



BAY AREA  
AIR QUALITY  
MANAGEMENT  
DISTRICT

**AGENDA: 15**

# **Public Hearing on Proposed Regulation 13: Climate Pollutants, Rule 5: Industrial Hydrogen Plants**

**Board of Directors Meeting**

**May 4, 2022**

**Victor Douglas**

**Rule Development Manager**

**[vdouglas@baaqmd.gov](mailto:vdouglas@baaqmd.gov)**

# Presentation Outcome



Provide information for consideration of the adoption of:

- Proposed New Regulation 13: Climate Pollutants, Rule 5: Petroleum Refinery Hydrogen Plants
- and
- Proposed Amendments to Regulation 8: Organic Compounds, Rule 2: Miscellaneous Operations.

# Presentation Outline



- Recent Rule Development History
- Background
- Summary of Proposed New Rule Provisions
- Impacts of proposed amendments
- Comments and responses
- Recommendations

# Presentation Requested Action



- Consider adoption of proposed Rule 13-5: Industrial Hydrogen Plants and proposed amendments to Regulation 8, Rule 2: Miscellaneous Operations.
- Consider certification of the Draft Environmental Impact Report.

# Recent Rule Development History



- June 2021 – Request for Comments on revised draft rule and Notice of Preparation and Initial Study for Draft Environmental Impact Report
- July 2021 – California Environmental Quality Act Scoping Meeting
- July 2021 – Presentation to Stationary Source and Climate Impacts Committee
- September 2021 – Discussion and Review of Alternative Reduction Measures proposed by Refiners
- January 2022 – Published Notice of Completion of Draft Environmental Impact Report and Public Hearing Notice
- March 2022 – Published Notice of Rescheduled Public Hearing

# Background



- **Climate Protection Goals:**
  - Reduce GHG emissions to 40 percent below 1990 levels by 2030, and 80 percent below 1990 levels by 2050.
- **Methane:**
  - Potent and short-lived climate pollutant
  - Global warming potential:
    - 34 times that of carbon dioxide on a 100-year time horizon
    - 86 times that of carbon dioxide on a 20-year time horizon
- **Proposed New Rule 13-5, Industrial Hydrogen Plants:**
  - Limits vented emissions of total organic compounds (including methane)
  - Affects hydrogen production and carrying systems
  - Includes alternative compliance option for equivalent control of GHG emissions
  - Affected sources exempt from Rule 8-2: Miscellaneous Operations

# Background: Hydrogen Production via Steam Methane Reformation

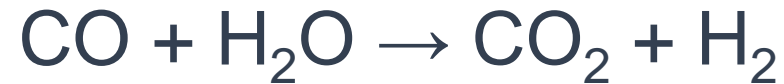


Step 1: Purification of the feed gas.

Step 2: Steam methane reformation reaction:



Step 3: Temperature shift reaction:



Step 4: Final product purification step.

- Pressure swing adsorption (PSA) system
- Solvent-based CO<sub>2</sub> removal system.

# Background: Hydrogen Production via Electrolysis



- Electrolysis produces hydrogen by using electricity to split water into hydrogen and oxygen.
- Significant amounts of water are needed for hydrogen production by electrolysis.
- Limitations to producing hydrogen via electrolysis
  - 1 kg of hydrogen can require 18 to 126 kg of water (Source: IRENA 2020)
  - Requires renewable electricity source to avoid increase in greenhouse gas emissions due to increased electricity demand. (Source: US DOE)
  - Meeting the hydrogen demands of refineries through electrolysis is not currently viable due to technology limitations.



# Background: Why Do Hydrogen Vent Emissions Occur?



- Excess hydrogen is required by refineries due to safety reasons.
- Sudden changes in hydrogen supplied and/or demand between the hydrogen plant and the hydrogen consumers can lead to a hydrogen imbalance.
- When a hydrogen imbalance occurs, excess hydrogen is removed by venting to the atmosphere or control device.
- Vented or controlled hydrogen gas may or may not contain methane depending on the refinery and controls in place.

# Background: Overview of Hydrogen Plant Configurations



Facility	Purification Method	Vent Control Method
Chevron	PSA System	Hydrogen Flare
Marathon (2)		
Air Products	PSA System	None
Marathon	CO <sub>2</sub> Removal	Refinery Flare
PBF Energy (3)		
Air Products	PSA System	None
PBF (2)	CO <sub>2</sub> Removal	None
Phillips 66 (Air Liquide)	PSA System	None
Valero	CO <sub>2</sub> Removal System	None

# Proposed New Rule 13-15 Provisions



- Limits emissions of Total Organic Compounds (methane and other organics) to 15 pounds per day and 300 parts per million
- Alternative Compliance Plan (ACP) option provided for Overall 90% control of Methane
  - Up to 20% of emissions reductions may be GHGs other than Methane on a CO<sub>2</sub>e basis
  - Provides flexibility to meet equivalent GHG emissions reductions without construction of new flares
- Alignment of permitting deadlines for control devices and alternative compliance measures (3 years from rule adoption)

# Rule 8-2 Proposed Amendments



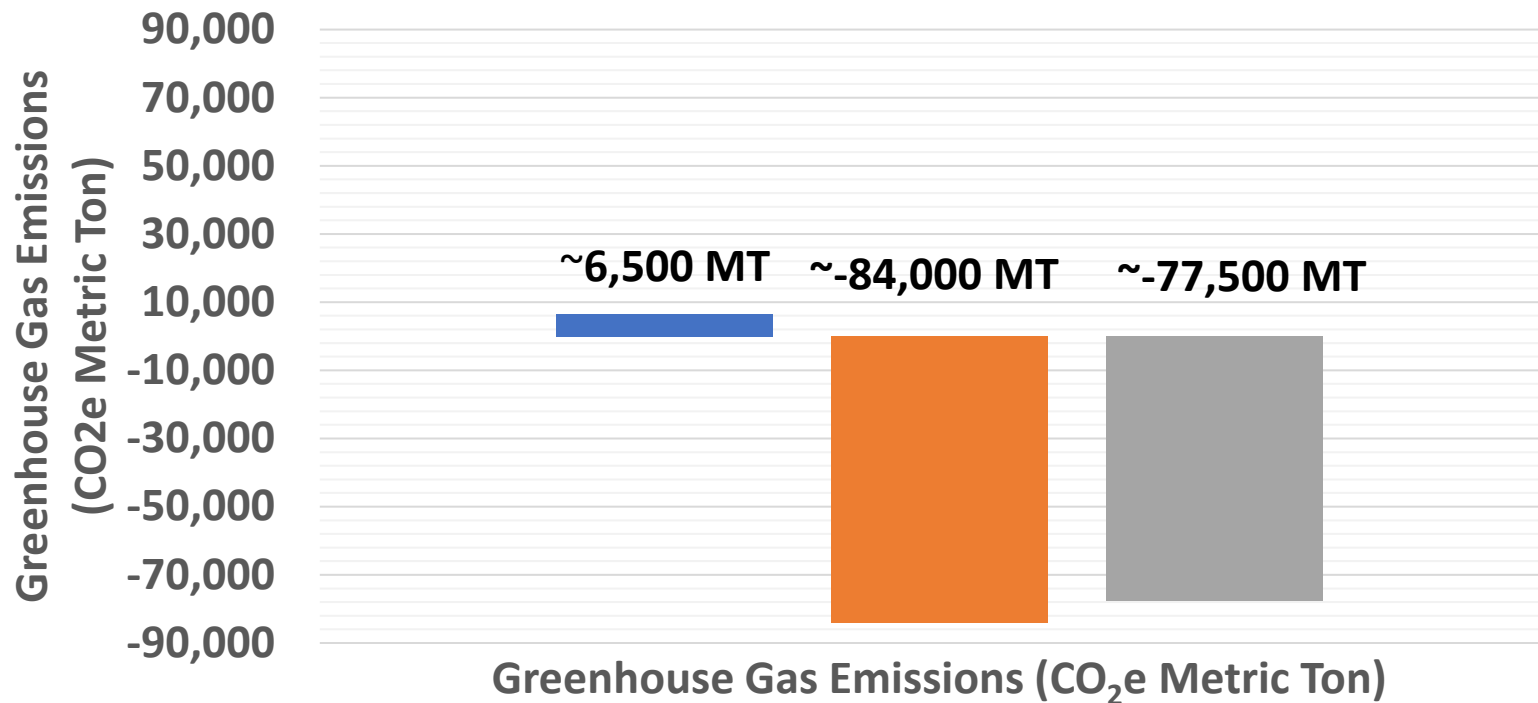
- Added exemption for sources complying with the control requirements of Section 13-5-301.
- Added amendments to allow for alternative test methods to ensure that facilities processing non-petroleum products utilize the appropriate test methods for those materials.

# Potential NOx and Greenhouse Gas Emissions Impacts of a Flare



- 35 tons per year potential NOx increase
  - 2% of the NOx inventory for both affected facilities
- 77,500 metric tons per year CO<sub>2</sub>e net emissions reductions of methane
  - 1.2% of GHG emissions inventory for both affected facilities
  - Equivalent to 770 passenger vehicles removed

# Net Annual Greenhouse Gas Emissions from Potential Operation of a Flare



- CO<sub>2</sub> Emissions Generated from Flare
- Emission Reductions from Controlled Methane
- Net Greenhouse Gas Reduction from Flare

# Aesthetic Impact of Potential New Flares



	Photograph 1
<p>Current View of Valero Benicia Refinery Looking North from Interstate 680</p>	
	Render 1
<p>Post Project View of Valero Benicia Refinery Looking North from Interstate 680</p>	

	Photograph 2
<p>Current View of PBF Martinez Refinery Looking Southwest from Waterbird Regional Preserve</p>	
	Render 2
<p>Post Project View of PBF Martinez Refinery Looking Southwest from Waterbird Regional Preserve</p>	

Source: Draft EIR, Chapter 3.1 Aesthetics. Environmental Audit, Inc.

# Aesthetic Impact: Visible Emissions from Flares



Source: Hydrogen Tools-H2Tools



# Aesthetic Impact: Visible Emissions from Flares, cont.



Source: Hydrogen Tools-H2Tools

# Visible Emissions from Flares, cont.



- More complex, heavier hydrocarbon gases typically generate more smoke than simpler, lighter hydrocarbon gases
- Hydrogen burns with a dim blue flame that may be invisible in daylight
- A flaring event associated with a hydrogen plant is expected to produce a clean burning flame with little-to-no smoke

# Cost and Cost Effectiveness Analysis



- Total annualized cost associated with flares = \$15.5 M per year
- Total methane reduction = 77,500 metric ton CO<sub>2</sub>e per year
- Cost-effectiveness of flares = \$6,800 per metric ton
- Total annualized cost associated with pressure swing adsorption (PSA) system = \$60.7 M per year
- Incremental cost-effectiveness between flare and PSA system = \$186,000 per metric ton

# Socioeconomic Impacts



 **Significant** impacts expected when costs exceed **10%** of net income

 **Potential Significant** impacts at one facility

Total compliance cost for all facilities = \$15.3 to 17.7 M per year.

Total compliance cost for all facilities / net income = 1.9 to 2.2 % of net income

Cost of compliance for Air Liquide = 7.5 to 11.3% of net income

 **Cost mitigation measures** available.

Carbon credit value for methane reduction = \$1.3M to \$2.1M

Social cost of carbon = \$1.7M to \$9.8M per year

# Environmental Impacts



- California Environmental Quality Act (CEQA)
- Analysis found air quality impact would be potentially significant after mitigation.

<b>Air Quality</b>	NO <sub>x</sub> emissions potentially significant during construction and operational activities.
<b>Greenhouse Gas</b>	The rule results in net GHG reduction. Therefore, GHG emissions would be less than significant threshold.

# Statutory Findings



- Before adopting, amending, or repealing a rule the Board of Directors must make findings of **necessity, authority, clarity, consistency, non-duplication and reference** (California H&SC Section 40727)
  - Necessity – H&SC Section 40727(b)(1)
  - Authority – H&SC Section 40727(b)(2)
  - Clarity – H&SC Section 40727(b)(3)
  - Consistency – H&SC Section 40727(b)(4)
  - Non-duplication – H&SC Section 40727(b)(5)
  - Reference – H&SC Section 40727(b)(6)

# Air District Impacts



- Implementation of proposed amendments will require a new fee to fund staffing of the additional full-time equivalents (FTE) staff resources
  - Engineering: 2 additional FTEs
  - Meteorology and Measurement: 1 additional FTEs
  - Compliance and Enforcement: 1 additional FTE
  
- Consideration in future amendments to Regulation 3: Fees

# Recommended Action



1. Adopt proposed new Regulation 13: Climate Pollutants, Rule 5: Industrial Hydrogen Plants (Rule 13-5);
2. Adopt proposed amendments to Regulation 8: Organic Compounds, Rule 2: Miscellaneous Operations (Rule 8-2);
3. Certify Final Environmental Impact Report