SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Preliminary Draft Staff Report
Proposed Rule 1165 – Control of Emissions from Municipal Solid Waste Incinerators

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EXECUTIVE SUMMARY

Proposed Rule 1165 (PR 1165) will regulate municipal solid waste incinerators within the South Coast Air Basin. Currently, the Southeast Resource Recovery Facility (SERRF) located in the Port of Long Beach is the only facility expected to be subject to PR 1165. Any future municipal solid waste incinerators meeting the applicability of the proposed rule will also be regulated by PR 1165.

The South Coast AQMD 2022 Air Quality Management Plan (AQMP) included control measure L-CMB-09: NOX REDUCTIONS FROM INCINERATORS to reduce emissions of nitrous oxides (NOx) by replacing or retrofitting incinerators and other combustion equipment associated with incinerators with zero and low NOx emission technologies. The South Coast Air Basin Attainment Plan for the 2012 Annual PM2.5 Standard includes control measure BCM-07: Emission Reductions from Incinerators (NOx).

Two criteria air pollutants will be regulated by PR 1165, NOx and particulate matter (PM). Both NOx and PM emission reductions will be realized through the installation of Best Available Retrofit Control Technology (BARCT). PR 1165's proposed NOx, CO, PM, and opacity emission limits will be based on the results of the BARCT analysis. PR 1165 will also require continuous emission monitoring and periodic source testing to ensure compliance. Approved cleaning methods will be required to minimize fugitive dust emissions on facility grounds. In addition, PR 1165 will establish requirements for recordkeeping.

PR 1165 was developed through a public process. Three Working Group meetings were held. Staff met with multiple stakeholders during the rule development process and conducted one site visit.

With the adoption of PR 1165, NOx emission reductions are estimated to be 2,117.25 tons (0.23 tons per day) and PM emission reductions are estimated to be 316.75 tons (0.035 tons per day). The cost-effectiveness for the rule for NOx reductions is expected to be $22,700 per ton of NOx reduced.

CHAPTER 1: BACKGROUND

INTRODUCTION

Proposed Rule 1165 (PR 1165) is a new South Coast AQMD rule to regulate municipal solid waste incinerators within the South Coast Air Basin.

The South Coast AQMD 2022 AQMP includes control measure L-CMB-09: NOx Reductions from Incinerators to reduce emissions of NOx by replacing or retrofitting incinerators and other combustion equipment associated with incinerators with zero and low NOx emission technologies. The control measure required the development of a command-and-control rule to implement zero and low NOx emission control technologies. In addition, the South Coast Air Basin Attainment Plan for the 2012 Annual PM2.5 Standard includes control measure BCM-07: Emission Reductions from Incinerators (NOx).

Figure 1: Southeast Resource Recovery Facility (SERRF).

The U.S. EPA issued the Federal 'Good Neighbor Plan' for the 2015 Ozone National Ambient Air Quality Standards ("Good Neighbor Plan") on March 15, 2023, requiring that the 23 identified states meet the Clean Air Act's "Good Neighbor" requirements by reducing air pollution that significantly contributes to downwind states' ability to meet or maintain compliance with the 2015 NAAQS standard for ozone. The Good Neighbor Plan identified a deficiency in the State of California's State Implementation Plan (SIP) not adequately securing emission reductions from various industries, including municipal solid waste incineration. PR 1165 is necessary to mandate NOx concentration emission limits at least as stringent as the NOx emission concentration limits specified in the Good Neighbor Plan for inclusion in the State of California's SIP.

PR 1165 conducted a BARCT analysis for the municipal solid waste incineration equipment category. Staff identified cost-effective solutions to reduce NOx emissions and assist in fulfilling the requirements of the South Coast AQMD's obligations under the 2022 AQMP, the South Coast Air Basin Attainment Plan, and the U.S. EPA's Good Neighbor Plan.

REGULATORY HISTORY

Units located within the South Coast Air Basin are subject to both the requirements specified in the unit's South Coast AQMD permit to operate as well as the requirements specified in any applicable rule.

There is no previous source-specific rule regulating the municipal solid waste (MSW) incineration equipment category. However, other regulations apply to this equipment category.

CFR 40 Part 60 subpart Eb and Cb New Source Performance Standards and Emission Guidelines that provide requirements for large municipal solid waste incinerators and CFR 40 Part 60 subpart

AAAA for small municipal solid waste incinerators depending on both combustion capacity (tons of MSW combusted per day) or time of construction or modification.

The South Coast AQMD's Regulation IV rules also apply, which specify particulate matter and combustion contaminant (such as NOx, CO, and sulfur compounds) emission requirements applicable to all equipment categories.

South Coast AQMD's permitting program implements the requirements of the federal and state Clean Air Act (CAA), the AQMP, and air quality rules and regulations by specifying operating and compliance requirements for stationary sources that emit air contaminants. In order to comply with federal and state CAA requirements, all major and non-major sources in the South Coast Air Basin are subject to "no net emission increase," and are subject to BACT and/or LAER source-specific, prohibitory, and toxics rules (federal, state and local), as well as other applicable requirements.

AFFECTED INDUSTRIES

PR 1165 affects one facility in the South Coast Air Basin, the Southeast Resource Recovery Facility (SERRF) located in the Port of Long Beach. PR 1165 will require the facility to comply with lower emission concentration limits for applicable units. New units that may be installed after adoption of PR 1165 may be subject to identical or more stringent emission concentration limits.

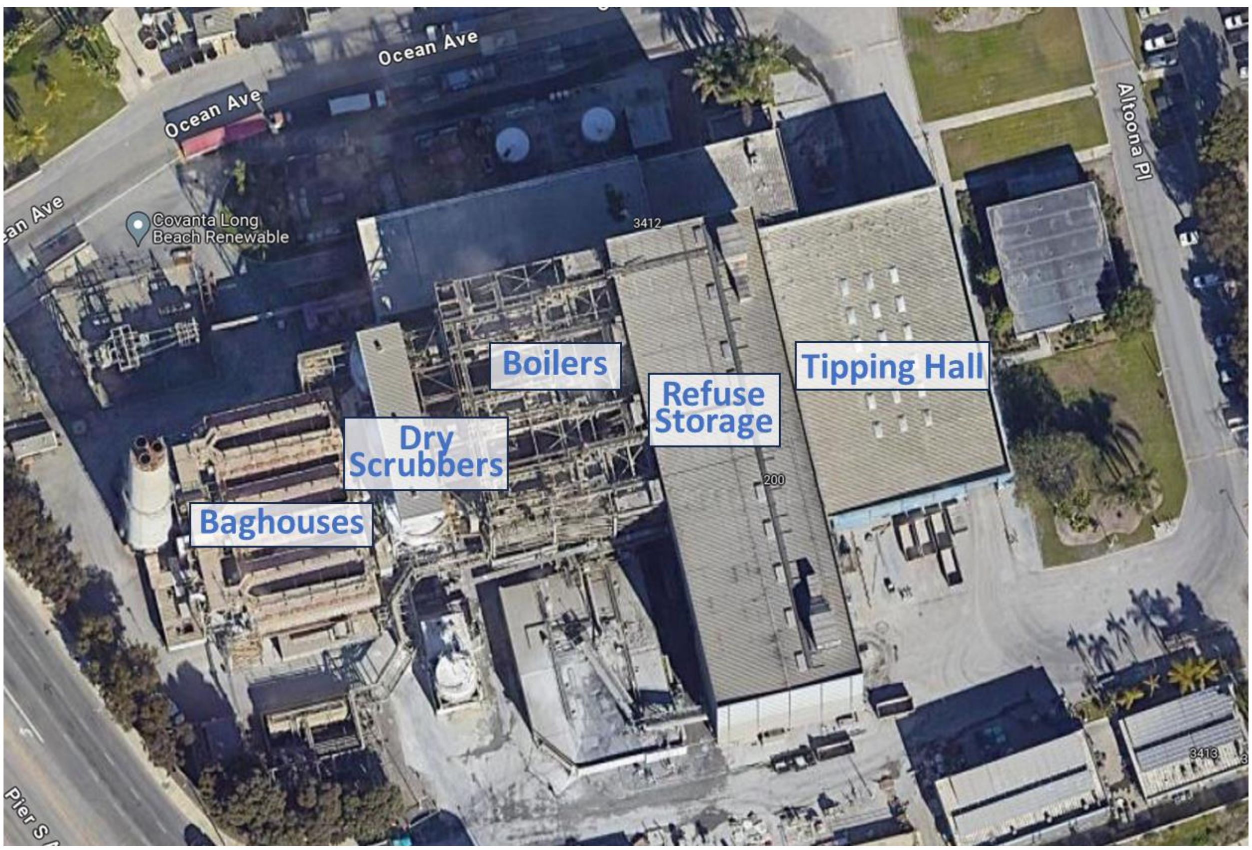


Figure 2: SERRF Facility (Google Maps).

PUBLIC PROCESS

Development of PR 1165 was conducted through a public process. Staff has held three Working Group meetings on November 9, 2023; March 12, 2024; and June 12, 2024. Working Group Meetings were held virtually via Zoom. The Working Group is composed of representatives from environmental and community groups, the affected facility, public agencies, consultants, and other interested parties. The purpose of the Working Group meetings is to discuss proposed concepts and to work through the details of staff's proposal. A Public Workshop will be held on July 11, 2024 to discuss PR 1165. Determination of the applicable California Environmental Quality Act (CEQA) document is pending.

Staff held numerous individual meetings with stakeholders to discuss issues unique to the facility's operations, technical details of the facility's operations, and the proposed rule. In addition, staff conducted site visits to understand the operations of the facility and the unique opportunities and challenges associated with the municipal solid waste incinerators regulated under PR 1165.

CHAPTER 2: BARCT ASSESSMENT

INTRODUCTION

As part of the rule development process, staff conducted a BARCT assessment of equipment subject to PR 1165. The purpose of a BARCT assessment is to identify any potential emission reductions from specific equipment or industries and to establish a concentration limit that is consistent with California state law. Under California Health and Safety Code Section 40406, BARCT is defined as:

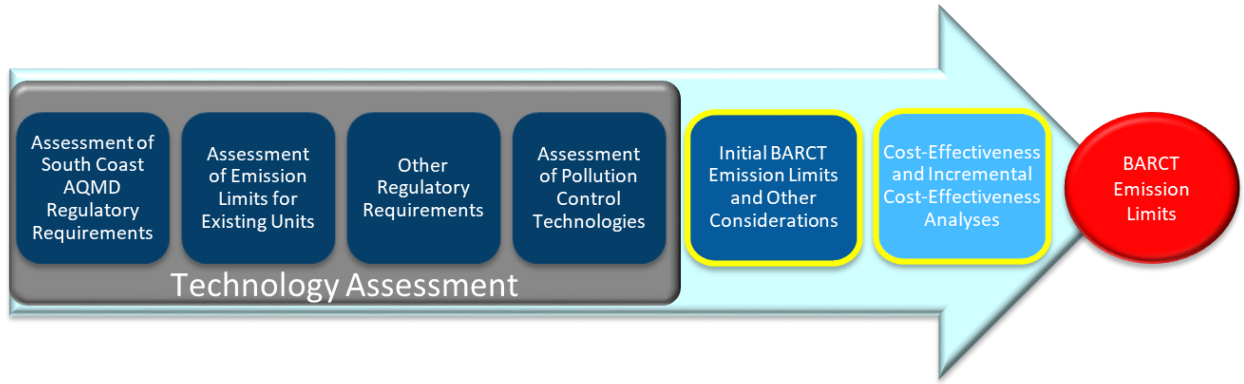
> "… an emission limitation that is based on the maximum degree of reduction achievable, taking into account environmental, energy, and economic impacts by each class or category of source."

BARCT assessments are performed periodically for specific equipment categories to determine if current concentration limits are representative of both current technologies and maximum achievable NO_x reductions. The BARCT assessment is a stepwise process that includes a robust technology assessment that seeks the maximum emission reductions achievable that are also cost-effective.

The BARCT assessment begins with a technology assessment to establish initial BARCT concentration limits. A technology assessment identifies current regulatory requirements for specific equipment categories, established by either the South Coast AQMD or other regulatory agencies. South Coast AQMD permits to operate, source test data, and Continuous Emission Monitoring System (CEMS) data are all analyzed to identify the emission levels being achieved with technology currently used in-practice. Current and emerging technologies are evaluated to determine the feasibility of achieving lower concentration limits, specifically and only with respect to equipment capabilities and limitations. This concludes the technology assessment portion of the BARCT assessment process.

Based on the results of the technology assessment, an initial BARCT concentration limit is identified and a cost-effectiveness analysis and, if necessary, an incremental cost-effectiveness analysis are conducted. The cost-effectiveness analysis considers the cost to implement one or more technologies that can meet the initial BARCT concentration limit determined by the technology assessment. An incremental cost-effectiveness analysis is conducted if multiple initial BARCT concentration limits are identified that vary in stringency and are each individually cost-effective. A final BARCT concentration limit is established that is both technologically feasible, achievable within the implementation schedule allowed in the proposed rule, cost-effective, and incrementally cost-effective.

Figure 2-1 – BARCT Assessment Process



ESTABLISHING EQUIPMENT CATEGORIES

Incinerator as a term encompasses many different types of incineration equipment. For example, other air districts within the state of California include crematories in their definition of incinerators. Specifically for waste, there is a further subdivision of incinerators depending on the type of waste they incinerate. Incinerators exist for combusting medical waste (hospital/medical/infectious waste), hazardous waste, and municipal solid waste (household, commercial, and institutional waste). Given that waste incinerators use the waste itself as the fuel source, nearly all of the emissions quantities, and the specific constituency of the emissions, come from the specific type of waste combusted. Specific attention is necessary to effectively regulate each waste incinerator equipment type.

PR 1165 establishes provisions for municipal solid waste incinerators, which affects incinerators combusting municipal solid waste (MSW). The subtypes of MSW incinerators (such as mass burn waterwall, rotary, etc.) will be subject to the rule due to the pollution control equipment being a post-combustion process that takes place downstream of the incinerator. Staff identified only one facility which included three MSW incinerators. Equipment not subject to PR 1165 includes crematories, hospital/medical/infectious waste incinerators, and hazardous waste incinerators.

The definition in PR 1165 for the MSW incinerator category, and related referenced definitions, is:

- "Municipal Solid Waste Incinerator" means any means any equipment that utilizes an exothermic process to combust Municipal Solid Waste in the presence of oxygen for the purpose of Municipal Solid Waste volume reduction. Municipal Solid Waste Incinerator does not include pyrolysis equipment, gasification equipment, nor equipment used to reduce the volume of Municipal Solid Waste by moisture removal and/or biological degradation processes.

- "Municipal Solid Waste" means any homogenous or composite mixture of Household Waste, Commercial Waste, or Institutional Waste; landscaping or yard waste including grass, grass clippings, bushes, shrubs, and bush and shrub clippings. This definition does not include medical/infectious waste as defined by 40 CFR Part 60 Subpart Ec; any waste with properties that make it potentially dangerous or harmful to human health or the environment and meets the criteria listed in California Code of Regulations Title 22 Section 66261.3; whole or chipped tree stumps; whole or chipped tree limbs; sewage sludge; wood pallets; construction, renovation, or demolition wastes; railroad ties; telephone poles; industrial process or manufacturing process wastes; or motor vehicles.

- "Household Waste" means any waste including, but not limited to, any material discarded by single and multiple residential dwellings, hotels, motels, and permanent or temporary housing establishments or facilities.

- "Commercial Waste" means any waste including, but not limited to, any material discarded by stores, offices, restaurants, warehouses, nonmanufacturing activities at industrial facilities, and other similar establishments or facilities.

- "Institutional Waste" means any waste including, but not limited to, any material discarded by schools, nonmedical waste discarded by hospitals, material discarded by nonmanufacturing activities at prisons and government facilities, and material discarded by other similar establishments or facilities.

GENERAL BARCT ASSESSMENT APPROACH

In identifying the initial universe that would be subject to PR 1165, staff used the South Coast AQMD's permit database and identified SERRF as the only MSW incineration facility currently operating in the South Coast Air Basin.

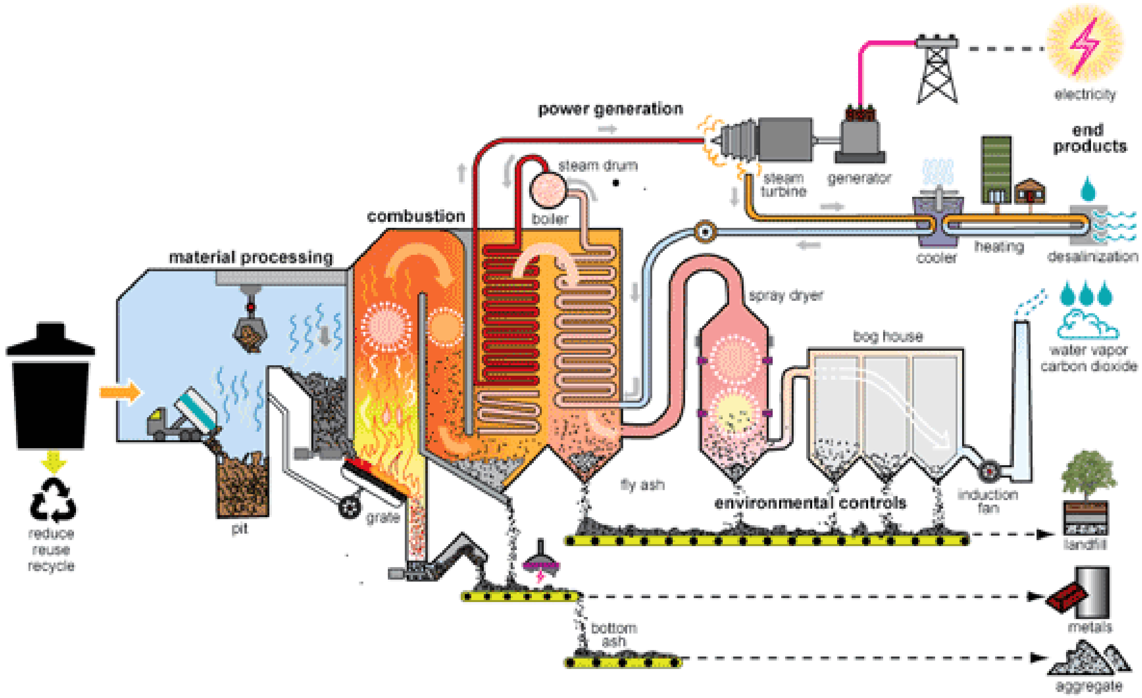


Figure 3: Schematic of SERRF Process.

As part of the rule development process, staff obtained data from multiple sources which included: online articles, industry publications, scientific and vendor literature, South Coast AQMD permit applications and Permits to Operate, source tests, annual emission reports, inspection reports, visits, stakeholder meetings, Working Group meetings, a public workshop, and South Coast AQMD inter-departmental meetings.

A BARCT assessment was conducted for the MSW incinerator equipment category. Each step in the BARCT process will include a discussion of the development of that specific portion of the BARCT assessment.

Assessment of South Coast AQMD Regulatory Requirements

Regulation 4 rules (Rules 404, 405, 407, 409, 475, and 476) currently apply to each of the three MSW incineration units located at the subject facility. These rules are applicable to all equipment types and industries within the South Coast Air Basin. The lowest NOx concentration limit specified in these Regulation 4 rules is 225 ppmv @ 3% O_2. Corrected to 7% O_2, this limit equates to 175 ppmv @ 7% O_2. The lowest PM concentration limit specified in these Regulation 4 rules is 23 milligrams per cubic meter (mg/m^3) at 3% O_2 (0.01 gr/scf @ 3% O_2). Corrected to 7% O_2, these limits equate to 18 mg/m^3 (0.008 gr/scf).

Assessment of Emission Limits for Equipment

Assessment of emission limits was conducted based on a NOx concentration measured in units of "ppmv", or parts per million on a volume basis.

All available source test and CEMS data were reviewed for each of the three MSW incineration units located at the subject facility. The permitted NOx limit for each of the three MSW incineration units is 225 ppmv NOx @ 3% O_2 (based on South Coast AQMD Rule 476). The permitted PM limit is 0.01 gr/scf @ 3% O_2 (based on South Coast AQMD Rules 475 and 476). The three incineration units are designed and operate identically to one another.

Other Regulatory Requirements

Staff assessed regulations at the local, state, national, and international levels to compare concentration limits of other air districts and air quality regulatory entities. Staff reviewed data for both newly installed as well as existing units to inform a full understanding of emission control capability as demonstrated in-practice. Data from this review was used to assess potential BARCT NOx concentration limits with respect to other established NOx emission limits.

Local

The three MSW incineration units at SERRF are the only known MSW incineration units in the South Coast Air Basin and no other comparison can be determined within the South Coast Air Basin.

State

Staff reviewed the regulations at each of the other 34 air districts within the State of California. Placer County Air Pollution Control District's Rule 206 (Incineration Burning) was the only air district that specified a NOx concentration limit. This NOx concentration limit is 50 ppmv NOx @ 12% CO_2. Based on operating data for CO_2 measurements of the three MSW incineration units, this is approximately equivalent to the current permitted operating limit of the three MSW incineration units.

Placer County Air Pollution Control District, San Joaquin Valley Air Pollution Control District, and San Luis Obispo County Air Pollution Control District specified PM concentration limits of 0.015 gr/ft^3 @ 12% CO_2, 0.1 gr/ft^3 @ 7% O_2, and 0.08 gr/ft^3 @ 7% O_2, respectively. Each of these PM concentration limits is less stringent than the 0.01 gr/scf at 3% O_2 (equivalent to 0.008 gr/scf @ 7% O_2) PM concentration limit currently required of the three MSW incineration units.

National

Staff consulted the U.S. EPA's RACT/BACT/LAER Clearinghouse (RBLC) to determine NOx and PM concentration limits across all 50 states and territories.

Eight units were classified as Best Available Control Technology (BACT) across Florida, Puerto Rico, Illinois, North Carolina, Virginia, and New Jersey with NOx concentration limits ranging from 45 ppmv @ 7% O_2 to 174 ppmv @ 7% O_2.

Four units were classified as BACT across Florida and Puerto Rico with PM concentration limits ranging from 0.004 gr/scf @ 7% O_2 to 0.009 gr/scf @ 7% O_2, with three of the four units more stringent than the three MSW incineration units' 0.008 gr/scf @ 7% O_2 PM concentration limit.

Three regulations were classified as BARCT for the state of Virginia and the state of Maryland. The operating permits for two units in the state of Virginia reference the Virginia State Air Pollution Board's 9 VAC Chapter 40 regulation when they require NOx concentration limits of 90 ppmv @ 7% O_2 (1-hour average) and 110 ppmv @ 7% O_2 (24-hour average). The Maryland Department of Environment's Chapter 26 Subtitle 11.08 regulation requires NOx concentration limits of 105 ppmv @ 7% O_2 (30-day rolling average) and 140 ppmv @ 7% O_2 (24-hour block average).

International

The company ARC's Amager-Bakke plant, located in Denmark, is considered one of the premier waste-to-energy municipal solid waste incineration plants in the world. See Figure 3. Staff contacted representatives of the Amager-Bakke plant to understand their facility's emissions performance and the regulations they are subject to. The Amager-Bakke plant is subject to the European Commission's Industrial Emissions Directive 2010/75/EU for Best Available Technology. This directive requires a 111 ppmv NOx @ 7% O_2 and a 3.6 milligrams per cubic meter PM @ 7% O_2 concentration limit. Reference conditions during monitoring may be slightly different than typically used in the United States.

Figure 4: Amager Bakke Waste-to-Energy Plant. https://a-r-c.dk/amager-bakke.

Table 2-1 shows a summary of the most stringent NOx and PM limits found during the review of other emission concentration regulations.

Table 2-1 – Other Regulatory Requirements Summary

Level	Most Stringent NOx Concentration Limit	Most Stringent PM Concentration Limit
South Coast AQMD Facility	225 ppmv @ 3% O_2 (175 ppmv @ 7% O_2) (32 ppmv @ 12% CO_2)	0.01 gr/scf @ 3% O_2 (0.008 gr/scf @ 7% O_2)
Local	More Stringent Limits Not Identified	More Stringent Limits Not Identified
State: California Air Districts	50 ppmv @ 12% CO_2 (1-hour average)	0.08 gr/scf @ 7% O_2
National: U.S. EPA RACT/BACT/LAER Clearinghouse	45 ppmv @ 7% O_2 (24-hour average) 90 ppmv @ 7% O_2 (1-hour average)	0.004 gr/scf @ 7% O_2
International: European Commission	111 ppmv @ 7% O_2 (24-hour average)[1]	0.002 gr/scf @ 7% O_2

Assessment of Pollution Control Technologies

Staff reviewed multiple sources to understand the available and applicable pollution control technologies for the MSW incinerator equipment category. This included a review of scientific literature, meetings with vendors and consultants, review of other MSW incinerators, and a site visit to the SERRF facility. These sources were analyzed with the objective of identifying relevant combustion and/or post-combustion control technologies and understanding the capabilities and limitations of each technology.

Staff's initial technology assessment identified several post-combustion control technologies. These included Selective Catalytic Reduction, Selective Non-Catalytic Reduction, Ceramic Catalytic Filters, Baghouses, and Electrostatic Precipitators.

Although combustion control is quite common for other combustion equipment in the South Coast Air Basin, due to the fuel being combusted (municipal solid waste instead of natural gas), emissions originate from the waste itself being burned. In contrast, other combustion units like water boilers or process heaters use burners supplied by natural gas to provide heat to a unit. The three MSW incineration units are equipped with burners, which are used only for startup to bring the units up to temperature. Once a unit reaches operating temperature, the burners are turned off, at which point the burning process is self-sustaining via the combusting of municipal solid waste. These burners are not subject to PR 1165.

A discussion of each of the post-combustion control technologies is below.

Selective Catalytic Reduction (SCR)

A post-combustion control technology, SCR involves the injection of ammonia (NH_3) or urea (which is vaporized into ammonia) into the flue gas stream to reduce NOx to N_2 and H_2O via the use of catalysts. The optimal range of flue gas temperatures corresponding to the highest NOx reductions and maximum catalyst life is 500-1,000 °F. A molar ratio of 0.9:1-1:1 NH_3:NOx provides the maximum NOx reductions while minimizing "ammonia slip". Ammonia slip occurs when ammonia from the ammonia injection passes through the catalyst bed without reacting with NOx and continues outside the flue stack to the ambient air. NOx reduction efficiencies generally can range from 80% to more than 90%.

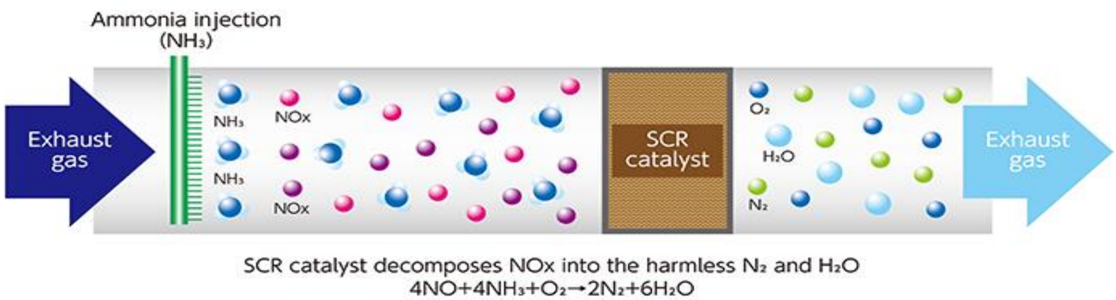


Figure 5: Selective Catalytic Reduction Flow Diagram.
Image source: Hitachi Zosen. SCR (Selective Catalytic Reduction) NOx Removal System. https://www.hitachizosen.co.jp/english/business/field/marine/denitration.html.

Catalysts are often installed in modular beds, with the first bed in the flue stream contributing to the most NOx reductions relative to the beds subsequent in the flue gas stream. Accordingly, catalyst beds can either be rotated or replaced on a regular basis in intervals in line with their usage. Catalysts can also be regenerated instead of replaced, which can be approximately 40% less expensive than catalyst replacement.

There are two facilities located in the United States equipped with SCR, Energy Answers Arecibo Puerto Rico Renewable Energy Project and Palm Beach Renewable Energy Park.

Selective Non-Catalytic Reduction (SNCR)

A post-combustion control technology, SNCR involves the injection of ammonia or urea into the flue gas stream to reduce NOx to N_2 and H_2O without the use of catalysts. The optimal range of flue gas temperatures corresponding to highest NOx reductions is comparatively higher than that for SCR, as the catalyst integrity and efficiency is no longer a concern. This temperature range is 1,500-2,200 °F. Relative to SCR, many processes may not need to install a dilution air fan nor additional duct work due to the elevated optimal temperature range capability. A molar ratio of 2:1-4:1 NH_3:NOx with a residence time of longer than one second provides the maximum NOx reductions. A higher molar ratio is necessary due to the absence of a catalyst facilitating the reaction between NH_3 and NOx. Due to this, ammonia slip is more of a concern with SNCR than it is for SCR.

The lack of a catalyst leads to a lower NOx reduction potential. SNCR has been demonstrated to achieve up to 60% NOx reduction efficiencies. Due to the lack of catalyst, operating costs and maintenance costs are also lower than those for SCR by approximately 20%.

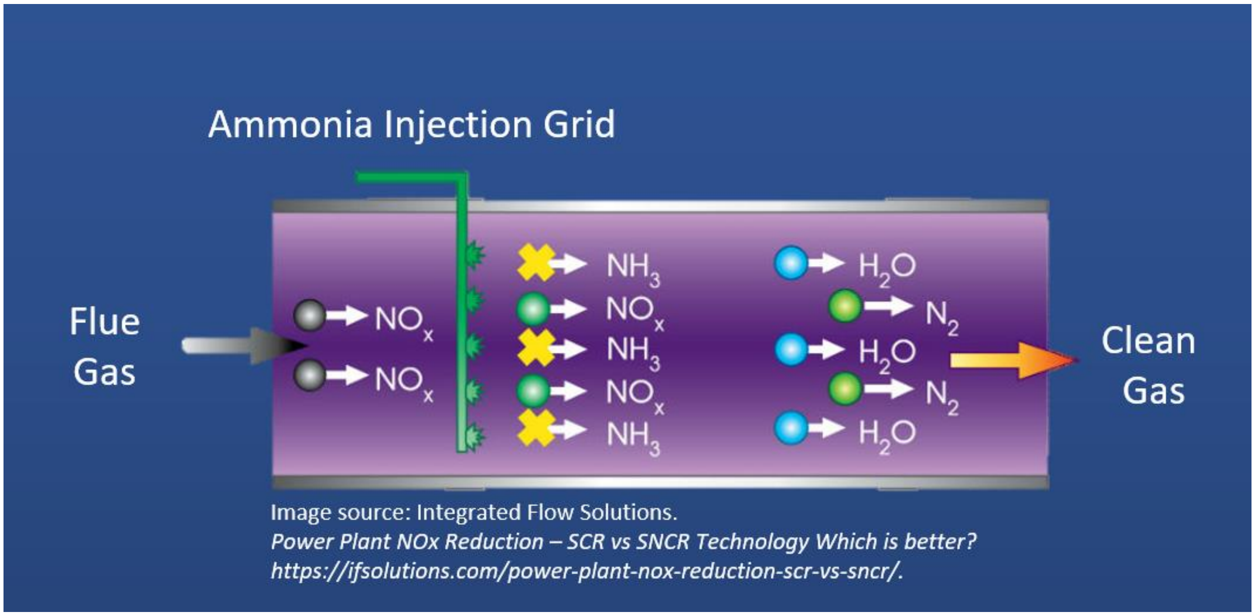


Figure 6: Selective Non-Catalytic Reductions Flow Diagram.

Ceramic Catalytic Filters

As a post-combustion control technology, Ceramic Catalytic Filters (CCFs) utilize an array of catalyst-embedded ceramic tubes to non-selectively remove both NOx and PM. Such systems may also remove acid gases such as SO_2 and HCl through the injection of dry sorbents such as hydrated lime, sodium bicarbonate, or trona upstream of the filters. The introduction of a dry sorbent reacts with the acid gases to create reaction by-products in the form of solid particles which can be collected onto the filters. Mercury can also be controlled through the injection of powder activated carbon upstream of the process to create reaction by-products in the form of solid particles which can be collected onto the filters.

The main benefit of CCFs is their multi-pollutant reduction capability. This feature can reduce the need for pollutant-specific pollution control equipment and thus reduce the aggregate footprint of all control technologies that may be required at a MSW incineration facility. CCFs are also resistant to high operating temperatures and corrosion and have a long operating life of the catalyst filter elements, between 5 and 10 years.

The CCF system can be modified for a facility's pollution reduction needs. The CCFs can be enhanced with additional pollutant removal capabilities and "stacked" upon one another. The base CCF configuration removes PM, dioxins, and furans. To also control NOx, catalysts can be impregnated into the CCFs and ammonia injected upstream. To also control for acid gases, dry sorbents can be injected upstream. To also control mercury, powder activated carbon can be injected upstream.

The CCFs are candle-shaped ceramic filters in the form of rigid tubes with high porosity. The composition of the filters includes high-temperature binders and plasticizers to allow for thermal resilience, with the operating temperature range between 300-1,600 °F. Each filter can be significantly heavy, weighing nearly 30 pounds for the entire typical 10-foot length and 6-inch diameter tube. The ceramic filters are comprised of micrometer-length diameter fibers that allow for a high internal surface area to capture pollutants.

Flue gas is drawn through the filter tube walls by an induced-draft fan. When the collected pollutants build up as a cake on the outside of the tube wall, the filters are cleaned through a pulse-jet of air to remove the buildup that is then collected for storage and disposal.

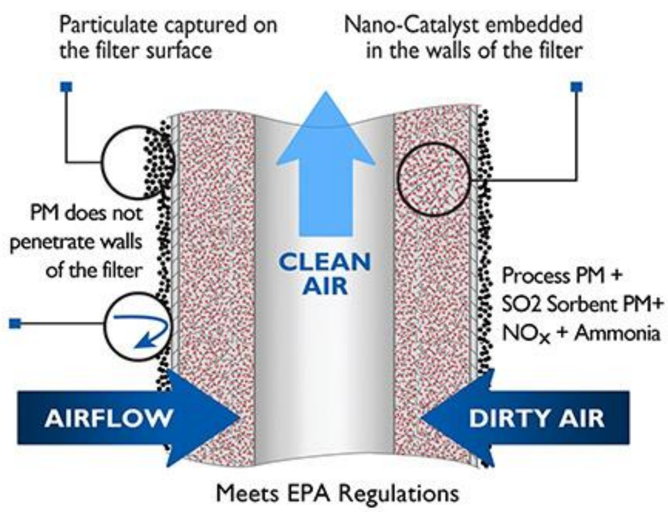


Figure 7: Ceramic Catalytic Filters.
Tri-Mer Corporation. High Temperature Filters for Hot Gas Filtration.
https://tri-mer.com/hot-gas-treatment/high-temperature-filter.html.

Baghouse

A post-combustion control technology, baghouses utilize a fabric filter for the collection and removal of PM. These systems use filter bags mounted vertically within a metal enclosure housing. An induced draft fan draws air into the system, with the air passing through the fabric filters. Particulates in the air are then captured by the filters, build up into a cake material, and are regenerated through various mechanisms.

The bags used in these systems can be constructed of various materials and in various styles, including woven materials, nonwoven materials, pleated, felt, polyester, nylon, Teflon, PTFE, and fiberglass. These systems are further distinguished by the type of cleaning method used to remove the collected pollutants, most commonly defined as pulse-jet, shaker, or reverse-air.

The pulse-jet system pushes a volume of compressed air into the fabric filters, dislodging the built-up particulate matter, which is then collected into a hopper and disposed of. These systems do not have to be taken offline when the pulse-jets are activated. The shaker system is taken offline during which time the fabric filters are shaken by a mechanical system. A reverse-air system operates similarly to pulse-jet systems, but instead uses a lower-pressure, higher-volume approach which improves the longevity of the bags but requires a higher-horsepower of the reverse-air blower system.

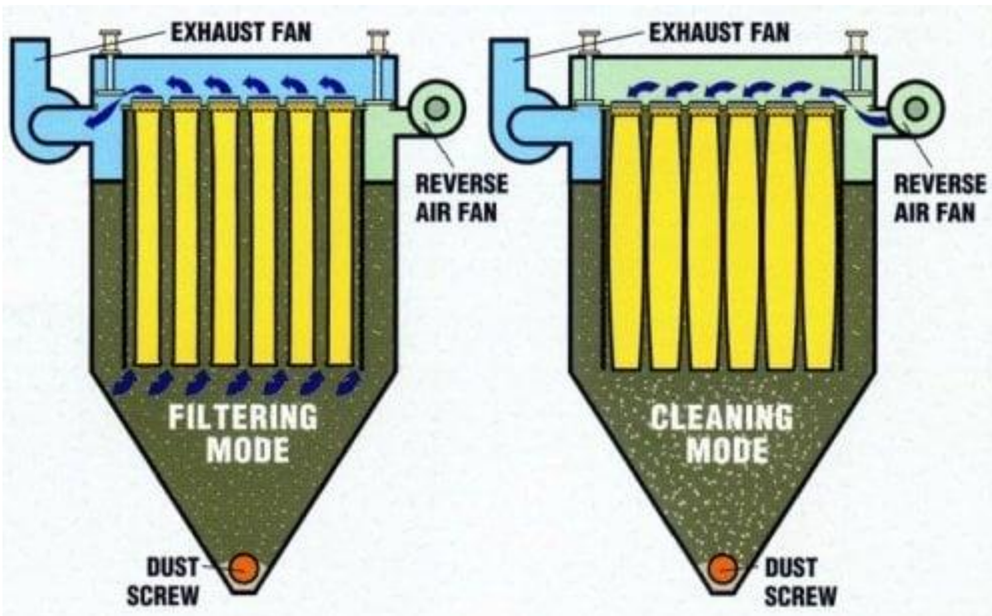


Figure 8: Baghouse
Image source: Micronics. Baghouse Filter Basics.
https://www.micronicsinc.com/filtration-news/baghouse-filter-basics/.

Initial BARCT Emission Limits and Other Considerations

Staff determined an initial BARCT NOx concentration limit using the information gathered from all previous steps in the BARCT assessment process, including existing emission limits and actual emission performance levels based on stack test and CEMS data for the three MSW incinerators, other regulatory requirements, and a review of pollution control technologies. Staff also reviewed the technical information, cost components, and stated emission performance levels from control technology vendors.

The average outlet NOx emission concentration in the exhaust stack across all years is 75 ppmv @ 7% O_2. None of the three MSW incineration units located at SERFF are equipped with an analyzer to measure the inlet NOx concentration into each unit's NOx post-combustion control equipment. Staff estimated the inlet NOx concentration based on an expected NOx reduction efficiency of the SCNR system installed on the three MSW incineration units. A NOx reduction efficiency of 60% was used, based on a U.S. EPA dataset for MSW incinerators. SCR is expected outperform SNCR by 33% with a overall NOx reduction efficiency of 80%. The initial BARCT emission limit of 50 ppmv @ 7% O2 is a 33.33% reduction from the current NOx emission concentration of 75 ppmv @ 7% O2 using SNCR control technology.

Staff identified that the majority of PM emissions comprised of condensable PM, which cannot be directly controlled by PM control technologies. Staff's initial BARCT emission limit for PM is based indirectly on the reduced use of condensable-precursors, namely ammonia. This reduced ammonia use would come as a result of a more efficient NOx emission reduction strategy involving the replacement of the current SNCR system with an SCR system, which utilizes a lower stochiometric ratio of ammonia to NOx in its control scheme.

Cost-Effectiveness Analysis & Incremental Cost-Effectiveness Analysis

A cost-effectiveness analysis and incremental cost-effectiveness analysis were conducted pursuant to California Health and Safety Code § Section 40920.6. A summary of the costs, emission reductions, cost-effectiveness, and incremental cost-effectiveness for the Municipal Solid Waste equipment category will be discussed in this chapter. A detailed analysis of the cost-effectiveness and incremental cost-effectiveness for this equipment category is found in Chapter 4 – Impact Assessment.

For the Municipal Solid Waste equipment category, both SCR and CCF were determined to be cost-effective. Although the South Coast AQMD does not have a cost-effectiveness threshold established for PM emission reductions, a cost-effectiveness analysis was still conducted for baghouse control technology to provide a guideline as to how costly PM emission reductions may be.

Over a 25-year period, the total costs of SCR control technology were determined to be $48,008,000 and the estimated NOx emission reductions to be 2,117.25 tons. The cost-effectiveness of this control technology was calculated as $22,700 per ton NOx reduced.

The total costs of CCF control technology over a 25-year period was determined to be $103,632,000 and the estimated NOx emission reductions to be 2,117.25 tons. The cost-effectiveness of this control technology was calculated as $48,900 per ton NOx reduced.

Over a 25-year period, the total costs of Baghouse control technology was determined to be $14,261,000 and the estimated NOx emission reductions to be 25.25 tons. This calculation estimated that it would require $564,800 to reduce one ton of PM.

CHAPTER 3: PROPOSED RULE 1165

INTRODUCTION

PR 1165 establishes NO_x, PM, CO, and Opacity limits for municipal solid waste incinerators. The following information describes the structure of PR 1165.

PROPOSED RULE STRUCTURE

PR 1165 will contain the following subdivisions:

a) Purpose
b) Applicability
c) Definitions
d) Requirements
e) Housekeeping Requirements
f) Monitoring and Source Testing Requirements
g) Reporting and Recordkeeping Requirements
h) Exemptions

PROPOSED RULE 1165

Subdivision (a) – Purpose

The purpose of this rule is to limit NOx, PM, and CO emissions from municipal solid waste incinerators.

Subdivision (b) – Applicability

PR 1165 applies to municipal solid waste incinerators that combust more than 35 tons of municipal solid waste per day. The rule excludes three types of incinerators: hospital/medical/infectious waste incinerators, pyrolysis units, and gasification units. The emissions produced in the incineration of waste are wholly dependent upon the type of waste being incinerated, and thus the emissions profile for hospital/medical/infectious waste differs from that for municipal solid waste and requires a dedicated BARCT analysis, which is beyond the scope of PR 1165. Pyrolysis and gasification units differ from municipal solid waste incinerators via the absence of a combustion process. The pyrolysis and gasification processes are a chemical transformation through the application of heat, rather than the physical incineration through combustion. Likewise, a dedicated BARCT analysis for that equipment category would be required and is beyond the scope of PR 1165.

Subdivision (c) – Definitions

Key definitions in PR 1165 are referenced and discussed below.

- *COMMERCIAL WASTE means any waste including, but not limited to, any material discarded by stores, offices, restaurants, warehouses, nonmanufacturing activities at industrial facilities, and other similar establishments or facilities.*

  This defines one of the components of Municipal Solid Waste.

- *HOUSEHOLD WASTE means any waste including, but not limited to, any material discarded by single and multiple residential dwellings, hotels, motels, and permanent or temporary housing establishments or facilities.*

  Another key component of Municipal Solid Waste explained.

- *INSTITUTIONAL WASTE means any waste including, but not limited to, any material discarded by schools, nonmedical waste discarded by hospitals, material discarded by nonmanufacturing activities at prisons and government facilities, and material discarded by other similar establishments or facilities.*

  Another key component of Municipal Solid Waste explained.

- *MALFUNCTION means any sudden, infrequent, and not reasonably preventable failure of air pollution control and monitoring equipment, process equipment, or a process to operate in a normal or usual manner which causes, or has the potential to cause, the equipment to exceed the emission limits of an applicable rule or standard. Equipment failures that are caused in part by poor maintenance or careless operation are not Malfunctions.*

  This constitutes an equipment breakdown and specifies the period during which emission data collected is excluded from compliance calculations.

- *MUNICIPAL SOLID WASTE means any homogenous or composite mixture of Household Waste, Commercial Waste, or Institutional Waste; landscaping or yard waste including grass, grass clippings, bushes, shrubs, and bush and shrub clippings. This definition does not include medical/infectious waste as defined by 40 CFR Part 60 Subpart Ec; any waste with properties that make it potentially dangerous or harmful to human health or the environment and meets the criteria listed in California Code of Regulations Title 22 Section 66261.3; whole or chipped tree stumps; whole or chipped tree limbs; sewage sludge; wood pallets; construction, renovation, or demolition wastes; railroad ties; telephone poles; industrial process or manufacturing process wastes; or motor vehicles.*

  Three key components, including composite mixtures, are the fuel source of Municipal Solid Waste incinerators. Several other types of waste are included or excluded from the definition of Municipal Solid Waste and therefor included or excluded from applicability to PR 1165. These inclusions and exclusions are intended to define the scope of Municipal Solid Waste and exclude large singular items of organics or large singular items of heavy industrial activity or commercial items. Additionally, equipment not subject to PR 1165 includes crematories, hospital/medical/infectious waste incinerators, and hazardous waste incinerators.

- *MUNICIPAL SOLID WASTE INCINERATOR means any equipment that utilizes an exothermic process to combust Municipal Solid Waste in the presence of oxygen for the purpose of Municipal Solid Waste volume reduction. This definition does not include* *pyrolysis equipment, gasification equipment, nor equipment used to reduce the volume of Municipal Solid Waste by moisture removal and/or biological degradation processes.*

Equipment subject to PR 1165 consists of exothermic municipal solid waste combustion devices such as mass burn waterwall incinerators, rotary incinerators, etc. Staff identified only one facility which included three MSW incinerators. Pyrolysis and gasification equipment, which utilize little to no oxygen to thermally degrade waste, and anaerobic digesters, which utilize biological processes to reduce the volume of waste, are not subject to PR 1165.

- *SHUTDOWN means that period of time beginning when an owner or operator reduces the load or heat input, and flue gas temperatures fall below the minimum operating temperature of the NOx Post Combustion Control Equipment, if applicable, and which ends in a period of zero fuel flow or zero feedstock, or when combustion/circulation air flow ends if the unit does not use fuel for combustion.*

- *STARTUP means the time period that begins when a Municipal Solid Waste Incinerator combusts fuel, after a period of zero fuel flow or zero feedstock, or when combustion/circulation air is introduced if the Municipal Solid Waste Incinerator does not use fuel for combustion, and ends when the flue gas temperature reaches the minimum operating temperature of the NOx Post Combustion Control Equipment and reaches stable conditions..*

  Shutdown and Startup specify the period of operation outside of normal operating conditions are reached during which emission data collected is excluded from compliance calculations.

- *WORKSPACE CLEANING METHOD means a process to remove or collect debris using a wet mop, damp cloth, wet wash, low-pressure spray nozzle, wet vacuum, dry vacuum with dust suppression, or a combination of the above methods.*

  Lists the cleaning methods used to capture or collect any particulate matter on the facility grounds, as opposed to simply moving such particulate matter from one location to another.

Subdivision (d) – Requirements

NOx, CO, PM, and Opacity Emission Requirements – Paragraph (d)(1)

- ***NOx***

NOx emission concentration limits have a two-phase implementation approach. The first phase is to comply with U.S. EPA's Good Neighbor Plan and satisfy the State of California's SIP submittal requirements to ensure compliance with the Good Neighbor Plan. The Good Neighbor Plan requires that two limits, 110 ppmv NOx @ 7% O_2 (24-hour block average) and 105 ppmv NOx @ 7% O_2 (30-day rolling average), be included in the California SIP. The second phase requires an emission limit based on BARCT. The BARCT assessment demonstrated that a 50 ppmv NOx @ 7% O_2 level is considered best available retrofit technology and is more stringent than the federal

Good Neighbor Plan limits. However, staff recognizes that additional time is necessary to both permit, construct, and test retrofit equipment, and therefore a three-year time frame is provided for this process to be completed before compliance with the BARCT NOx limit is required.

- ***CO***

A CO limit of 100 ppmv @ 7% O_2 is proposed in order to limit the ability of a unit to reduce NOx emissions by increasing CO emissions. The proposed CO emission concentration standard is identical to the U.S. EPA emission concentration limit for CO in the Good Neighbor Plan.

- ***Total PM***

The Total PM emission concentration limits also have a two-phase implementation approach. The first limit was calculated based on the source tests for all three MSW incineration units conducted in 2014, 2017, 2020, and 2021. During each source test for each unit, a total of three runs were conducted during the source test for each pollutant. This resulted in a total of 36 data points for each pollutant, including Total PM. All three MSW incineration units operate significantly below their Total PM emission concentration limits on each unit's South Coast AQMD permit to operate. Staff sought to calculate a Total PM emission concentration limit that reflects actual operating performance while including a compliance buffer between operating levels and the required limit in PR 1165.

Two methods were used to calculate this limit.

Method 1 calculated the limit using the median value and is shown in Equation 3-1. This method was used to estimate the highest level of actual emissions performance while removing the effect of outliers that were significantly higher than the remaining data set of emission concentration values.

$$Proposed\ Limit = (Median\ Value\ of\ Data\ Set) * 2 + 20\% \qquad \text{(Eq. 3-1)}$$

The median value of the 36-point dataset was 11.0 milligrams per dry standard cubic meter (mg/dscm) @ 7% O_2. A 20% compliance buffer was added to provide an operating margin. Using Equation 3-1, this results in a proposed Total PM emission concentration limit of 26.4 mg/dscm @ 7% O_2

Method 2 calculated the limit using the maximum value and is shown in Equation 3-2. This method was used to utilize the highest emission concentration in the operating history of all three MSW incineration units to ensure compliance under all operating conditions that can be expected.

$$Proposed\ Limit = (Maximum\ Value\ of\ Data\ Set) * 2 + 20\% \qquad \text{(Eq. 3-2)}$$

The maximum value of the 36-point dataset was 37.2 dscm @ 7% O_2. Using Equation 3-2, this results in a proposed Total PM emission concentration limit of 44.6 dscm @ 7% O_2 (the maximum value of the 36-point dataset that was reported in units of dry standard cubic feet @ 12% CO_2 was 5.02 grains per dry standard cubic foot @ 12% CO_2).

As the result of Method 2 is higher than the current Total PM emission concentration limit for each of the three MSW incineration units of 0.1 grains per dry standard cubic foot @ 12% CO_2, the result of Method 1 was used to establish the first phase of the Total PM emission concentration limit for PR 1165.

The second phase of the Total PM emission concentration limit was based on the percentage reduction of ammonia translated to the percentage reduction of Total PM emissions. The use of ammonia in an SCNR control technology system can lead to ammonia slip. Ammonia slip is the ammonia remaining that did not react with the NOx molecules in the flue gas. This remaining ammonia remains in the flue gas and can lead to the formation of ammonium salts, which are classified as condensable PM and are not filterable by a PM control device. The median ammonia slip of the three-MSW incineration unit system at the subject facility, based on the 36-point data set is 15 ppmv @ 7% O_2. Reducing the use of ammonia and/or increasing the reaction percentage between ammonia and NOx will reduce the ammonia slip.

SCR control technology employs the use of a catalyst to facilitate the reaction between ammonia and NOx. SNCR control technology does not employ a catalyst. SCR control technology NOx reduction efficiency was quoted to staff at 90%, which is higher than the estimated 60% efficiency for the SNCR control technology currently installed at the subject facility. The quotes that vendors provided to staff for the installation of SCR control technology specified a 10 ppmv @ 7% O_2 ammonia slip.

Reducing the ammonia slip from a median value of 15 ppmv @ 7% O_2 to a value of 10 ppmv @ 7% O_2 represents a 33% decrease. The amount of ammonia used in the quoted SCR system is also 33% less than the amount currently utilized in the SNCR system. The overall reduction of condensable PM in the flue gas is thus estimated to be 33%. The median of the 36-point dataset for the mass fraction of condensable PM in the flue gas is 96%.

By replacing the SNCR control technology with a SCR control technology, the Total PM limit can be reduced from 26.4 mg/dscm @ 7% O_2 to 17.7 mg/dscm @ 7% O_2.

This reduction is associated with the installation of SCR control technology, and additional time is necessary to both permit, construct, and test retrofit equipment. A three-year timeframe is provided for this process for the SCR installation before compliance with the lower Total PM limit is required.

- ***PM-Filterable***

PM-Filterable emission concentration limits would not be lowered via the installation of SCR control technology, as the reduction in ammonia slip only reduces PM-Condensable emissions. Therefore, staff proposed only one PM-Filterable emission concentration limit. The 36-point data set was used. The median value of PM-Filterable was 4.24 mg/dscm @ 7% O_2. The maximum value of PM-Filterable was 18.2 mg/dscm @ 7% O_2. Equation 3-1 and Equation 3-2 were used to calculate a proposed PM-Filterable emission concentration limit. The result of Equation 3-1 for PM-Filterable was 10.2 mg/dscm @ 7% O_2; of Equation 3-2 for PM-Filterable was 21.8 mg/dscm

@ 7% O_2. Staff chose the lower of these two values to establish the proposed PM-Filterable emission rate limit.

- ***PM-Condensable***

The same methodology was applied to the PM-Condensable emission concentration limits. The 36-point data set was used. The median value of PM-Condensable was 9.70 mg/dscm @ 7% O_2. The maximum value of PM-Condensable was 37.2 mg/dscm @ 7% O_2. Equation 3-1 and Equation 3-2 were used to calculate a proposed PM-Condensable emission rate limit. The result of Equation 3-1 for PM-Condensable was 23.3 mg/dscm @ 7% O_2; of Equation 3-2 for PM-Condensable was 44.6 mg/dscm @ 7% O_2. Staff chose the lower of these two values to establish the proposed PM-Condensable emission rate limit.

Using the same information for the condensable PM as evaluated for Total PM, reducing the ammonia slip from a median value of 15 ppmv @ 7% O2 to a value of 10 ppmv @ 7% O2 represents a 33% decrease. The amount of ammonia used in the quoted SCR system is also 33% less than currently utilized in the existing SNCR system. The overall reduction of condensable PM in the flue gas is therefore estimated to be 33%. The median of the 36-point dataset for the mass fraction of condensable PM in the flue gas is 96%.

- ***Opacity***

The process of incineration, if not controlled properly, can lead to white or black smoke from the exhaust stack of a MSW incineration unit. This smoke is mostly comprised of particulate matter. An opacity limit is proposed to limit the smoke produced from MSW incineration units. The proposed opacity limit of PR 1165 of 10% every six minutes, is currently specified in the South Coast AQMD permit to operate for each of the three MSW incineration units and is also the proposed limit in the Good Neighbor Plan.

<u>Odor Capture and Control – Paragraph (d)(2)</u>

Odors from any location that MSW is stored, such as in a tipping hall or other waste unloading area, is required to be vented to an odor capture and control system. This system is required to prevent the emission of odors beyond the facility grounds and prevent public nuisance to any adjacent communities or sensitive receptors such as schools.

<u>Ash Storage Containers Control – Paragraph (d)(3)</u>

All particulate matter collected from the MSW incineration process must be stored in containers that prevent the stored material from becoming airborne and causing fugitive particulate matter emissions.

<u>Exhaust Emission Control Operation – Paragraph (d)(4)</u>

This provision is to require the operation of any exhaust emission control system, if the minimum operating temperature is met in order for such a system to operate, including during normal operation and during periods of startup, shutdown, or malfunction. This is to prevent any uncontrolled emissions from occurring if the operating conditions are met for any exhaust emission control system, yet the system is not active to reduce emissions.

Exhaust Emission Control-Based Startup and Shutdown– Paragraph (d)(5)

Emission data collected during startup and shutdown periods are not included for compliance calculations. This provision provides a maximum duration of time for any startup and shutdown period.

Decommission – Paragraph (d)(6)

An owner or operator may elect to decommission a unit at any time. A South Coast AQMD permit inactivation form is required and the unit must be disconnected from all utilities, such that the unit cannot once again resume operating. The decommissioning process is intended to be a permanent event.

Subdivision (e) – Housekeeping Requirements

Facility Cleaning Frequency – Paragraph (e)(1)

Various locations within the facility grounds must be periodically cleaned using specified cleaning methods. These methods help mitigate any fugitive dust emissions that may occur from particulate matter depositing on the grounds of the facility and winds causing such particulate matter to become airborne.

Construction Cleaning Frequency – Paragraph (e)(2)

This provision is to ensure the immediate cleaning of any areas affected by construction or maintenance and to prevent any particulate matter deposited around such areas from remaining on the facility grounds until the next cleaning period specified in paragraph (e)(1).

Prohibited Cleaning Methods – Paragraph (e)(3)

Cleaning methods that simply move any particulate matter that may be deposited on the facility grounds are not allowed. Only those methods specified in the Workspace Cleaning Methods definition are allowed, which require only those cleaning methods that actively collect or capture deposited particulate matter on the facility grounds.

Housekeeping Collected Material Storage Containers Control – Paragraph (e)(4)

All particulate matter collected from the conducting housekeeping must be stored in containers that prevent the stored material from becoming airborne and creating fugitive particulate matter emissions.

Subdivision (f) – Monitoring and Source Testing Requirements

Opacity Monitoring – Paragraphs (f)(1) and (f)(2)

PR 1165 specifies an opacity limit to prevent the production of black or white smoke from the exhaust stack of any MSW incineration unit. This opacity is to be measured by a continuous monitoring system at all times. In the event that the continuous monitoring system ceases to operate, a certified individual must manually monitor the opacity in lieu of the continuous monitoring system until the system is operating again. This is to provide a redundancy measure and ensure that the opacity of a MSW incineration unit's flue gas is continuously monitored.

CEMS Requirement – Paragraph (f)(3)

A certified CEMS is required to be installed to continuously monitor NOx, CO, and O_2. This ensures the most comprehensive emission data reporting for NOx.

Temperature Measurement Device Requirement – Paragraph (f)(4)

A temperature measurement device is required to be installed prior to each exhaust emission control device to ensure that the minimum operating temperature for each control equipment is maintained during normal operation.

Source Test Protocol Submission – Paragraph (f)(5) and (f)(6)

A source test protocol must be submitted at least 90 days prior to a scheduled source test to allow for adequate time for protocol review and approval. A previously approved source test protocol may be submitted if no alterations requiring a permit modification were performed on the unit as the test setup and conditions can reasonably be expected to be similar to those of the previous source test. A new source test protocol is required to be submitted if the Executive Officer determines that the previously approved protocol is no longer applicable or requires modification.

Certified Source Testing Firm and Test Methods – Paragraph (f)(7)

The South Coast AQMD offers a Laboratory Approval Program, on a method-by-method basis, to allow for a means for firms to appropriately and accurately source test emission sources. This requirement also ensures standardization across both different MSW incineration units as well as the same MSW incineration unit across time.

Subdivision (g) – Reporting and Recordkeeping Requirements

Raw NOx Recordkeeping – Paragraph (g)(1)

Any NOx emission data collected must include the raw, uncorrected NOx value in addition to the 7% O_2-corrected value. This facilitates conversions to different oxygen-corrected values. The existing CEMS on the three MSW incineration units are already equipped to collect raw, uncorrected NOx emission data.

Maintenance of Compliance Records – Paragraph (g)(2)

An owner or operator must maintain compliance records for a minimum period of five years to facilitate inspections and ensure compliance with the requirements of PR 1165.

Opacity Monitoring Personnel Records – Paragraph (g)(3)

This provision is to ensure that compliance with the opacity requirements of PR 1165 through manual means and appropriate personnel certifications are properly documented and maintained for a minimum of five years.

Municipal Solid Waste Throughput Records – Paragraph (g)(4)

This provision is to ensure that MSW is properly accounted for and to ensure accurate permitting and emissions calculations are conducted.

Startup, Shutdown, and Malfunction Records – Paragraph (g)(6)

This provision is to ensure that all startups, shutdowns, and malfunctions are properly documented and that the appropriate CEMS data are excluded from compliance calculations. A list of scheduled startups allows for potentially excess emissions during the period of startup to be anticipated and accounted for.

CHAPTER 4: IMPACT ASSESSMENT

INTRODUCTION

Impact assessments were conducted during the PR 1165 rule development process to assess the environmental and socioeconomic implications of PR 1165. These assessments include emission reduction calculations, cost-effectiveness and incremental cost-effectiveness analyses, a socioeconomic impact assessment, and a California Environmental Quality Act (CEQA) analysis. Staff has prepared draft findings and a comparative analysis pursuant to California Health and Safety Code Section 40727 and Section 40727.2, respectively.

EMISSION REDUCTIONS

PR 1165 will establish lower concentration emission limits for equipment subject to this rule. Municipal Solid Waste incinerators will be required to meet 50 ppmv NOx @ 7% O_2, dry. Baseline emissions for each of the three MSW incineration units located at SERRF were estimated from a review of Annual Emission Reports (AER reports), CEMS data, and source test results.

Staff reviewed AER reports for the emission years 2014-2017, inclusive, and 2019-2022, inclusive, which contained self-reported NOx and PM emission data. The average NOx emissions across all years was 276.21 tons per year. The average PM emissions across all years was 39.98 tons per year.

Staff reviewed CEMS data for the emission years 2018-2022, inclusive, which contained NOx, O_2, NH_3, and CO emission data. The facility is not equipped with a CEMS to measure PM.

Staff reviewed source test data conducted in the years 2014, 2017, 2020, and 2021, which contained NOx, O_2, and PM data.

SCR Emission Reductions

The average outlet NOx emission concentration in the exhaust stack across all years is 75 ppmv @ 7% O_2. To calculate the tons of NOx reduced per year figure requires knowing the inlet NOx concentration prior to the NOx post-combustion control equipment. None of the three MSW incineration units located at SERFF are equipped with an analyzer to measure the inlet NOx concentration into each unit's NOx post-combustion control equipment.

As an alternative, staff estimated the inlet NOx concentration based on an expected NOx reduction efficiency of the SCNR system installed on the three MSW incineration units. A NOx reduction efficiency of 60% was used, based on a U.S. EPA dataset for MSW incinerators. This basis resulted in an estimated inlet NOx concentration of 188 ppmv @ 7% O_2. The 188 ppmv @ 7% O_2 will be corrected to 3% O_2, as the permit to operate for each of the three MSW incineration units at this facility specify their NOx emission concentration limits corrected to 3% O_2.

The oxygen correction formula from 7% O_2 to 3% O_2 is:

$$NOx\ Concentration\ @\ 3\%\ O2 = NOx\ Concentration\ @\ 7\%\ O2 * \frac{20.9\% - 3\%}{20.9\% - 7\%}$$

$$NOx\ Concentration\ @\ 3\%\ O2 = 188\ ppm * \left(\frac{17.9}{13.9}\right) = 242\ ppm\ NOx\ @\ 3\%\ O2$$

Reverse-calculating using the inlet NOx concentration involves determining the rated heat input and the emission factor of the units. Municipal solid waste has an energy density of 8-12 MJ/kg of MSW[1] incinerated. Staff used a midpoint between 8-12 MJ/kg, for an average of 10 MJ/kg of MSW incinerated, which is equivalent to 1,055.87 MJ/MMBtu. The facility's South Coast AQMD permit specifies that the facility incinerates 1,380 tons of MSW per day. This equates to 52,273 kg of MSW incinerated per hour. Combining these values yields a heat input capacity for the facility of 495 MMBtu/hr. Using a 242 ppmv @ 3% O_2 reverse-calculated inlet NOx concentration is equivalent to a 0.293 pounds NOx per MMBtu emission factor. Multiplying the heat input capacity by the emission factor yields a value of: 495 MMBtu per hour * 0.293 pounds per MMBtu = 145.04 pounds per hour. This facility operates 24 hours per day, 365 days per year. Staff then calculated the amount of uncontrolled NOx emissions as: 145.04 pounds per hour * 24 hours per day * 365 days per year / 2000 pounds per ton = 635.28 tons NOx per year.

With the assumed 60% NOx reduction efficiency, the SCNR currently installed at the facility reduces the NOx emissions from the baseline of 635.28 tons NOx per year to 254.11 tons per year. This is calculated as the facility's current NOx emissions. Compared to the aggregate average AER of 276.21 tons per year, this represents a difference of 8%. Given the assumptions of heat density of MSW and the NOx reduction efficiency of the SNCR, staff considered this calculation to be consistent with AER data.

The emission reductions associated with the installation of SCR control technology will only include the increased NOx emission reductions beyond what the current SNCR control technology is reducing itself. The preceding paragraphs yielded a range of estimated NOx emissions between 254.11 tons per year to 276.21 tons per year. The lower side of this range will be used, which assumes a higher performance for the existing SNCR installation. This provides a more conservative estimate of the NOx emission reductions associated with the installation of SCR control technology.

The initial BARCT emission limit of 50 ppmv @ 7% O_2 is a 33.33% reduction from the current NOx emission concentration using SNCR control technology. This percentage reduction is based on average outlet NOx emission concentrations across all years of 75 ppmv @ 7% O_2 reduced to 50 ppmv @ 7% O_2. The emission reductions associated with the installation of SCR control technology can therefore be estimated to be 254.11 tons per year * 33.33% reduction = 84.69 tons per year.

The assumed useful life of SCR control technology is 25 years. Therefore, the total lifetime NOx emission reductions associated with the installation of SCR control is 84.69 tons per year * 25 years = 2,117.25 tons.

[1] Reference: https://www.ieabioenergy.com/wp-content/uploads/2013/10/40_IEAPositionPaperMSW.pdf.

A co-benefit of SCR control technology installation is a reduction in PM emissions. Installation of SCR control technology will reduce the quantity of ammonia used as well as increase the efficiency of ammonia-NOx reactions, reducing condensable PM emissions created by unreacted ammonia forming ammonium salts. The use of SCR in lieu of SNCR will reduce the current ammonia slip of the subject facility from 15 ppmv @ 7% O_2 to the SCR vendor-quoted 10 ppmv @ 7% O_2. Staff used the current total PM emissions of 39.98 tons per year and applied this reduction in ammonia slip, as well as applied the 96% mass fraction of condensable PM to total PM in the exhaust stack, to yield a total estimated co-benefit PM emission reduction of 12.67 tons PM per year, or 316.75 tons PM over the 25-year lifetime of the SCR control technology.

Ceramic Catalytic Filter Emission Reductions

The vendor associated with CCF control technology also installs SCR control technology. The vendor quoted an identical NOx reduction efficiency for both CCF and SCR systems. A second vendor who installs SCR control technology quoted an identical NOx emission reduction efficiency for an SCR installation. The estimated useful life of CCF control technology is also assumed to be 25 years. The NOx emission reductions associated with CCF control technology are therefore estimated to be the same as those for SCR control technology, at 2,117.25 tons.

Baghouse Emission Reductions

The facility is currently equipped with a baghouse to control particulate matter emissions. The average PM emissions across all years is 39.98 tons per year and includes filterable PM and condensable PM.

Filterable PM is particulate matter in the solid or liquid phase at stack conditions that can be captured, collected, and disposed of. Based on the average aggregate of all source tests available, filterable PM comprises 4% of the PM emissions from the facility's exhaust stack. Condensable PM is particulate matter in the gaseous phase at stack conditions of temperature and pressure that then condenses and/or reacts upon cooling and diluting in the ambient air to form particulate matter in the solid or liquid phase. Condensable PM is particulate matter that cannot be captured and thus continues to be airborne in the flue gas and exit the exhaust stack. Based on the average aggregate of all source tests available, condensable PM comprises 96% of the PM emissions from the facility's exhaust stack. Based on the mass fraction of filterable PM, the total average PM emissions across all years of 39.98 tons per year is comprised of 1.60 tons per year of filterable PM.

Current filterable PM concentrations were calculated as an average aggregate of all source tests available to yield a filterable PM emission concentration of 0.0027 grains per cubic foot @ 7% O_2. Staff reviewed a quote for a baghouse that was stated to use a more efficient baghouse material that can reduce filterable PM emissions to a concentration of 0.001 grains per cubic foot @ 7% O_2.

Staff calculated the filterable PM emission concentration reduction comparing the current filterable PM emission concentration to the filterable PM emission concentration stated in the quote.

$$\begin{aligned} &Filterable\ PM\ Reduction\ \% \\ &= \frac{(0.0027\ grains\ per\ cubic\ foot - 0.001\ grains\ per\ cubic\ foot}{0.0027\ grains\ per\ cubic\ foot} * 100\% \\ &= 63\%\ Reduction \end{aligned}$$

This reduction can then be applied to the current baseline of 1.60 tons per year of filterable PM to calculate the filterable PM emission reductions associated with the installation of the upgraded baghouse.

The total PM emission reductions associated with the upgraded baghouse can be calculated using the mass fraction of filterable PM and the filterable PM emission concentration reduction from the technology vendor.

$$PM\ Emission\ Reductions =$$

$$\begin{aligned} &39.98 \frac{tons\ PM}{year} * 4\%\ mass\ fraction\ of\ filterable\ PM \\ &* 63\%\ filterable\ PM\ emission\ concentration\ reduction \\ &= 1.01\ tons\ filterable\ PM\ reduced\ per\ year \end{aligned}$$

The estimated useful life of a baghouse is also assumed to be 25 years. The filterable PM emission reductions associated with an upgraded baghouse are estimated to be 25.25 tons.

COSTS AND COST-EFFECTIVENESS

Overview

The California Health & Safety Code Section 40920.6 requires a cost-effectiveness analysis to be assessed when establishing BARCT requirements. The cost-effectiveness of a control technology is measured in terms of the control cost in dollars per ton of air pollutant reduced. The costs for the control technology include purchasing, installation, operation, maintenance, permitting, and compliance demonstration of the control technology. Emission reductions were based on AER reports, CEMS data, source test data, literature, and technology vendor quotes.

The 2022 AQMP established a cost-effectiveness threshold of \$325,000 per ton of NO_x reduced, which when adjusted for inflation to 2023 dollars, is \$388,500 per ton of NOx reduced. A cost-effectiveness greater than \$388,500 per ton of NO_x reduced requires additional analysis and a hearing before the South Coast AQMD Governing Board to discuss costs. The cost-effectiveness is estimated based on the present value of the retrofit cost, which was calculated according to the capital cost (initial one-time equipment, installation, and startup costs) plus the annual operating cost (recurring expenses over the useful life of the control equipment multiplied by a present value factor).

Staff obtained costs for retrofits from both technology vendors and cost-estimation tools. The cost analysis for post-combustion control equipment such as SCR, CCF, and baghouse considers capital costs and recurring costs.

The discounted cash flow method is used to calculate cost-effectiveness. To capitalize recurring expenses in the future and account for the time-value of money, a discount rate is applied to future cash expenditures for annual operating expenses. The cost-effectiveness formula is shown below:

$$\text{Cost-Effectiveness} = \frac{Capital\ Costs + (Increased\ Recurring\ Costs * Present\ Value\ Factor)}{Emissions\ Reduced\ Over\ Equipment\ Life}$$

Where "Present Value Factor" is a factor that capitalizes into the present-time, the discounted future cash expenditures. This factor is calculated as:

$$\text{Present Value Factor} = \mathbf{1}/\left[\frac{\boldsymbol{i}*(\mathbf{1}+\boldsymbol{i})^{\boldsymbol{n}}}{(\mathbf{1}+\boldsymbol{i})^{\boldsymbol{n}}-\mathbf{1}}\right]$$

Where,

i = Nominal discount rate

n = Equipment useful life

For SCR, CCF, and baghouse, staff used a nominal discount rate of 4% and an equipment useful life of 25 years. This equates to a Present Value Factor of 15.62.

Capital Costs

Capital costs are one-time costs that cover the components required to assemble a project. These costs include, but are not limited to, equipment, installation, permitting, and source testing. Staff reviewed two vendor quotes for SCR control technology and staff also used a cost-estimation tool to estimate capital costs and recurring costs for SCR.

<u>SCR</u>

SCR Vendor 1 provided a quote for only base SCR equipment of $3,800,000. Additional capital costs for installation, freight, and startup were not included. These additional costs were assumed to be 400% of the base equipment cost, based on the vendor quote that staff received for baghouse control technology which provided a 400% ratio for these additional costs. The base equipment and additional capital costs for this SCR Vendor 1 are therefore $19,000,000.

SCR Vendor 2 provided a quote for only base SCR equipment of $8,463,000. Additional costs for installation, freight, and startup were not included. These additional costs were assumed to be 400% of the base equipment cost, based on the vendor quote that staff received for baghouse control technology which provided a 400% figure for these additional costs. The base equipment and additional costs for this SCR Vendor 2 are therefore $42,315,000.

Staff utilized the U.S. EPA Selective Catalytic Reduction cost estimator tool (SCR Calculator)[2] to estimate SCR installation costs as well. This cost estimator tool accounts for installation and startup costs. Based on the energy density of MSW and the MSW incineration rate of the subject facility, continuous operation and an inlet NOx concentration of 75 ppmv @ 7% O_2, the total capital costs were estimated to be $26,963,000.

Although there is a range of capital costs between $19,000,000 and $42,315,000 for SCR control technology installation, staff used the higher end of this range to estimate capital costs, to provide a more conservative estimate for use in the cost-effectiveness calculation.

Ceramic Catalytic Filter

Staff reviewed one vendor quote for a CCF system. This quote included installation and startup. The total capital cost for CCF control technology was $44,940,000.

Baghouse

Staff reviewed one vendor quote for an upgraded baghouse. This quote included installation and startup. The total capital cost for an upgraded baghouse technology was $14,250,000.

All Control Technology

Several capital costs were included in addition to equipment. A one-time permitting fee per control technology was included and is based on the 2024-2025 Fee Schedule identified in Rule 301 Table 1B which ranges in size from Schedule C for a Selective Catalytic Reduction system to Schedule D for a Non-Ambient Temperature Baghouse system. Actual costs were then cross-referenced with Rule 301 Table 1A for Title V Alteration/Modification fees as the subject facility is a federal Title V facility. Schedule C has a Title V Alteration/Modification fee of $7,615.64; Schedule D has a Title V Alteration/Modification fee of $10,510.89. CCFs are not included in Rule 301 Table 1B but are assigned the same fee as Selective Catalytic Reduction due to the similarity in operation. Periodic source testing is a requirement of PR 1165 and costs were considered, but as no additional source tests are required beyond what is currently required, no additional costs were included in the cost-effectiveness analysis.

Stranded asset costs are the salvageable value for any equipment that is replaced before the end of its useful life. The subject facility's equipment has been operating since 1988, a total of 36 years as of 2024, which is beyond the assumed 25 years of useful life of the SNCR and baghouse currently installed at the subject facility. Thus, no stranded asset costs were included in the cost-effectiveness analysis.

[2] Reference: U.S. EPA Selective Catalytic Reduction cost estimator tool. https://www.epa.gov/economic and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution.

Recurring Costs

Recurring costs are any annual or periodic costs required to operate equipment. These costs include operating and maintenance (O&M) costs such as electricity, monitoring, and consumable costs.

SCR

Recurring costs for SCR control technology included maintenance, reagent in the form of 19% aqueous ammonia, electricity, catalyst module replacement, and administrative fees. The recurring costs were calculated using the SCR Calculator. These costs were estimated to be $186,000 per year. Because there is a potential for catalyst poisoning, staff increased catalyst replacement from every 32,000 hours to every 2,160 hours. The revised recurring costs for SCR is $364,000 per year. This recurring cost figure was applied to both SCR Vendor 1 and SCR Vendor 2 quotes.

CCF

Recurring costs for CCF control technology included maintenance, reagent in the form of 19% aqueous ammonia, electricity, filter tube replacement, and administrative fees. Rule 1117 staff received CCF vendor quotes that included recurring costs for CCF control technology as part of the rule development process. These recurring costs were then calculated as a percentage of the capital cost. These same percentages were then applied to the capital cost for the CCF control technology vendor quote reviewed by PR 1165 staff. These recurring costs were estimated to be $3,757,000 per year.

Baghouse

For an upgraded baghouse, no additional recurring costs were included as the subject facility currently operates a baghouse with its associated recurring costs.

Summary

The costs associated with each control technology are detailed in Table 4-1:

Table 4-1 – Summary of Control Technology Costs

Control Technology	Capital Costs[1]	Annual Costs[1]	Permitting Costs[2]	Source Testing Costs	Stranded Asset Costs	Total Costs[1]
SCR	$42,315,000	$364,000 per year ($5,686,000 present value-discounted)	$7,600	N/A	N/A	$48,008,000
CCF	$44,940,000	$3,757,000 per year ($58,684,000 present value-discounted)	$7,600	N/A	N/A	$103,632,000
Upgraded Baghouse	$14,250,000	No Additional Costs	$10,500	N/A	N/A	$14,261,000

[1] *Dollar figures are rounded to the nearest thousand dollars*
[2] *Dollar figures are rounded to the nearest hundred dollars*

The cost-effectiveness associated with each control technology is detailed in Table 4-2.

Table 4-2 – Summary of Cost-Effectiveness

Control Technology	Total Costs	Total Lifetime Emission Reductions	Cost-Effectiveness
SCR	$48,008,000	2,117.25 tons NOx	$22,700/ton NOx Reduced
CCF	$103,632,000	2,117.25 tons NOx	$48,900/ton NOx Reduced
Upgraded Baghouse	$14,261,000	25.25 tons PM	$564,800/ton PM Reduced

INCREMENTAL COST EFFECTIVENESS

An incremental cost-effectiveness analysis was conducted for each equipment category pursuant to California Health and Safety Code Section 40920.6:

> "*To determine the incremental cost-effectiveness under this paragraph, the district shall calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more stringent potential control option as compared to the next less expensive control option.*"

This analysis is conducted for each equipment category if multiple cost-effective pollution control technologies are identified.

Equation 4-4 is used to calculate incremental cost-effectiveness.

$$\text{Incremental Cost-Effectiveness (\$/ton)} = \frac{Costs_A - Costs_B}{ER_A - ER_B} \qquad \text{(Eq. 4-4)}$$

Where,

A	=	Pollution control option A ($)
B	=	Pollution control option B ($)
ER	=	Emission reductions over lifetime of equipment (tons of NOx)

Per California Health and Safety Code Section 40920.6, if the incremental cost-effectiveness is substantially greater than $388,500/ton, the more stringent control technology is not pursued.

However, although two cost-effective control technologies were calculated for NOx control, they both have the identical NOx emission reduction potential, and thus the less costly NOx control technology is pursued. The SCR control technology cost is lower than that of CCF control technology, and thus SCR control technology is pursued.

SOCIOECONOMIC ANALYSIS

A socioeconomic impact assessment will be conducted and released for public review and comment at least 30 days prior to the South Coast AQMD Governing Board Hearing, which is anticipated to be on [*Rule Adoption Date*].

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 currently reviewing the proposed project (PR 1165) to determine if it will result in any potential adverse environmental impacts. Appropriate CEQA documentation will be prepared based on the analysis.

DRAFT FINDINGS UNDER CALIFORNIA HEALTH AND SAFETY CODE SECTION 40727

Requirements to Make Findings

California Health and Safety Code Section 40727 requires that prior to adopting, amending, or repealing a rule or regulation, the South Coast AQMD Governing Board shall make findings of necessity, authority, clarity, consistency, non-duplication, and reference based on relevant information presented at the public hearing and in the staff report. To determine compliance with Section 40727, 40727.2 requires a written analysis comparing the proposed rule with existing regulations, if the rule meets certain requirements. The following provides the draft findings.

Necessity

A need exists to adopt PR 1165 to provide NO_x, PM, CO, and Opacity limits for the municipal solid waste incineration industry to reflect current BARCT concentration limits.

Authority

The South Coast AQMD obtains its authority to adopt, amend, or repeal rules and regulations from California Health and Safety Code Sections 39002, 40000, 40001, 40440, 40506, 40510, 40702, 40725 through 40728, 41508, 41700, and 42300 et seq..

Clarity

PR 1165 is written or displayed so that its meaning can be easily understood by the persons directly affected by them.

Consistency

PR 1165 is in harmony with and not in conflict with or contradictory to, existing statutes, court decisions or state or federal regulations.

Non-Duplication

PR 1165 will not impose the same requirements as any existing state or federal regulations. The proposed rule is necessary and proper to execute the powers and duties granted to, and imposed upon, the South Coast AQMD.

Reference

In adopting this rule, the following statutes which the South Coast AQMD hereby implements, interprets or makes specific are referenced: AB 617, California Health and Safety Code Sections 39002, 40001, 40406, 40506, 40702, 40440(a), 40725 through 40728.5, 40920.6, and 42300 et seq..

COMPARATIVE ANALYSIS

California Health and Safety Code Section 40727.2 requires a comparative analysis of the proposed rule with any federal or South Coast AQMD rules and regulations applicable to the same source. A comparative analysis is presented below in Table 4-3.

Table 4-3 – Comparative Analysis

Rule Element	Proposed Rule 1165	Equivalent Federal Regulation
Applicability	Municipal Solid Waste incineration units that combust more than 35 tons per day of municipal solid waste	40 CFR Part 60, Subpart AAAA Municipal solid waste combustion units that combust greater than or equal to 35 tons per day but less than 250 tons per day of municipal solid waste 40 CFR Part 60, Subpart Eb Municipal solid waste combustion units that combust greater than 250 tons per day of municipal solid waste
Requirements	**By Date of Adoption** • CO: 100 ppmv (30-day rolling average) • Total PM: 0.017 gr/dscf @ 12% CO_2 (30-day rolling average) • PM10: 150 lbs/day (30-day rolling average) • PM–Filterable: 10.2 mg/dscm (30-day rolling average) • PM–Condensable 6.11 lbs/hr (30-day rolling average) • Opacity: 10% (6-minutes)	40 CFR Part 60, Subpart Cb, Subpart Ea, Subpart Eb, Subpart AAAA, Subpart BBBB: CO: 100 ppmv (4-hour average) 40 CFR Part 60, Subpart Cb: NOx: 185 ppmv @ 7% O_2 (24-hour block average) 40 CFR Part 60, Subpart Ea: NOx: 180 ppmv @ 7% O_2 (24-hour block average) 40 CFR Part 60, Subpart Eb: NOx: 150 ppmv @ 7% O_2 (24-hour block average) 40 CFR Part 60, Subpart AAAA: NOx: 150 ppmv @ 7% O_2 (24-hour block average) 40 CFR Part 60, Subpart BBBB: NOx: 200 ppmv @ 7% O_2 (24-hour block average)
Rule Element	**Proposed Rule 1165**	**Equivalent Federal Regulation**
	By May 1, 2026 • NOx: 110 ppmv (24-hour block average) • NOx: 105 ppmv (30-day rolling average) **By May 1, 2029** • NOx: 50 ppmv (30-day rolling average) **By July 1, 2029** • Total PM: 0.011 gr/dscf @ 12% CO_2 (30-day rolling average) • PM–Condensable: 4.09 lbs/hr (30-day rolling average)	U.S. EPA Good Neighbor Plan for 2015 Ozone NAAQS NOx: 110 ppmv @ 7% O2 (24-hour block average) U.S. EPA Good Neighbor Plan for 2015 Ozone NAAQS NOx: 105 ppmv @ 7% O2 (30-day rolling average)

Reporting and Recordkeeping	All data required by this rule shall be maintained for at least five years and made available for inspection by the Executive Officer	40 CFR Part 60, Subpart Ea: Maintain compliance records for 2 years 40 CFR Part 60, Subpart Eb: Maintain compliance records for 5 years 40 CFR Part 60, Subpart BBBB: Maintain compliance records for 5 years
Monitoring	• Operate a COMS to measure opacity on a 6 minute basis • Operate a CEMS to measure NOx and CO emissions at the corresponding oxygen correction and averaging times • Operate a device to continually measure temperature of the flue gas stream	40 CFR Part 60, Subpart Ea: Operate a COMS to measure opacity on a 6-minute basis; Operate a device to continually measure temperature at the inlet of a PM control device on a 4-hour block average basis 40 CFR Part 60, Subpart Eb: Operate a CEMS to measure O_2 and CO_2 wherever NOx, SO_2, CO, or PM are monitored 40 CFR Part 60, Subpart AAAA: Operate a CEMS for SO_2, O_2 or CO_2, CO, and NOx 40 CFR Part 60, Subpart BBBB: Operate a CEMS for SO_2, O_2 or CO_2, CO, and NOx

APPENDIX A: LIST OF AFFECTED FACILITIES

Table A-1: Facility Affected by PR 1165

Facility ID	Facility Name
44577	Southeast Resource Recovery Facility

APPENDIX B: RESPONSE TO PUBLIC COMMENTS

To be included in the Draft Staff Report