Proposed Rule 1165 Control of Emissions from Municipal Solid Waste Incinerators

Working Group Meeting #3
June 12, 2024

Zoom Meeting Information

URL: https://scaqmd.zoom.us/j/96068287409
Webinar Meeting ID: 960 6828 7409
Dial-In: +1 (669) 900-6833

Agenda

- Summary of Working Group Meeting #2
- SERRF Facility Update
- BARCT Assessment & Cost-Effectiveness
- Proposed Rule Concepts
- Next Steps

Summary of Working Group Meeting #2

Summary of Working Group Meeting #2

- Updates on SERRF's decommission plans and remaining need for PR 1165
- Comparative analysis of BARCT and BACT regulations of other regulatory entities at state, national, and international levels
- Review of applicable NOx and PM control technologies
  - Ceramic catalytic filters
  - SNCR/SCR
  - Baghouse

SERRF Facility Update

Recent History for SERRF

- **Jan 31, 2024** — SERRF halts the receiving of waste
- **Feb 1, 2024** — Decommission Plan begins
- **Feb 6, 2024** — Long Beach City Council votes to decommission the facility
- **Dec 31, 2024** — Estimated Decommission Plan date of completion

SERRF Decommission and Policy Update

- Staff confirmed through an in-person observation that no municipal solid waste (MSW) was being processed, and the emission stack did not have a plume
- Decommission personnel were on-site
- Decommission-related temporary equipment was observed on-site
- Existing waste inflows are handled by several waste management operators in the area
  - Waste is being hauled to landfills and transfer stations in the Los Angeles Basin and San Diego

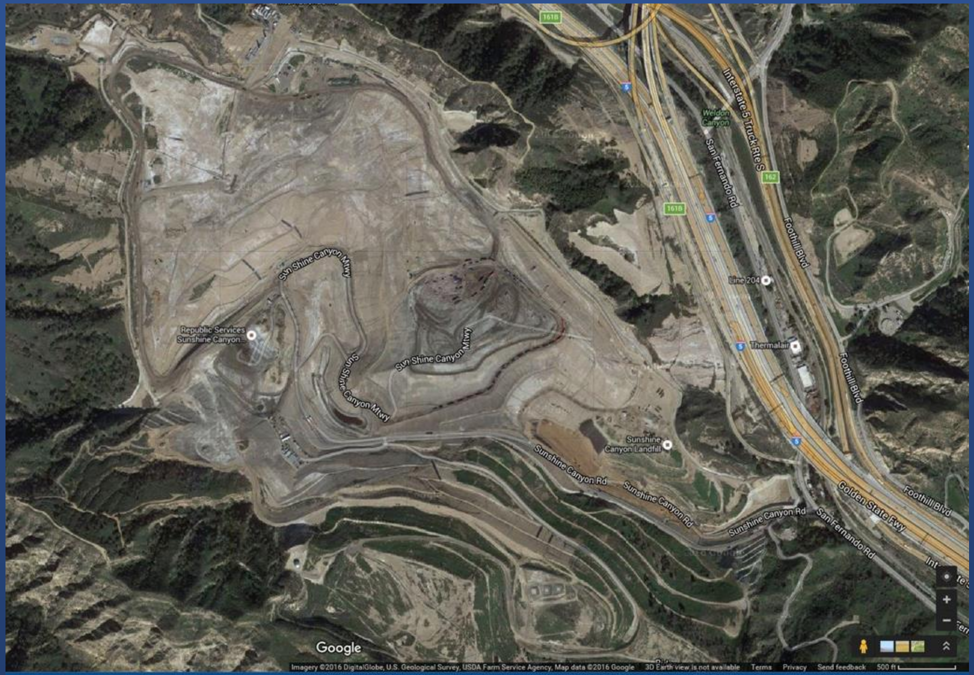


Image source: South Coast AQMD. Sunshine Canyon Landfill. https://www.aqmd.gov/home/news-events/community-investigations/sunshine-canyon-landfill.

SERRF Decommission and Policy Update

- Staff will continue rule development for PR 1165
- U.S. EPA Good Neighbor Plan[1] requires California to submit a SIP for meeting the 2015 NAAQS standards and adopt the specified NOx limits
- South Coast AQMD's 2022 AQMP[2] requires the implementation of control measure L-CMB-09 to reduce NOx emissions

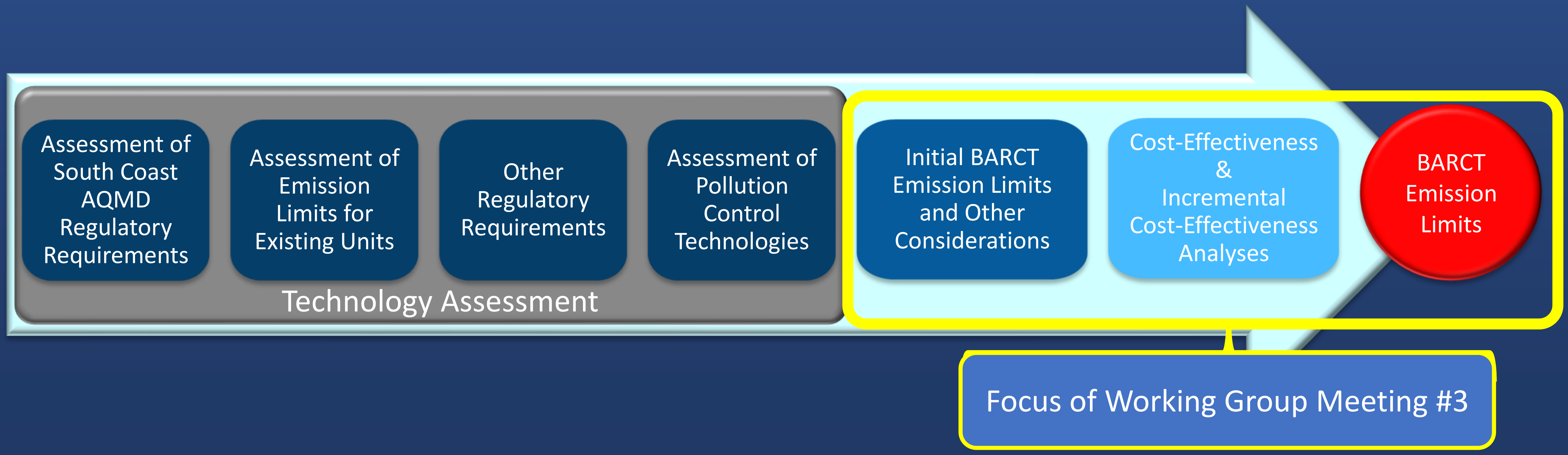
Image source: South Coast AQMD. 2022 AQMP. https://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=16.

[1] U.S. EPA Good Neighbor Plan. https://www.govinfo.gov/content/pkg/FR-2023-06-05/pdf/2023-05744.pdf.
[2] South Coast AQMD 2022 AQMP. http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=16.

BARCT Assessment

BARCT Assessment Process

- Best Available Retrofit Control Technology (BARCT) Assessment is conducted for each class and category of equipment
- Technology assessment will review both current regulations and control technologies



BARCT Assessment Process

Initial BARCT Emission Limits and Other Considerations

- Staff spoke with several vendors of NOx and PM control equipment
- Staff received quotes for both NOx control only and PM control only
- Due to the high mass fraction of condensable PM (96%) in the flue stream, Staff concluded that PM would be better controlled by reducing the formation of condensable PM
- Staff assessed that a Selective Catalytic Reduction (SCR) system would replace the Selective Non-Catalytic Reduction (SNCR) system
    - Would reduce ammonium bisulfate salts in the exhaust stream (condensable PM)
- Staff also conducted a cost-effectiveness analysis on Ceramic Catalytic Filter and Upgraded Baghouse control technologies

[1] Each air pollution control system (including each baghouse) has a 25 mg/dscm particulate matter emission limit not correlated to a South Coast AQMD rule

[2] Some emission limit values are converted to equivalent units or correction factors for the sake of comparison

BARCT Assessment Process

Initial BARCT Emission Limits and Other Considerations

Initial BARCT Emission Limits will be analyzed in Cost-Effectiveness Analyses

Control Technology	Pollutant Controlled	Initial BARCT Emission Limit	Considerations
Selective Catalytic Reduction (SCR)	NOx	50 ppm NOx @ 7% O2	Requires a higher minimum operating temperature
Ceramic Catalytic Filters	NOx, PM	50 ppm NOx @ 7% O2	Higher cost than SCR control alone
Upgraded Baghouse	PM	0.001 gr/ft^3 filterable PM	Potential for only minimal incremental filterable PM emission reductions

Cost-Effectiveness Analysis

Overview of Cost-Effectiveness

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Cost-effectiveness is the cost (capital and annual costs) over the emission reductions for the life of the equipment

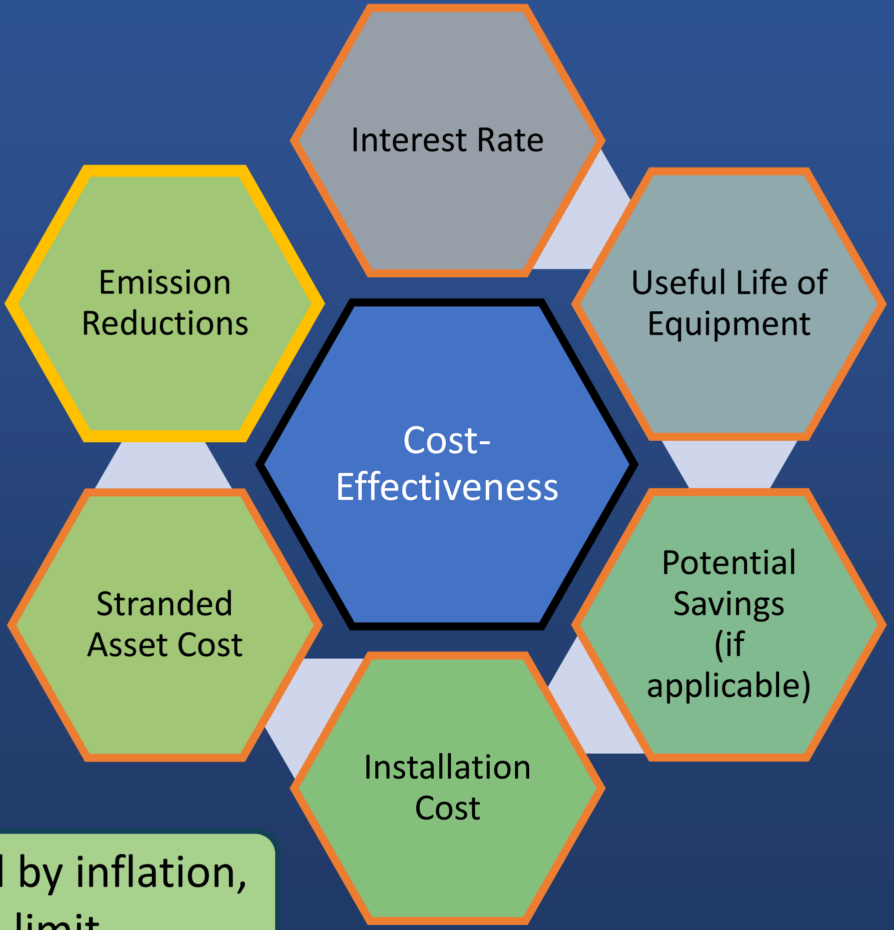
- Cost-effectiveness is expressed in dollars per ton of pollutant reduced ($/ton)

Costs

- Capital costs
- Annual costs

Emission Reductions

- Baseline emissions
- Initial BARCT Emission Limit emissions



Staff uses the 2022 AQMP[1] cost-effectiveness of $325,000/ton, adjusted by inflation, of NOx reduced as guidance for establishing the BARCT emission limit

[1] South Coast AQMD 2022 AQMP, Page 4-76. http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=16.

Overview of Cost-Effectiveness

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Discounted Cash Flow (DCF) Method used to calculate cost-effectiveness

- Accounts for both capital and operating expenses
- Utilizes a discount rate (*i*) to lower the present value of future-year cash expenditures (prevents overestimated of actually-incurred costs)
- Longer useful life (*n*) of equipment yields a higher discount (and lower incurred cost of future expenditures)

Cost-Effectiveness = $$\frac{\textit{Capital Costs} + (\textit{Increased Annual Operating Costs}) * \textit{Present Value Factor}}{\textit{Emission Reduced Over Equipment Life}}$$

Present Value Factor for annualizing equipment cost = $1/[\frac{i*(1+i)^n}{(1+i)^n-1}]$

- *i* = nominal interest rate
- *n* = equipment useful life

Overview of Cost-Effectiveness: Costs

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Costs

Capital Costs
(One-Time Expenses)

- Equipment costs
- Installation costs
- Permit application fee
- Source test costs

Annual Operating Costs
(Increased Recurring Expenses)

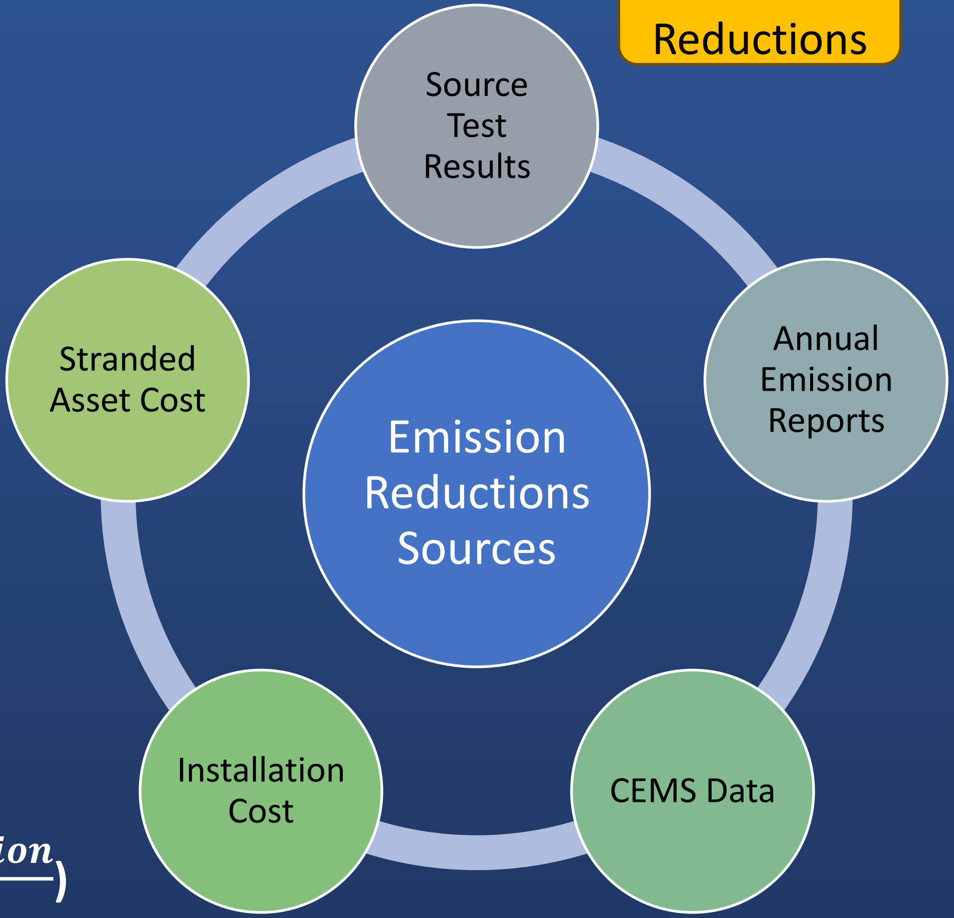
- Labor and maintenance
- Fuel and electricity
- Catalyst (SCR Only) (*as an annual cost*)
- Reagent (SCR Only)
- Monitoring, Reporting, and Recordkeeping

Overview of Cost-Effectiveness: Emission Reductions

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Emission Reductions

Emission Reductions = Baseline Emissions – Proposed Emissions



Baseline Emissions:

CEMS Data Annual Average

Proposed Emissions:

CEMS Data Annual Average $* \left(\frac{\textit{Initial BARCT Emission Limit Concentration}}{\textit{Baseline Concentration}}\right)$

Cost-Effectiveness Analysis: SCR

Cost-Effectiveness
&
Incremental
Cost-Effectiveness
Analyses

- Staff worked with multiple vendors of SCR technology
  - One quote received, one quote is pending
- Staff also utilized the U.S. EPA's SCR Cost Calculator[1] (SCR Calculator) to estimate SCR installation costs
  - Calculator used in previous rulemakings, such as in Rule 1147.2's[2] BARCT analysis
  - Because of potential catalyst poisoning staff increased catalyst replacement from every 32,000 hours to every 2,160 hours (14.8x increase)
- Multiple assumptions and inputs used in both sources of costs

Data Point	Value
Heat Content of MSW	10 MJ/Kg
CEPCI[3]	797.9
MSW Processing Rate	1,380 tons/day
NOx Reduction %	20%-60%[4]
Consumables	Electricity, 19% Aqueous Ammonia, Catalyst, and Additional Operating Labor
Present Value Factor	Discount Rate: 4%; Years of Useful Life: 25

[1] See Section 4, Chapter 2. https://www.epa.gov/economic-and-cost-analysis-air-pollution-regulations/cost-reports-and-guidance-air-pollution.
[2] Rule 1147.2. https://www.aqmd.gov/docs/default-source/rule-book/reg-xi/rule-1147-2.pdf?sfvrsn=8.
[3] Chemical Engineering Plant Cost Index (CEPCI) is a tool to measure the indexed relative price changes of equipment and plant costs for the chemical and process industries. Value shown is the index value for 2023, which can be obtained here: https://www.chemengonline.com/pci-home
[4] 20% based on low value of SNCR efficiency found SERRF's permit; 60% based on high value of SCNR efficiency of U.S. EPA SNCR Cost Manual. Pg. 6, Figure 1.1a. https://www.epa.gov/sites/default/files/2017-12/documents/sncrcostmanualchapter7thedition20162017revisions.pdf.

Cost-Effectiveness Analysis: SCR

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Costs

Capital Costs (One-Time Expenses)	▪ SCR equipment ▪ Air pre-heater ▪ Upgraded ducting ▪ Freight and installation ▪ Permit fee
Annual Operating Costs (Increased Recurring Expenses)	▪ Decrease in ammonia usage by 60%[1] ▪ Electricity ▪ Catalyst ▪ Annual maintenance

[1] Ammonia usage reduction based difference in stochiometric ratios of NH3:NOx for SNCR (2:1 – 4:1) and SCR (0.9:1.0 – 1:1)

Cost-Effectiveness Analysis: SCR

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Costs

Two different estimates provide a range of total costs
To be conservative, higher costs will be used

Estimate 1
SCR Calculator

Cost Variable	Value
Capital Costs	$42,315,000
Increased Annual Operating Costs	$364,000 per year
Expected Useful Life of Control Equipment	25 years
Assumed Discount Rate	4%
Total Costs	$48,008,000

Estimate 2
Vendor Quote

Cost Variable	Value
Capital Costs[1]	$19,006,000
Increased Annual Operating Costs[2]	$364,000 per year
Expected Useful Life of Control Equipment	25 years
Assumed Discount Rate	4%
Total Costs	$24,692,000

[1] Vendor provided costs for only base equipment; additional costs for installation, freight, and other items assumed to be 400% of base equipment cost based on vendor quote received for baghouse control equipment
[2] Vendor did not provide estimates of operating costs; increased annual operating costs are assumed to be the same as determined in the SCR Calculator

Cost-Effectiveness Analysis: SCR

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Emission Reductions

Three variables necessary to calculate emission reductions

1 • **Inlet NOx concentration** (uncontrolled NOx) to each of the three incinerators currently unknown

2 • **Outlet NOx concentration** is known based on CEMS data

3 • Back calculating based on estimated **NOx reduction efficiency** can estimate inlet NOx concentration

- The greater the reduction efficiency, the **higher** the inlet NOx concentration

$$\frac{\boldsymbol{Outlet\ NOx\ Concentration}}{(100\% - \boldsymbol{Reduction\ Efficiency\ \%})} = Inlet\ NOx\ Concentration$$

Low Estimate of Efficiency

$$\frac{\boldsymbol{75\ ppm\ @\ 7\%\ O2}^{1}}{(100\% - \boldsymbol{20\%})} = \boldsymbol{94\ ppm\ @\ 7\%\ O2}$$

High Estimate of Efficiency

$$\frac{\boldsymbol{75\ ppm\ @\ 7\%\ O2}^{1}}{(100\% - \boldsymbol{60\%})} = \boldsymbol{188\ ppm\ @\ 7\%\ O2}$$

[1] Based on aggregate of all CEMS data for all three incinerators for years 2018-2022, inclusive

Cost-Effectiveness Analysis: SCR

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Emission Reductions

- Staff used the high estimate of efficiency of 60% based on:
  - Literature suggests open burning NOx concentrations can reach > 200 ppm @ 7% O2
  - Existing controlled MSW incinerators across the country operate at > 105 ppm @ 7% O2[1]
  - U.S. EPA unlikely to have set Good Neighbor Plan limits at 105 and 110 ppm @ 7% O2 if uncontrolled emissions were already compliant

- Staff estimated a fixed NOx outlet of 50 ppm @ 7% O2 for an SCR retrofit based on:
  - U.S. EPA's acknowledgement of SCR installations on MSW incinerators with 50 ppm @ 7% O2[2] NOx limits
  - South Coast AQMD's comparative analysis findings of two SCR installations with ≤ 50 ppm @ 7% O2 NOx limits[1]

Inlet (Uncontrolled) NOx Concentration estimated to be 188 ppm @ 7% O2

[1] South Coast AQMD, Proposed Rule 1165, WGM #2. https://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/pr-1165/pr-1165_wgm-2-presentation.pdf?sfvrsn=10.
[2] U.S. EPA Good Neighbor Plan, Document Page 36837. https://www.govinfo.gov/content/pkg/FR-2023-06-05/pdf/2023-05744.pdf

Cost-Effectiveness Analysis: SCR

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

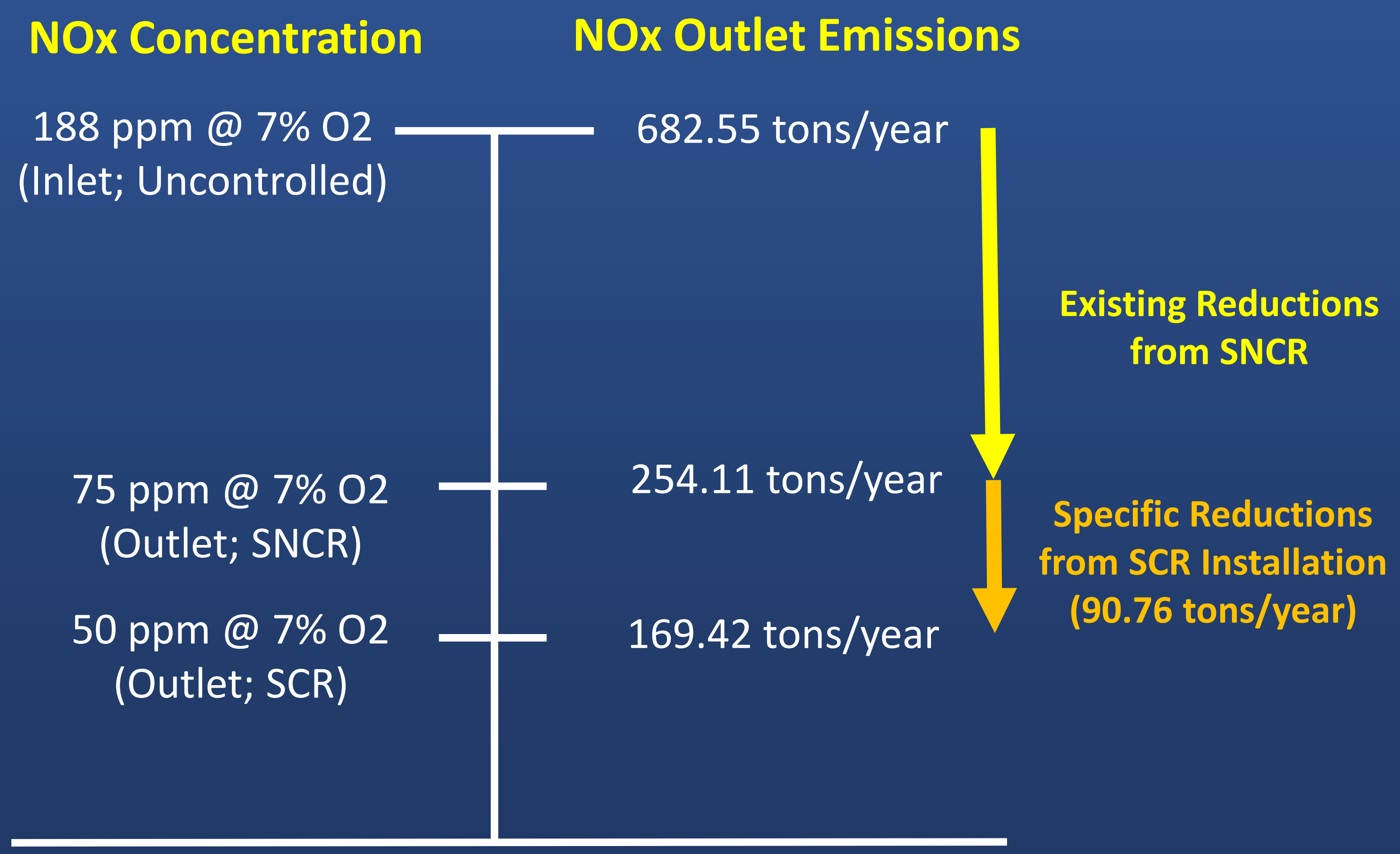
Emission Reductions

Emission reductions are inclusive only from the reductions achieved specifically by the installation of an SCR

Existing NOx control equipment (SNCR) replaced by improved NOx control equipment (SCR)

<u>SCR Emission Reductions</u>

84.69 tons/year * 25 years = 2,117 tons



Cost-Effectiveness Analysis: SCR

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Cost-Effectiveness = $$\frac{\textit{Capital Costs} + (\textit{Increased Annual Operating Costs}) * \textit{Present Value Factor}}{\textit{Emission Reduced Over Equipment Life}}$$

Cost-Effectiveness = $$\frac{\$48,008,000}{2,269\ tons}$$ **= $22,700/ton NOx Reduced**

Cost-Effectiveness is less than $325,000/ton threshold, adjusted by inflation, specified in South Coast AQMD's 2022 AQMP[1]

Installation of an SCR to achieve a 50 ppm @ 7% NOx outlet concentration is cost-effective

[1] South Coast AQMD 2022 AQMP. http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=16.

Cost-Effectiveness Analysis: Ceramic Catalytic Filters

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Staff worked with a vendor of ceramic filter technology that has use in a wide variety of industrial applications

Costs

- Vendor provided a quote for turnkey capital cost, but did not include an estimate of annual operating costs
- Annual operating costs based on quotes given to Staff by the same vendor for Rule 1117 (Glass Melting Furnaces)
- Useful life and discount rate identical to SCR and thus Present Value Factor is identical

Emission Reductions

- Ceramic catalytic filter technology reductions both NOx and PM emissions
- Stated PM emission performance would not result in any additional reductions given the current use of a baghouse
- Quoted the same NOx emission performance as SCR (up to 90% efficiency)

Cost-Effectiveness Analysis: Ceramic Catalytic Filters

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Cost-Effectiveness = $\frac{\boldsymbol{Capital\ Costs + (Increased\ Annual\ Operating\ Costs) * Present\ Value\ Factor}}{\boldsymbol{Emission\ Reduced\ Over\ Equipment\ Life}}$

Cost-Effectiveness = $\frac{\$\mathbf{103,637,000}}{\mathbf{2,269}\ \boldsymbol{tons}}$ **= $48,900/ton NOx Reduced**

Cost-Effectiveness is less than $325,000/ton threshold, adjusted by inflation, specified in South Coast AQMD's 2022 AQMP[1]

Installation of Catalytic Ceramic Filters to achieve a 50 ppm @ 7% NOx outlet concentration is cost-effective

Cost-Effectiveness Analysis: Upgraded Baghouse

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Staff reached out to multiple vendors of baghouses to assess potential to achieve lower PM emissions than the installation and received one quote

Costs

- Vendor provided a quote for base equipment cost
- Auxiliary costs such as startup, installation, demolition stated to be an estimated 400% of base equipment cost
- Assumed no increase in annual operating cost due to only upgrading the bag material

Emission Reductions

- Baghouses can only reduce "filterable PM"
- Only 4% of CEMS PM emissions is "filterable PM"

Emission Variable	Value
Total PM – Current Outlet	39.98 tons/year
Filterable PM – Current Outlet	0.0027 gr/scf @ 7% O2
Filterable PM – Vendor Performance	0.001 gr/scf @ 7% O2

[1] Based on aggregate of all CEMS data for all three incinerators for years 2018-2022, inclusive
[2] Based on aggregate of all stack test data for all three incinerators for years 2014, 2017, 2020, and 2021

Cost-Effectiveness Analysis: Upgraded Baghouse

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

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

Cost-Effectiveness = $$\frac{\$14,250,000}{25\ tons}$$ **= $570,000/ton PM Reduced**

South Coast AQMD does not have a cost-effectiveness threshold established for PM

Staff recommends to install SCR or Ceramic Catalytic Filters for PM emission reductions due to reduced ammonia usage

Reduced ammonia usage leads to a reduction of ammonium bisulfate (condensable PM), which comprises 96% of SERRF's PM emissions

Cost-Effectiveness Analysis: Summary

Cost-Effectiveness & Incremental Cost-Effectiveness Analyses

Control Technology	Pollutant	Total Costs	Total Emission Reductions	Cost-Effectiveness
Selective Catalytic Reduction (SCR)	NOx	$48,008,000	2,117 tons	$22,700/ton
Ceramic Catalytic Filters	NOx	$103,637,000	2,117 tons	$48,900/ton
Upgraded Baghouse	Filterable PM	$14,261,000	25 tons	$564,800/ton

No incremental cost-effectiveness analysis was conducted between SCR and Ceramic Catalytic Filter control technologies as the emission reductions for each are identical

Cost-Effectiveness Analysis: Summary

Cost-Effectiveness
&
Incremental
Cost-Effectiveness
Analyses

- An incremental cost-effectiveness analysis was conducted between the SCR and Ceramic Catalytic Filter NOx control technologies pursuant to California Health and Safety Code – HSC § 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."*

Cost-Effectiveness =

$$\frac{\textbf{Capital Costs} + (\textbf{Increased Annual Operating Costs}) * \textbf{Present Factor}}{\textbf{Emission Reduced Over Equipment Life}}$$

Proposed Rule Concepts

Proposed Rule Concepts

- Applicability
  - Only to <u>municipal solid waste</u> incinerators
  - Only to units combusting > 35 tons/day of municipal solid waste
- Housekeeping requirements to minimize fugitive dust
- Time limits on startup, shutdown, malfunction, and idling
- CEMS and Stack Test requirements for specific pollutants
- Reporting and record keeping for operational logs and emissions data

Proposed Emission Limits

Pollutant	Limit[1]	Averaging Time	Compliance Date
NOx	110 ppm	24-Hour Block Average	May 1, 2026
NOx	105 ppm	30-Day Rolling Average	May 1, 2026
NOx	50 ppm		May 1, 2029
CO	100 ppm		*[date of adoption]*
Total Particulate Matter	0.017 gr/dscf @ 12% CO2		*[date of adoption]*
Total Particulate Matter	0.011 gr/dscf @ 12% CO2		July 1, 2029
PM10	150 lbs/day		*[date of adoption]*
PM–Filterable	10.2 mg/dscm		*[date of adoption]*
PM–Condensable	6.11 lbs/hr		*[date of adoption]*
PM–Condensable	4.09 lbs/hr		July 1, 2029
Opacity	10%	6-minutes	*[date of adoption]*

[1] Unless specified otherwise, concentration limits corrected to 7% O2, dry

Proposed rule language available at https://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book/proposed-rules/rule-1165

Next Steps

Next Steps

Public Workshop

Tentatively scheduled for late June 2024

Public Process Timeline

Set Hearing:
August 2024

Public Hearing:
Q4 2024

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Proposed Rules Page

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