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Rule 1109.1 – NOx Emission Reduction for Refinery Equipment

Working Group Meeting #15
November 4, 2020

Agenda

- Progress of Rule Development
- Follow-Up on Comments from Last WGM
- Assessment: Heaters and Boilers with SCR
- BARCT Assessment Follow-Up: Sulfuric Acid Plants
- Rule Concepts
- Potential Implementation Scenarios
- Next Steps

Progress of Rule Development

Summary of Working Group # 14 (8/27/20)

- Provided rule update to communities of Carson, Wilmington, and West Long Beach
- Summarized BARCT limits for equipment categories
- Presented implementation concepts

Since Last Working Group Meeting

- Stakeholder meetings and follow-ups
- Provided update to September Stationary Source Committee
- Distributed initial draft rule language

Follow-Up Comment from Community Working Group Meeting #14

Comments from Last Working Group Meeting

1st Comment	Response
Proposed 8-hour averaging time for heaters and boilers is too long and will allow for higher emissions	Factors considered when establishing averaging times: • Equipment stability (e.g., burner control) • Complex control technology requires a balance of operating parameters • Operators must optimize and balance the NOx, ammonia, and CO emissions • Complex operations with multiple pieces of equipment • Varying feedstock • Adjustments for unit response time • 2-hour averaging period for units requiring burners replacement • 8-hour averaging period for units requiring SCR • 365-day averaging period for large process units, e.g., FCCU, calciner

Comments from Last Working Group Meeting (*cont.*)

2nd Comment	Response

Start-up and shutdown provisions will allow excess emissions	• Starting up and shutting down equipment are necessary operations:
	  • Time and temperature is needed for SCR control equipment to achieve NOx reduction and operate effectively
	  • Equipment without SCR needs time to reach optimal unit operating temperatures
	• PR 1109.1 establishes limits to the time period and frequency of start-up and shutdowns to minimize emissions

Community Comments from Last Working Group Meeting (*cont.*)

3rd Comment	Response
South Coast AQMD should release information on the equipment at the refineries including: emissions, current controls, proposed controls and equipment age	Staff has been working on this request and it will be posted on the Rule 1109.1 Proposed Rules Webpage: http://www.aqmd.gov/home/rules-compliance/rules/scaqmd-rule-book/proposed-rules/proposed-rule-1109-1

Gas Turbine Category Follow-Up

Stakeholder Comment: Redding Electric Utility

- Stakeholder questioned staff's proposed BARCT limit of 2 ppm for the gas turbine category
  - Existing gas turbine at Redding Electric Utility is currently achieving lower than 2 ppm
  - BARCT assessment should include a review of that unit including source test data

Staff's Response: Redding Electric Utility

SCR&CO Retrofit on Two Gas Turbines – SCONOX Replacement

Test Results: January 2018

UNIT	#	5	5	5
LOAD	%	50	75	100
INLET NOX	PPMVD	16.5	17.9	15.2
NOX REDUCTION	%	90+	89	90+
INLET CO	PPMVD	0.3	0.3	0.3
CO REDUCTION	%	50	50	50
PREVIOUSE SCONOX DP	INWC	-	-	6.0
CURRENT SCR DP	INWC	0.9	1.4	1.6
POWER OUTPUT INCREASE	%			5

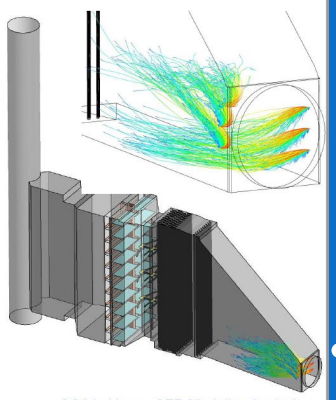
UNIT	#	6	6	6
LOAD	%	50	75	100
INLET NOX	PPMVD	13.6	13.3	16.7
NOX REDUCTION	%	87	86	90
INLET CO	PPMVD	0.3	0.3	0.3
CO REDUCTION	%	50	50	50
PREVIOUSE SCONOX DP	INWC	-	-	6.0
CURRENT SCR DP	INWC	0.9	1.4	1.6
POWER OUTPUT INCREASE	%			5

SCR&CO Retrofit – SCONOX Replacement Benefits

❑ **Increased Efficiency**

- **Total Output Increase: 5.5 MW or 5% of total plant output***
  - 3.5 MW increased Gas Turbine Output
    - The reduction in pressure drop increased output from the gas turbines by 3.5 MW combined.
  - 2 MW increased Steam Turbine Output
    - The elimination of the hydrogen reformer using steam resulted in the steam turbine output increasing by 2 MW.
- Removal of the SCONOX system with the associated blowers, hydrogen reformer, and higher pressure drop catalyst reduced electrical consumption, eliminated natural gas and steam consumption needed for hydrogen formation and increased turbine performance by decreasing pressure drop.

*Output Efficiency increase is based of the data collected from previous SCONOX Retrofit



CCA In House CFD Modeling Analysis

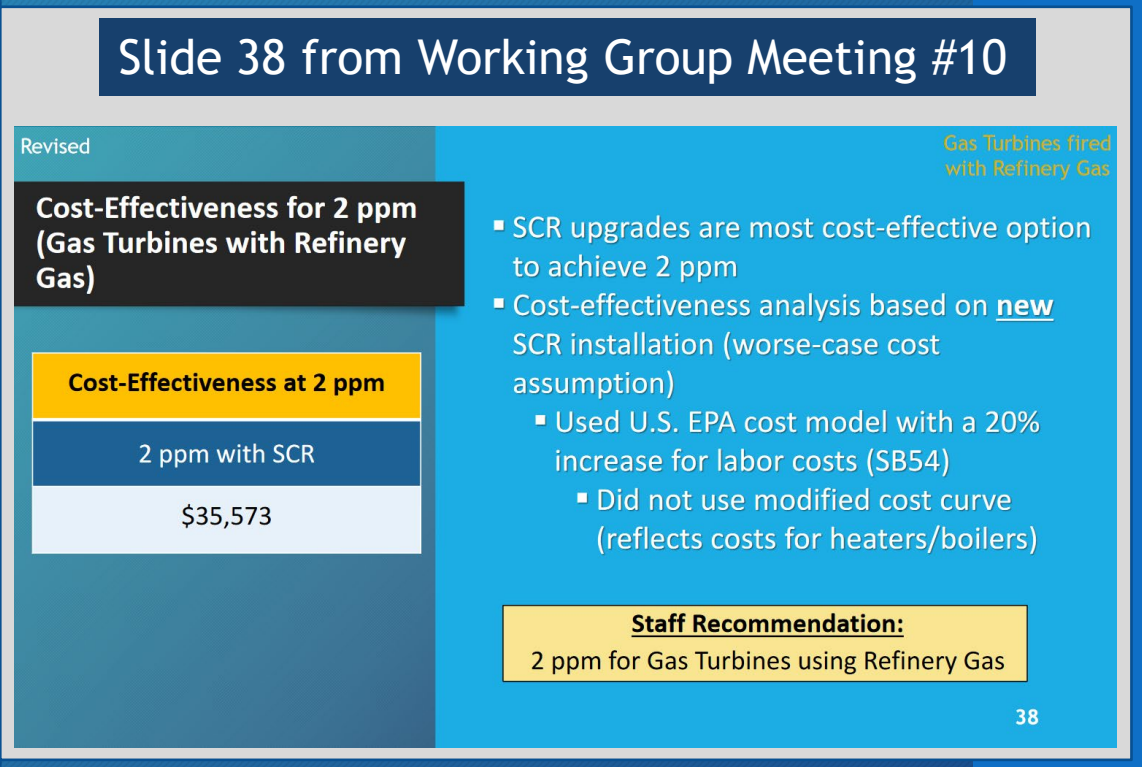
CECO Peerless

- Staff did consider the unit at Redding Electric in the BARCT assessment for Gas Turbines
  - During BARCT assessment, staff met several times with the vendors responsible for the retrofit:
    - CECO Peerless – designed and installed the SCR in 2018
    - Umicore – supplied the dual function (NOx and CO) catalyst
  - Staff reached out to Shasta County AQMD for emissions data for the unit
  - Third Party Consultants also considered this unit as part of their assessment
- SCR is achieving about 90% reductions
  - 2.5 ppm NOx permit limit
    - Achieving ~1.5 ppm NOx at 15% O_2 (1-hour average)
  - 5 ppm ammonia permit limit
  - Fueled with natural gas
  - Operation includes frequent start-up and shutdown
- Staff maintains proposed BARCT limit of 2 ppm for Gas Turbines fueled with Natural Gas and Refinery Fuel Gas

Gas Turbines Near Proposed BARCT Limit

Stakeholder commented that staff should evaluate Gas Turbines achieving NOx emissions close to proposed BARCT limit

Gas Turbines Near Proposed BARCT Limit



- At WGM #10, staff proposed a 2 ppm BARCT limit for all gas turbines
- Cost-effectiveness was determined using U.S. EPA cost spreadsheet modified for a 20% labor increase due to Senate Bill 54
  - Total installed costs are for brand new SCR installations (worse-case cost assumption)
- Existing gas turbines all have SCRs and a permit limit between 2 to 96 ppm
  - Currently operate between 1.2 to 10 ppm NOx
- Similar to heaters/boilers with existing SCRs, stakeholders requested staff evaluate incremental cost-effectiveness for gas turbines *achieving* low NOx emissions

Gas Turbines Near Proposed BARCT Limit

- Staff reviewed the BARCT assessment for gas turbine category
  - Overall cost-effectiveness considerably lower than $50,000/ton NOx reduced threshold
    - No outliers in the class and category
    - Highest cost-effectiveness is $67,372/ton NOx reduced
  - Costs estimated for retrofit likely overstated – considered complete SCR replacement
  - Several units are near the proposed 2 ppm limit but still cost-effective to retrofit
    - High NOx emission reductions even for units close to proposed limits

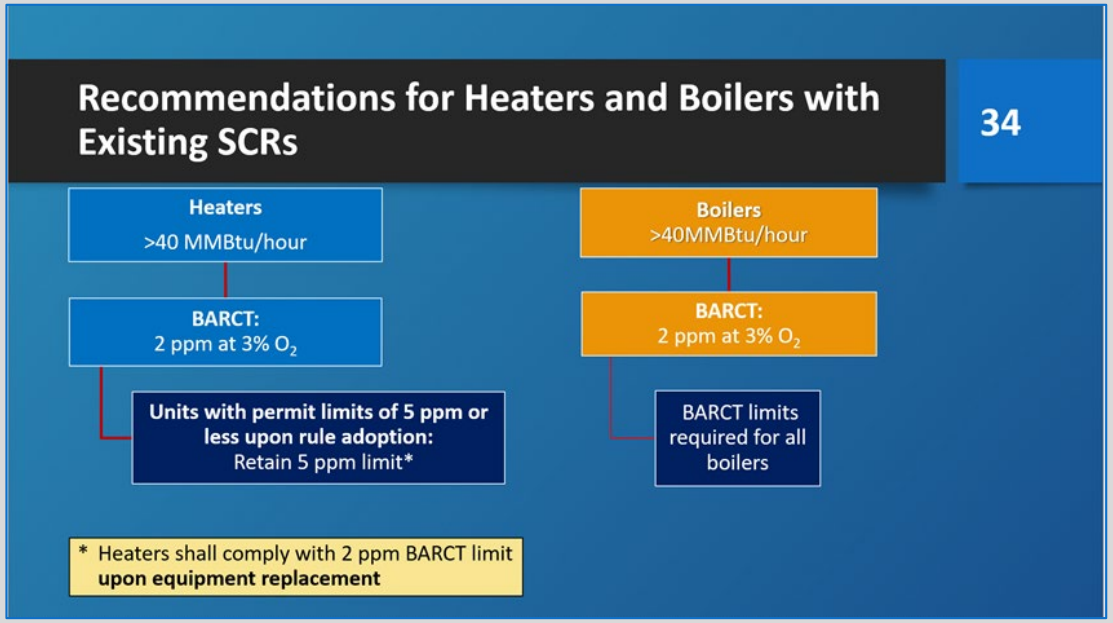
Staff's Recommendation:

Require all gas turbines to meet the proposed 2 ppm BARCT limit

Heaters and Boilers Near Proposed BARCT Limit Follow-Up

Comments From Working Group Meeting #13

Slide 34 from Working Group Meeting #13



- Staff proposed to allow heaters greater than 40 MMBtu/hour to maintain their 5 ppm permit limit until either a future date, or SCR replacement, whichever is sooner
  - Retrofitting a heater achieving 5 ppm to meet 2 ppm is not cost-effective
  - Addresses stranded assets for facilities that installed SCR to comply with NOx shave but did not design the system to meet 2 ppm
- Stakeholders requested staff evaluate units *achieving* low NOx concentrations based on CEMS data, even if they do not have a permit limit or have a permit limit greater than 5 ppm

Background on Outlier Assessment

- The BARCT cost-effectiveness calculation is averaged over the class and category of equipment
  - Some units in the category can be over the threshold provided the average comes close to the threshold
  - Some units can significantly exceed the threshold, staff evaluates those units as outliers
- Outliers typically result from low-use/low-emitting units or from units with NOx controls achieving close to the proposed limit
- Staff addressed those units through low-use exemptions (e.g., start-up heaters) or a delayed implementation schedule
  - A delayed implementation schedule for units with existing controls is consistent with AB 617 which requires the highest priority for implementation will be for those sources that “have not modified emissions-related permit conditions the greatest period of time”

Background on Stranded Asset Determination

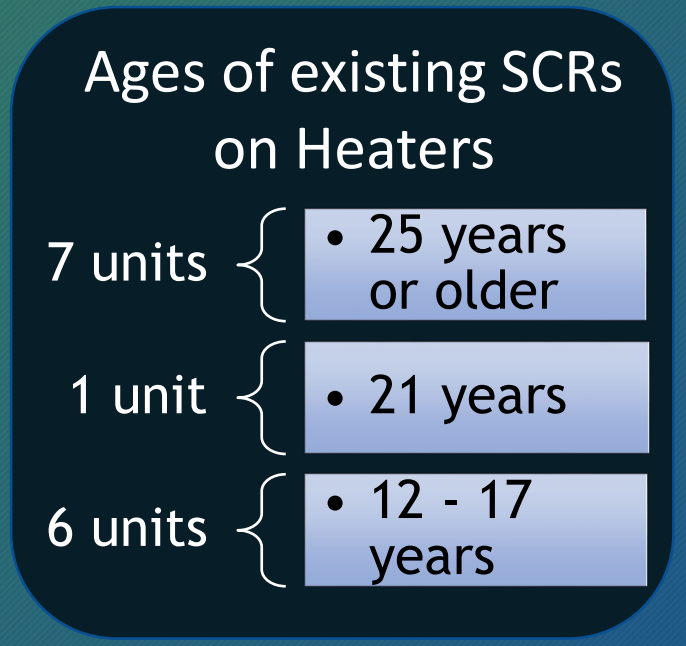
- Cost-effectiveness assessment can consider stranded assets from recently installed units or controls
  - For example, an SCR installed to meet the 2015 NOx RECLAIM shave that does not meet the PR 1109.1 NOx limit
- Staff evaluates units with existing SCRs achieving near the proposed NOx limit to address potential stranded assets

Heaters Performing Near Proposed BARCT Limit

- Staff previously identified 14 heaters with a 5 ppm permit limit that are not cost-effective to retrofit to 2 ppm (~$200,000/ton of NOx reduced)
- Staff reviewed the data and identified three heaters *achieving* emissions less than 8 ppm
  - Two have no permit limits
  - One has a 12 ppm permit limit
- Staff evaluated cost-effectiveness to retrofit to 2 ppm
  - One unit achieving ~ 5 ppm – not cost effective to retrofit to 2 ppm (~$100,000)
  - Two units achieving ~ 8 ppm – cost-effective to retrofit to 2 ppm (~$50,000)

Heaters Performing Near Proposed BARCT Limit (cont.)

- Staff evaluated if the existing SCRs on heaters would be considered stranded assets
  - BARCT cost-effectiveness calculation uses a 25-year “useful life”
  - Based on data provided in the survey, most SCRs will be older than 25 years by first implementation date



Revised

Heaters Performing Near Proposed BARCT Limit (*cont.*)

- Cost-effectiveness assessment shows it is not cost effective to retrofit units *achieving* 5 ppm to 2 ppm
- Some SCRs on heaters have not reached the end of their useful life
- Units with no or higher permit limits that can achieve 5 ppm, can request a 5 ppm limit in their permit

Staff's Recommendation:

Heaters >40 MMBtu/hour that have a permit limit of 5 ppm or less *within 6 months of rule adoption*, can maintain the 5 ppm limit until a future effective date, or when the SCR is replaced, whichever is sooner

Boilers Performing Near Proposed BARCT Limit

- Staff previously determined that boilers with a 9 or 12 ppm permit limit are cost-effective to retrofit to 2 ppm
- Staff reviewed the data and found three units performing close to 6 ppm
  - All units are large boilers (340 – 350 MMBtu/hour) with high emissions
  - Cost-effectiveness to retrofit from 6 to 2 ppm is $45,000/ton NOx reduced

Boilers Performing near Proposed BARCT Limit (*cont.*)

- Based on data provided in survey, SCRs installed on boilers would not be considered stranded assets
  - Survey only included age for 4 out of the 9 boilers with SCR, all installed in the early 1990
  - BARCT cost-effectiveness calculation uses a 25-year as the end of useful life

Boilers Performing near Proposed BARCT Limit (*cont.*)

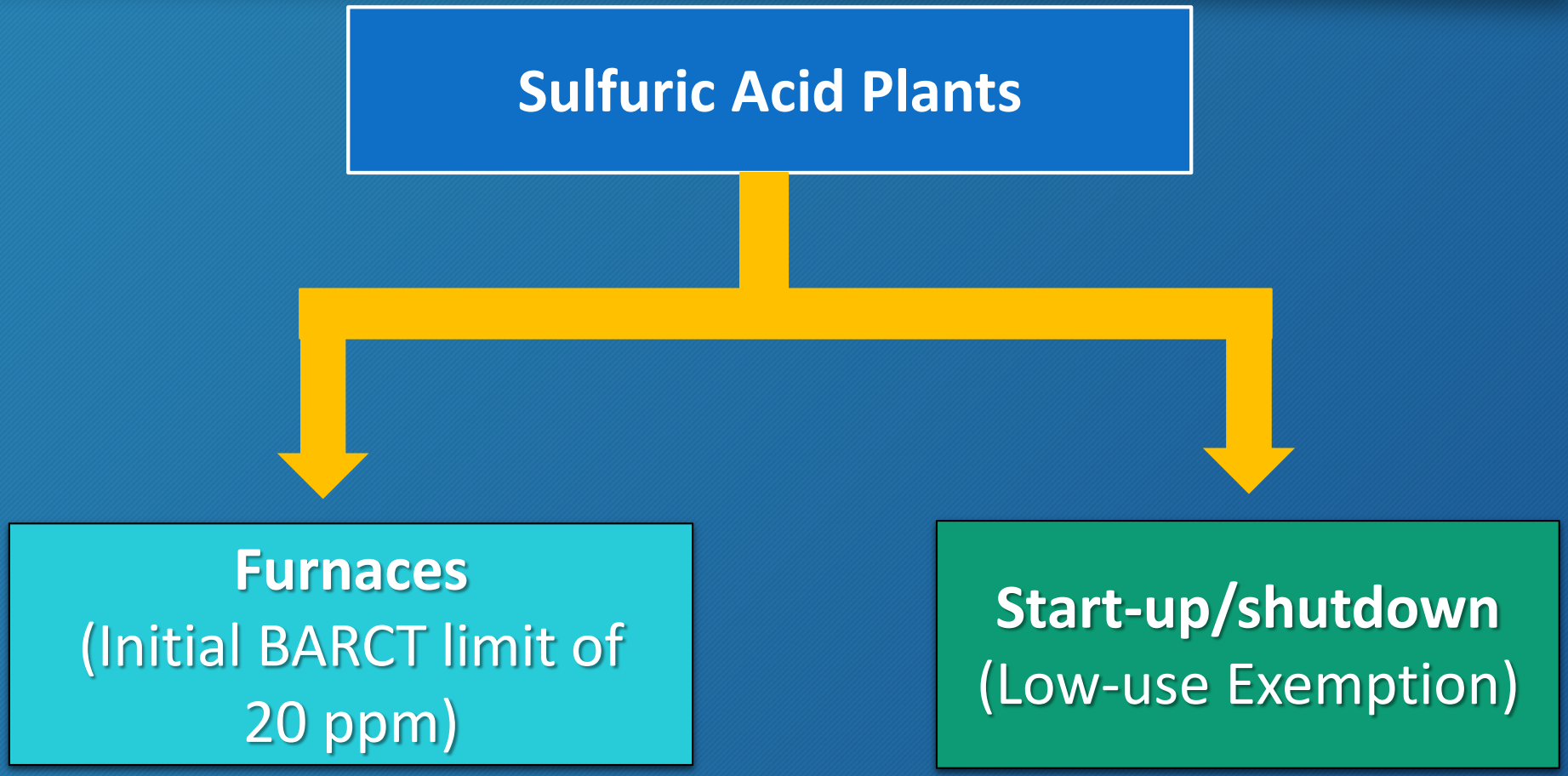
- Cost-effectiveness assessment shows it is cost effective to retrofit boilers *achieving* 6 ppm to meet 2 ppm
- Existing SCRs on boilers are not considered stranded assets
- Data does not support a higher NOx limit; however, a longer implementation approach is consistent with AB 617

Staff's Recommendation:

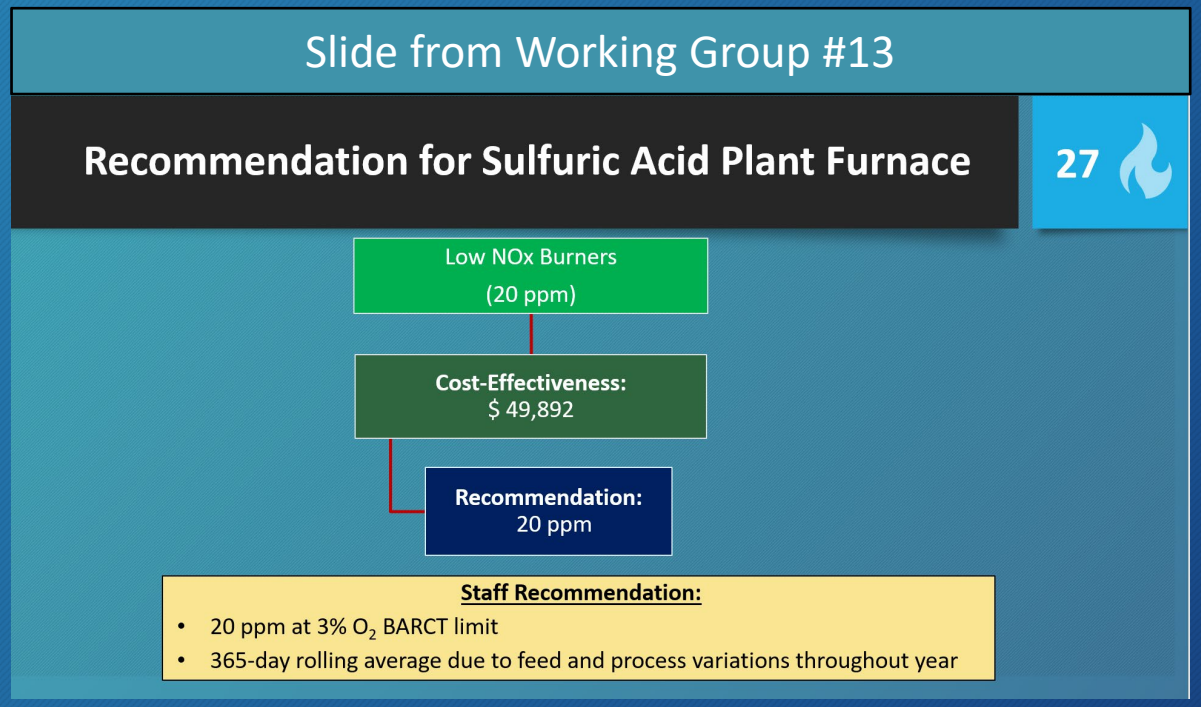
For an operator of a boiler with an existing SCR, the implementation approach being proposed by staff will allow flexibility to meet the proposed NOx limit in a later implementation phase. Further discussion at the end of this presentation.

Sulfuric Acid Plant Follow-Up

Sulfuric Acid Plant Proposed BARCT Limits



Sulfuric Acid Plants Follow-Up



- BARCT assessment determined 2 ppm was not cost-effective for Sulfuric Acid Furnaces (e.g., SCR and LoTOx)
- Staff proposed a 20 ppm NOx BARCT limit based on low-NOx burner technology
  - One facility reported furnace performing at 20 ppm
  - Other facility cost-effective to retrofit to 20 ppm
- Stakeholder with unit performing at 20 ppm expressed concern with limit after further review of their CEMS emissions data
  - Submitted five years of CEMS data for staff to review

Sulfuric Acid Plants Follow-Up (*cont.*)

- Staff review of CEMS data demonstrated emissions exceed the proposed 20 ppm BARCT limit
  - NOx emissions vary due to feed and process variations
  - Existing unit performing at ~25 ppm
- Staff reached out to technology vendors, permit engineering staff, and Third-Party Consultant
  - Concluded that 20 ppm is not technically feasible for Sulfuric Acid Furnaces, even with a 365-day rolling average
- Based on the review of CEMS data and input from technology vendors, permit engineering staff, and Third-Party Consultant staff is recommending:
  - Change the proposed Initial BARCT NOx emission limit from 20 ppm
  - Evaluate the cost-effectiveness at: 25 ppm and 30 ppm

Sulfuric Acid Plant Reassessment

	RECLAIM 2005/2015 BARCT	Existing Units	Other Regulatory	Technology Assessment	Revised Initial BARCT NOx Limit	Cost-Effectiveness
Two Affected Furnaces: 74 and 150 MMBtu/hr	N/A	~25 to 28 ppm[1]	N/A	2 to 30 ppm	25 ppm and 30 ppm	Need to conduct cost-effectiveness on Revised Initial BARCT NOx Limits

[1] Based on CEMS data, 365-day average

- Assess if cost-effective for facility at 28 ppm to achieve 25 ppm
- If not cost-effective, will evaluate 30 ppm

Initial BARCT NOx Limits for Cost-Effectiveness for Sulfuric Acid Plant Furnaces

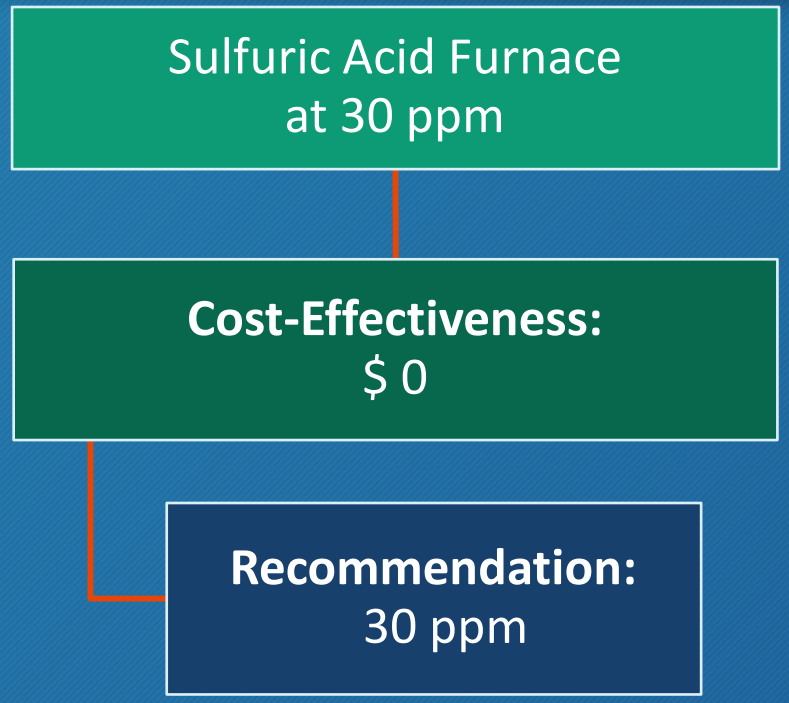
Total NOx emission for category is 0.097 tpd

Cost-Effectiveness for Sulfuric Acid Plant Furnaces

Cost-Effectiveness		
Equipment	25 ppm	30 ppm
Sulfuric Acid Furnaces	**$133,000**	**$0**

- Calculated cost-effectiveness based on Revised Initial BARCT NOx Limits
- Emission reductions based on annual average NOx ppm as provided by facilities
- Total Low-NOx Burner cost estimated using cost curve generated for Process Heaters & Boilers
  - ~$3.2MM capital and installation
  - ~$2,000 annual O&M
- Results of cost-effectiveness analysis:
  - $133,000 per ton of NOx reduced for 25 ppm is not cost-effective (low emission reductions)
  - No additional cost for 30 ppm since both facilities are currently achieving limit
- Recommendation: Proposed NOx limit of 30 ppm

Revised Recommendation for Sulfuric Acid Plant Furnace



Staff's Revised Recommendation:

- 30 ppm at 3% O_2 BARCT limit
- 365-day rolling average due to feed and process variations throughout year

Rule Concepts

Initial Preliminary Draft Rule Language

- Initial rule language was distributed on October 23rd
- Staff is seeking feedback and comments on rule language
  - Comments received by November 6th can be considered for the next version of the rule
- Revised rule language (*second draft*) will be released in November
- The following slides provide overview of rule concepts and rule language

Rule Structure

- Purpose
- Applicability
- Definitions
- Emission Limits
- Start-up, Shutdown, and Malfunction
- CEMS Requirements
- Source Test Requirements
- Diagnostic Emission Checks
- Monitoring, Recordkeeping, and Reporting
- Compliance Schedule
- BARCT Compliance Alternative Plan
- Exemptions

Purpose and Applicability – Subdivisions (a) and (b)

Purpose

- Reduce emissions of oxides of nitrogen (NOx), while limiting carbon monoxide (CO) emissions, from units at petroleum refineries and facilities with related operations to petroleum refineries

Applicability

- Applies to an owner or operator of units at petroleum refineries and facilities with related operations to petroleum refineries, including:

Petroleum Refineries	Hydrogen Production Plants
Petroleum Coke Calciner	Sulfuric Acid Plants
Sulfur Recovery Plants	Biofuels Plant
Asphalt Plants	

Definitions - Subdivision (c)

- Initial draft contains 27 definitions
- Staff included definitions for each type of facility and combustion unit that will be subject to 1109.1 and is seeking feedback
- The following slides highlight key definitions

Key Definitions (*cont.*)

- START-UP is the time period that begins when a NOx emitting unit combusts fuel after a period of zero fuel flow and which ends when the flue gas temperature reaches the minimal operating temperature of the emission control equipment. Start-up does not include the time used to dry refractory if a separate unit is used for the drying process.
- SHUTDOWN is the time period that begins when an operator with the intent to shut down a unit, reduces load and for flue gas temperatures to fall below the minimum operating temperature of the emission control equipment, and which ends in a period of zero fuel flow, unless otherwise defined in the South Coast AQMD permit to operate.
- MALFUNCTION means any sudden, infrequent, and not reasonably preventable failure of any process, air pollution control, or monitoring equipment, or a process to operate in a normal manner which causes, or has the potential to cause, the emission limitations to be exceeded. Breakdowns subject to Rule 430 – Breakdown Provisions and incidents subject to Rule 2004 – Requirements are not malfunctions.

Key Definitions (*cont.*)

- UNIT means, for the purpose of this rule, boilers, fluid catalytic cracking units, gas turbines, ground-level flares, petroleum coke calciner, process heaters, steam methane reformer heaters, sulfuric acid furnace, sulfur recovery units/tail gas incinerators, and vapor incinerators requiring a District permit and not specifically required to comply with a NOx emission limit by other South Coast AQMD Regulation XI rules.

Emission Limits – Subdivision (d)

- Includes the table of emission limits for each class and category of equipment, including:
  - NOx and CO limits
  - Averaging times
  - Compliance dates
- Provision that units with combined stacks will be subject to the emission limits and corresponding averaging time of the unit with the most stringent limit

Start-up, Shutdown and Malfunction – Subdivision (e)

- Applicable NOx and CO emission limits (Table 1) are exempt during start-up, shutdown, or malfunction for:
  - Time periods specified in Table 2, or
  - Lesser time if specified in a South Coast AQMD permit

TABLE 2: START-UP, SHUTDOWN, MALFUNCTION ALLOWANCES

Unit	Not to Exceed per Start-up, Shutdown, or Malfunction (hours)
Gas Turbines	2
Sulfuric Acid Furnace	24
Boilers, Process Heaters, or Steam Methane Reformer Heaters	48
Steam Methane Reformer with Gas Turbine	60
FCCUs, Petroleum Coke Calciner, or SRU/TG Incinerators	120

Start-up, Shutdown and Malfunction (*cont.*)

- An owner or operator of a unit complying with the emission limits by using the start-up, shutdown, and malfunction allowances shall:
  - Submit the timetable of the estimated dates for the scheduled startup and shutdown events to the Executive Officer by January 1 of each year
  - Not to exceed XX scheduled start-up and shutdown events per year
- An owner or operator of a unit that exceeds the NOx and CO emissions limit shall:
  - Implement good air pollution control practices to minimize NOx emissions during periods of start-up, shutdown, and malfunction
  - Notify the Executive Officer within 24 hours following the shutdown and within 24 hours following the startup
  - Submit a monthly report to Executive Officer

CEMS Requirements – Subdivision (f)

- Requires installation, operation, and maintenance of CEMS, or an equivalent verification system, to measure NOx, CO, and O2, that complies with the applicable Rule 218 series to demonstrate compliance with the NOx and CO emissions limits for:
  - All units with a rated heat input capacity greater than 40 MMBtu/hour
    - Boilers and heaters
    - Gas turbine
    - FCCU
    - Petroleum coke calciner
    - SMR heater
    - SMR heater with a gas turbine
    - Sulfuric acid furnace

CEMS Requirements (*cont.*)

- Non-operational CEMS subject to applicable Rule 218 series
- For units with 365-day averaging period, the missing CEMS data during non-operational periods, will be determined as follows:
  - 8 hours or less: substitute data shall be calculated using the average of the recorded emissions for the hour immediately before the missing data period and the hour immediately after the missing data period
  - More than 8 hours: substitute data shall be calculated using the maximum hourly emissions recorded for the previous 30 days commencing on the day immediately prior to the day the missing data occurred

Source Test Requirements – Subdivision (g)

- Units without CEMS are subject to source testing requirements
- An owner or operator of a new or modified unit shall conduct the initial source test within 6 months from installation
- An owner or operator of a unit that has not conducted a source test within the schedule in the following timeframes shall conduct a source test within 6 months from [DATE OF RULE ADOPTION]
  - All categories less than 40 MMBtu/hr and SRU Incinerators shall conduct source test annually
  - Vapor Incinerators and flares shall conduct source test every 36 months
- Emissions determined to exceed any limits established by this rule by any of the reference test methods shall constitute a violation of the rule and must notify the Executive Officer

Source Test Requirements – Test Methods

- Test Methods
  - South Coast AQMD Source Test Method 100.1 - Instrumental Analyzer Procedures for Continuous Gaseous Emission Sampling (March 1989)
  - South Coast AQMD Source Test Method 7.1 - Determination of Nitrogen Oxide Emissions from Stationary Sources (March 1989) and South Coast AQMD Source Test Method 10.1 - Carbon Monoxide and Carbon Dioxide by Gas Chromatograph/Non-Dispersive Infrared Detector (GC/NDIR) - Oxygen by Gas Chromatograph-Thermal Conductivity (GC/TCD) (March 1989)
  - Any other test method determined to be alternative and approved before the test in writing by the Executive Officer of the South Coast AQMD and the California Air Resources Board and the Regional Administrator of the U.S. EPA, Region IX

Diagnostic Test Requirements – Subdivision (h)

- Owner or operators of units required to perform source tests must also conduct interim diagnostic test of NOx and CO emissions as follows:
  - Perform diagnostic emissions checks of NOx, CO, and O2 emissions, with a portable analyzer at least monthly or every 744 operating hours, whichever occurs later
  - If the unit is in compliance for three consecutive diagnostic emission checks, then the unit may be checked every 90 days or every 2,000 operating hours, whichever occurs later
- Excess emissions shall not constitute a violation if the operator
  - Corrects the problem; and
  - demonstrates compliance with another diagnostic emissions check within 72 hours from the time an owner or operator knew or reasonably should have known of excess emissions

Revised

Monitoring, Recordkeeping, and Reporting Requirements – Subdivision (i)

- Requires that each source that requires CEMS comply with the Rule 218 series rules to demonstrate compliance with the NOx emissions limits
- An owner or operator of a unit shall maintain the following daily records for each unit:
  - Time and duration of start-ups and shutdowns
  - Total hours of operation
  - Quantity of fuel
  - Cumulative hours of operation to date for the calendar year

Monitoring, Recordkeeping, and Reporting Requirements (*cont.*)

- Operators must keep and maintain all records, including CEMS data, source tests reports, diagnostic emission checks and written logs of start-ups, shutdowns, and malfunctions, and all maintenance, service and tuning records, and any other information required by this rule:
  - On-site for five years, except that all data gathered or computed for intervals of less than 15 minutes shall be maintained for a minimum of 48 hours, and
  - Records shall be made available to the Executive Officer upon request

Revised

Compliance Schedule – Subdivision (j)

- An owner or operator of a boiler with a rated heat input capacity <40 MMBtu/hour must comply with the 5 ppm NOx limit based on the earlier of:
  - Unit replacement or when 50 percent or more of the unit's burners are replaced, but no later than 10 years after rule adoption
- Effective [TEN YEARS AFTER RULE ADOPTION], an owner or operator of a process heater with a rated heat input capacity <40 MMBtu/hour must comply with the 9 ppm NOx limit at replacement when 50 percent or more of the unit's burners are replaced

Compliance Schedule *(cont.)*

- For a Process Heater with a Rated Heat Input Capacity ≥40 MMBtu/hour exempt from the emission limits (e.g., with a 5 ppm permit limit), must comply with the 2 ppm emission limits according to the following schedule:
  - [TEN YEARS AFTER RULE ADOPTION] or when the existing post-combustion air pollution control equipment is replaced, whichever is earlier, for units with post-combustion controls operating more than 25 years
  - 25 years after the installation of post-combustion control equipment, for units with post-combustion controls operating less than 25 years

Revised

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BARCT Compliance Alternative Plan – Subdivision (k)

Staff is still developing the BARCT Compliance Alternative Plan (B-CAP) subdivision and will discuss further at the end of this presentation

Exemptions – Subdivision (l)

- Exempt for the provisions of the rule:
  - Boilers that are unfired or used as heat recovery
  - Boilers and Heaters ≤5 MMBtu/hour used exclusively for space or water heating (subject to Rule 1146.1)
- Exempt from emission limits:
  - Process Heater or Boiler only used for start-up of a FCCU or Sulfuric Acid Furnace will have a low-use exemption
  - Ground-Level Flares that operates 20 hours or less per calendar year, or with an annual throughput limit equivalent to 20 hours per year
  - Vapor incinerator that emits 100 pounds of NOx or less in a year

Exemptions – Subdivision (l) (*cont.*)

- Exempt from the emission limits :
  - Process heaters 20 to < 40 MMBtu/hr installed prior to rule adoption with 40 ppm or lower NOx permit limit are exempt from the 30 ppm NOx limit
    - Pursuant to the compliance schedule subdivision, units will have to meet the emission limits ten years from rule adoption or when 50% or more of the burners are replaced
  - Process heaters ≥40 MMBtu/hr installed prior to rule adoption with 5 ppm or lower NOx permit limit are exempt from the 2 ppm NOx limit (*rule will allow 6 months from rule adoption for operator to change or add permit limit*)
    - Pursuant to the compliance schedule subdivision, units will have to meet the emission limits:
      - 10 years after rule adoption or when SCR is replaced for units with post-combustion controls operating more than 25 years
      - 25 years after the installation of post-combustion control equipment, for units with post-combustion controls operating less than 25 years

Implementation Approach

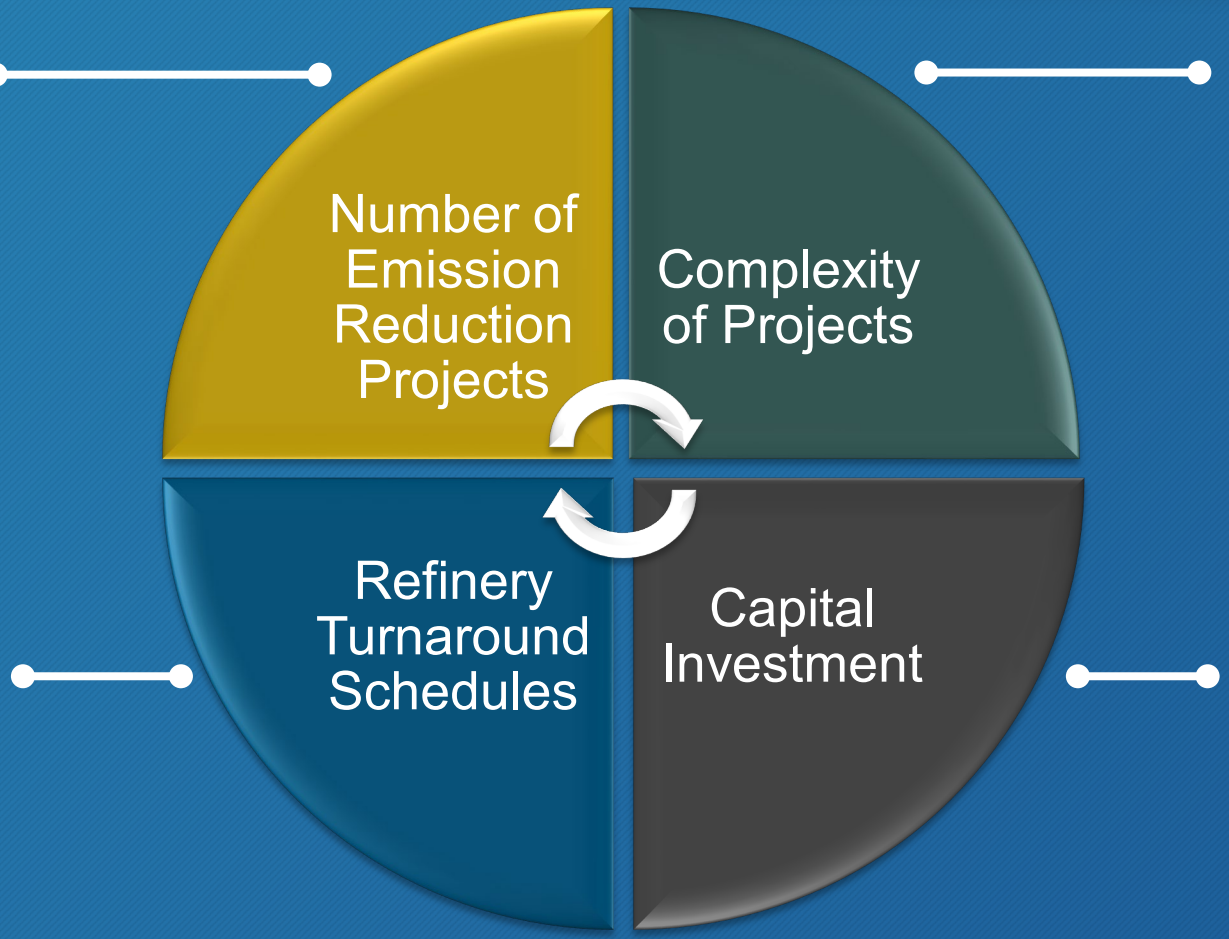
Implementation Schedule for Facilities with 5 or fewer units

- Staff is proposing a fixed compliance date for facilities with 5 or fewer units to retrofit and for units already achieving BARCT limits
- Sulfuric Acid Plants
  - Both furnaces achieving BARCT limits but do not have NOx permit limits
  - Facilities required to submit permit application change to include 30 ppm NOx limit within 6 months of rule adoption
- Hydrogen Production Plants with 5 or fewer units to retrofit
  - Implementation date will be consistent with the Phase I implementation date
- Marathon Calciner and Sulfur Recovery Plant
  - Under common ownership with Marathon Refineries
  - Consider allowing all facilities under common ownership in same B-CAP provided there is equitable reductions for facilities located in different communities
  - Make similar consideration for other facilities with multiple units under common ownership

Implementation Consideration for Facilities with More than Five Units

- ~ 220 pieces of equipment are not meeting proposed NOx emission limits

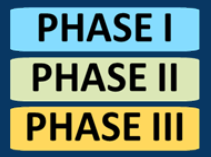
- Accounting for refinery turnarounds schedules will minimize disruptions
- Staggered schedules will reduce the demand for construction resources



- Projects are complex requiring significant engineering, design, installation, and commissioning
- ~110 SCR/SCR upgrade projects for the boiler/heater category
- ~130 burner replacement projects that can involve 10's to 100's of burner replacements per unit

- Most emission reduction projects will be more than $10 million
- Each of the petroleum refineries have many projects

Proposed Implementation Approach for Facilities with More Than 5 Units

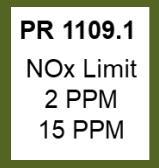


Proposing a three-phased implementation approach

Selection of the equipment in each phase must meet target NOx emission reductions

Operator can select units that will be in each of the three phases

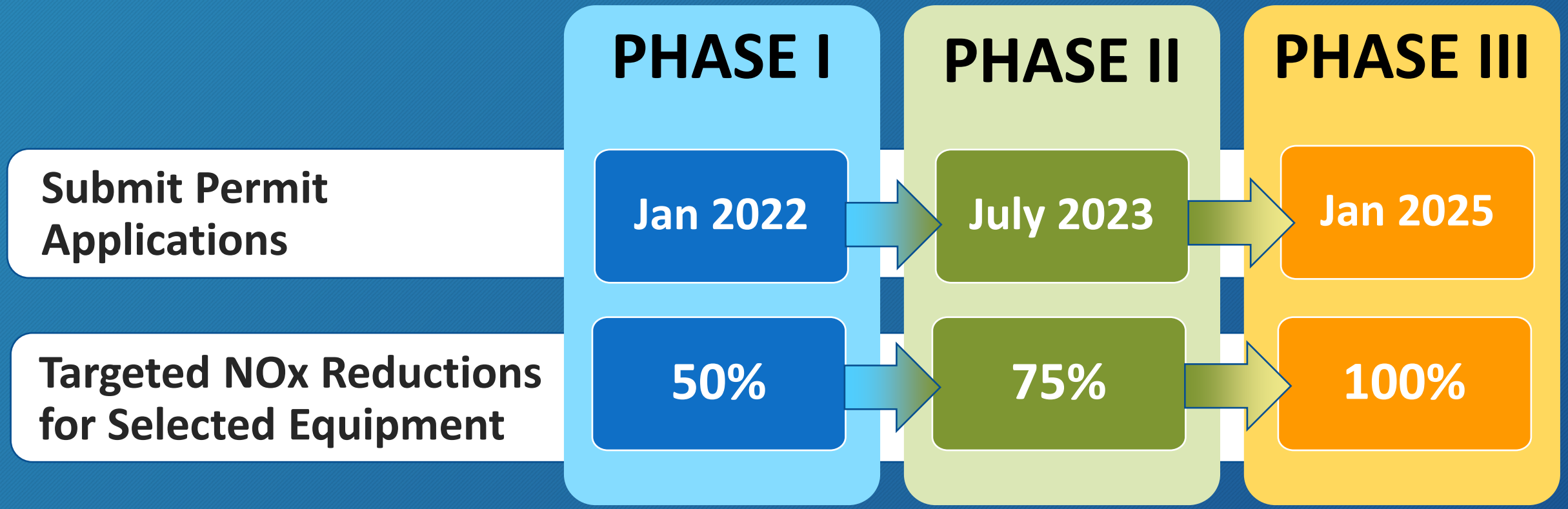
Each phase has compliance dates that operators must meet NOx emission limits for specific groups of equipment



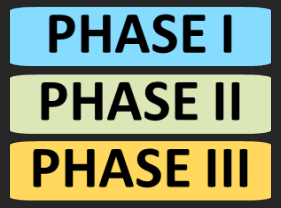
Each piece of equipment must meet the Proposed Rule 1109.1 NOx and CO emission limits

Three Phase Implementation Approach

PHASE I
PHASE II
PHASE III



Overview of Implementation Approach



- Each combustion unit will be assigned NOx reductions based on 2017 baseline emissions and the Proposed Rule 1109.1 NOx concentration limit
- Operators can select any group of combustion units to implement in Phase 1, Phase 2, and Phase 3 provided the aggregate emission reductions targets are met for each phase
  - Phase 1: 50% reduction of 2017 baseline emissions
  - Phase 2: 75% reduction of 2017 baseline emissions
  - Phase 3: 100% reduction of 2017 baseline emissions
- NOx emission reductions assigned to each unit is only used for identifying which combustion units will be placed in each of the three phases

Operators must achieve the Proposed Rule 1109.1 NOx concentration limit

Targeted NOx Reductions

- Selection of units for each phase will be based on 2017 estimated emission reductions to achieve the targeted reductions for each phase
- 2017 estimated emissions reductions based on:
  - Baseline 2017 emissions submitted by facility (AER)
  - NOx emission reductions based on the PR 1109.1 NOx concentration limits
- The 2017 estimated emission reductions are used only to select which pieces of equipment will be implemented in each phase, each unit must meet the PR 1109.1 NOx and CO emission limits
  - There is “no credit” if the unit achieves greater emission reductions than estimated
  - Targeted reductions are cumulative, allows use of earlier reductions for a later phase

Phases	Targeted Reductions
Phase I	50%
Phase II	75%
Phase III	100%

Selecting Units for Each Phase

- Each operator can select units that will be implemented within each phase provided the targeted reductions are met
  - Allows operators to select units based on turnaround schedules
- South Coast AQMD staff will be working with individual facilities to provide the 2017 baseline and estimated emission reductions for each PR 1109.1 unit
- Operators will be required to submit a BARCT Compliance Alternative Plan (B-CAP) that will specify which units will be implemented within each of the three phases
- Units modified to comply with replacement requirement would be outside the B-CAP
- B-CAPs must be submitted six months from date of adoption
  - B-CAP is a compliance plan and will be subject to fees pursuant to Rule 306 – Plan Fees
- Operators can move the units within each phase no later than 90 days from the date the permit application is required to be submitted provided targeted reductions are met

Example of Selecting Units for Each Phase

- Example shows three variation to achieve targeted reductions - many more variations
- Units selected must meet the PR 1109.1 NOx and CO limits and follow the proposed implementation schedule

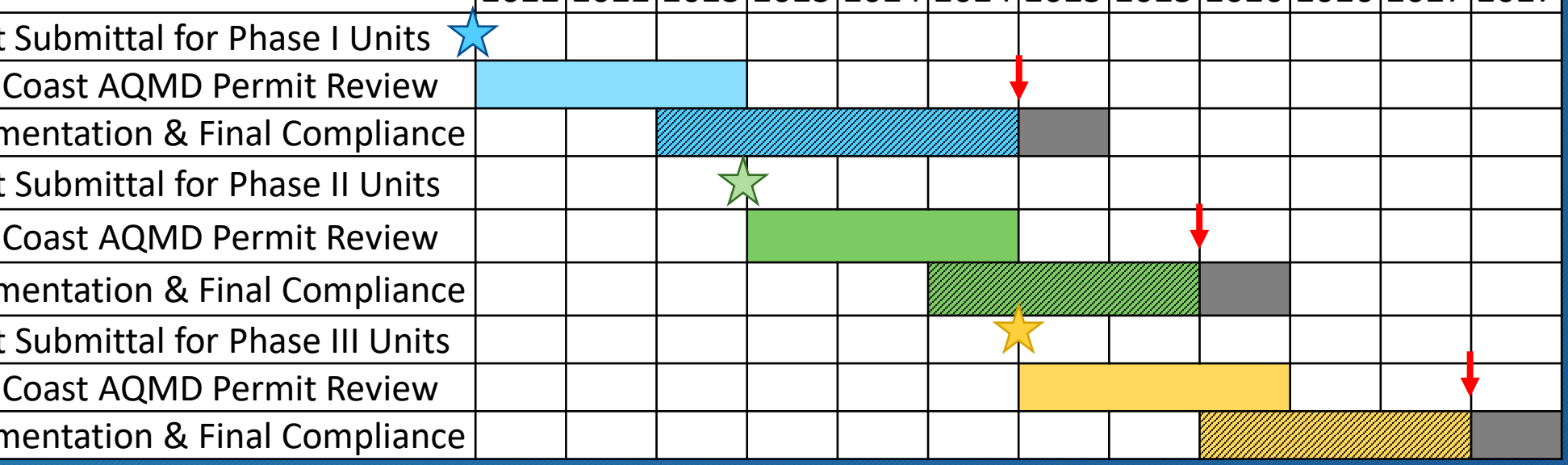
Description		Option 1	Option 2	Option 3
Phase I	Number of Units	2	4	11
	% of Targeted Reductions	55%	52%	51%
Phase II	Number of Units	3	6	1
	% of Targeted Reductions	79%	76%	92%
Phase III	Number of Units	8	7	1
	% of Targeted Reductions	100%	100%	100%

Unit	NOx Emissions Reductions (lb/year)		
	Option 1	Option 2	Option 3
#1	170000	170000	170000
#2	61000	61000	61000
#3	34000	34000	34000
#4	27000	27000	27000
#5	37000	37000	37000
#6	19000	19000	19000
#7	17000	17000	17000
#8	11000	11000	11000
#9	11000	11000	11000
#10	10000	10000	10000
#11	9000	9000	9000
#12	6000	6000	6000
#13	7000	7000	7000

Implementation Dates

- Proposed implementation dates are staggered to allow operators to manage projects
- Each phase will have specified implementation dates:
  - Permit Submittal: Operator must submit permit applications for all units that will be implemented for each phase
  - Implementation Period and Final Compliance: Time period to achieve PR 1109.1 NOx and CO emission limits
    - Phase I: 24 months from issuance of Permit to Construct
    - Phase II and III: 18 months from issuance of Permit to Construct
  - Time extension: Up to 6 additional months provided operator meets specified criteria (additional details in later slides)
- Compliance with all PR 1109.1 NOx and CO emission limits is January 1, 2028
  - South Coast AQMD permitting is expected to be 18 months, times may vary
  - Adding a final compliance date encourages operator to work with South Coast AQMD through the permit process

Proposed Implementation Schedule



Must meet PR 1109.1 NOx and CO emission limits

Time extension provided meets specified criteria

Note: Schedule assumes permit applications will be approved in 18 months, actual times may vary

Final Compliance with PR 1109.1 NOx and CO limits no later than January 1, 2028

Time Extensions

- Time extensions at the end of each compliance period are allowed provided:
  - Permit applications were submitted on time, based on the date specified for each phase
  - NOx and CO limit was not achieved by the compliance date of the Phase due to reasons outside of the control of the operator
- Reasons outside of the control of the operator include, but are not limited to:
  - Equipment or parts were ordered, but not received within sufficient time to complete installation
  - Work could not be completed due to unforeseen circumstances
- Approval of a time extension will be based on the facility submitting sufficient information justifying the request, such as:
  - Detailed schedules, engineering designs, construction plans, permit applications, purchase orders, economic burden, and technical infeasibility

PR 1109.1 NOx and CO Emission Limits

PR 1109.1
NOx Limit
2 PPM
15 PPM

- Use of 2017 estimated emission reductions is a surrogate to select which units will be implemented within the three phases
- The “targeted emission reductions” may not be the actual emission reductions that will occur as some operators may choose to replace units to meet the PR 1109.1 emission limits
- Staff wants to underscore that the B-CAP provides flexibility to select units in each phase, but requires that:

Each unit in each phase will be required to meet the PR 1109.1 NOx and CO emission limits

Next Steps

- Further Define Implementation Plan
- Continued Meeting with Stakeholders
- Final Assessment Report from Consultants
- Draft Rule Language – second version
- Preliminary Draft Staff Report
- Public Workshop/Public Hearing

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