SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

FINAL DRAFT STAFF REPORT

Proposed Amendments to Rule 4354 (Glass Melting Furnaces)

December 16, 2021

Prepared by: Ariana Hooks, Air Quality Specialist
Jag Kahlon, Senior Air Quality Engineer
Dustin Brown, Supervising Air Quality Engineer

Reviewed By: Jessica Coria, Program Manager
Nick Peirce, Permit Services Manager
Jonathan Klassen, Director of Air Quality Science and Planning
Sheraz Gill, Deputy Air Pollution Control Officer

San Joaquin Valley
UNIFIED AIR POLLUTION CONTROL DISTRICT

HEALTHY AIR LIVING™

This page intentionally blank.

Table of Contents

I. SUMMARY

The San Joaquin Valley Unified Air Pollution Control District (District) is committed to protecting public health for all residents in the San Joaquin Valley (Valley) through efforts to meet health-based state and federal ambient air quality standards with efficient, effective, and entrepreneurial air quality management strategies. One such strategy includes a commitment in the District's *2018 Plan for the 1997, 2006, and 2012 PM2.5 Standards* (*2018 PM2.5 Plan*) to amend District Rule 4354 (Glass Melting Furnaces) to reduce emissions of oxides of nitrogen (NOx) from this source category.

In support of this commitment, District staff have conducted a comprehensive technical evaluation of controls capable of further reducing emissions from glass melting furnaces operating in the Valley, as well as an in-depth review of air district, state, and federal regulations for this source category, and a robust public process. Proposed amendments to the rule include more stringent NOx, sulfur oxide (SOx) and particulate matter (PM10) emission limits for glass melting furnaces in the Valley. Due to the high costs associated with the control technology necessary to comply with the proposed final NOx emissions limits, a phased compliance schedule is being proposed whereby operators must comply with lower Phase I NOx emissions limits by 2024, and then must comply with the final NOx emissions limits by 2030 or upon the completion of the next furnace rebuild, whichever is sooner.

A. Reasons for Rule Development and Implementation

The U.S. Environmental Protection Agency (EPA) periodically reviews and establishes health-based air quality standards for ozone, particulates, and other pollutants. Although the San Joaquin Valley's (Valley) air quality is steadily improving, the Valley experiences unique and significant difficulties in achieving these increasingly stringent standards. The Valley's challenges in meeting the national ambient air quality standards are unmatched in the nation due to the region's unique geography, meteorology and topography. In response to the latest federal mandates and to improve quality of life for Valley residents, the San Joaquin Valley Air Pollution Control District (District) has developed and implemented multiple generations of rules on various sources of air pollution. Valley businesses are currently subject to the most stringent air quality regulations in the nation. Since 1992, the District has adopted nearly 650 rules to implement an aggressive on-going control strategy to reduce emissions in the Valley, resulting in air quality benefits throughout the Valley. Similarly, the California Air Resources Board (CARB) has adopted stringent regulations for mobile sources. Together, these efforts represent the nation's toughest air pollution emissions controls and have greatly contributed to reduced ozone and particulate matter concentrations in the Valley.

Due to the significant investments made by Valley businesses and residents and stringent regulatory programs established by the District and CARB, the Valley's ozone and PM2.5 (particulate matter that is 2.5 microns or less in diameter) emissions are at

historically low levels, and air quality over the past few years has continued to set new clean air records. Despite the significant progress under these regulations, greatly aided by the efforts of Valley businesses and residents, many air quality challenges remain, including attainment of the federal air quality standards for PM2.5 that are addressed in the District's *2018 PM2.5 Plan.*

The *2018 PM2.5 Plan* contains a comprehensive set of local and state measures that build on existing measures to further reduce air pollution from stationary, area, and mobile sources throughout the Valley. Attaining the multiple federal PM2.5 standards by the mandated deadlines is not possible without significant additional reductions in directly emitted PM2.5 and key PM2.5 precursors like NOx. The attainment strategy includes a suite of innovative regulatory and incentive-based measures, supported by robust public education and outreach efforts to reduce emissions of PM2.5 in the Valley. One of the measures included in the plan is to amend District Rule 4354 (Glass Melting Furnaces) as a necessary measure for further reducing NOx and bringing the Valley into attainment with federal PM2.5 standards within the mandated federal deadlines.

In addition, through the District's implementation of AB 617 and the development of the South Central Fresno Community Emissions Reduction Program (CERP), the District heard concerns from community residents and other community stakeholders regarding glass melting furnace operations. These discussions with the community led to specific measures being included within the South Central Fresno CERP to evaluate Rule 4354 for potential further emissions reductions. The proposed amendments to Rule 4354 address this measure within the South Central Fresno CERP.

Based on a comprehensive technical analysis, in-depth review of local, state, and federal regulations, and a robust public process, District staff are proposing several modifications to Rule 4354 to reduce emissions from glass melting furnaces operating in the San Joaquin Valley. This rule amendment project is proposed to satisfy the commitments in the District's *2018 PM2.5 Plan*, and to ensure that Rule 4354 requires the implementation of state and federal standards of Reasonably Available Control Technology (RACT), Best Available Retrofit Control Technology (BARCT), and Most Stringent Measures (MSM). In addition, the proposed amendments address commitments included in Board/CARB-approved South Central Fresno Community Emissions Reduction Program developed through the AB 617 community engagement process.

B. Health Benefits of Implementing Plan Measures

Exposure to PM2.5 and ozone has been linked to a variety of health issues, including aggravated asthma, increased respiratory symptoms (irritation of the airways, coughing, difficulty breathing), decreased lung function in children, development of chronic bronchitis, irregular heartbeat, non-fatal heart attacks, increased respiratory and cardiovascular hospitalizations, lung cancer, and premature death. PM2.5 is a major health risk because it can be inhaled more deeply into the gas exchange tissues of the

lungs, where it can be absorbed into the bloodstream and carried to other parts of the body. CARB explains that even short-term exposure of less than 24 hours can cause premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, emergency room visits, respiratory symptoms, and restricted activity days. Children, older adults, and individuals with heart or lung diseases are the most likely to be affected by PM2.5 and ozone.

As NOx emissions are a key precursor in the formation of both ozone and PM2.5, continuing to assess the feasibility of achieving additional NOx reductions across the Valley is critical to improving PM2.5 and ozone throughout the region. PM2.5 emissions are characterized by a unique combination of direct and indirectly formed constituents. NOx emissions are a precursor to the formation of ammonium nitrate, which is a large portion of total PM2.5 during the Valley's peak winter season. NOx is also a precursor to ozone, which is formed when heat and sunlight interact with NOx and volatile organic compounds (VOC). Harmful ozone is predominantly formed at the surface during the summer season in the Valley. The District has long worked to reduce NOx emissions as the primary precursor for the formation of ozone and PM2.5 in the Valley.

To address federal health-based standards for ozone and PM2.5 and improve public health, the District develops attainment plans and implements control measures to lower direct and precursor emissions throughout the San Joaquin Valley. The proposed amendments will achieve additional reductions in NOx emissions as requirements are implemented by affected sources, and new technologies are installed. New regulatory and incentive-based measures proposed by both the District and CARB, combined with existing measures achieving new emissions reductions, are necessary to achieve the emissions reductions required to attain the health-based federal standards as expeditiously as practicable, and will improve public health as emissions reductions are realized.

C. Description of Project

The District Governing Board first adopted Rule 4354 on September 14, 1994, and the rule has subsequently been amended six times, with the last amendment occurring in 2011. Through recent federal review, Rule 4354 has been found to implement or exceed RACT levels of control.[1] In February 2020, EPA also found that this rule implements Best Available Control Measures (BACM) and MSM, as further discussed in EPA's TSD for the approval of the *San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQS*.[2]

[1] U.S. Environmental Protection Agency: Air Plan Approval; California; San Joaquin Valley Unified Air Pollution Control District; Reasonably Available Control Technology Demonstration. August 2018.
[2] U.S. Environmental Protection Agency: Technical Support Document for EPA's Technical Support Document "EPA Evaluation of BACM/MSM" for the San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQA. February 2020.

Rule 4354 applies to any glass melting furnace and limits NOx, carbon monoxide (CO), VOC, SOx, and PM10 emissions from any glass melting furnace. Industrial glass making is a continuous process with raw materials supplied to the furnace at the front end, and product taken off the line at the back end of the process. The raw materials for making glass are silica sand, soda ash, limestone and salt cake. Melting these basic materials and forming them into the desired product geometry creates the final glass product. The different end products vary widely in raw material additives, processing equipment, conditions, and product quality requirements. The emission limits of Rule 4354 depend on the type of glass produced, furnace firing technology and the emission averaging period.

During the development of the *2018 PM2.5 Plan,* the District evaluated all potential control technologies and all control technologies achieved in practice in other areas, as well as those included in other state implementation plans for this category. The District's evaluation of the South Coast Air Quality Management District (SCAQMD) container glass facility found that potential further control technologies, such as the pairing of the Tri-Mer UltraCat ceramic catalytic filtration system in combination with an oxy-fuel furnace, to be practicable and achievable. On June 5, 2020, SCAQMD amended their District Rule 1117 (Emissions from Container Glass Melting and Sodium Silicate Furnaces) to include:

- Transition the Regional Clean Air Incentive Market (RECLAIM) program to a command-and-control regulatory structure
- Establish NOx and SOx emission standards for container glass melting and sodium silicate furnaces
- Update monitoring, reporting and recordkeeping requirements,
- Establish provisions for idling, startup, and shutdown of the furnaces

While the current District rule meets or exceeds state and federal control requirements for this source category, given the enormity of reductions needed to demonstrate attainment with the latest PM2.5 standards, the District committed in the *2018 PM2.5 Plan* to go beyond Most Stringent Measures to pursue the following potential opportunities to reduce NOx emissions from container glass facilities. The District will go one step further to reduce emissions in the Valley, and will also pursue emission reductions from other glass melting source categories, such as those from flat glass facilities, to the extent that additional NOx controls are technologically and economically feasible. The *2018 PM2.5 Plan* commitments for container glass melting furnaces include:

- Evaluate feasible ultra low-NOx control technologies (catalytic filtration, oxy-fuel combined with SCR, etc.)
- Lower the NOx limit from 1.5 lb/ton to a level ranging from 1.0-1.2 lb-NOx/ton glass pulled or lower, based on a rolling 30-day average

The proposed amendments to Rule 4354, which satisfy commitments in the *2018 PM2.5 Plan*, include lowering the existing NOx, PM10, and SOx emissions limits with a phased compliance schedule for container and flat glass facilities. The proposed

emissions limits and compliance timeframes have been established based on the results of a comprehensive technical evaluation, as further discussed later in this staff report and associated appendices. The limits proposed would require the installation of advanced combustion technology and permit modification. An evaluation was also conducted as to the feasibility of requiring alternative technologies.

Through the implementation of the proposed Rule 4354 amendments, from this source category an estimated 18% reduction of NOx, 49% reduction of PM10, 58% reduction of PM2.5, and 4.1% reduction in SOx emissions will be achieved from the baseline emissions inventory by 2024. An estimated total 43% reduction of NOx emissions will occur by 2030. The proposed rule amendments would result in estimated emissions reductions of 0.64 tpd NOx in 2024, and total emissions reductions of 1.67 tpd NOx by 2030. Emission reductions of 0.13 tpd PM10, 0.13 tpd PM2.5, and 0.07 tpd SOx would also be achieved by 2024. Emission reductions achieved through the proposed requirements of this rule amendment will contribute towards the Valley's attainment of the health-based federal PM2.5 and ozone standards, and satisfy the commitments in the *2018 PM2.5 Plan.*

D. Rule Development Process

District staff conducted a public Scoping Meeting in December 2020, and held public workshops in September 2021, and November 2021. Information about public meetings was shared with members of the public, affected sources, manufacturers of control technologies, and other interested stakeholders. Information about the regulatory amendments and workshops were also made available at meetings of the Citizens' Advisory Committee, Environmental Justice Advisory Group, and AB 617 Community Steering Committees. Workshop announcements and public notices were provided in both English and Spanish, and interpretation services were made available upon request. At the public workshops, District staff presented the emission reduction and public health objectives of the proposed rulemaking project, and solicited feedback from the public on potential amendments. Initial draft amendments to Rule 4354 were published for public review on November 4, 2021, and an updated draft was published on November 16, 2021.

Throughout the rule development process, District staff solicited information from affected source operators, consultants, vendors and manufacturers of control technologies, and trade associations on the technological feasibility and compliance cost information that would be useful in developing amendments to Rule 4354. The comments received from the public, affected sources, and interested parties during the public outreach and workshop process were incorporated into the rule or addressed in the staff report as appropriate.

The proposed rule amendments and draft staff report with associated appendices were published for 30-day public review and comment prior to the public hearing to consider the adoption of the proposed amendments to Rule 4354 by the District Governing

Board. A summary of significant comments and District responses is available in Appendix A of the final draft staff report.

In addition, pursuant to state law, the District is required to perform a socioeconomic impact analysis prior to adoption, amendment, or repeal of a rule that has significant air quality benefits or that will strengthen emission limitations. As part of the District's socioeconomic analysis process, the District hired a socioeconomic consultant to prepare a socioeconomic impact report. The results of the socioeconomic analysis are included in this report (Appendix D).

DISCUSSION

A. Source Category

The San Joaquin Valley is home to six glass manufacturing facilities that represent three different glass industry types: container glass, flat glass and fiberglass. There are twelve glass melting furnaces at these six facilities that are subject to Rule 4354.

The glass manufacturing process starts with the receiving and storage of raw materials consisting mainly of silica sand, limestone, soda ash and salt cake. The raw materials are mixed and conveyed to the glass melting furnace where they are heated and melted down in to molten glass. Glass melting furnaces typically operate at temperatures ranging from 2,700 °F to 3,100 °F. The molten glass is removed from the melting furnace and then shaped or formed based on the products that are being manufactured at a specific facility. The different end products vary widely in raw material additives, processing equipment and conditions, and product quality requirements.

Glass melting furnaces contribute to over 99% of the total emissions from a glass plant, including both particulates and gaseous pollutants. Particulates result from volatilization of materials in the melt that combine with gases and form condensates. NOx results from the combustion of fuels in the furnace burners and when nitrogen and oxygen react in the high temperatures of the furnace. SOx results from oxidation of sulfur in fuel, raw material, and a refining agent called salt cake (sodium sulfate, chemical formula Na2SO4), and also from direct application of gaseous SO_2 in annealing ovens (lehrs) to achieve the desired glass properties.

B. Emissions Control Technologies

Over the years, the District has adopted numerous generations of rules and rule amendments for glass melting furnaces that have significantly reduced emissions from this source category. As part of these regulatory efforts, all of the glass melting furnaces in the Valley have been equipped with the best available NOx, SOx and PM control technologies. There are two primary methods that the glass manufacturing facilities within the Valley currently employ for controlling NOx emissions from their

glass melting furnaces. Four facilities have retrofitted their glass furnaces to be fired on oxy-fuel instead of regular natural gas and two facilities have installed a selective catalytic reduction system (SCR) on the exhaust of their glass furnaces. These controls reduce the overall amount of NOx generated from a glass furnace during the combustion/raw material melting process or reduce the amount of NOx in the exhaust stream from a glass furnace before it is emitted into the atmosphere. Emissions of particulate matter are typically controlled by an electrostatic precipitator (ESP) or a filtration system. SOx emissions are controlled through the injection of a sorbent into the exhaust stream, and/or through the use of scrubbers.

The following sections discuss the control technologies evaluated as a part of this regulatory development effort in further detail.

NOx Emission Control Technologies

Oxy-Fuel Firing

An oxy-fuel furnace reduces NOx emissions by minimizing the availability of nitrogen during the combustion process. Ambient air is made up of approximately 78% nitrogen. In an uncontrolled furnace, ambient air is introduced into the furnace with the fuel gas for combustion. NOx emissions are formed by the chemical reaction of the nitrogen in the combustion air during the combustion process. In an oxy-fuel furnace, ambient air is replaced with 100% oxygen, which reduces the amount of nitrogen in the combustion air. With less nitrogen in the combustion air, the overall NOx emissions created from the combustion process is also reduced. The oxy-fuel furnace is designed, maintained, and operated to minimize the infiltration of the ambient air into the combustion zone.

Selective Catalytic Reduction

Selective Catalytic Reduction (SCR) is a way to reduce NOx in the exhaust gases from glass melting furnaces. NOx is reduced to molecular nitrogen by adding an exhaust gas treatment system consisting of a catalyst module and a reagent injection system to add the reagent to the glass melting furnace exhaust. SCR units must operate at a certain temperature range to effectively reduce NOx in the exhaust gas by injecting either ammonia stored in aqueous form, anhydrous form, generated on demand, or released from urea into the post-combustion zone of the engine.

Catalytic Ceramic Filtration Systems

Ceramic Catalytic Filtration Systems (CCFS) is another method of reducing NOx in the exhaust gases from glass melting furnaces. CCFS are typically designed as modular housing units that are made up of numerous individual ceramic catalytic filters. Inside of each filter, nanobits of catalyst material are embedded throughout the filter walls. A reagent, typically anhydrous ammonia, is injected in to the exhaust stream before the gases pass through the CCFS. As the exhaust gases and reagent pass through the

ceramic catalytic filter walls, a chemical reaction occurs on the catalyst surface that reduces NOx to molecular nitrogen and water (H_2O).

Electric Glass Melting Furnaces

As part of researching potential amendments to Rule 4354, District staff considered the feasibility of reducing emissions through the use of electric furnaces. One of the container glass manufacturing facilities in the Valley is permitted to operate an electric glass melting furnace. However, this electric furnace has been out of glass production operation for more than ten years. During staff research, it was found that electric furnaces require a limited pull rate, and have a production capacity limited to a maximum of about 300 tons of glass per day. Furthermore, District staff found that electric furnace technology is only compatible with container glass manufacturing, and is not able to be utilized for flat glass production due to the technological design of electric furnaces and the need for a substantial float to provide heat insulation. District staff are not aware of any electric furnaces operating as the primary glass melting unit for flat glass manufacturing facilities. For container glass operations, multiple electric furnaces would need to be purchased to replace one existing natural-gas fired furnace, and operators would incur significant additional operation and maintenance costs, as compared to the operation of a furnace fired on natural gas. The typical electric furnace life is 4 years, compared to 10-12 years of that of a natural gas furnace with electric boost, further increasing the costs associated with operating an electric furnace in lieu of a natural gas-fired furnace.

Furthermore, electric furnaces consume more total energy per ton of glass, and would require much higher electricity capacity than is currently available from the electrical grid. For example, a modern 230 ton per day electric furnace has an electricity consumption rating of approximately 7.5 megawatts (MW), compared to a 430 ton per day natural gas furnace with electric boost where the maximum energy consumption is about 2.6 MW. More than 10 MW of additional electrical capacity at a glass production plant would be required to replace just one 430 ton per day furnace. The associated draw on the electrical grid to support required glass production levels for plants operating in the Valley would not be feasible or able to be supported through the current electrical infrastructure or electrify generation capacity in the region. While electric furnaces may be utilized for small production operations, or to provide additional heating boosts as an auxiliary unit at large manufacturing plants, District have found that the use of electric furnaces as the primary glass melting furnace for large production operations is not currently feasible or cost effective due to the above considerations.

Particulate Matter (PM) Emission Control Techniques

The airflow through a glass melting furnace can be on the order of 30,000 standard cubic feet per minute. With airflow this high, un-melted raw material in the furnace can be lifted off the surface of the molten glass to go directly into the furnace's exhaust stream. Operators can influence the rate at which raw materials become directly

emitted PM through raw materials specification, control of the raw material moisture at the point the material is delivered to the furnace, and design of the furnace's material charging system.

The reduced PM10 emission limits are based off emission test data from each facility and the test data shows they are already capable of meeting the revised PM10 emission limits without major modifications to controls. Therefore, a detailed discussion of PM10 emission control techniques will not be included as a part of this analysis. Facilities will continue to employ the PM emission control techniques they currently use, which can consist of the following: raw material particle size selection, raw material moisture content control, properly designed charging system, reduction of raw material volatilization, and post combustion PM removal with an ESP or similar filter device.

SOx Emissions Control Techniques

Dry Sorbent Injection (DSI)

In dry sorbent injection, dry sorbent material, such as calcium hydroxide (also known as hydrated lime) or trona (raw form of sodium bicarbonate), is dispensed from a silo, fluidized, and injected through a port into the exhaust gas or into a reaction chamber where it reacts with SO_2 to form sodium sulfate (when trona is injected), or calcium sulfate (when calcium hydroxide is injected). The reaction products are captured by a downstream PM control such as an ESP or ceramic dust collectors (CDC). Additional reactions and SO_2 absorption may occur at the surface of the CDC or ESP. A properly engineered DSI system could achieve up to 80% reduction in sulfur dioxide emissions.

Based on the type of glass plant, all or a portion of the reaction products (e.g. sodium sulfate, calcium sulfate, etc.) is recycled into the batch. This recycling reduces the need to purchase and deliver raw ingredients. Flat glass plants recycle most of their reaction products into a glass batch, whereas, only a limited amount of these materials are able to be recycled at container glass facilities due to production processes.

Semi-Dry Absorbers (SDA)

Semi-Dry Absorbers operate by mixing a small amount of water with dry sorbent such as soda ash or lime to make slurry solution. Slurry is atomized into the absorber. The SO_2 is absorbed into the slurry and reacts to form sodium (when soda ash is used) or calcium (when lime is used) salts. These salts are captured by a particulate matter control system such as ESP or ceramic dust collectors (CDC) which is located downstream. Additional reactions and SO_2 absorption may occur at the surface of the CDC or ESP. A properly engineering system could be effective to reduce up to 80% sulfur dioxide emissions.

II. PROPOSED AMENDMENTS TO RULE 4354

A. Current Rule 4354

Rule 4354 was adopted in September 1994, and was last amended May 19, 2011. The rule applies to any glass melting furnace, but the rule exempts electric glass furnaces, glass furnaces that are located at a stationary source with a total potential to emit, for all processes, of less than ten tons per year (tpy) of NOx or less than ten tpy of VOCs. The current rule limits emissions of NOx, VOC, CO, SOx and PM10.

The emission limits currently established in the rule depend on type of glass produced, furnace firing technology and emission averaging period. Table 1 shows the existing range of emission limits for the various pollutants. The rule also contains testing, monitoring, and reporting provisions. Where operations have multiple furnaces connected through a battery or where averaging provisions are utilized across multiple furnaces, operators are required to comply with emissions limits 10% lower that the stated emission limits in the rule to ensure environmental benefits.

Table 1 – Current Rule 4354 Selected Emission Limits

Glass Type	NOx Limit (lb/ton glass)	CO Limit	VOC Limit	SOx Limit (lb/ton glass)	PM10 Limit (lb/ton glass)
Container	1.5	300 ppm/1.0 lb/ton glass	20 ppm /0.25 lb/ton glass	0.9 - 1.1	0.5
Fiberglass	1.3 - 3.0	300 ppm/1.0 lb/ton glass	20 ppm/0.25 lb/ton glass	0.9	0.5
Flat (Float)	2.9 - 3.2	300 ppm/0.9 lb/ton glass	20 ppm/0.10 lb/ton glass	1.2	0.7

B. Proposed Amendments to Rule 4354

As a result of the comprehensive regulatory analysis conducted in support of the commitments in the *2018 PM2.5 Plan*, District staff are recommending several amendments to existing Rule 4354. The following paragraphs detail the proposed modifications to existing rule language and requirements. For further information on how proposed limits were determined, please see the Incremental Cost Analysis in Appendix C. Additionally, in an effort to simplify rule language and clarify existing requirements, expired language would be removed in several sections of the rule. See Proposed Rule 4354 for exact language.

Purpose (Section 1.0)

No changes proposed at this time.

Applicability (Section 2.0)

No changes proposed at this time.

Definitions (Section 3.0)

Minor updates and clarifications to existing definitions have been made.

The definition of Continuous Emissions Monitoring System (CEMS) has been updated to provide clarity as follows:

> *Continuous Emissions Monitoring System (CEMS): The total equipment necessary for the determination of a gas or particulate matter concentration or emission rate using pollutant analyzer measurements and a conversion equation, graph, or computer program to produce results in units of the applicable emission limitation or standard*

Exemptions (Section 4.0)

Section 4.2 – Proposed updates would amend this section to remove exemptions for any glass melting furnace that is part of a stationary source with a total potential to emit for all process less than 10.0 tpy of NOx and less than 10.0 tpy of VOC. There is one facility in the Valley that would be newly subject to the requirements of Rule 4354 through the removal of this exemption.

Requirements (Section 5.0)

Updates in this section specify the proposed updated emission limits for the pollutants controlled though the rule, with proposed updated emission limits included for NOx, PM10, and SOx. The proposed emissions limits included in this section of the rule are based on an in-depth technical analysis, and a thorough public process. District staff have found control technologies necessary to achieve the proposed limits to be reasonably available, economically feasible, and cost effective. Please see the evaluation included in Appendix C for further information on how proposed limits were established. Compliance with the proposed requirements would be required per the schedule detailed in Section 7 of the rule. Proposed amendments would also update this section to remove outdated requirements.

Due to the results of the District's technical evaluation of feasible further control technologies, emission limits for fiberglass melting furnaces are not proposed to be changed as a part of this rule project, although these emission limits may be further evaluated as part of future regulatory development efforts.

Proposed Container Glass Melting Furnace Emissions Limits

The current container glass NOx limit of 1.5 lb-NOx/ton of glass pulled will be lowered in Phase I to the proposed limit of 1.1 lb-NOx/ton lb-NOx/ton of glass pulled based on a rolling 30-day average with a compliance deadline of January 1, 2024. The Phase II proposed limit of 0.75 lb-NOx/ton of glass pulled is based on a rolling 30-day average, with a phased in compliance schedule based on the furnace rebuild schedule starting in 2024, but no later than 2029. The proposed PM10 emission limits will lower the current container glass PM10 limits from 0.5 lb-PM10/ton of glass pulled to a proposed limit in the range of 0.2 lb-PM10/ton of glass pulled based on a 24-hour block average starting in 2024.

Regarding the assessment of potential changes to the current SOx emissions limits in the rule, in initial workshops during the rulemaking process, preliminary rule concepts and potential emissions limits were discussed. As the technical and feasibility analyses of further SOx emissions reductions continued, the final draft proposed Rule 4354 lowered the SOx emissions limits from the current 1.1 lbs/ton of glass pulled to 0.85 lbs/ton of glass pulled on a rolling 30 day average, with compliance required by 2024.

Proposed Flat Glass Melting Furnace Emissions Limits

Similarly, the proposed amendments to the flat glass category include lowering the existing NOx emission limits in two phases. The current limit of 3.2 lb/ton of glass pulled on a 30-day average will change to the proposed Phase I limit of 2.5 lb-NOx/ton of glass pulled (30-day rolling average) with the compliance deadline of January 1, 2024. The proposed Phase II limit will be set at 1.5 lb-NOx/ton glass pulled (30-day rolling average) phased in by the furnace rebuild schedule starting in 2024, but no later than 2029. Starting in 2024, the proposed PM10 emission limits will be lowered from the current limit of 0.7 lb-PM10/ton of glass pulled to 0.2 lb-PM10/ton of glass pulled based on a 24-hour block average.

After careful evaluation of the current control technology and the feasibility of further emissions controls, District staff recommends no changes to the SOx emissions limit for flat glass due to the nature of the current control operations at the flat glass facilities. During the analysis, staff found that the achievable SOx emission levels are directly related to the NOx control technologies a facility employs. It was determined that SOx emissions levels lower than the current 1.2 lb/ton rule limit are only achievable for facilities that utilize a semi-dry scrubber system. Semi-dry scrubber systems are only used at facilities that operate oxy-fuel fired furnaces and/or ceramic filter systems for NOx emission control. The use of SCR systems as a NOx control technology require that the exhaust stream be at a higher temperature, to ensure effective NOx control. The use of a semi-dry scrubbing system can lower the exhaust temperature to a level that is below what is required for the SCR system to operate efficiently. For flat glass facilities utilizing SCR as a NOx control system, meeting a lower SOx emissions limit would require replacing their current NOx control system. As shown in Appendix C of

this staff report, this is an extremely costly control option and is not a cost-effective compliance option. Therefore, District staff are recommending that the current SOx limits for flat glass melting furnaces be maintained.

The current CO and VOC limits included in the rule would be maintained for both container and flat glass melting furnaces. Requiring additional reductions in CO and VOC emissions could jeopardize the ability for glass furnaces to achieve further NOx, SOx , PM2.5 and PM10 emission reductions, which are critical to meet *2018 PM2.5 Plan* goals. Keeping the existing CO and VOC emission limits in the current rule would allow operators the much-needed flexibility to be able to achieve more stringent NOx, SOx and PM10 emissions limits under varying field operating conditions and applications.

The proposed limits for both types of glass melting furnace would require Phase I permit modifications and potential upgraders or tuning to existing facility control technologies. In Phase II, compliance with proposed limits would require the installation or enhancements of advanced emission control technologies such as oxy-fuel combustion, ceramic catalytic filters, selective catalytic reduction or a combination of control technologies. The following tables outline the specific emissions limits proposed. *Section 5.1* – This section has been updated to specify proposed updates to NOx emissions limits. Expired language has been deleted from the section. Table 1 has been updated to remove expired provisions, and Table 2, included below, has been added to the rule to detail the phased NOx emissions limits.

Rule 4354 Table 2 – NOx Emission Limits in pounds NOx per ton glass produced, in effect on and after January 1, 2024

Type of Glass Produced	Phase I NOx limit	Phase II NOx limit
Container Glass	1.1 [B]	0.75 [B]
Fiberglass	1.3 [A, C] 3.0 [A, D]	1.3 [A, C] 3.0 [A, D]
Flat Glass (Standard)	2.8 [A] 2.5 [B]	1.7 [A] 1.5 [B]
Flat Glass (Enhanced)		

[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

Section 5.3.1: This section has been updated to specify proposed updates to SOx control requirements. The existing SOx emissions limits in the rule are specified in Rule 4354 Table 4, which was renumbered, and a new Table 5 has been added to the rule to specify the proposed SOx emissions limits.

Rule 4354 Table 5 - SOx Emission Limits, in pounds SOx per ton glass produced, in effect on and after January 1, 2024		
Type of Glass Produced	Firing Technology	SOx Limit
Container Glass	All technologies	0.85 [B]
Fiberglass	All technologies	0.90 [C]
Flat Glass	All technologies	1.7 [A] 1.2 [B]

[A] Block 24-hour average
[B] Rolling 30-day average
[C] Rolling 24-hour average

Section 5.4 – Section 5.4 has been updated to include the proposed updated PM10 control requirements. Tables in this section have been renumbered, and expired provisions have been removed. Table 7, copied below, has been added to the rule to specify the proposed updated PM10 emissions limits.

Rule 4354 Table 7 - PM10 Emission Limits, in pounds total PM10 per ton glass produced, Block 24-hour average, effective on and after January 1, 2024		
Type of Glass Produced	Firing Technology	PM10 Limit
Container Glass	All technologies	0.20
Fiberglass	All technologies	0.50
Flat Glass	All technologies	0.20

Administrative Requirements (Section 6.0)

This section has been updated to remove expired language

Compliance Schedule (Section 7.0)

This section has been updated to remove outdated language, and to establish compliance timeframes required for full compliance with the proposed emission limits established in Section 5.0. Furnaces subject to the requirements of Section 5 shall comply with applicable emissions limits in accordance to the schedule included in Table 9, 10, and 11 of the proposed rule, as included below.

Rule 4354 Table 9: NOx Emissions Limits Compliance Schedule		
Emission Level	Authority to Construct	Compliance Deadline
Phase I NOx Emission Limits	June 1, 2022	January 1, 2024

Rule 4354 Table 9: NOx Emissions Limits Compliance Schedule		
Emission Level	Authority to Construct	Compliance Deadline
Phase II NOx Emission Limits	For furnace rebuilds occurring after January 1, 2024, 18 months prior to the date of the furnace rebuild, but not later than June 1, 2028	Date of completion of next furnace rebuild occurring after January 1, 2024, or by January 1, 2030, whichever is sooner

Rule 4354 Table 10: SOx Compliance Schedule		
Emission Level	Authority to Construct	Compliance Deadline
Table 5 SOx Emission Limits	June 1, 2022	January 1, 2024

Rule 4354 Table 11: PM10 Compliance Schedule		
Emission Level	Authority to Construct	Compliance Deadline
Table 7 PM10 Emission Limits	June 1, 2022	January 1, 2024

Timeframes established in the proposed rule reflect the time necessary for facilities to plan for full compliance with the proposed emission limits, including budgeting for any required modifications to the facility or facility operations, and modifying existing controls or facility control practices, and installing any required further control technologies. As discussed further in Appendix C of this staff report, due to the high cost of controls required to meet the proposed Phase II emissions limits, an extended timeframe is being proposed for compliance with the Phase II emissions limits to ensure that the proposed requirements are cost-effective and economically feasible.

Along with the tables outlining the proposed compliance timeframes, language in this section has been added or modified to provide more clarity with the proposed changes to the rule, including definitions for Authority to Construct and Compliance Deadlines referenced in the proceeding tables.

Calculations (Section 8.0)

No changes proposed at this time.

Furnace Battery or Multiple Furnaces Control (Section 9.0)

Draft amendments would update this section to remove expired language no longer applicable. No additional amendments to Section 9.0 are proposed in this rule amendment, as the section in the current Rule 4354 meets or exceeds all state and federal requirements. Due to glass plant design and control operations, it is common

practice for the emissions from multiple furnaces to be controlled through one integrated control system. This is referred to as a furnace battery. Section 9.0 of the rule requires that operations where a furnace battery is employed, or where averaging provisions are used across multiple furnaces, that a 10% environmental benefit be achieved and therefore operators must comply with emissions limits 10% lower than the emission limits detailed in Section 5.0 of the rule.

Section 9.1 – 9.10 Outdated language has been removed, and various language has been added or modified to provide more clarity with the proposed changes to the rule.

III. ANALYSIS

A. Emission Reduction Analysis

In order to determine the emission reductions associated with the proposed changes, District staff queried the District Permit Services Databases for all glass melting furnaces, and then sorted the furnaces into categories based on the types of glass melting operation (container, flat, and fiber glass). Based on existing permitted limits, District staff calculated the potential to emit for each affected unit, and then, based on the proposed new emissions limit for each pollutant, calculated the percent reduction that would be achieved through compliance with the proposed rule updates.
For State Implementation Plan (SIP) purposes, the percent reduction achieved through compliance with the proposed rule was applied to the baseline emissions inventory used in the District's *2018 PM2.5 Plan.* Based on these calculations, the SIP-creditable emission reductions estimated to be achieved from the proposed amendments to the Rule 4354 are illustrated in the table below, in tons per day (tpd) on an annual average basis. Please see Appendix B of this draft staff report for further details.

Estimated Emission Reductions								
Pollutant	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**
NOx	0.64	0.64	0.64	0.64	0.64	0.64	1.67	1.67
SOx	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
PM10	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
PM2.5	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13

B. Cost Effectiveness Analysis

The California Health and Safety Code (CH&SC) Section 40920.6(a) requires the District to conduct both an absolute cost effectiveness analysis and an incremental cost effectiveness analysis of available emission control options before adopting each BARCT rule. The purpose of conducting a cost effectiveness analysis is to evaluate the economic reasonableness of the pollution control measure or rule. The analysis also serves as a guideline in developing the control requirements of a rule. Details of the cost effectiveness analysis is contained in Appendix C to this report.

C. Socioeconomic Analysis

State law requires the District to analyze the socioeconomic impacts of any proposed rule or rule amendment that significantly affects air quality or strengthens an emission limitation. The socioeconomic analysis has been used to further refine the rule amendments. The final socioeconomic report is attached to this staff report as Appendix D.

D. Environmental Impact Analysis

Based on the District's assessment of the Rule Amendment, the District concludes that the Rule Amendment will not cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment, and as such is not a "project" as that term is defined under the CEQA Guidelines § 15378.

The Rule Amendment to Rule 4354 will lower the existing NOx, PM10, and SOx emission limits and will result in obtaining NOx emission reductions. According to Section 15061 (b)(3) of the CEQA Guidelines, a project is exempt from CEQA if, "(t)he activity is covered by the general rule that CEQA applies only to projects which have the potential for causing a significant effect on the environment. Where it can be seen with certainty that there is no possibility that the activity in question may have a significant effect on the environment, the activity is not subject to CEQA." As such, substantial evidence supports the District's assessment that assuming the Rule Amendment is a "project" under CEQA, it will not have any significant adverse effects on the environment.

In Furthermore, the Rule Amendment is an action taken by a regulatory agency, the San Joaquin Valley Air Pollution Control District, as authorized by state law to assure the maintenance, restoration, enhancement, or protection of air quality in the San Joaquin Valley where the regulatory process involves procedures for protection of air quality. CEQA Guidelines §15308 (Actions by Regulatory Agencies for Protection of the Environment), provides a categorical exemption for "actions taken by regulatory agencies, as authorized by state or local ordinance, to assure the maintenance, restoration, enhancement, or protection of the environment where the regulatory process involves procedures for protection of the environment. Construction activities and relaxation of standards allowing environmental degradation are not included in this exemption." No construction activities or relaxation of standards are included in this Rule Amendment.

Therefore, for all the above reasons, the Rule Amendment is exempt from CEQA. Pursuant to Section 15062 of the CEQA Guidelines, District staff will file a Notice of Exemption upon Governing Board approval of Rule Amendment.

E. Rule Consistency Analysis

Prior to adopting, amending, or repealing a rule or regulation, California Health and Safety Code § 40727.2 requires a written analysis that identifies and compares requirements of the proposed rule with corresponding, existing and proposed District rules and corresponding EPA rules, regulations, and guidelines. Based on the analysis, District staff concludes that the proposed amendments to Rule 4354 are consistent with other District rules and are not in conflict with these rules. Further, the proposed rule amendments are consistent with EPA rules, regulations, and guidelines that apply to the same source category. The analysis is presented in Appendix E of the Final Draft Staff Report.

F. Most Stringent Measures (MSM) and Best Available Retrofit Control Technology (BARCT) Analyses

As previously discussed, on November 15, 2018, the District adopted the District's *2018 PM2.5 Plan* to satisfy Clean Air Act requirements for the PM2.5 national ambient air quality standards. As a part of the *2018 PM2.5 Plan*, the District demonstrated that Rule 4354 continued to satisfy BACM (Best Available Control Measures) and performed a Most Stringent Measures (MSM) analysis for all rules that contain emission limits or requirements for NOx or PM. EPA defines MSM as, "*the maximum degree of emission reductions that has been required or achieved from a source or source category in any other attainment plans or in practice in any other states and that can feasibly be implemented in the area.*"

In February 2020, EPA published the *Technical Support Document - EPA Evaluation of BACM/MSM, San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQS*,[3] and determined that Rule 4354 establishes BACM and MSM control requirements for glass melting furnaces.

In addition to federal control requirements, most existing stationary sources in California non-attainment areas such as the San Joaquin Valley have been subject to state Best Available Retrofit Control Technology (BARCT) requirements since the 1980s. California Health and Safety Code Section 40406 defines BARCT as follows:

> *"Best Available Retrofit Control Technology (BARCT) is an air emission limit that applies to existing sources and is the maximum degree of reduction achievable, taking into account environmental, energy and economic impacts by each class or category of source."*

[3] Technical Support Document - EPA Evaluation of BACM/MSM, San Joaquin Valley PM2.5 Plan for the 2006 PM2.5 NAAQS (February 2020)

In December 2018, District staff conducted a comprehensive review of requirements in other air districts, and found that Rule 4354 meets or exceeds BARCT.[4] As discussed above, the District and EPA have determined that the current requirements of Rule 4354 satisfy MSM and BACM for NOx and PM precursors. However, these conclusions were made prior to June 2020. Since that time, the South Coast Air Quality Management District (SCAQMD) amended their Rule 1117 – Emissions from Container Glass Melting and Sodium Silicate Furnaces on June 5, 2020 to lower the NOx emissions limit for container glass melting furnaces to 0.75 lb/ton of glass pulled averaged over a rolling 30-day period.

Among other changes, the proposed amendments to District Rule 4354 will lower the NOx and PM emissions limits to:

- 0.75 lb-NOx/ton of glass pulled for container glass furnaces (30-day rolling average)
- 1.5 lb-NOx/ton of glass pulled for flat glass furnaces (30-day rolling average)
- 0.2 lb-PM10/ton of glass pulled for both container and flat glass furnaces (block 24-hour average)

The proposed amendments will make the NOx, PM, and SOx emission limits in Rule 4354 as stringent or more stringent than SCAQMD Rule 1117. Based on District staff review of other air district requirements, the proposed updates would establish requirements that are more stringent than any other rule in non-attainment areas in California and in the nation. Consequently, the proposed version of Rule 4354 will continue to meet or exceed BARCT requirements for NOx and PM emissions. Adoption of the proposed amendments will also ensure that Rule 4354 continues to meet or exceed BACM and MSM levels of emissions control.

[4] SJVAPCD, *Final Draft Staff Report: Expedited Best Available Retrofit Control Technology Implementation Schedule Under AB 617,* (December 16, 2018). Available at http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2018/December/final/13.pdf