PROPOSED RULE 1118.1
Control of Emissions From Non-Refinery Flares

South Coast Air Quality Management District

Diamond Bar, California

June 12, 2018

Progress Since Last Meeting

- Last Working Group Meeting – April 4th
- Met with key stakeholders:
  - ✓ Southern California Alliance of Publically Owned Treatment Works (SCAP)
  - ✓ Western States Petroleum Association (WSPA)
  - ✓ Eastern Municipal Water District
  - ✓ City of San Bernardino
- Received nine comment letters
- Further evaluated and revised rule concepts, emission inventory, and cost-effectiveness

Comment Letters received to date:

Organization	**Date Received**
California Independent Petroleum Association (CIPA)	3/22/2018
Michael Salman	3/28/2018
	3/7/2018
	3/20/2018
Rancho LPG Holdings LLC	5/15/2018
Signal Hill Petroleum	3/22/2018
Sempra Utilities	4/2/2018
SCAP	4/4/2018
	3/30/2018

Concerns Raised by Stakeholders

- Difficult to commit to specific beneficial use percentage
- Initial proposal not cost effective for all applications
- Emission reductions too low to justify flare replacement

Goals of Proposed Rule 1118.1

- Minimize routine flaring
- Modernize old flares that routinely flare
- Encourage beneficial use

ULTIMATE GOAL: REDUCE NOX EMISSIONS AND MINIMIZE FLARING

Challenges By Industry

Wastewater

- Constant gas production
- Low gas quality/ high clean-up cost
- Difficult to commit to beneficial use
  - Equipment downtime
  - Fluctuating gas supply

Landfill

- Constant gas production at active landfills
- Low gas quality/ high clean-up cost
- Diminishing quality and quantity of gas overtime at closed landfills

Oil & Gas

- Stringent pipeline standards
- Need to account for unknown gas volume
- High cost of infrastructure for pipeline connection

Addressing Industries' Challenges and Concerns

Include different requirements for each industries

Reduce the cost impact by:

- Allowing facilities to operate 0.060 lb/MMBtu flare for "non-routine use"
- Providing reasonable timeframe to prepare and install new equipment

Include different expectation for closed landfills

Re-assess emissions baseline and refine cost effectiveness calculation

New Rule Concepts

Existing flares to meet 0.060 lb/MMBtu NOx limit within three years

- Candlestick and old enclosed flares
- Burner replacement possible for enclosed flares

Allow 0.060 lb/MMBtu NOx flares provided facilities stay below established threshold
(Additional information on threshold in next slide)

- If threshold exceeded for a certain time period
  - Replace with 0.025 lb/MMBtu NOx limit flare
  - Submit plan to reduce flaring below threshold

Set NOx limit of 0.025 lb/MMBtu

- Already required for Major Sources
- Assessing cost effectiveness for minor sources

Threshold Concepts

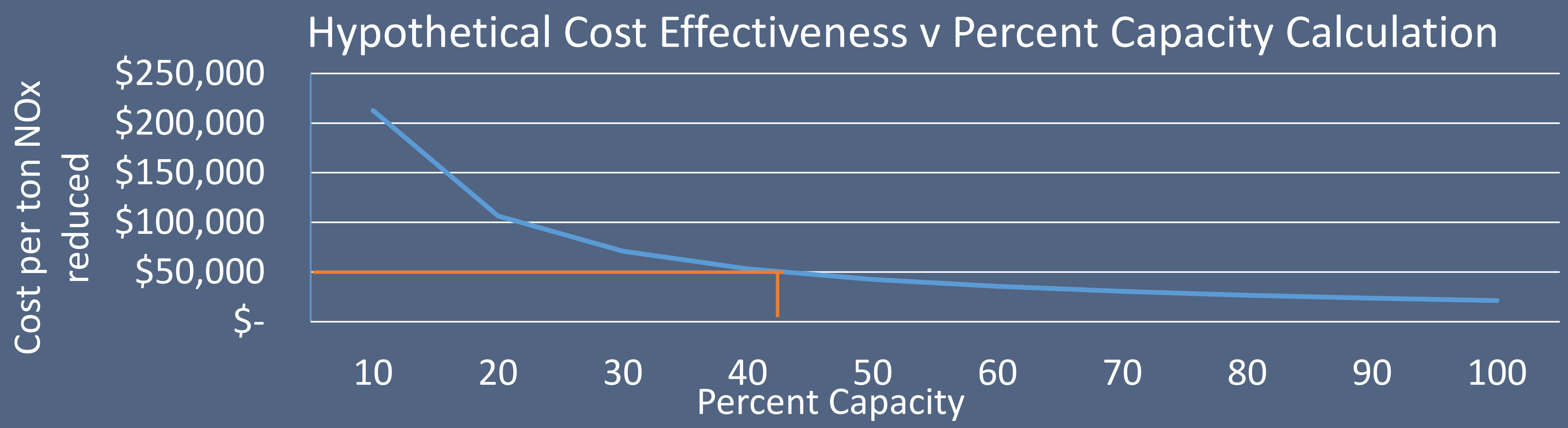
- **Goal → Minimize routine flaring**
  - ✓ Evaluate need for flaring and appropriate threshold
  - ✓ Consider threshold based on:
    - Capacity limit
    - Time limits
    - NOx emission limit
    - Volume limit
  - ✓ Cost effectiveness could guide threshold determination

Threshold Concepts (cont.)

- Establishing the threshold
  - ✓ Evaluate available flare data
    - Permit data - rating or size
    - AER – throughput, NOx emissions
    - Consider size of flare and industry
  - ✓ Evaluate cost effectiveness
    - Replacing low-use units not cost effective
    - Calculate when replacement becomes cost effective
  - ✓ Seek stakeholder feedback

Threshold Concepts (cont.)

- Example of cost effective threshold calculation based on percent capacity
- Calculate cost effectiveness of replacing a flare operating from 0 - 100%
- Similar approach could be employed for other metrics
  - ✓ Time, NOx, volume, or Btu threshold



- Further examples follow after cost effectiveness slides

COST EFFECTIVENESS CALCULATION

Cost Effectiveness

- 2016 AQMP established a threshold of $50,000/ton NOx reduced
- Rule cost effectiveness considers number of flare replacement and NOx reduced
- Staff considers:
  - ✓ Capital Costs (unit cost plus installation)
  - ✓ Annual Operating and Maintenance (O&M) Costs
  - ✓ Equipment life
  - ✓ Tons NOx reduced
- Calculation based on the discount cash flow methodology which uses present worth value (PWV)
  - ✓ Present value is the current worth of a future sum of money (e.g. the annual operating costs) given a specified interest rate

Sample Cost Effective Calculation

Rating:	120 MMBtu/hr	Interest rate:	4%
Operation:	24/7	Capital Cost:	$2.6 million
Capacity:	70%	Annual O&M cost:	$460,000/year
Service Life:	25 years		

Present Value Factor (PVF): 15.62

$$PVF = \frac{(1+r)^N - 1}{r * (1+r)^N}$$

r = interest

N = number of cycles

Cost Effectiveness : $\frac{Initial\ Capital\ Investiment + (Annual\ O\&M\ x\ PVF)}{Emission\ Reductions\ x\ Years\ of\ Equipment\ Life}$

Sample Cost Effective Calculation (cont.)

Present Value of Capital Costs:	\$2.6 mil
Present Value of Annual cost in 25 years:	\$7.2 mil
Total 25-Year Capital Cost:	\$9.8 mil

$$\mathit{Emission\ Reduction}:\ \underbrace{120\,\frac{MMBtu}{hour}}_{\text{Capacity}}\ x\ \underbrace{0.035\,\frac{lb}{MMBtu}}_{\text{NOx Emission Reduction}}\ x\ \underbrace{\frac{24\ hours}{day}}_{\text{Operation}}\ x\ \underbrace{70\%}_{\text{Percent Capacity}}\ = 71\text{ lbs / day}$$

Emission Reduction:	71 lbs/day or 13 tons/year
Emission Reduction lifetime:	325 tons
Cost per ton NOx removed:	\$30,108 / ton

$$\text{Cost Effectiveness}: \frac{\$2.6\ mil + (\$460{,}000\ x\ 15.62)}{13\frac{tons}{yr}x\ 25\ years} = \frac{\$2.6\ mil + \$7.2\ mil}{325\ tons} = \frac{\$9.8\ mil}{325\ tons} = \$30{,}108 \text{ / ton}$$

Current Cost Estimates Received

Industry	Size (MMBtu/hr)	Flare Type	Capital Cost	Annual Cost	Cost/ton NOx reduced[1]
Oil & Gas	40	CEB 1200	$410,000	$30,000	$8,000
	17	CEB 500	$420,000	$19,000	$16,000
	39	CEB 800-CA	$350,000	$30,000	$7,800
Landfill	167	Zink "ZULE"	$1.4 mil	$220,000	$11,000
	120	Zink "ZULE"	$2.6 mil	$460,000	$30,000

1. Based on assumptions listed on slide 13 (e.g. flare operates 24/7 at 70% capacity)

Current Cost Estimates Received

Industry	Size (MMBtu/hr)	Flare Type	Capital Cost	Annual Cost	Cost/ton NOx reduced[1]
Waste water	75.6	Zink "ZULE"	$1.8 mil	$122,000[2]	$18,000
	27 x 3 Flares[3]	CEB 800	$2.0 mil	$122,000[2]	$17,000
	42.6 x 3 Flares[3]	Zink "ZULE"	$1.8 mil	$122,000[2]	$10,000
	39.3[3]	Zink "ZULE"	$1.5 mil	$122,000[2]	$32,000
	40 x 2 Flares	CEB 350	$1.2 mil	$70,000	$11,000

1. Based on assumptions listed on slide 13 (e.g. flare operates 24/7 at 70% capacity)
2. Based on highest O&M cost estimate for existing flare
3. Projects in design phase

Cost Effectiveness Calculation for PR1118.1

Determine number of flare replacements once rule concept finalized

Calculate applicable emission reductions

Estimate cost of flare replacement based on:

- Industry (landfill, wastewater, oil and gas)
- Size

THRESHOLD CALCULATIONS BASED ON COST ESTIMATES RECEIVED

Threshold Calculations

Industry	Size (MMBtu/hr)	Capital Cost	Annual Cost	Cost/ton NOx reduced[1]	%Capacity to reach $50k/ton
Oil & Gas	40	$410,000	$30,000	$8,000	**12%**
	17	$420,000	$19,000	$16,000	**22%**
	39	$350,000	$30,000	$7,800	**11%**
Landfill	167	$1.4 mil	$220,000	$11,000	**16%**
	120	$2.6 mil	$460,000	$30,000	**43%**

1. Based on assumptions listed on slide 13 (e.g. flare operates 24/7 at 70% capacity)

Threshold Calculations

Industry	Size (MMBtu/hr)	Capital Cost	Annual Cost	Cost/ton NOx reduced[1]	%Capacity to reach $50k/ton
Waste water	75.6	$1.8 mil	$122,000[2]	$18,000	26%
	27 x 3 Flares[3]	$2.0 mil	$122,000[2]	$17,000	25%
	42.6 x 3 Flares[3]	$1.8 mil	$122,000[2]	$10,000	16%
	39.3[3]	$1.5 mil	$122,000[2]	$32,000	45%
	40 x 2 Flares	$1.2 mil	$70,000	$11,000	16%

1. Based on assumptions listed on slide 13 (e.g. flare operates 24/7 at 70% capacity)
2. Based on highest O&M cost estimate for existing flare
3. Projects in design phase

OTHER RULE PROVISIONS

Flare Definition

FLARE means a combustion device that oxidizes combustible gases or vapors, **where the combustible gases or vapors being destroyed are routed directly into the burner**.

- Afterburners and thermal oxidizers route combustible gases or vapors into the chamber for destruction
  - ✓ Flares that combust gases or vapors in the chamber (e.g. after the burner) would be subject to PR1118.1, unless the burner is directly fed with 100% natural gas
    - Regenerative flares that combust regenerative gas would be subject to PR1118.1, unless the burner is directly fed with 100% natural gas
- Rule 1147 emission limits apply to burners in units fueled by 100% natural gas

Exemptions

Addition of Subdivision (g) Exemptions

The provisions of this rule shall not apply to owners or operators of flares:

(A) Operating at petroleum refineries, sulfur recovery plants, and hydrogen production plants subject to District Rule 1118 – Control of Emissions from Refinery Flares;

(B) Using 100% natural gas directed into the flare burner to oxidize combustible gases or vapors and are subject to District Rule 1147 – NOx Reductions from Miscellaneous Sources NOx emission limits; or

(C) Operating at closed landfills generating less than 1,000 MMscf per year.

Exemptions - continued

Paragraph (g)(2)

An owner or operator of a flare subject to this rule shall not be required to meet the emission limits in Table 1 provided the owner or operator meets the provisions specified in either subparagraph (g)(2)(A), or (g)(2)(B), and the flare has a permit that specifies conditions that limits the applicable NOx emissions or the operating hours consistent with the following subparagraphs:

(A) Operates a flare that emits less than 30 pounds per calendar month of NOx;

(B) Operates a flare less than 200 hours per year.

Other Changes under Consideration

- Allow fuel meters per flare station instead of per flare
- Remove ultrasonic meter requirement
- Clarify the Source Test section
- Extend time required for Source Test to one-year

EMISSION INVENTORY

Emission Inventory

- AQMP used top down approach
  - ✓ Attributed all NOx emissions from point sources to flaring
- Initial estimates during rule development included:
  - ✓ Pounds of NOx/year from Annual Emission Reports (AER)
  - ✓ Potential to emit assumptions for facilities without any AER data
- Current estimates focusing on:
  - ✓ Throughput from AER data - average of 2015-2017
  - ✓ Surveys will be sent to sources with no AER data
  - ✓ NOx concentration limit from permit

Emission Inventory

Baseline calculations:

$$Emission\ Baseline\left(\frac{lbs}{year}\right) = Throughput\ \left(\frac{MMSCF}{year}\right) * \frac{Btu}{SCF} * Permit\ Concentration\ Limit\ \left(\frac{lbs}{MMBtu}\right)$$

Assumptions:

Industry Type	Btu/scf
Oil & Gas Production	1000
Landfills	500
Closed Landfills	400
Wastewater Treatment	600
Other Flaring	1000

Emission Inventory

AQMP Emission Inventory **2.4 tpd**	Initial Rule Emission Inventory **0.85 tpd**	Current Concept Emission Inventory **> 1 tpd**
+ • Upper level estimate	• Majority of emissions based on data reported by facilities	• Three year average throughput • Reflects actual use of flare
– • Overestimated emissions from flares	• Using potential to emit for non-AER facilities could overestimate emissions • Found anomalies in emission factors in AER	• Need to use default Btu/scf values for calculation • Inventory incomplete – need further data

Next Steps for Rule Development

- Select thresholds
- Update rule language to reflect stakeholder comments
- Finalize cost-effectiveness analysis
- Establish next Working Group meeting date
- Provide Preliminary Draft Staff Report
- Update Public Hearing date