



BAY AREA  
AIR QUALITY  
MANAGEMENT  
DISTRICT

AGENDA: 2A

# Public Hearing on Amendments to Rule 6-5: *Rule Development Process Background and Overview*

Board of Directors Meeting  
June 2, 2021

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# Outcome



- Provide information on the rule development process for amendments to Rule 6-5
- Provide information on regulatory and control options considered

# Outline



- Background
- Rule development process
- Control options considered and estimated impacts
- Rulemaking paths considered
- Proposed amendments

# Requested Action



- No requested action
- Informational only

# Background



- Fluidized Catalytic Cracking Units (FCCUs) convert heavy components of crude oil into gasoline and high-octane products
- Four of the five Bay Area refineries have FCCUs
  - Three FCCUs currently in operation, one already has a wet gas scrubber
  - Marathon FCCU has been indefinitely idled, but would be subject to rule and amendments if restarted
- Large source of particulate matter (PM) emissions
  - Over 800 tons per year of PM<sub>10</sub>
  - Approximately 50% of overall PM<sub>10</sub> emissions at these refineries
  - 17% of PM<sub>10</sub> emissions from all permitted stationary sources

# Background (cont.)



- Rule 6-5 originally adopted in 2015 to reduce PM & precursors
- Assembly Bill (AB) 617 Expedited Best Available Retrofit Control Technology (BARCT) Implementation Schedule – Identified potential rule development efforts to evaluate and implement BARCT at FCCUs
- Further address PM emissions
- Achieve public health benefits and continue progress towards attainment of ambient air quality standards

# Background (cont.)



## Air District Advisory Council findings on PM (December 2020)

1. PM is the most important risk driver in Bay Area
2. Current PM NAAQS is not health protective
3. No known threshold for harmful PM<sub>2.5</sub> health effects and thus more reductions are needed to achieve health benefits
4. Localized PM emissions need additional control measures
5. Some species of PM may be more dangerous than others; no PM species can be exonerated
6. Take maximum feasible action on the sources under our authority

# Rule Development Process



- Air District released draft amendments to Rule 6-5 in May 2020 for public review and comment
- Further evaluation of impacts and other potential control options to reduce PM from FCCUs and updates to Stationary Source and Climate Impacts (SSCI) Committee
- Released workshop package in January 2021 with draft amendments for two control options and information on potential impacts
- Virtual public workshop and public comment period on two control options and materials



# Rule Development Process (cont.)



- SSCI Committee presentation on March 15, 2021, to discuss regulatory and control options and receive input
  - Two control options presented in workshop
  - New “Stair-Step” regulatory concept
- Proposed amendments and Staff Report released in March 2021 for public review and comment
- Final proposed amendments for Public Hearing on June 2, 2021

# Draft Amendments – Control Scenario A and B



Requirements	Control Scenario A (ESP)	Control Scenario B (WGS)
<b>Ammonia (NH<sub>3</sub>)</b>	10 ppm	10 ppm
<b>Sulfur dioxide (SO<sub>2</sub>)</b>	25 ppm (365-day average) 50 ppm (7-day average)	25 ppm (365-day average) 50 ppm (7-day average)
<b>Total PM<sub>10</sub></b>	0.020 gr/dscf	0.010 gr/dscf
<b>Effective date</b>	January 1, 2023	January 1, 2026
<b>Affected refineries</b>	Chevron Products Richmond PBF Martinez Refinery	Chevron Products Richmond PBF Martinez Refinery <i>Marathon Martinez Refinery</i>
<b>Anticipated controls</b>	Improve / expand existing controls: ESP, feed hydrotreatment, catalyst additives	Install new WGS

ppm = parts per million

gr/dscf = grains per dry standard cubic foot

ESP = electrostatic precipitator

WGS = wet gas scrubber



# Control Scenario A: Estimated Impacts

Refinery	PM <sub>10</sub> Reductions	Est. Capital Cost	Est. Total Annualized Cost	Cost Effectiveness
Chevron Richmond	80 TPY	\$30 MM	\$4.4 MM/year	\$55,300/ton
PBF Martinez	170 TPY	\$80 MM	\$14 MM/year	\$84,900/ton
<i>Marathon Martinez</i>	<i>0 TPY</i>	<i>\$0</i>	<i>\$0/year</i>	<i>n/a</i>
TPY = tons per year, MM = million				

- **Socioeconomic Impacts**

- Not considered “significant” since costs are less than 10% of annual estimated profits for the Chevron and PBF refineries, based on 2019 sales estimates
- Marathon Martinez Refinery complied with this standard before stopping production

- **Environmental Impacts Assessed Under CEQA**

- Construction air quality impacts exceeds CEQA significance thresholds

# Control Scenario B: Estimated Impacts



Refinery	PM <sub>10</sub> Reductions	Est. Capital Cost	Est. Total Annualized Cost	Cost Effectiveness	Incremental Cost Effectiveness
Chevron Richmond	160 TPY	\$241 MM	\$39 MM/year	\$242,700/ton	\$430,200/ton
PBF Martinez	240 TPY	\$255 MM	\$40 MM/year	\$165,000/ton	\$359,400/ton
<i>Marathon Martinez</i>	<i>93 TPY</i>	<i>\$235 MM</i>	<i>\$38 MM/year</i>	<i>\$406,400/ton</i>	—
TPY = tons per year, MM = million					

- **Socioeconomic Impacts**

- “Significant” for all three impacted refineries since costs exceed 10% of estimated annual plant profits
- Potential for job losses and/or fuel price increases
- Marathon Martinez Refinery would have expenses under this scenario if restarted

- **Environmental Impacts Assessed Under CEQA**

- Construction air quality impacts exceeds CEQA significance thresholds
- Operational water use exceed CEQA significance thresholds

# Health Impacts Estimates



## Impacts and Benefits in Modeled Study Area Only

- Localized PM<sub>2.5</sub> impacts from Chevron Richmond and PBF Martinez
- Equity and health benefits of Control Scenario A and B

Facility	Control Scenario	Modeled Health Benefits <sup>1,2</sup>
Chevron Products Richmond	A (ESP)	\$6.8 MM to \$15.2 MM/yr
	B (WGS)	\$12.2 MM to \$27.4 MM/yr
PBF Martinez Refinery	A (ESP)	\$10.1 MM to \$22.7 MM/yr
	B (WGS)	\$14.4 MM to \$32.4 MM/yr

ESP = electrostatic precipitator

WGS = wet gas scrubber

<sup>1</sup> Based on conventional US EPA valuations of selected health impacts.

<sup>2</sup> Valuations are in 2015 US dollars, calculated using the US EPA BenMAP system.



# Study Area for Health Impacts

- White
- Hispanic / Latino
- Asian / Pacific Isl.
- Afr. Amer. / Black
- Other

*Study area is the region inside the outermost contour*

+0.1  $\mu\text{g}/\text{m}^3$

*Contours correspond to modeled contributions of +1.0, +0.9, ... +0.1  $\mu\text{g}/\text{m}^3$*

**Study area population (2020) is about 1 million residents**

# “Stair-Step” Regulatory Concept



- Potential approach developed in response to concerns received at public workshop and in public comments
  - Support for most stringent limits and controls
  - Concern for potential job losses and economic impacts
- Main goal/objective:
  - Require most stringent standard (Scenario B – WGS), but require or incentivize early reductions to reduce health impacts
- Approach:
  - "Stair-step" or phase-in
  - Required to achieve an interim emissions standard (similar to Scenario A – ESP), as soon as possible
  - Provide additional time to meet the WGS-equivalent control level
  - Ensure greater emission reductions over time than would be possible with WGS alone

# “Stair-Step” Regulatory Concept (cont.)



- Benefits:

- Require health protective emissions reductions sooner
- Establish path to most stringent limits and controls
- Provide additional flexibility in planning for installation of wet gas scrubbers and opportunity for facilities to potentially mitigate negative economic impacts

- Challenges:

- May delay implementation of most stringent control level
- Total cost may exceed that of WGS
- Additional time for rule development process
  - Stakeholder engagement on regulatory concept
  - Development of new draft amendments
  - Additional public workshop and comment period
  - Development of proposed amendments
  - Public comment and Public Hearing



# Potential Paths Considered



- Sought input from SSCI Committee on control options and paths forward in March 2021
  - Path 1: Prepare Scenario A (ESP) **and** Scenario B (WGS) for Board consideration
  - Path 2: Prepare Scenario A (ESP) **or** Scenario B (WGS) for Board consideration
  - Path 3: Develop rule language for Stair-Step approach, seek public input, and prepare for Board consideration
- Majority of committee members expressed support to pursue Path 2 to prepare proposed amendments for Scenario B (WGS) for Board consideration

# Proposed Amendments



- Proposed amendments to Rule 6-5, Staff Report, and Public Hearing Notice published March 30, 2021
- Written public comment period closed April 30, 2021
- Final proposal package for consideration



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AGENDA: 2B

# Public Hearing on Amendments to Rule 6-5: *Proposed Amendments*

Board of Directors Meeting  
June 2, 2021

Greg Nudd  
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# Outcome



- Provide information on the proposed amendments to Rule 6-5: Particulate Emissions from Refinery Fluidized Catalytic Cracking Units
- Consideration of adoption of proposed amendments to Rule 6-5

# Outline



- Rule development process and engagement
- Proposed amendments
- Impacts of proposed amendments
- Comments and responses
- Recommendations

# Requested Action



- Consider adoption of proposed amendments to Regulation 6, Particulate Matter, Rule 5: Particulate Emissions from Refinery Fluidized Catalytic Cracking Units

# Rule Development Process and Engagement



- 2019

- October, November 2019: Early stakeholder engagement with Refinery Rules Technical Working Group
- Various site visits and individual stakeholder meetings

- 2020

- May 2020: Draft amendments to Rule 6-5 published for public review and comment
- June 2020: Presentation of draft amendments to Stationary Source and Climate Impacts Committee (SSCIC)
- July, October, December 2020: Additional information on impacts and other potential control options

# Rule Development Process and Engagement (cont.)



- 2021

- January 2021: Draft amendments for two control options and workshop report for public review and comment
- February 2021: Virtual public workshop
- March 2021: Update to SSCIC
- March 2021: Proposed amendments to Rule 6-5 published for public review and comment
- May 2021: Final proposal package and response to comments published
- June 2021: Public Hearing to consider adoption of proposed amendments to Rule 6-5



# Proposed Amendments to Rule 6-5



Pollutant	Limit	Monitoring Requirement
<b>Ammonia (NH<sub>3</sub>)</b>	10 ppm at 3% O <sub>2</sub> (daily average)	No proposed changes
<b>Sulfur dioxide (SO<sub>2</sub>)</b>	25 ppm at 0% O <sub>2</sub> (365-day average) 50 ppm at 0% O <sub>2</sub> (7-day average)	Continuous Emission Monitoring (CEM)
<b>Total PM<sub>10</sub></b>	0.010 gr/dscf at 5% O <sub>2</sub> (four quarter rolling average)	Quarterly source testing, or other emission monitoring system approved by APCO
<b>Effective date</b>	5 years after adoption date	5 years after adoption date

ppm = parts per million

gr/dscf = grains per dry standard cubic foot

- Reflects levels of stringency that have been achieved at units using wet gas scrubbing controls
- Anticipate Chevron Richmond and PBF Martinez would be required to install WGS
- Marathon Martinez would be required to install WGS if petroleum refining operation restarted
- Valero Benicia anticipated to comply using existing WGS

# Proposed Amendments to Rule 6-5 (cont.)



## Feasibility of 0.01 gr/dscf Total PM10 Limit

- Historically, wet gas scrubbers used for sulfur dioxide control
- WGSs Total PM10 ranged from 0.002 to 0.078 gr/dscf
  - 30 source test results for WGS
  - 16 less than 0.01 gr/dscf
  - 21 less than 0.02 gr/dscf
- WGS at affected facilities would be designed and optimized for Total PM to meet the 0.01 gr/dscf limit

Conclusion: 0.01 gr/dscf Total PM limit demonstrated to be achieved in practice by wet gas scrubbers.

# Impacts of Proposed Amendments



## Required impact considerations

- Emission reductions: Reductions in pollutant emissions
- Compliance costs: Costs for installing and operating controls
- Cost effectiveness: Costs per ton of reduction
- Incremental cost effectiveness: Measure of incremental costs and emission reductions between different potential control options
- Socioeconomic impacts: Economic impacts, job losses, consumer impacts
- Environmental impacts: Impacts from installation or use of controls

# Emissions Estimates



<b>Facility</b>	<b>FCCU Fresh Feed Capacity (barrels per day)</b>	<b>PM10 (tons per year)</b>	<b>PM2.5 (tons per year)</b>
Chevron Products Richmond	80,000	245	229
Marathon Martinez Refinery	70,000	190	190
PBF Martinez Refinery	67,400	309	300
Valero Benicia Refinery	72,000	81	81
<b>Total</b>	<b>289,400</b>	<b>825</b>	<b>800</b>

# Emissions Estimates (cont.)



Emission estimates reflect most current approved emissions inventories

- Chevron and PBF emissions based on approved 2018 emissions inventory for total PM
- Marathon:
  - Shown emissions estimates based on average 2020 source test emission rate data for total PM
  - PM2.5 emissions were assumed to be equal to PM10 emissions.
- Valero:
  - Shown emissions estimates based on average 2016-2019 source test emission rates data for total PM at flue gas scrubber stack
  - Includes combined emissions from FCCU and coker unit
  - PM2.5 emissions were assumed to be equal to PM10 emissions.

# Emission Reductions, Cost Impacts, and Incremental Cost Analysis



Refinery	PM <sub>10</sub> Reductions	Est. Capital Cost	Est. Total Annualized Cost	Cost Effectiveness	Incremental Cost Effectiveness
Proposed Amendments					
Chevron Richmond	160 TPY	\$241 MM	\$39 MM/year	\$242,700/ton	\$430,200/ton
PBF Martinez	240 TPY	\$255 MM	\$40 MM/year	\$165,000/ton	\$359,400/ton
<i>Marathon Martinez</i>	<i>93 TPY</i>	<i>\$235 MM</i>	<i>\$38 MM/year</i>	<i>\$406,400/ton</i>	—
Less Stringent Control Option					
Chevron Richmond	80 TPY	\$30 MM	\$4.4 MM/year	\$55,300/ton	—
PBF Martinez	170 TPY	\$80 MM	\$14 MM/year	\$84,900/ton	—

TPY = tons per year, MM = million

# Costs of Refinery Wet Gas Scrubbing System Installations

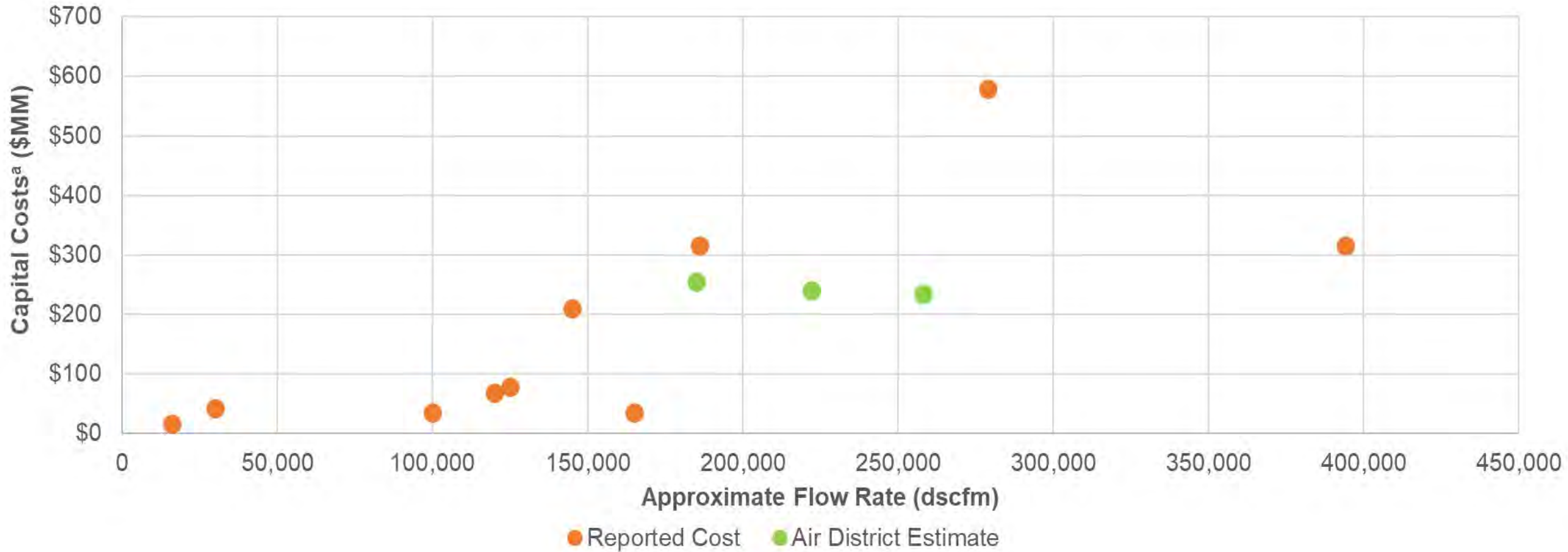


Installation/ Operational Year	Facility/Unit	Reported Capital Cost, Adjusted <sup>a</sup>	Approximate Flow Rate (dscfm) <sup>b</sup>
2011	HollyFrontier Woods Cross Unit 4 FCCU #1	\$16 million	16,000
2015	HollyFrontier Cheyenne FCCU	\$43 million	30,000
2004	Tesoro Mandan FCCU	\$36 million	100,000
2008	Unspecified SCAQMD Refinery X FCCU	\$68 million	120,000
2006	Shell Puget Sound Refinery FCCU	\$79 million	125,000
2007	CITGO Lemont FCCU	\$210 million	145,000
2004	Shell Deer Park FCCU	\$36 million	165,000
2006	Valero Delaware City Refinery Coker	\$316 million	186,000
2010	Valero Benicia FCCU and Coker	\$579 million	280,000
2006	Valero Delaware City Refinery FCCU	\$316 million	394,000

<sup>a</sup> Capital costs shown were adjusted to year 2019 dollars and California market cost basis where appropriate.

<sup>b</sup> dscfm = dry standard cubic feet per minute

# Costs of Refinery Wet Gas Scrubbing System Installations (cont.)





# Socioeconomic Impacts



- Significant impacts expected when costs exceed 10% of net income
- Facilities expected to implement adjustments to reduce significant impacts
- Based on most recent financial information for year 2019

<b>Refinery</b>	<b>Estimated Annual Net Income (2019)</b>	<b>Est. Total Annualized Cost</b>	<b>Compliance Cost (% of Income)</b>	<b>Expected Annual Adjustment</b>
Chevron Richmond	\$283 MM	\$39 MM	13.7%	\$11 MM
PBF Martinez	\$178 MM	\$40 MM	22.3%	\$22 MM
<i>Marathon Martinez</i>	<i>\$147 MM</i>	<i>\$38 MM</i>	<i>25.8%</i>	<i>\$23 MM</i>

MM = million

# Socioeconomic Impacts (cont.)



- Refineries would be expected to reduce cost impacts below significant level (10%)
- Potential adjustments:
  - Reduce labor costs – Equivalent to reducing employment by:
    - 62 jobs at Chevron Richmond
    - 128 jobs at PBF Martinez
    - 136 jobs at Marathon Martinez (*facility has been indefinitely idled*)
  - Increase gas prices – Equivalent to approximately \$0.02 per gallon increase
- Feasibility of cost/revenue adjustments uncertain:
  - Feasibility of operating at reduced staffing is uncertain
  - Equivalent price increases are within normal fluctuations, but individual refineries have limited ability to unilaterally increase pricing
  - Cannot predict individual business decisions or actions that the affected facilities may elect to take

# Environmental Impacts



- Final Environmental Impact Report (EIR) for the AB 617 Expedited BARCT Implementation Schedule certified by Board of Directors in December 2018
- Identified significant impacts:
  - Air quality impacts during construction of pollution control equipment
  - Water usage impacts from use of Wet Gas Scrubbing (WGS)
  - Board of Directors adopted a Statement of Overriding Consideration in Resolution 2018-08
- Proposed amendments do not present substantial changes to the project or new information requiring new analysis
- Air District continues to rely on the EIR pursuant to CEQA section 21166

# Test Methods



## US EPA Test Method 202

- Revised in 2010
- Method 202 further reduced bias attributable to sulfur dioxide

## OTM – 37

- Has not been adequately evaluated by US EPA
- Has not been demonstrated in practice
- No evidence that cooling with ambient air gives more representative results
- Evidence of lower condensable PM results vs. Method 202 / differences need evaluation

Conclusion: Method 202 is most appropriate for determining compliance with the Total PM10 limit

# 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)

# Comments and Responses



- 46 comment letters received on proposed amendments during written comment period
- Full Response to Comments document in Board package
  - Support for proposed amendments
  - Opposition to proposed amendments and support for less stringent control option
  - Feasibility of limits
  - Closure of facility and impact to fuels markets
  - Test methods and emission estimates

# Feedback Requested/Prompt



- Recommend adoption of proposed amendments to Regulation 6, Rule 5: Particulate Emissions from Refinery Fluidized Catalytic Cracking Units