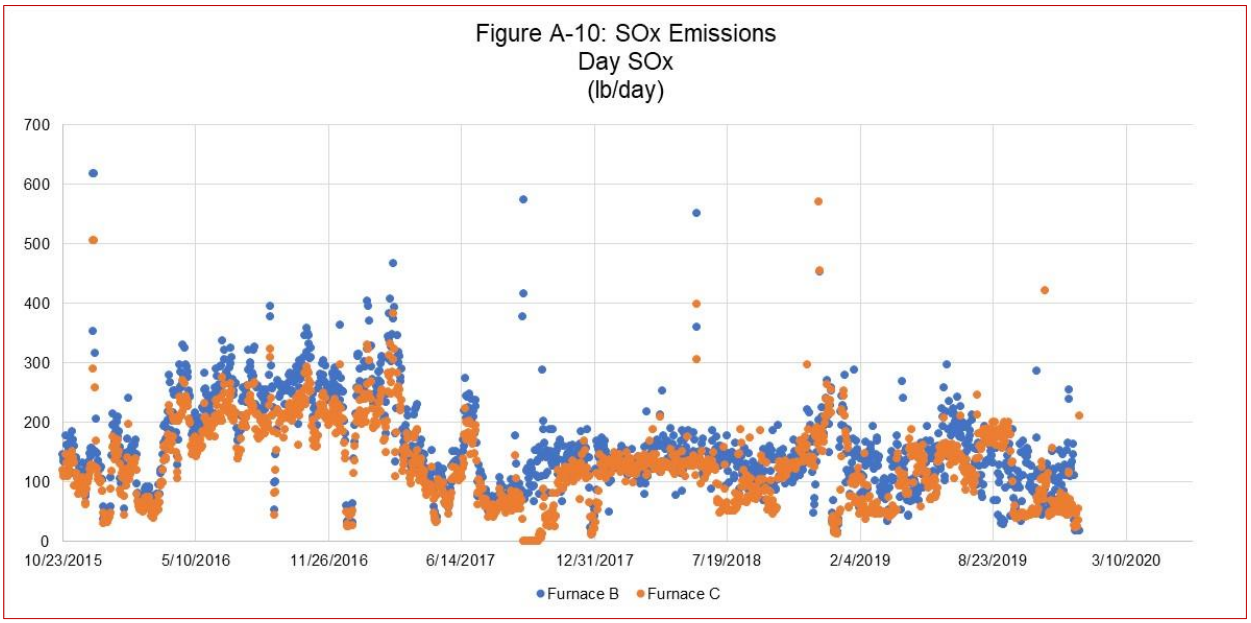
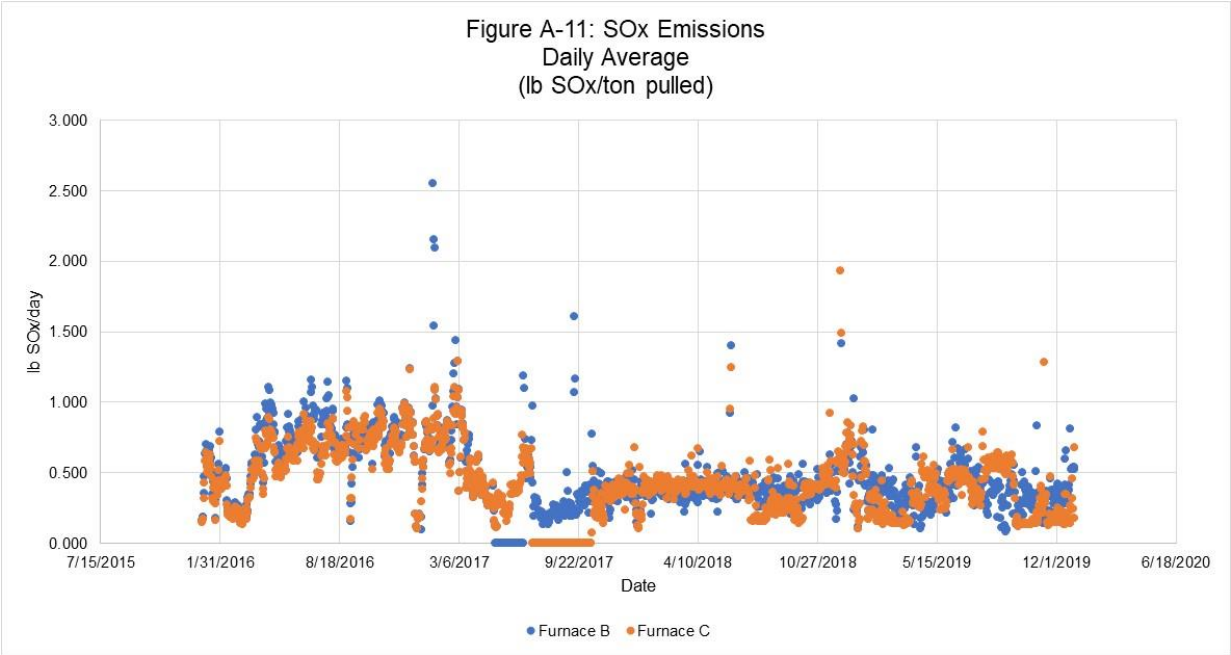
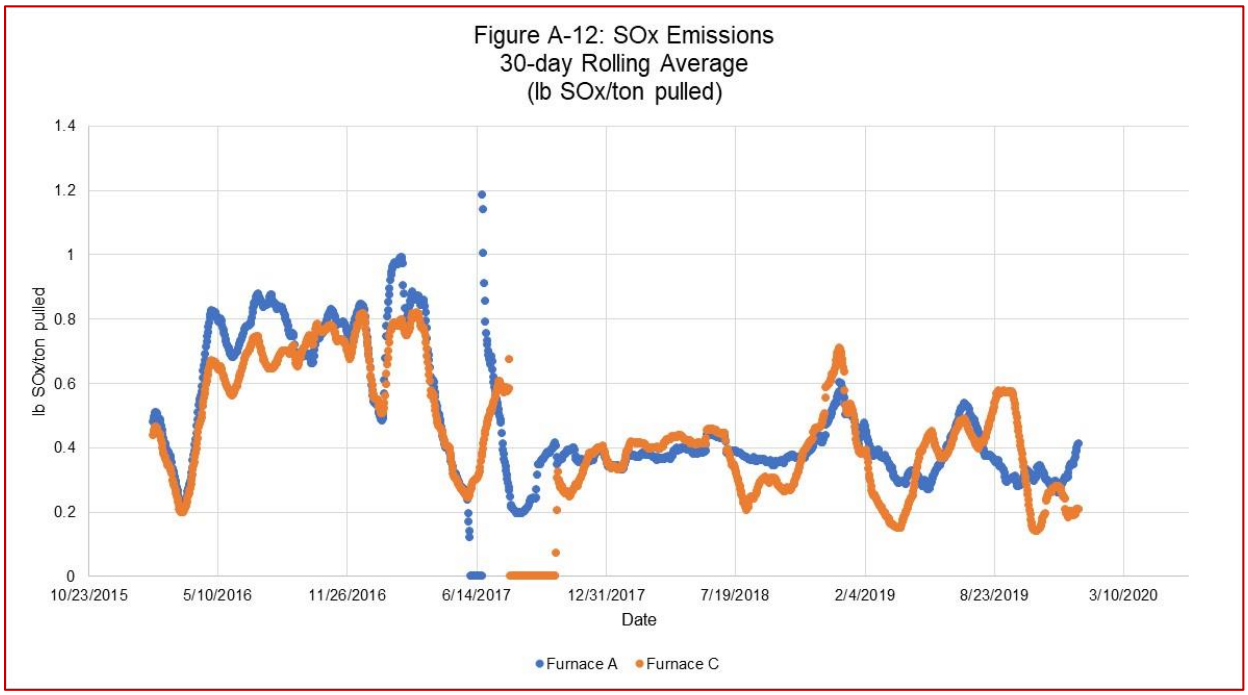


Figure A-11 illustrates the SOx emissions per day based on the ratio of emissions to glass pulled from the container glass melting furnaces from CY 2016 to CY 2019.



Figures A-12 illustrates the NOx emissions on a rolling 30-day average based on the ratio of emissions to glass pulled for the container glass melting furnaces from CY 2016 to CY 2019.



SOx Data Analysis

The primary goal for the installation of the CCF and oxy fuel burners at the container glass facility was tied to reducing NOx emissions. Although there is some observable SOx reduction at the

container glass facility due to the CCF, the emissions impacts will be evaluated at a later date when the RECLAIM SOx program is also transitioned to a command-and-control regulatory structure.