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:

<table>
<thead>
<tr>
<th>Organization</th>
<th>Date Received</th>
</tr>
</thead>
<tbody>
<tr>
<td>California Independent Petroleum Association (CIPA)</td>
<td>3/22/2018</td>
</tr>
<tr>
<td>Michael Salman</td>
<td>3/28/2018</td>
</tr>
<tr>
<td>Rancho LPG Holdings LLC</td>
<td>3/20/2018</td>
</tr>
<tr>
<td>Signal Hill Petroleum</td>
<td>5/15/2018</td>
</tr>
<tr>
<td>Sempra Utilities</td>
<td>4/2/2018</td>
</tr>
<tr>
<td>SCAP</td>
<td>4/4/2018</td>
</tr>
<tr>
<td>3/30/2018</td>
<td></td>
</tr>
</tbody>
</table>
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 industry

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
    o Permit data - rating or size
    o AER – throughput, NOx emissions
    o Consider size of flare and industry
  ✓ Evaluate cost effectiveness
    o Replacing low-use units not cost effective
    o 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rating:</td>
<td>120 MMBtu/hr</td>
</tr>
<tr>
<td>Operation:</td>
<td>24/7</td>
</tr>
<tr>
<td>Capacity:</td>
<td>70%</td>
</tr>
<tr>
<td>Service Life:</td>
<td>25 years</td>
</tr>
<tr>
<td>Interest rate:</td>
<td>4%</td>
</tr>
<tr>
<td>Capital Cost:</td>
<td>$2.6 million</td>
</tr>
<tr>
<td>Annual O&amp;M cost:</td>
<td>$460,000/year</td>
</tr>
<tr>
<td>Present Value Factor (PVF):</td>
<td>15.62</td>
</tr>
</tbody>
</table>

**Present Value Factor (PVF):**

\[
PVF = \frac{(1 + r)^N - 1}{r \times (1 + r)^N}
\]

- \( r \) = interest
- \( N \) = number of cycles

**Cost Effectiveness:***

\[
\text{Initial Capital Investment} + \left( \text{Annual O&M x PVF} \right) / \left( \text{Emission Reductions x Years of Equipment Life} \right)
\]
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

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

Cost Effectiveness: \[
\frac{$2.6 \text{ mil} + ($460,000 \times 15.62)}{13 \frac{\text{tons}}{\text{yr}} \times 25 \text{ years}} = \frac{$2.6 \text{ mil} + $7.2 \text{ mil}}{325 \text{ tons}} = \frac{$9.8 \text{ mil}}{325 \text{ tons}} = $30,108 / \text{ton}
\]
<table>
<thead>
<tr>
<th>Industry</th>
<th>Size (MMBtu/hr)</th>
<th>Flare Type</th>
<th>Capital Cost</th>
<th>Annual Cost</th>
<th>Cost/ton NOx reduced&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>40</td>
<td>CEB 1200</td>
<td>$410,000</td>
<td>$30,000</td>
<td>$8,000</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>CEB 500</td>
<td>$420,000</td>
<td>$19,000</td>
<td>$16,000</td>
</tr>
<tr>
<td></td>
<td>39</td>
<td>CEB 800-CA</td>
<td>$350,000</td>
<td>$30,000</td>
<td>$7,800</td>
</tr>
<tr>
<td>Landfill</td>
<td>167</td>
<td>Zink &quot;ZULE&quot;</td>
<td>$1.4 mil</td>
<td>$220,000</td>
<td>$11,000</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>Zink &quot;ZULE&quot;</td>
<td>$2.6 mil</td>
<td>$460,000</td>
<td>$30,000</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Industry</th>
<th>Size (MMBtu/hr)</th>
<th>Flare Type</th>
<th>Capital Cost</th>
<th>Annual Cost</th>
<th>Cost/ton NOx reduced¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste water</td>
<td>75.6</td>
<td>Zink &quot;ZULE&quot;</td>
<td>$1.8 mil</td>
<td>$122,000²</td>
<td>$18,000</td>
</tr>
<tr>
<td></td>
<td>27 x 3 Flares³</td>
<td>CEB 800</td>
<td>$2.0 mil</td>
<td>$122,000²</td>
<td>$17,000</td>
</tr>
<tr>
<td></td>
<td>42.6 x 3 Flares³</td>
<td>Zink &quot;ZULE&quot;</td>
<td>$1.8 mil</td>
<td>$122,000²</td>
<td>$10,000</td>
</tr>
<tr>
<td></td>
<td>39.3³</td>
<td>Zink &quot;ZULE&quot;</td>
<td>$1.5 mil</td>
<td>$122,000²</td>
<td>$32,000</td>
</tr>
<tr>
<td></td>
<td>40 x 2 Flares</td>
<td>CEB 350</td>
<td>$1.2 mil</td>
<td>$70,000</td>
<td>$11,000</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Industry</th>
<th>Size (MMBtu/hr)</th>
<th>Capital Cost</th>
<th>Annual Cost</th>
<th>Cost/ton NOx reduced</th>
<th>%Capacity to reach $50k/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas</td>
<td>40</td>
<td>$410,000</td>
<td>$30,000</td>
<td>$8,000</td>
<td>12%</td>
</tr>
<tr>
<td></td>
<td>17</td>
<td>$420,000</td>
<td>$19,000</td>
<td>$16,000</td>
<td>22%</td>
</tr>
<tr>
<td></td>
<td>39</td>
<td>$350,000</td>
<td>$30,000</td>
<td>$7,800</td>
<td>11%</td>
</tr>
<tr>
<td>Landfill</td>
<td>167</td>
<td>$1.4 mil</td>
<td>$220,000</td>
<td>$11,000</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td>120</td>
<td>$2.6 mil</td>
<td>$460,000</td>
<td>$30,000</td>
<td>43%</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Industry</th>
<th>Size (MMBtu/hr)</th>
<th>Capital Cost</th>
<th>Annual Cost</th>
<th>Cost/ton NOx reduced&lt;sup&gt;1&lt;/sup&gt;</th>
<th>%Capacity to reach $50k/ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>75.6</td>
<td>$1.8 mil</td>
<td>$122,000&lt;sup&gt;2&lt;/sup&gt;</td>
<td>$18,000</td>
<td>26%</td>
</tr>
<tr>
<td></td>
<td>27 x 3 Flares&lt;sup&gt;3&lt;/sup&gt;</td>
<td>$2.0 mil</td>
<td>$122,000&lt;sup&gt;2&lt;/sup&gt;</td>
<td>$17,000</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>42.6 x 3 Flares&lt;sup&gt;3&lt;/sup&gt;</td>
<td>$1.8 mil</td>
<td>$122,000&lt;sup&gt;2&lt;/sup&gt;</td>
<td>$10,000</td>
<td>16%</td>
</tr>
<tr>
<td></td>
<td>39.3&lt;sup&gt;3&lt;/sup&gt;</td>
<td>$1.5 mil</td>
<td>$122,000&lt;sup&gt;2&lt;/sup&gt;</td>
<td>$32,000</td>
<td>45%</td>
</tr>
<tr>
<td></td>
<td>40 x 2 Flares</td>
<td>$1.2 mil</td>
<td>$70,000</td>
<td>$11,000</td>
<td>16%</td>
</tr>
</tbody>
</table>

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 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
Baseline calculations:

\[
\text{Emission Baseline } \left( \frac{\text{lbs}}{\text{year}} \right) = \text{Throughput } \left( \frac{\text{MMSCF}}{\text{year}} \right) \times \frac{\text{Btu}}{\text{SCF}} \times \text{Permit Concentration Limit } \left( \frac{\text{lbs}}{\text{MMBtu}} \right)
\]

Assumptions:

<table>
<thead>
<tr>
<th>Industry Type</th>
<th>Btu/scf</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil &amp; Gas Production</td>
<td>1000</td>
</tr>
<tr>
<td>Landfills</td>
<td>500</td>
</tr>
<tr>
<td>Closed Landfills</td>
<td>400</td>
</tr>
<tr>
<td>Wastewater Treatment</td>
<td>600</td>
</tr>
<tr>
<td>Other Flaring</td>
<td>1000</td>
</tr>
</tbody>
</table>
Emission Inventory

- AQMP Emission Inventory: 2.4 tpd
- Initial Rule Emission Inventory: 0.85 tpd
- Current Concept Emission Inventory: > 1 tpd

- Overestimated emissions from flares
- Majority of emissions based on data reported by facilities
- Three year average throughput
- Reflects actual use of flare
- 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