Proposed Rule 1109.1 – NOx Emission Reduction for Refinery Equipment and Related Operations

Working Group Meeting #20

April 30, 2021

Join Zoom Webinar
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Agenda

- Progress of Rule Development
- Progress and Status Since Working Group Meeting 19
- Implementation Compliance Plan & BARCT Equivalent Plan
- Proposed Rule 429.1 – SU/SD Provisions at Petroleum Refineries
- ClearSign Update

Progress of Rule Development

Summary of Working Group # 19 (02/11/21)

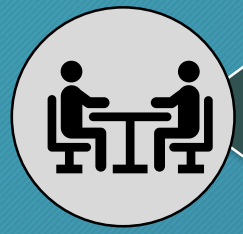
- Requested revised cost data and the reassessment of the following categories:
  - Boilers and heaters (≥ 40 MMBtu/hr)
  - FCCUs with SCR near BARCT limit
  - Vapor incinerators
- Cut-off time for revised cost data was March 12, 2021
- Provided update to implementation compliance plan (i-Plan)
- Presented initial concepts for BARCT equivalent compliance plan (b-Plan)

Progress and Status Since WGM 19

Status and Progress Since Last WGM

March Stationary Source Committee Update

Comment Letters Received



Continued Meeting with Stakeholders

Revised Cost Submission and Assessment

March Stationary Source Committee Update

- Staff provided an update to Stationary Source Committee on March 19th
- Staff presented the following topics:
  - Cost data submission and socioeconomic analyses for the rule
  - Third party reviews for the cost and socioeconomic analysis, details on next slide
  - Proposal to reassess of BARCT for various categories
    - Large Boilers & Heaters (≥ 40 MMBtu/hr)
    - Fluidized Catalytic Cracking Units (FCCU) with existing SCRs
    - Vapor Incinerators
  - Revised Implementation Compliance plan Targets and dates (i-Plan)
  - Initial concepts to the BARCT equivalency compliance plan (b-Plan)

Third Party Reviewers for Socioeconomic Impact Analysis

Review of Cost Data

Norton Engineering Consultants Inc.

- Nearly 40 years of experience with petroleum and petrochemical industries worldwide
- Experienced with environmental control technologies
- Experienced in evaluation, design and selection of retrofit control applications for NOx , SOx, and PM
- Specializes in all areas of refining processes

Review of Socioeconomic Analysis

Kleinhenz Economics

- Over 30 years of experience with economic forecasts, impact studies, and public policy analyses
- Principal Economist at Kleinhenz Economics
- Associate Director of Office of Economic Research at California State University, Long Beach
- Research Fellow, Inland Empire Economic Partnership
- South Coast AQMD Scientific, Technical & Modeling Peer Review Advisory Group for AQMP

Review of Benefits

Industrial Economics, Incorporated (IEc)

- 30 years of environmental consulting experience
- National leader in quantifying and monetizing the health and other benefits of reducing air pollution
- Conducted hundreds of studies on benefit-cost analyses of national air emissions rules, water quality policy, and waste management policy (U.S. EPA, U.S. Coast Guard, etc.)

Comment Letters Received

- Staff received six comments letters since last Working Group Meeting
  - Environmental Groups submitted two comment letters: April 1, 2021 and April 12, 2021
  - Tesoro Refining and Marketing Company LLC submitted comment letter on April 7, 2021
  - Latham and Watkins LLP on behalf of the Regulatory Flexibility Group and the Western States Petroleum Association submitted a comment letter on April 15, 2021
  - Torrance Refining Company LLC submitted two comment letters on April 16, 2021

Comment Letters Received

- Seven environmental and community groups submitted two comment letters:
  - Governing Board on April 1, 2021
  - Staff on April 12, 2021
- Letters expressed concern over recently proposed changes to the rule:
  - Opposes revising BARCT from 2 to 5 ppm for heaters and boilers (≥ 40 MMBtu/hr)
  - Opposes long compliance timelines and alternative compliance plans
  - Opposes start-up, shutdown, and malfunction provisions
    - Concerned provisions are loopholes that allow additional emissions
  - Supports shorter averaging times, believes longer averaging times will result in higher emissions
- Opposes further delay of the Public Hearing for PR 1109.1

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COMMUNITIES FOR A BETTER ENVIRONMENT established 1978
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East Yard Communities for Environmental Justice
COALITION FOR CLEAN AIR
SIERRA CLUB
CENTER for BIOLOGICAL DIVERSITY

April 1, 2021

VIA: ELECTRONIC MAIL ONLY

William A. Burke, Ed.D., Chair (c/o Marie Patrick (mwpatrick@aqmd.gov))
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Carlos Rodriguez (crodriguez@yorbalindaca.gov)
Janice Rutherford (supervisorrutherford@sbcounty.gov)

Re: Proposed Delay of Refinery Rule 1109.1 to Septem

Dear Governing Board Members,

The undersigned organizations write to express concern ab
to delay finalizing Refinery Rule 1109.1 to September 2021
to adopting Refinery Rule 1109.1 by October 2019. Since
postponed finalizing this rule several times, with the most

These delays have only weakened the regulation, including
increased pollution and diminished accountability:

- Increased emission limits from 2ppm to 5ppm
- speculative reasons and generalizations;
- Long compliance timelines extending to 2034 t
- whether to comply with emission limits for vari
- Startup, shutdown, and malfunction loopholes
- accountability and contravene federal law; and
- Emissions averaging times of 24-hours that allo
- pollution releases into surrounding communitie

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April 12, 2021

VIA: ELECTRONIC MAIL ONLY (mkrause@aqmd.gov)

Michael Krause
Planning & Rules Manager
South Coast AQMD
21865 Copley Dr.
Diamond Bar, CA 91765

Re: Proposed Changes to Refinery Rule 1109.1

Dear Mr. Krause:

The undersigned organizations submit these comments concerning recent proposed changes to Refinery Rule 1109.1. Over the last month, the South Coast Air Quality Management District (South Coast AQMD) has made several concessions to petroleum refineries under Refinery Rule 1109.1. These changes have diminished the potential emissions reductions under the regulation and are not only concerning, but also unjustified. The reasons provided by the agency for these rule changes are based on broad generalizations and speculation. Moreover, these changes conflict with the Health and Safety Code and other legal mandates, as well as the agency's own analysis and evidence. In the aggregate, these proposed rule changes have weakened the rule by allowing for increased NOx emissions, while undermining accountability and transparency. For the reasons detailed below, the South Coast AQMD must reverse these changes.

***

- **The South Coast AQMD Proposes to Increase the Emissions Limit to 5ppm from 2ppm Based on Speculative and Generalized Safety Concerns.**

The South Coast AQMD's Best Available Retrofit Control Technology (BARCT) analysis concluded that a 2ppm emissions limit is feasible and cost effective for large boilers and heaters. The agency now proposes to weaken this limit based on general assertions made by petroleum refineries that meeting the 2ppm limit would result in safety concerns. These safety assertions are highly speculative. The agency has not verified the number of equipment that would experience safety issues, and based on information presented, it appears these safety concerns would impact a small number of equipment at maybe one or two petroleum refineries. The South Coast AQMD cannot use these safety assertions to move the emissions limit to 5ppm for an *entire* category of equipment across *all* petroleum refineries, the vast majority of which would not experience any safety issues in achieving the 2ppm emissions limit for large boilers and heaters. Rather than increasing the emissions limit across all petroleum refineries, staff should consider alternatives to address any potential safety concerns:

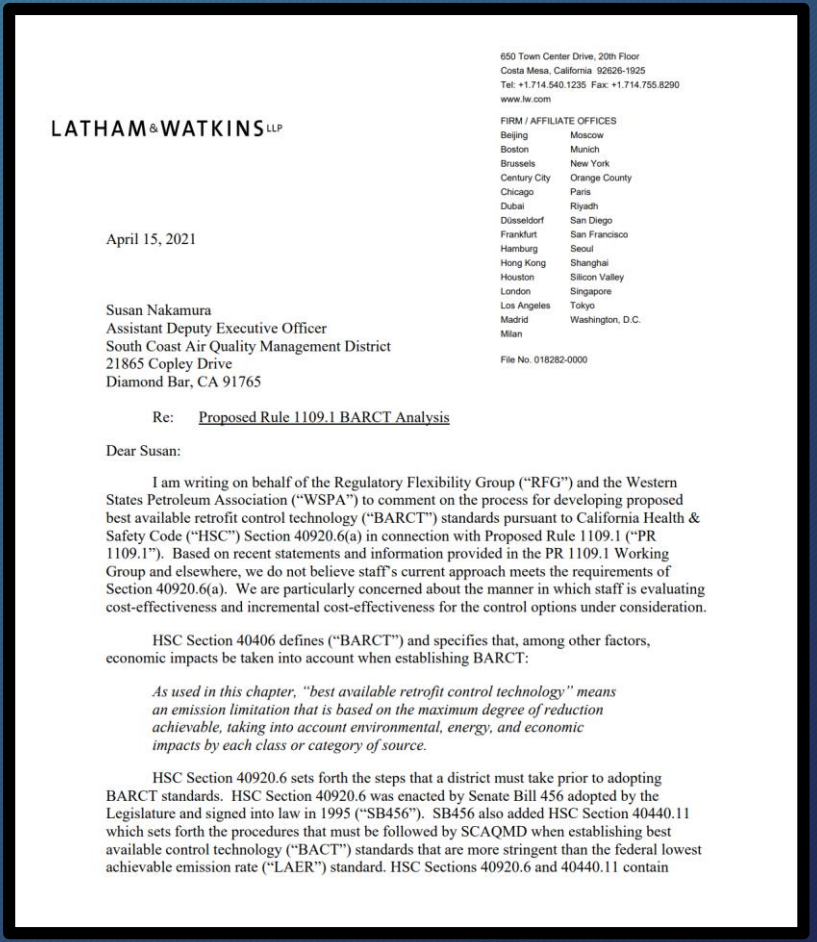
Revised

Comment Letters Received – cont.

- Tesoro Refining and Marketing Company LLC submitted a comment letter on April 7, 2021
- Letter expressed the following concerns over PR 1109.1:
  - Tesoro considers units with existing LNB or SCR to be "well-controlled units"
    - Further retrofits to meet a 5 ppm NOx limit for many of the "well-controlled units" not cost-effective
  - Reiterated their viewpoint that South Coast AQMD is not calculating the incremental cost-effectiveness properly
  - Asked staff to reconsider the BARCT assessment for heaters operating with air preheat systems as they lead to higher NOx concentrations
  - Stated the high cost of operation and maintenance for high-performance SCR systems is not being included in cost-effectiveness calculations
  - Considers a 25-year useful life to be overstated
    - Supports a 10 to 15-year useful life to reflect Governor's Executive Order to transition to zero-emission vehicles by 2035 and carbon neutrality goal by 2045

Comment Letters Received – cont.

- Latham and Watkins LLP submitted a comment letter on April 15, 2021 on behalf of the Regulatory Flexibility Group and the Western States Petroleum Association
- Letter maintains staff misinterprets California Health and Safety Code (HSC) in determining the Cost Effectiveness and Incremental Cost Effectiveness.
- HSC requires staff to:
  - Evaluate cost-effectiveness for each control options identified to be technologically feasible
  - Rank each potential control option and cost-effectiveness from least to most stringent and determine incremental cost-effectiveness
  - Present findings at the public hearing at which the regulation is adopted
- HSC prohibits Districts from imposing a more stringent control option unless it is incrementally cost-effective relative to the next less stringent control option



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File No. 018282-0000

April 15, 2021

Susan Nakamura
Assistant Deputy Executive Officer
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

Re: Proposed Rule 1109.1 BARCT Analysis

Dear Susan:

I am writing on behalf of the Regulatory Flexibility Group ("RFG") and the Western States Petroleum Association ("WSPA") to comment on the process for developing proposed best available retrofit control technology ("BARCT") standards pursuant to California Health & Safety Code ("HSC") Section 40920.6(a) in connection with Proposed Rule 1109.1 ("PR 1109.1"). Based on recent statements and information provided in the PR 1109.1 Working Group and elsewhere, we do not believe staff's current approach meets the requirements of Section 40920.6(a). We are particularly concerned about the manner in which staff is evaluating cost-effectiveness and incremental cost-effectiveness for the control options under consideration.

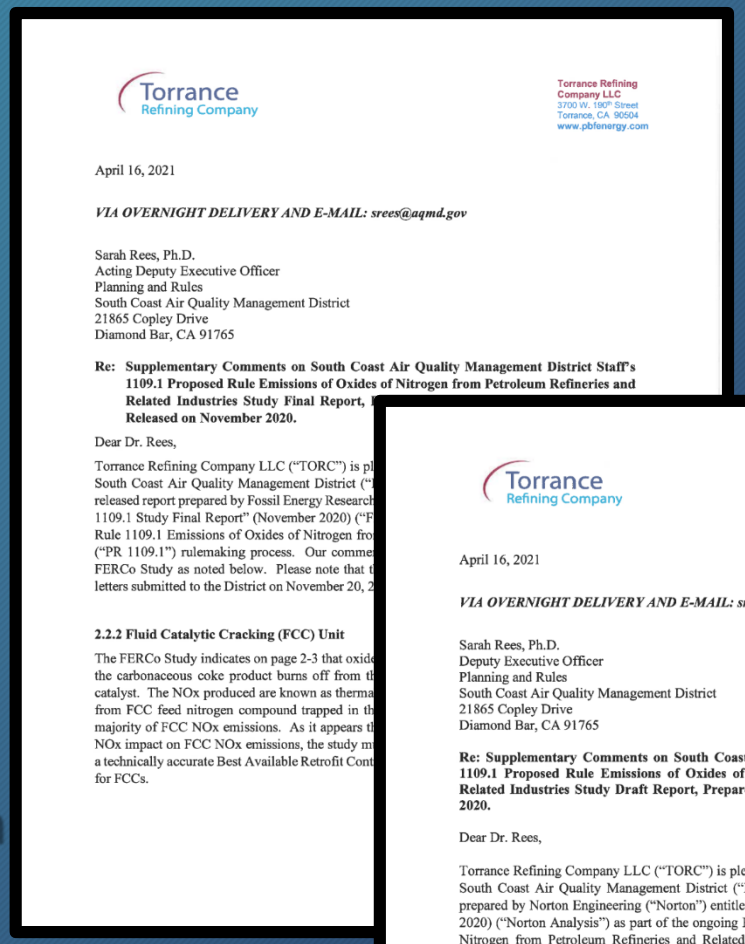
HSC Section 40406 defines ("BARCT") and specifies that, among other factors, economic impacts be taken into account when establishing BARCT:

As used in this chapter, "best available retrofit control technology" means 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.

HSC Section 40920.6 sets forth the steps that a district must take prior to adopting BARCT standards. HSC Section 40920.6 was enacted by Senate Bill 456 adopted by the Legislature and signed into law in 1995 ("SB456"). SB456 also added HSC Section 40440.11 which sets forth the procedures that must be followed by SCAQMD when establishing best available control technology ("BACT") standards that are more stringent than the federal lowest achievable emission rate ("LAER") standard. HSC Sections 40920.6 and 40440.11 contain

Comment Letters Received – cont.

- Torrance Refining Company LLC submitted two comment letters on April 16, 2021 in response to:
  - FERCo final study report (November 2020)
  - Norton study draft report (December 4, 2020)
- Letters expressed concern over some assumptions and perceived deficiencies in the FERCo and Norton reports regarding:
  - NOx formation in FCCU and SRU/TG Incinerators
  - The distinction between ULNB and LNB
  - Feasibility of achieving 2 ppm NOx BARCT limit with one SCR
  - Underestimation of SCR upgrade and ULNB installation cost
  - Combining control devices (e.g., ULNB and SCR)



Torrance Refining Company

Torrance Refining Company LLC
3700 W. 190th Street
Torrance, CA 90504
www.pbfenergy.com

April 16, 2021

VIA OVERNIGHT DELIVERY AND E-MAIL: srees@aqmd.gov

Sarah Rees, Ph.D.
Acting Deputy Executive Officer
Planning and Rules
South Coast Air Quality Management District
21865 Copley Drive
Diamond Bar, CA 91765

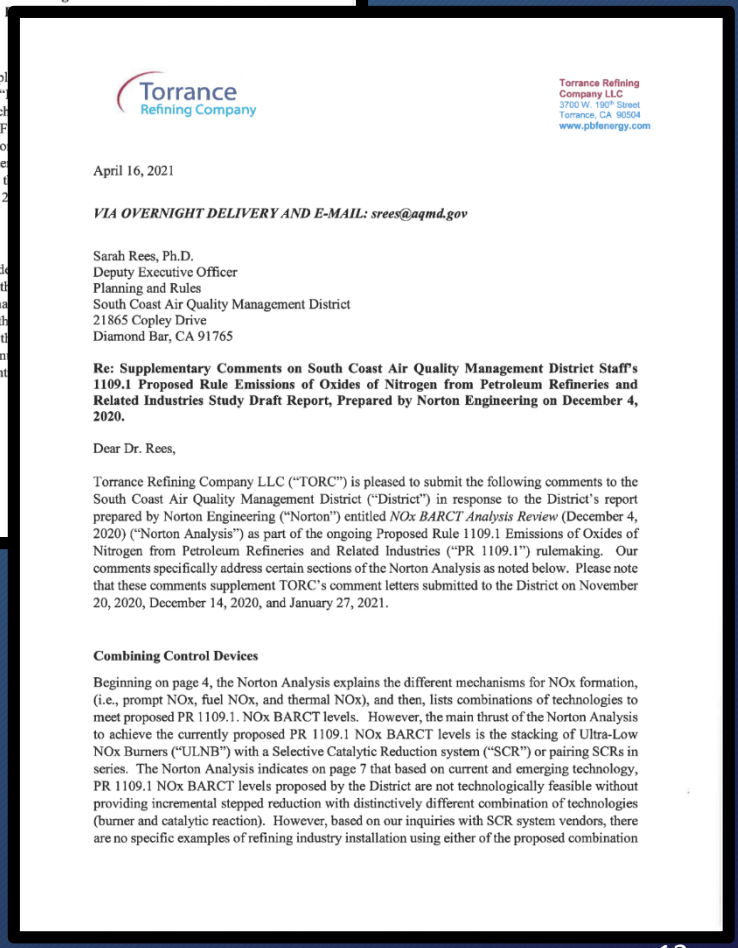
Re: Supplementary Comments on South Coast Air Quality Management District Staff's 1109.1 Proposed Rule Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Industries Study Final Report, [illegible] Released on November 2020.

Dear Dr. Rees,

Torrance Refining Company LLC ("TORC") is pl
South Coast Air Quality Management District ("
released report prepared by Fossil Energy Research
1109.1 Study Final Report" (November 2020) ("F
Rule 1109.1 Emissions of Oxides of Nitrogen fro
("PR 1109.1") rulemaking process. Our comme
FERCo Study as noted below. Please note that t
letters submitted to the District on November 20, 2

2.2.2 Fluid Catalytic Cracking (FCC) Unit

The FERCo Study indicates on page 2-3 that oxid
the carbonaceous coke product burns off from th
catalyst. The NOx produced are known as therma
from FCC feed nitrogen compound trapped in th
majority of FCC NOx emissions. As it appears th
NOx impact on FCC NOx emissions, the study m
a technically accurate Best Available Retrofit Cont
for FCCs.



Torrance Refining Company

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April 16, 2021

VIA OVERNIGHT DELIVERY AND E-MAIL: srees@aqmd.gov

Sarah Rees, Ph.D.
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21865 Copley Drive
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Re: Supplementary Comments on South Coast Air Quality Management District Staff's 1109.1 Proposed Rule Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Industries Study Draft Report, Prepared by Norton Engineering on December 4, 2020.

Dear Dr. Rees,

Torrance Refining Company LLC ("TORC") is pleased to submit the following comments to the South Coast Air Quality Management District ("District") in response to the District's report prepared by Norton Engineering ("Norton") entitled *NOx BARCT Analysis Review* (December 4, 2020) ("Norton Analysis") as part of the ongoing Proposed Rule 1109.1 Emissions of Oxides of Nitrogen from Petroleum Refineries and Related Industries ("PR 1109.1") rulemaking. Our comments specifically address certain sections of the Norton Analysis as noted below. Please note that these comments supplement TORC's comment letters submitted to the District on November 20, 2020, December 14, 2020, and January 27, 2021.

Combining Control Devices

Beginning on page 4, the Norton Analysis explains the different mechanisms for NOx formation, (i.e., prompt NOx, fuel NOx, and thermal NOx), and then, lists combinations of technologies to meet proposed PR 1109.1. NOx BARCT levels. However, the main thrust of the Norton Analysis to achieve the currently proposed PR 1109.1 NOx BARCT levels is the stacking of Ultra-Low NOx Burners ("ULNB") with a Selective Catalytic Reduction system ("SCR") or pairing SCRs in series. The Norton Analysis indicates on page 7 that based on current and emerging technology, PR 1109.1 NOx BARCT levels proposed by the District are not technologically feasible without providing incremental stepped reduction with distinctively different combination of technologies (burner and catalytic reaction). However, based on our inquiries with SCR system vendors, there are no specific examples of refining industry installation using either of the proposed combination

Ongoing Stakeholder Meetings

- Staff is continuing to meet with refineries to discuss:
  - Feedback on proposed i-Plan and b-Plan
  - Site-specific challenges in meeting BARCT limits
  - Concerns about timelines and turnaround schedule
- Staff is continuing to meet with environmental and community groups to discuss:
  - Proposed NOx BARCT limits and implementation schedule
  - Concerns regarding the i-Plan and b-Plan
  - Process in vetting the recently submitted revised cost data
- All stakeholders requested that staff provide further clarity regarding the proposed implementation and compliance pathways

Continued Meetings with Stakeholders

Environmental and Community Groups[1]	Chevron	Marathon	Phillips 66	Torrance	Valero
February 28	February 19	January 27	February 16	January 29	January 29
March 11	February 26	February 17	March 4	February 12	February 24
April 2	April 1	February 24	March 31	February 26	April 16
		March 9		March 12	
		March 19		March 24	
				April 9	

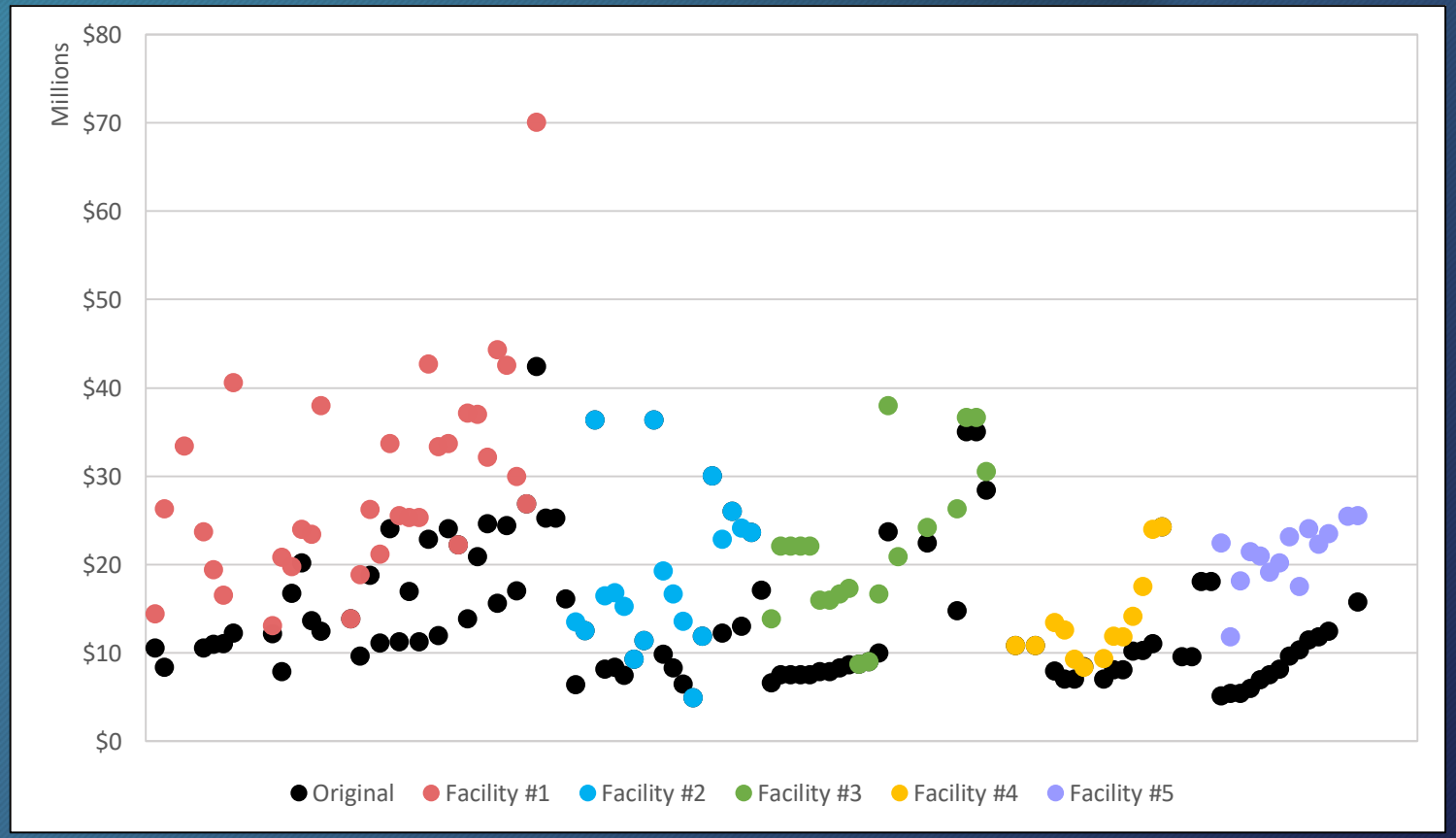
[1] Biological Diversity, Coalition for Clean Air, Earth Justice, Communities for a Better Environment, Natural Resources Defense Council and East Yard Communities for Environmental Justice

Revised Cost and Cost-Effective Reassessment

- Received revised cost from facilities in March
  - Previously received cost for 58 SCR projects
  - 108 new or revised cost estimates
  - Costs provided for various projects and various units
    - SCR, SCR upgrades, wet gas scrubbers, burners, fuel gas treatment, and unit replacement
    - Heaters, boilers, SMR heaters, and FCCUs
  - Costs ranged from $2 MM to $300 MM per project
- Staff is currently reviewing and analyzing cost information
  - Working with facilities for clarification of data submission
  - Meeting with Norton Engineering to discuss their review of the revised cost data
- Facility provided costs are being used to revise the U.S. EPA cost model
  - Cost model used to estimate SCR projects where costs were not provided by facilities
- If costs for a unit were provided by facilities, the provided costs will be used
  - Controls must relate to NOx reductions required by PR 1109.1
- Costs are being compiled and reviewed to reassess BARCT limits

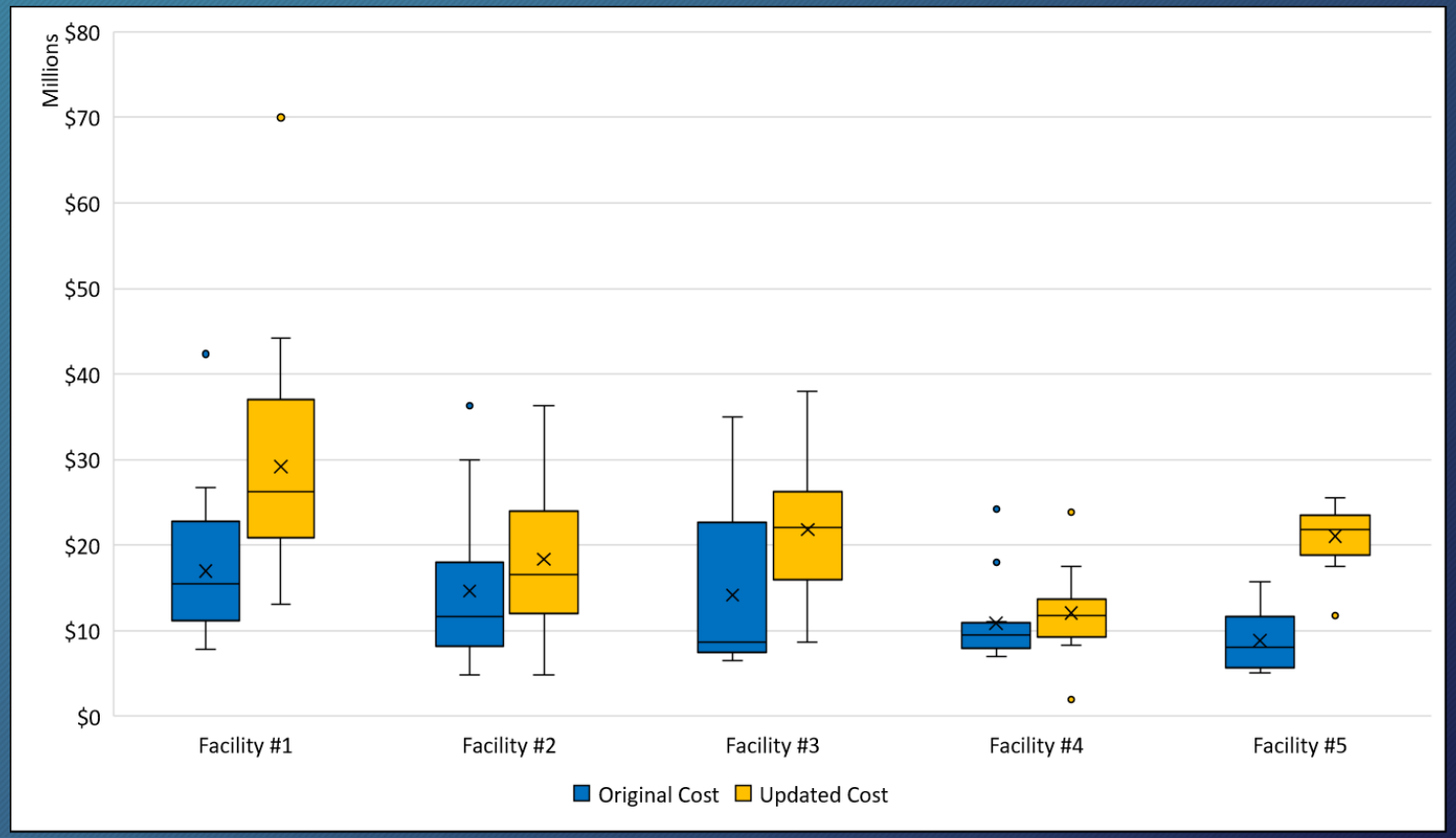
Preliminary Revised Cost Estimates

- Scatter chart provides the difference between the original and revised cost estimates
- Chart includes:
  - Heaters and boilers ≥ 40 MMBtu/hr
  - SCR replacement and upgrades to achieve 5 ppm or less
- Revised cost data is being reviewed by Norton Engineering



Preliminary Revised Cost Estimates (*cont.*)

- Box chart provides difference between the original and revised cost estimates
  - Each box includes the minimum, maximum, and median values
  - Outlier data is noted as a points outside of boxes
- Chart includes:
  - Heaters and boilers ≥ 40 MMBtu/hr
  - SCR replacement and upgrades to achieve 5 ppm or less
- Revised cost data is being reviewed by Norton Engineering



BARCT Implementation and Compliance Plans

Alternative Compliance Options

- Staff has been conducting meetings with stakeholders to discuss the BARCT Implementation Plans (b-Plan) and Implementation Plans (i-Plans)
  - Discussing specific challenges at each facility
  - Considering number of units that require retrofits at each facility to meet proposed NOx limit
  - Requested clarification on how the plans would work together
- i-Plans
  - Trying to accommodate turnaround schedules within the i-Plans to minimize refinery downtime
- b-Plans
  - A few facilities have requested an alternative pathway based on a facility-wide mass cap

Considerations for a Mass Based Approach

- Alternative compliance options must result in emission reductions equivalent to BARCT, as defined in California Health and Safety Code § 40406:

  "an emission limitation that is based on the maximum degree of reduction achievable by each class or category of source, taking into account environmental, energy, and economic impacts."
- BARCT NOx limits must be technically feasible and cost-effective based on class and category of equipment for all affected facilities
  - Cost-effectiveness is an average, there will be individual units with a cost-effectiveness above the threshold that will have to be retrofit to meet BARCT
- Must ensure it complies with AB 617
- Requirements for CEMS, SSM, missing data procedure, etc. would have to be similar to RECLAIM

Challenges with a Facility-Wide Mass Emissions Based Alternative b-Plan Compliance Options

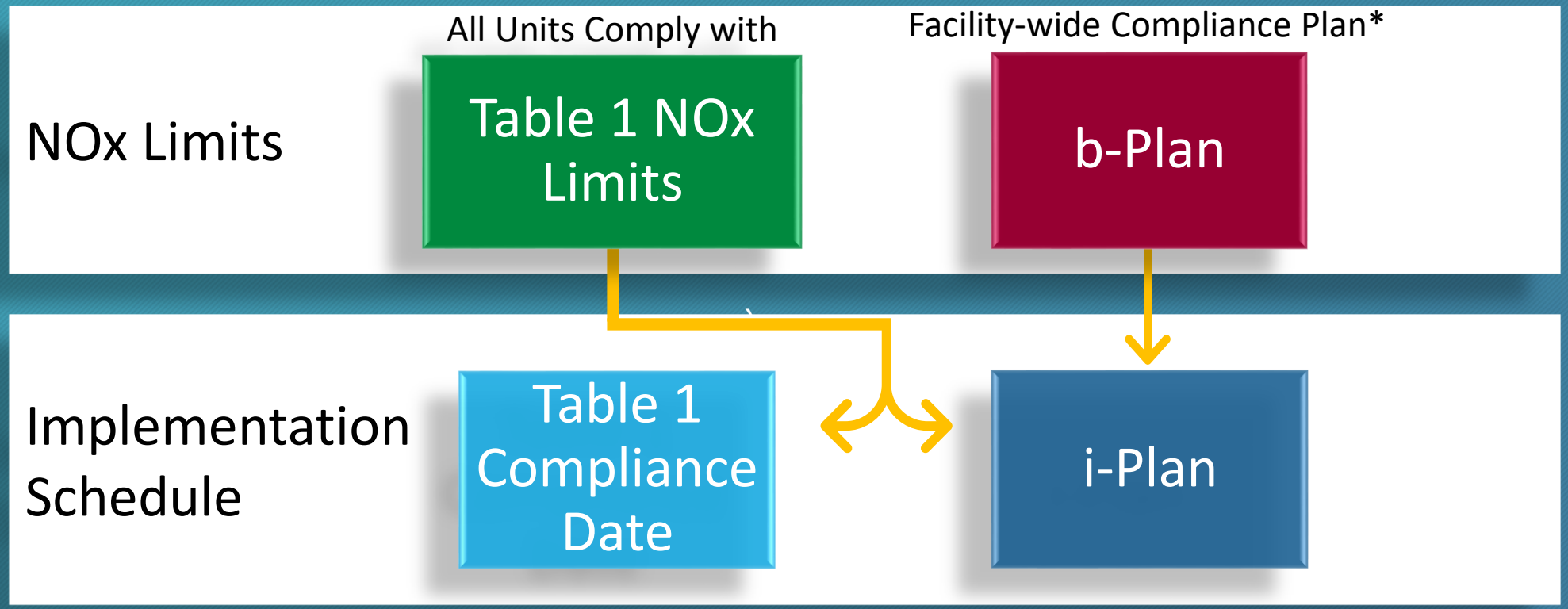
Staff discussing concepts internally

Challenges

- Facility may be forced to reduce production or shutdown if the emissions cap is exceeded leading to an unexpected interruption in fuel supply
- Allowing vastly different compliance approaches could lead to inequities between facilities
- Potentially relieves sources from making any reductions if equipment shutdowns are allowed
- No commitment for per unit limitations, i.e. concentration or mass emission limit

NOx Limits and Implementation Schedule

Current proposal establishes various compliance pathways for BARCT equivalency and the implementation of BARCT requirements



* b-Plan is not required to include units that will be required to meet BARCT limits with Emerging Technology

Compliance with Table 1 NOx Limits

- Facilities with less than six units or that prefer not using the flexibility of the b-Plan, will meet the Table 1 NOx limits
- Facilities with less than six units are be required to submit a permit application by the deadline stated in Table 1 and meet the applicable emission limit 18 months after the permit to construct is issued (subdivision (d)(1))
- Facilities with six or more units can opt to comply with Table 1 emissions limits and comply with the implementation schedule in an approved i-Plan

TABLE 1: NOx AND CO EMISSION LIMITS

STEAM METHANE REFORMER HEATERS				
Equipment Category	NOx (ppmv)	CO (ppmv)	Averaging Time (Rolling Average)	Permit Application Submittal Deadline
	3% O_2			
SMR Heater	5	400	24 hours	July 1, 2022 or pursuant to subdivision (k)

BARCT Equivalent Compliance Plan (b-Plan)

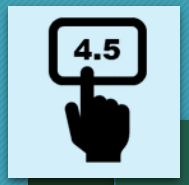
- The b-Plan is designed to address challenging retrofits that can achieve close to the BARCT limits, but would be very costly to meet the proposed BARCT limits
  - Achieve equivalent NOx reductions at reduced cost
  - Can select an alternative NOx concentration limit, provided emissions in aggregate representative of BARCT
- b-Plan will be facility-wide (all facilities within the company) and tailored to each facility's equipment
- A facility NOx **target** will be established as the sum of the mass emissions from all equipment meeting the BARCT limits
- Two approaches to comply being considered:
  - Facility selects a NOx concentration limit that can be met for each unit, provided the total annual emissions are less than or equal to facility NOx **target**
    - One-time demonstration, NOx concentration limit for each unit included on permit
  - Facility demonstrates total emissions are less than or equal to a facility NOx target (mass cap)
    - Require ongoing compliance demonstrations

b-Plan

Review of the Proposed b-Plan

25

Steps to Establish a Concentration b-Plan



Step 1

Operator selects the Alternative BARCT NOx Limit for each unit

Step 2

- Calculate NOx emissions for each unit using:
  - Alternative BARCT NOx Limit in Step 1
  - Use emission data from 2017 as base year activity

Step 3

Calculate the Equivalent Mass Emissions by summing emissions for all units from Step 2

Step 4

- Confirm Equivalent Mass Emissions ≤ Facility BARCT Emission Target
- Return to Step 1, if Equivalent Mass Emissions > Facility BARCT Emission Target

Revised

b-Plan

Example of Calculating the Facility BARCT Emission Target*

- BARCT Control Efficiency is ratio of the PR 1109.1 Table 1 Proposed NOx Limit to the 2017 NOx Concentration
- Facility BARCT Emission Target is the product of:
  - BARCT Control Efficiency
  - 2017 Baseline Emissions
- Total Facility BARCT Emission Target is 26.1 tons/year (remaining emissions)

Category	Size (MMBtu/hr)	2017 Baseline Emissions (tpy)	2017 NOx Conc (ppmv)	PR 1109.1 Table 1 Proposed NOx Limit (ppmv)	BARCT Control Efficiency	Facility BARCT Emission Target (tpy)
Heater	100	8.8	20.0	5.0	75%	2.2
Heater	200	56.4	60.0	5.0	92%	4.7
Heater	150	16.8	40.0	5.0	88%	2.1
Boiler	300	104.4	60.0	5.0	92%	8.7
Heater	130	25.0	50.0	5.0	90%	2.5
Heater	100	6.0	25.0	5.0	80%	1.2
Heater	150	28.2	30.0	5.0	83%	4.7
						26.1

* Example assumes that Table 1 NOx limit for boilers and heaters ≥ 40 MMBtu/hr is 5 ppmv

Revised

b-Plan =

Example of Calculating *Equivalent Mass Emissions*

- Alternative BARCT Control Efficiency is ratio of the Alternative NOx BARCT Limit to the 2017 NOx Concentration
- *Equivalent Mass Emissions* is the product of the
  - Alternative BARCT Control Efficiency
  - 2017 Baseline Emissions
- Total Facility *Equivalent Mass Emissions* is 22.9 tons/year (remaining emissions)
- Emission reductions from units that are shutdown will be removed from the b-Plan

Category	Size (MMBtu/hr)	2017 NOx Conc (ppmv)	Alternative NOx BARCT Limit (ppmv)	Alternative BARCT Control Efficiency	Equivalent Mass Emissions (tpy)
Heater	100	20.0	*8*	60%	3.6
Heater	200	60.0	*4*	93%	3.7
Heater	150	40.0	*3*	93%	1.3
Boiler	300	60.0	*5*	92%	8.7
Heater	130	50.0	*4*	92%	2.0
Heater	100	25.0	*7*	72%	1.7
Heater	150	30.0	*2*	93%	1.9
					22.9

Comparison

- Alternative NOx concentrations may be higher or lower than PR 1109.1 Table 1 Proposed NOx limit
- *Equivalent Mass Emissions* must be less than or equal to Facility BARCT Emission Target

Category	Size (MMBtu/hr)	PR 1109.1 Table 1 Proposed NOx Limit (ppmv)	BARCT Control Efficiency	Facility BARCT Emission Target (tpy)	Alternative NOx BARCT Limit (ppmv)	Alternative BARCT Control Efficiency	Equivalent Mass Emissions (tpy)
Heater	100	5.0	75%	2.2	*8*	60%	3.6
Heater	200	5.0	92%	4.7	*4*	93%	3.7
Heater	150	5.0	88%	2.1	*3*	93%	1.3
Boiler	300	5.0	92%	8.7	*5*	92%	8.7
Heater	130	5.0	90%	2.5	*4*	92%	2.0
Heater	100	5.0	80%	1.2	*7*	72%	1.7
Heater	150	5.0	83%	4.7	*2*	93%	1.9
				26.1			22.9

Additional Details of Concentration b-Plan

- Approach retains the command-and-control structure, but acknowledges certain units may have greater challenges to achieve the proposed NOx BARCT limits in Table 1
- Operator will be required to achieve the Alternative NOx BARCT Limit in lieu of the NOx concentration limits in PR 1109.1 Table 1
  - The alternative NOx concentration limits will be on permit
- Facilities will need to comply with the NOx limit over the averaging time for that equipment type as prescribed in PR 1109.1
- No throughput limitations
- All other concentration-based requirements (e.g., CEMS, SSM, etc) would be applicable

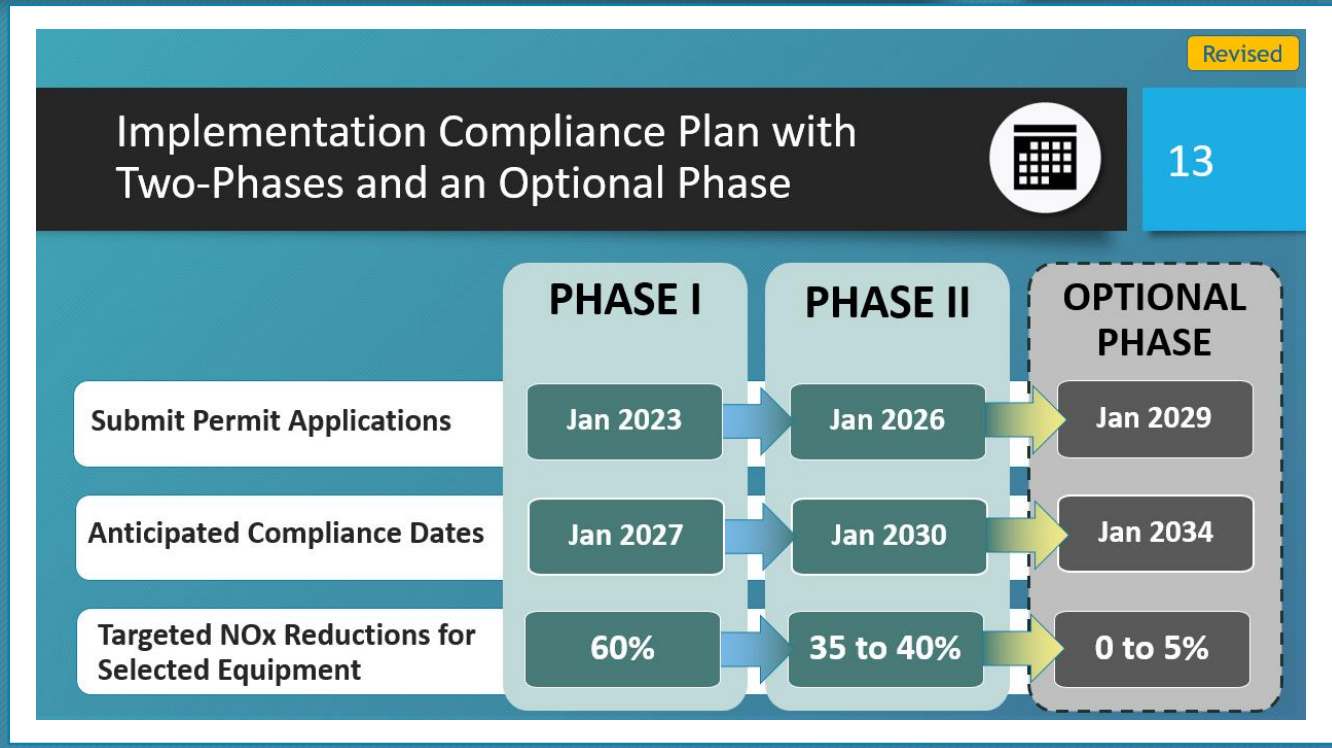
Implementation Plan (i-Plan)

Implementation Plan (i-Plan)

- Establishes a framework to outline which projects will be implemented and within a certain timeframe (phase)
- Each phase of the schedule will be assigned an emission reduction goal
- Facilities can choose which projects will be part of each phase as long as the all projects in that phase meet the emission reduction goal
- The total emission reductions from each phase is the total of the lifetime emission reductions (unit share) for each of the projects
- The unit share is the emission reductions achieved from the unit meeting the BARCT limit compared to their 2017 emissions
  - If a facility elects to comply through a b-Plan, the emission reductions will be calculated based on the alternative NOx limits

i-Plan Original Proposal

- At the last WGM, staff presented a revised implementation plan (i-Plan) to two main phases, with an optional third phase for the most challenging projects or units with an extended turnaround schedule
  - Approach will seek 95 percent of the reductions by 2030, with the remaining 5 percent by 2034
- After discussions with stakeholders on challenges for units with long turnaround schedules, staff proposing an alternative option that:
  - Allows for longer implementation windows to minimize production disruption
  - Frontloads the emissions reductions in the first phase to compensate for longer timeline

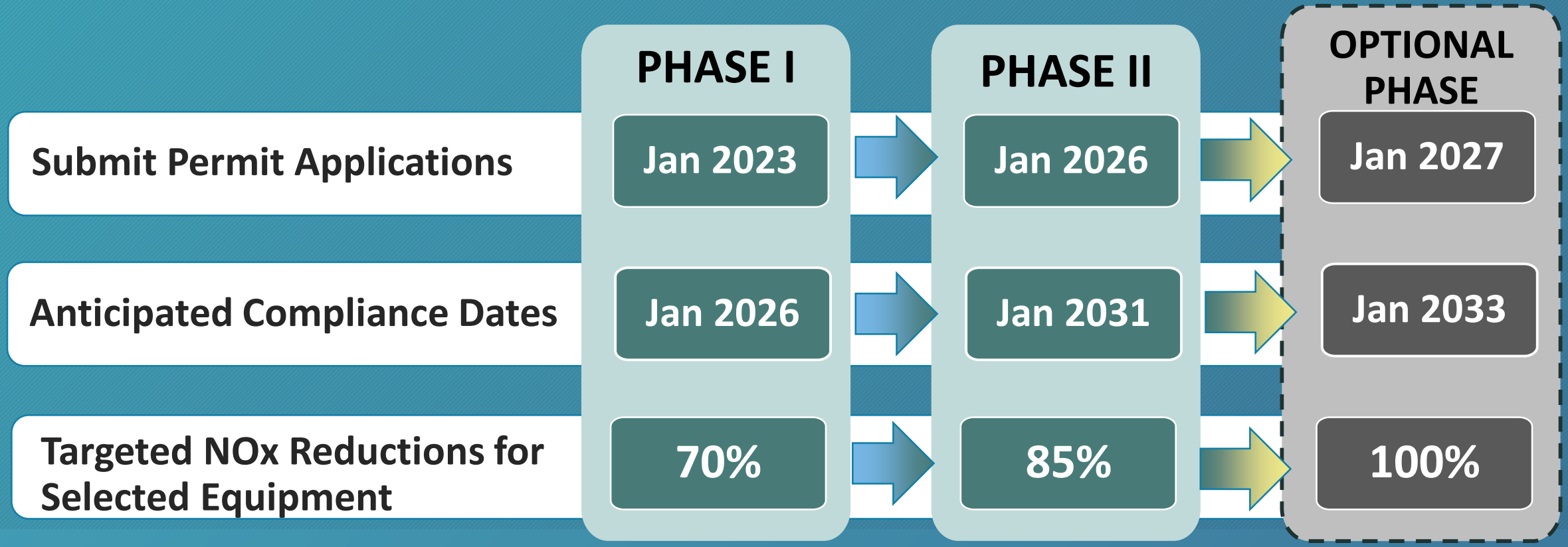


Units with Extended Turn Around Schedules

- Some units at the refineries have extended turnaround schedules
  - For example, the crude unit is the first unit that processes petroleum in any refinery, so these units or related units may have an extended turnaround schedule
    - Critical unit for the operation of the refinery that is only shutdown during major turnarounds
    - Major turnaround may only occur once every 8 to 10 years to minimize disruption to the overall refining process
- Staff is seeking to accommodate turnaround schedules to minimize disruptions at the refineries and to achieve emissions reductions as soon as feasible
- Staff is committed to work closely with the refineries during the permit application submittal and issuance to avoid any costly delays that result in missing a turnaround window

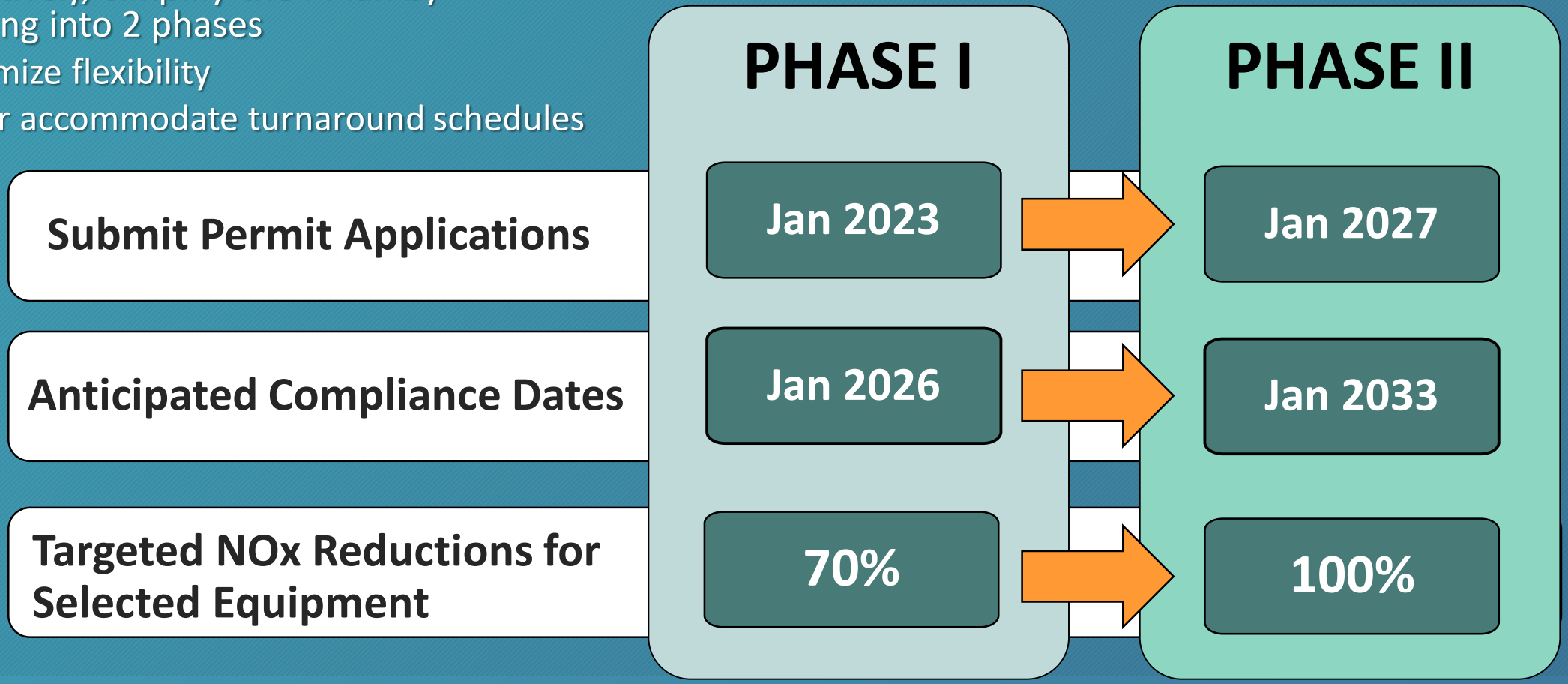
i-Plan Revision to 2 Phase/Optional Phase

- Modified targets in the two phase/optional approach to reflect realistic schedules
- Could achieve greater reductions earlier and final compliance date sooner



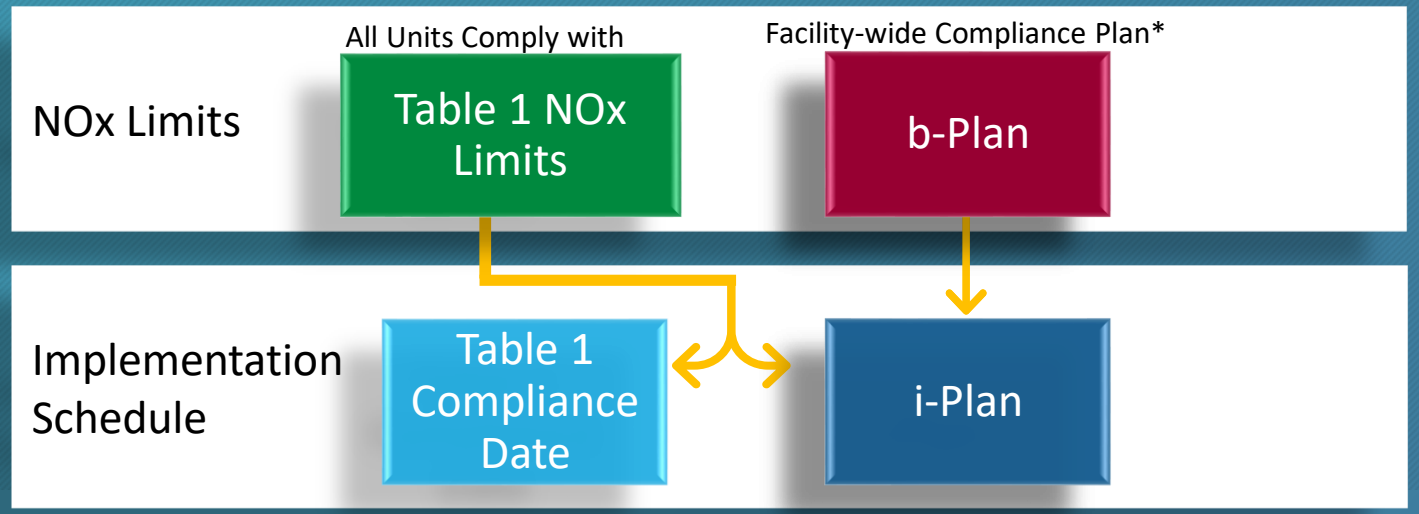
i-Plan Revision to 2 Phase Only (No Optional Phase)

- Alternatively, simplify the i-Plan by collapsing into 2 phases
  - Maximize flexibility
  - Better accommodate turnaround schedules



i-Plan Implementation

- Facilities that opt to comply with Table 1 NOx limits may submit an i-Plan
- Facilities that opt to comply with a b-Plan will be required to submit an i-Plan
- All units that require retrofit will have to be included in the i-Plan other than units that require emerging technology to be installed at the end of useful life
- The following slides have examples of how the i-Plan will work with units complying with:
  - Table 1 NOx limits
  - b-Plan



Example of a Concentration b-Plan and i-Plan

Facility Selects "Not to Exceed" Alternative NOx BARCT Limit

Category	Size (MMBtu/hr)	PR 1109.1 Table 1 Proposed NOx Limit (ppmv)	Alternative NOx BARCT Limit (ppmv)	Total Emissions (tpy)	b-Plan Emission Reduction (tpy)	i-Plan Remaining Emission (tpy)
Heater	100	5	**8**	5.7	2.1	3.6
Heater	200	5	**4**	10.1	6.4	3.7
Heater	150	5	**3**	4.4	3.1	1.3
Boiler	300	5	**5**	18.2	9.5	8.7
Heater	130	5	**4**	5.1	3.1	2.0
Heater	100	5	**7**	2.9	1.2	1.7
Heater	150	5	**2**	7.8	5.9	1.9
Total				54.2	31.3	22.9

Phase I
70% Reduction

Full Compliance
100%

Proposed Rule 429.1: Start-Up and Shutdown Provisions at Petroleum Refineries

Background and Applicability

- Staff initially included start-up and shutdown provisions in PR 1109.1
- Staff has since decided it would be more appropriate to incorporate start-up and shutdown provisions for PR 1109.1 facilities into a companion rule – Proposed Rule 429.1 (PR 429.1)
  - Start-up and shutdown requirements for Rule 1109 – Emissions of Oxides of Nitrogen from Boilers and Process Heaters in Petroleum Refineries are addressed in Rule 429 – Start-Up and Shutdown Exemption Provisions for Oxides of Nitrogen
- PR 429.1 will apply to all units at former RECLAIM facilities and new facilities that are subject to PR 1109.1
  - Petroleum refineries
  - Facilities with related operations to petroleum refineries

Need for Start-Up and Shutdown Provisions

- During start-up and shutdown events, units cannot achieve proposed NOx emission limits when:
  - Unit is not at steady-state conditions
  - Temperature is not optimal for pollution control equipment such as SCR
- RECLAIM does not establish limitations on the length of start-up and shutdown events
  - RECLAIM facilities are required to hold RTCs for all emissions, including excess emissions during start-up and shutdown events
- Some units have permit limits for start-up and shutdown events
  - Limitations can include the length of time and best management practices during start-up and shutdown events, provisions are determined on a case-by-case basis

Start-up and Shutdown Duration Limits

- Start-up and shutdown duration limits from PR 1109.1 were incorporated into PR 429.1
- Table 1 provides start-up and shutdown duration limits for units
- Start-up and shutdown are further limited
  - May not last longer than the time necessary to reach the minimum temperature of any post combustion control
  - Shall not last longer than is necessary to reach stable conditions

Requirements

(1) An owner or operator of a unit shall not exceed the start-up and shutdown time periods specified in Table 1.

TABLE 1: START-UP AND SHUTDOWN DURATION LIMITS

Unit	Not to Exceed per Start-up or Shutdown Event (hours)
Boilers and Process Heaters with a rated heat input capacity < 40 MMBtu/hr, Gas Turbines, Flares, Vapor Incinerators	2
Sulfuric Acid Furnace	24
Boilers and Process Heaters with a rated heat input capacity ≥ 40 MMBtu/hr, Steam Methane Reformer Heaters	48
Steam Methane Reformer with Gas Turbine	60
FCCU, Petroleum Coke Calciner, SRU/TG Incinerators	120

(A) An owner or operator of a unit shall not allow start-up or shutdown time period to last longer than the time that is necessary to reach minimum operating temperature of the exhaust emission control system, if applicable.

(B) An owner or operator of a unit shall not allow start-up and shutdown time period to last longer than is necessary to reach stable conditions.

Efforts to Minimize Emissions During Start-up and Shutdown Events

During start-up and shutdown events, operators must take all possible steps to minimize emissions

An owner or operator of a unit shall take all possible steps to minimize emissions during start-up and shutdown events.

- Includes equipment repairs and adjusting temperatures of post-combustion controls

Requirements for Units with Exhaust Emission Control Systems

(4) An owner or operator of a unit shall install and maintain a calibrated temperature gauge on all units with an exhaust emission control system.

(5) If the temperature of the gas to the inlet of the emission control system is greater than or equal to 450° F, an owner or operator of a unit with an exhaust emission control system shall operate an exhaust emission control system, including the injection of any associated chemical reagent into the exhaust stream to control NOx.

Units with exhaust emission controls are required to install and maintain a calibrated temperature gauge

Units with exhaust emission controls are required to operate the exhaust emission control when the inlet gas temperature is ≥ 450° F

Limit to the Number of Scheduled Start-up and Shutdown Events

- Staff received comments about provision limiting the number of start-up and shutdown events
  - Comment: The proposed rule would authorize facilities to exceed emission limits an undetermined number of times a year for long periods of time
  - Comment: There should not be any limit to the number of start-ups and shutdowns because they are typically driven by emergencies or maintenance needs
- Staff is considering a provision to limit a unit to 10 scheduled start-up and shutdown events per year
  - Provision based on existing Rule 429 requirements that limits units subject to Rule 1109 to a maximum of 10 scheduled start-up or shutdown events per year
- Staff is considering fewer scheduled start-ups and shutdowns for FCCUs, petroleum coke calciners, and SRU/TG incinerators because of the longer start-up and shutdown duration
- Staff is seeking input from stakeholders

Proposed Rule 429.1 Definitions and Recordkeeping

- Staff will include applicable PR 1109.1 definitions in PR 429.1
- PR 429.1 requires records to be maintained on-site for 5 years
  - Operating log
  - List of scheduled start-up(s) and shutdown(s)

Recordkeeping

(1) An owner or operator of a unit shall maintain the following records on-site for 5 years:

(A) An operating log containing the date, time, duration, reason for the start-up(s) and shutdown(s), and signature of a supervisor following each start-up and shutdown; and

(B) A list of scheduled start-ups and shutdowns.

Other PR 429.1 Provisions

- In response to stakeholder comments, staff included an exemption from start-up and shutdown duration limits and recordkeeping when fuel is burned exclusively in a pilot light

> An owner or operator of a unit is exempt from paragraphs (d)(1) and (e)(1) when fuel is burned exclusively in a pilot light.

- Staff is considering additional provisions to address:
  - Maintenance of an exhaust emission control system (e.g. SCR)
  - Refractory dry out
- Staff is seeking input from stakeholders

ClearSign™ Technologies Update

ClearSign Update
World Oil Demonstration Project

- Partnership of ClearSign, World Oil, and SCAQMD
- Vertical cylindrical, natural draft Crude Heater
- 5 burners, 39MM BTU/hr (HHV) total fired duty
- Multi-burner factory test completed November 2020
  - Sub 6ppm NOx corrected to 3% oxygen at max rate in multi-burner test
- March 2021 installation
  - Burners installed during turnaround commencing Feb 21st
  - Installation took 3 days
  - March 1st start up
  - Full firing rate achieved with all 5 burners operating
  - Burners currently operating with some modifications resulting in higher than expected NOx performance
  - Replacement components being fabricated for installation in 2022

ClearSign Update
Second Los Angeles Project

- Confidential client within SCAQMD
- Vertical cylindrical, natural draft reboiler heater
- 3 burners, 12.5 MM BTU/hr (HHV) total fired duty
- Co-fires natural gas and process offgas
- March 2021 successful installation
  - March 10, 2021 start up
  - Full firing rate achieved with all 3 burners operating
  - NOx emissions range from 4.5-6.5 ppm NOx (corrected to 3% O2)
  - Meets 7 ppm NOx guarantee
  - Source test scheduled for April

Next Steps

- Continue Discussions with Stakeholders
- Complete Cost-Effectiveness and BARCT Reassessment
- Release Preliminary Draft Staff Report and Rule Language
- Public Workshop
- Public Hearing September 2021

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