



BAY AREA
AIR QUALITY
MANAGEMENT
DISTRICT

AGENDA: 3A

Update on the Status of the Assembly Bill (AB) 617 Expedited Best Available Retrofit Control Technology (BARCT) Schedule

**Stationary Source Committee Meeting
December 17, 2020**

**Victor Douglas
Manager
Rule Development**

Overview



- AB 617 Expedited BARCT Implementation Schedule Review
- Regulation 8, Rule 5 (Rule 8-5): Organic Liquids Storage Tanks
- Regulation 8, Rule 8 (Rule 8-8): Petroleum Wastewater Treating
- Regulation 8, Rule 18 (Rule 8-18): Refinery Heavy Liquids Leaks

Overview Cont'd



- Regulation 9, Rule 13 (Rule 9-13): Portland Cement Manufacturing
- Regulation 9, Rule 14 (Rule 9-14): Petroleum Coke Calcining Operations
- Regulation 6, Rule 5 (Rule 6-5): Refinery Fluidized Catalytic Cracking Units (FCCUs)
- Conclusions

AB 617 Expedited BARCT Review



- AB 617 signed into law in July 2017
- Requires air districts to develop and adopt an expedited schedule for implementation of BARCT at industrial Cap-and-Trade facilities
- Schedule was adopted on December 19, 2018
- Schedule contained six rule development efforts
- Must be implemented by earliest date, but no later than December 31, 2023

AB 617 Expedited BARCT Review

Cont'd



- “Best Available Retrofit Control Technology” is...
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.
- Does not apply to sources that have implemented BARCT since 2007
- Priority for sources that have not modified emissions limits for longest period of time

AB 617 Expedited BARCT Review Cont'd



Prioritization of Projects

- Local clean air and public health benefits, including toxic emissions reduction co-benefits
- Substantial emission reductions—particulate matter (PM) emissions
- Focused on sources where BARCT controls had not been recently updated
- Cost effectiveness of potential control options

AB 617 Expedited BARCT Schedule



Rule Development Projects

- Rule 8-5: Organic Liquids Storage Tanks
- Rule 8-8: Petroleum Wastewater Treating
- Rule 8-18: Refinery Heavy Liquids Leaks
- Rule 9-13: Portland Cement Manufacturing
- Rule 9-14: Petroleum Coke Calcining Operations
- Rule 6-5: Refinery Fluidized Catalytic Cracking Units

Rule 8-5: Organic Liquids Storage Tanks



Regulatory History

- Adopted in 1978 and last amended in 2006
 - Reduce Volatile Organic Compound (VOC) emissions from storage of organic liquids, like gasoline
 - Standards for floating roof rim seals, pressure vacuum valve setpoint, closure for tank roof fittings, and tank degassing
- 2017 Clean Air Plan Control Measure SS13
- BARCT Schedule Control Options
 - Domed tanks
 - Domed tanks with vapor recovery units
 - Domed tanks with vapor recovery units and incineration

Rule 8-5: Organic Liquids Storage Tanks Cont'd



Rule Development Process

- Technical research, site visits, Refinery Rules Technical Working Group in 2019
- Draft amendments: Q1 2021
 - 95% control requirement
 - Affects 30 tanks District-wide
 - Estimated total VOC reductions of 100 tons per year
- Board Hearing: Q2 2021
 - Package released: Q1 2021

Rule 8-8: Petroleum Wastewater Treating



Regulatory History

- Originally adopted in 1979 / Last Amended 2004

Rule Development Process

- Staff technical research, site visits, Refinery Rules Technical Working Group in 2019
- Further Emissions Inventory Verification: 2021
 - Emissions estimates vary
 - Secondary treatment systems (“back end”)
 - Do actual emissions warrant rule amendments?
- AB 617 BARCT Schedule Deadline: December 31, 2023

Rule 8-18: Refinery Heavy Liquids Leaks



Regulatory History

- Originally adopted in 1980
 - Reduces fugitive emissions of organic gases
 - Valves, connectors, pumps, compressors
 - Leak Detection and Repair (“LDAR”) programs
 - Refineries, chemical plants, bulk plants and bulk terminals
- Amended in 2015 to included equipment in heavy liquid service
- Heavy Liquids Study at all five refineries
 - Final Results: Q1 2021

Rule 8-18: Refinery Heavy Liquids Leaks

Cont'd



Rule Development Process

- Complete Heavy Liquids Study
 - Emission factors and inventory development
 - Final results: Q1 2021
- Draft amendments: Q4 2021
 - LDAR Program for affected equipment in heavy liquid service
 - Preliminary cost estimates
 - Capital Cost: \$250,000
 - Annual Cost: \$6.8 million
 - Emission reductions: Uncertain

Rule 9-13: Portland Cement Manufacturing



Regulatory History

- Originally adopted in 2012
 - Dust Control Measures
 - Emission limits for Cement Kiln—Oxides of Nitrogen (NO_x), PM, Ammonia, Dioxins & Furans, Mercury, Organic Toxic Air Contaminants (TACs), and Hydrochloric Acid
- 2017 Clean Air Plan—Control Measure SS19
 - Limit Sulfur Dioxide (SO₂) emissions (PM precursor)
 - Address potential for detached plumes
 - Revise ammonia standard
 - Consider Greenhouse Gas (GHG) emissions

Rule 9-13: Portland Cement Manufacturing Cont'd



Consent Decree—Lehigh, US EPA, Air District et al.: Nov 18, 2020

- Penalties: \$1.3 million / \$119,000 to Air District
- Effective November 18, 2021
 - Continuous operation of selective non-catalytic reduction
 - NOx continuous monitor on stack
 - 30-day average NOx emission limit: 2.0 pounds per ton of clinker

Rule 9-13: Portland Cement Manufacturing Cont'd



Consent Decree—Lehigh, US EPA, Air District et al.: Nov 18, 2020

- “Test and Set” Protocol for SO₂ emissions from Kiln
 - Design and Optimization Protocol Due: January 18, 2021
 - Demonstration & EPA Approval
 - Interim SO₂ limit not to exceed 2.1 pounds per ton of clinker
- Timeline for Consent Decree implementation: About 3 years or more for final SO₂ limit

Rule 9-13: Portland Cement Manufacturing

Cont'd



Consent Decree Benefits and Impacts Analysis

| NOx | Emission Limits (lbs/ton clinker) | 2017 Actual Emissions (tons/year) | Allowable Emissions Based on Limit (tons/year) |
|-----------------------|--|--|---|
| Current | 2.3 | 1,010 | 1,265 |
| Consent Decree | 2.0 | n/a | 1,100 |

Current NOx limits reflect BARCT and no additional rule making for **NOx** emissions is anticipated.

| SO₂ | Emission Limits (lbs/ton clinker) | Emissions (tons/year) | Emission Reductions (tons/year) | Costs (\$/year) | Cost Effectiveness (\$/ton reduced) |
|-----------------------|--|------------------------------|--|------------------------|--|
| Current | 2.4-3.4 | 1,300-1,850 | n/a | n/a | n/a |
| Consent Decree | < 2.1* | 440-1,150 | 160-1,415 | \$1.5 million | \$1,000 to 9,000 |

* Final limit will be based on test results.

Rule 9-14: Coke Calcining Operations



Regulatory History / Rule Development

- Originally Adopted in 2016
 - Limits SO₂ emissions from coke calcining kilns
 - Phillips 66 operates only facility in Air District
- BARCT Schedule Control Options
 - Limit NOx emissions
 - Selective Catalytic Reduction using ammonia
 - LoTOx using ozone
- Fate of Coke Calcining Kiln
 - Phillips 66 refinery conversion to renewable fuels production
 - Impact on Coke Plant operation is unknown

Rule 6-5: Refinery Fluidized Catalytic Cracking Units



Regulatory History

- Originally adopted in 2015
 - First step to address FCCU condensable PM
 - Requirements to reduce ammonia (a PM precursor)
- 2017 Clean Air Plan
 - Included Control Measure SS1 to further evaluate and address FCCU condensable PM emissions
- Achieve public health benefits and continue progress towards attainment of ambient air quality standards

Rule 6-5: Refinery Fluidized Catalytic Cracking Units Cont'd



Rule Development Process

- Staff technical research, site visits, Refinery Rules Technical Working Group in 2019
- Draft amendments released in May 2020:
 - Modified requirements for ammonia limit of 10 ppm
 - New limits on sulfur dioxide:
 - 25 ppm on a 365-day rolling average basis
 - 50 ppm on a 7-day rolling average basis
 - New limit on total PM₁₀ of 0.020 gr/dscf (filterable and condensable PM)
 - Estimated total PM10 reductions of 250 tons per year

Rule 6-5: Refinery Fluidized Catalytic Cracking Units Cont'd



Rule Development Process (continued)

- Efforts since May 2020 draft release:
 - Evaluation of more stringent control options—Wet Gas Scrubber
 - Presentations to Stationary Source Committee: June, July, and October
 - Additional refinery visits and consultations
 - Further emissions characterization, including additional source testing
- Board Hearing: Spring 2021
 - Dual Proposals for total PM:
 - 0.01 gr/dscf based on installation of wet gas scrubber
 - 0.02 gr/dscf based on installation of electrostatic precipitator
 - Package release: Q1 2021

Rule 6-5: Refinery Fluidized Catalytic Cracking Units Cont'd



Estimated Emissions Reductions and Costs Analyses (0.020 gr/dscf)

| Facility | PM ₁₀ Emissions (tpy) | PM ₁₀ Reductions (tpy) | Capital Costs (\$MM) | Total Annualized Costs (\$MM) | Cost Effectiveness (\$/ton) |
|---------------------------|----------------------------------|-----------------------------------|----------------------|-------------------------------|-----------------------------|
| Chevron Richmond | 245 | 80 | \$30 | \$4.5 | \$56K/ton |
| <i>Marathon Martinez*</i> | 190 | 0 | – | – | – |
| PBF Martinez | 309 | 170 | \$80 | \$14.5 | \$85K/ton |
| Valero Benicia | 83 | 0 | – | – | – |
| TOTALS | 827 | 250 | \$110 | \$19.0 | \$75K/ton |

* Facility has been indefinitely idled

Rule 6-5: Refinery Fluidized Catalytic Cracking Units Cont'd



Estimated Emissions Reductions and Costs Analyses (0.010 gr/dscf)

| Facility | PM ₁₀ Emissions (tpy) | PM ₁₀ Reductions (tpy) | Capital Costs (\$MM) | Total Annualized Costs (\$MM) | Cost Effectiveness (\$/ton) | Incremental Cost Effectiveness (\$/ton) |
|---------------------------|----------------------------------|-----------------------------------|----------------------|-------------------------------|-----------------------------|---|
| Chevron Richmond | 245 | 160 | \$182 | \$31 | \$194K/ton | \$331K/ton |
| <i>Marathon Martinez*</i> | 190 | 93 | \$179 | \$31 | \$330K/ton | – |
| PBF Martinez | 309 | 240 | \$218 | \$35 | \$145K/ton | \$293K/ton |
| Valero Benicia | 83 | 0 | – | – | – | – |
| TOTALS* | 827 | 400 | \$400 | \$66 | \$165K/ton | \$300K/ton |

* *Marathon Martinez has been indefinitely idled; emissions, reductions, and costs are not included in the final totals.*

Conclusions



- Rule 8-5: Organic Liquids Storage Tanks
 - Draft rule language: Q1 2021
 - Board Hearing: Q2 2021
- Rule 8-8: Petroleum Wastewater Treating
 - Pending emissions review
- Rule 8-18: Refinery Heavy Liquids Leaks
 - Finalizing heavy liquid study
 - Rule amendments to follow

Conclusions Cont'd



- Rule 9-13: Portland Cement Manufacturing
 - Implementation of Consent Decree provisions
 - Incremental Analysis to determine need for further regulation
 - Additional source testing
 - Research other cement kilns
- Rule 9-14: Petroleum Coke Calcining Operations
 - Pending Phillips 66 conversion to renewable fuels production
- Rule 6-5: Refinery Fluidized Catalytic Cracking Units
 - Board Hearing: Spring 2021



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AGENDA: 3B

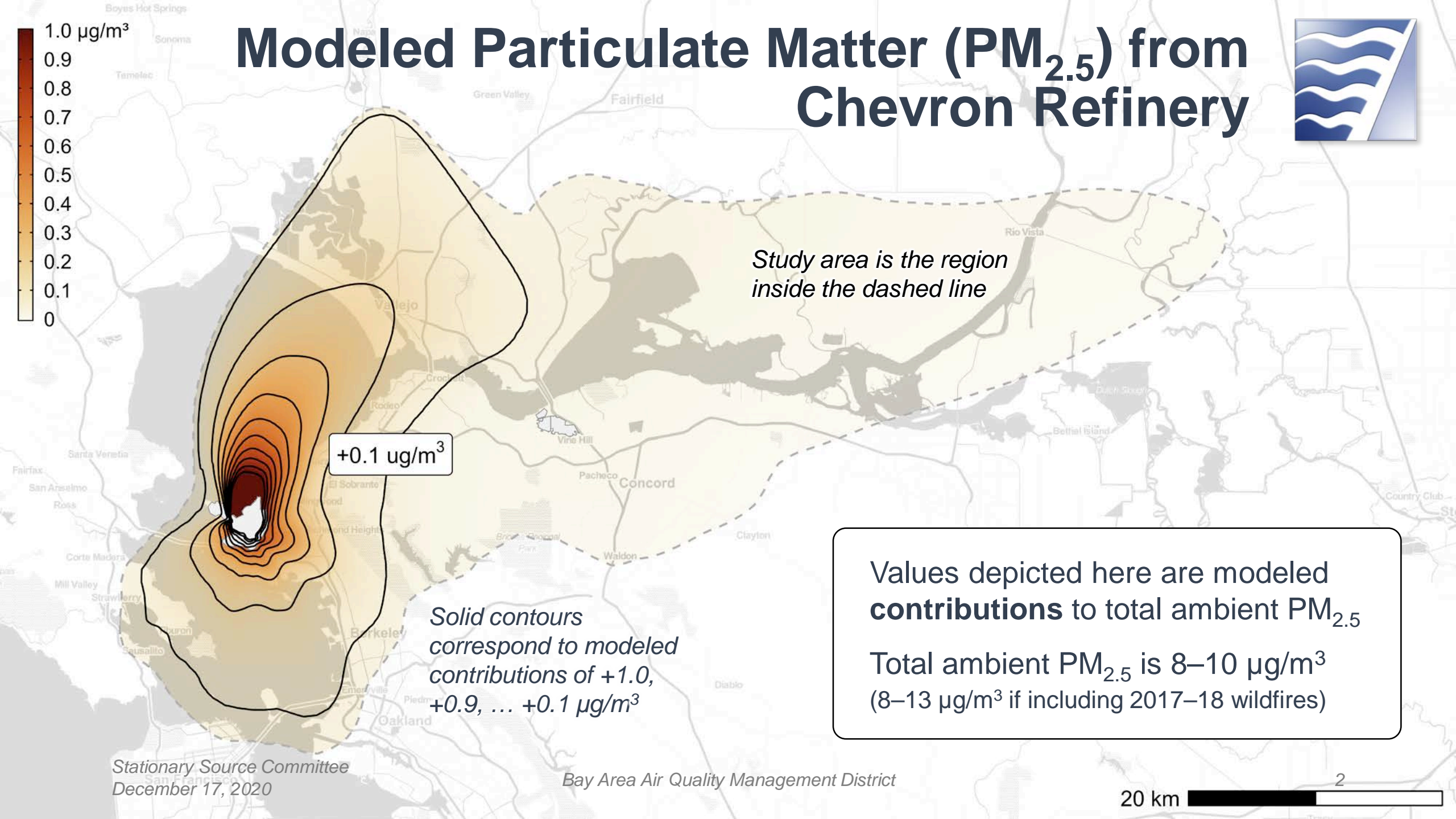
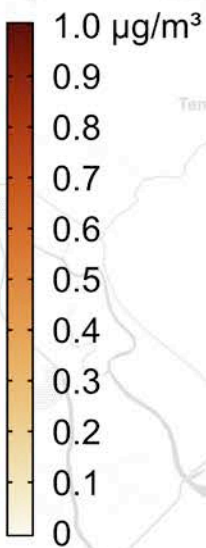
Update on the Status of the Assembly Bill (AB) 617 Expedited Best Available Retrofit Control Technology (BARCT) Schedule - Equity and Health Benefits Assessment for Rule 6-5

**Stationary Source Committee Meeting
December 17, 2020**

**Phil Martien, PhD
Director**

Assessment, Inventory, & Modeling Division

Modeled Particulate Matter (PM_{2.5}) from Chevron Refinery



Study area is the region inside the dashed line

+0.1 µg/m³

Solid contours correspond to modeled contributions of +1.0, +0.9, ... +0.1 µg/m³

Values depicted here are modeled **contributions** to total ambient PM_{2.5}
Total ambient PM_{2.5} is 8–10 µg/m³
(8–13 µg/m³ if including 2017–18 wildfires)

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

Study Population



Study area is the region inside the dashed line

+0.1 ug/m³

Each dot corresponds to 1 resident
Modeled 2020 population within the study area is **1 million residents**

Population Exposure

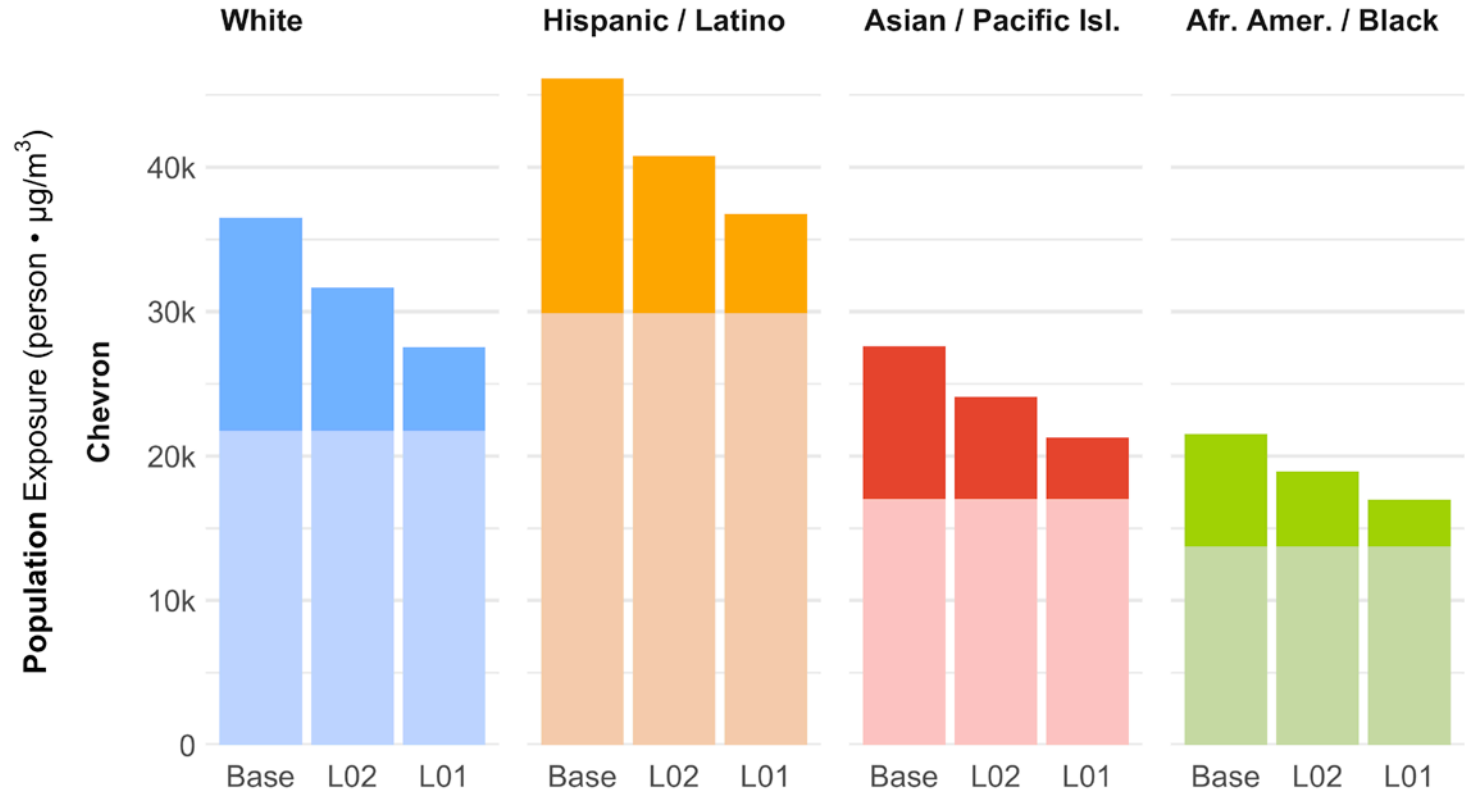


At baseline:

- Hispanic / Latino residents comprise 28% of the population in the study area and 35% of the modeled exposure burden
- Afr-Amer/Black: 12% vs 16%
- White: 37% vs 28%
- Asian/Pac. Isl.: 22% vs 21%

Exposure reductions:

- Limit 0.02 gr/dscf (L02): -12%
- Limit 0.01 gr/dscf (L01): -22%



*Fluidized Catalytic Cracking Unit (FCCU) impacts shown in darker colors
Bar heights = total impacts (FCCU + Non-FCCU)*

Exposure Per Capita

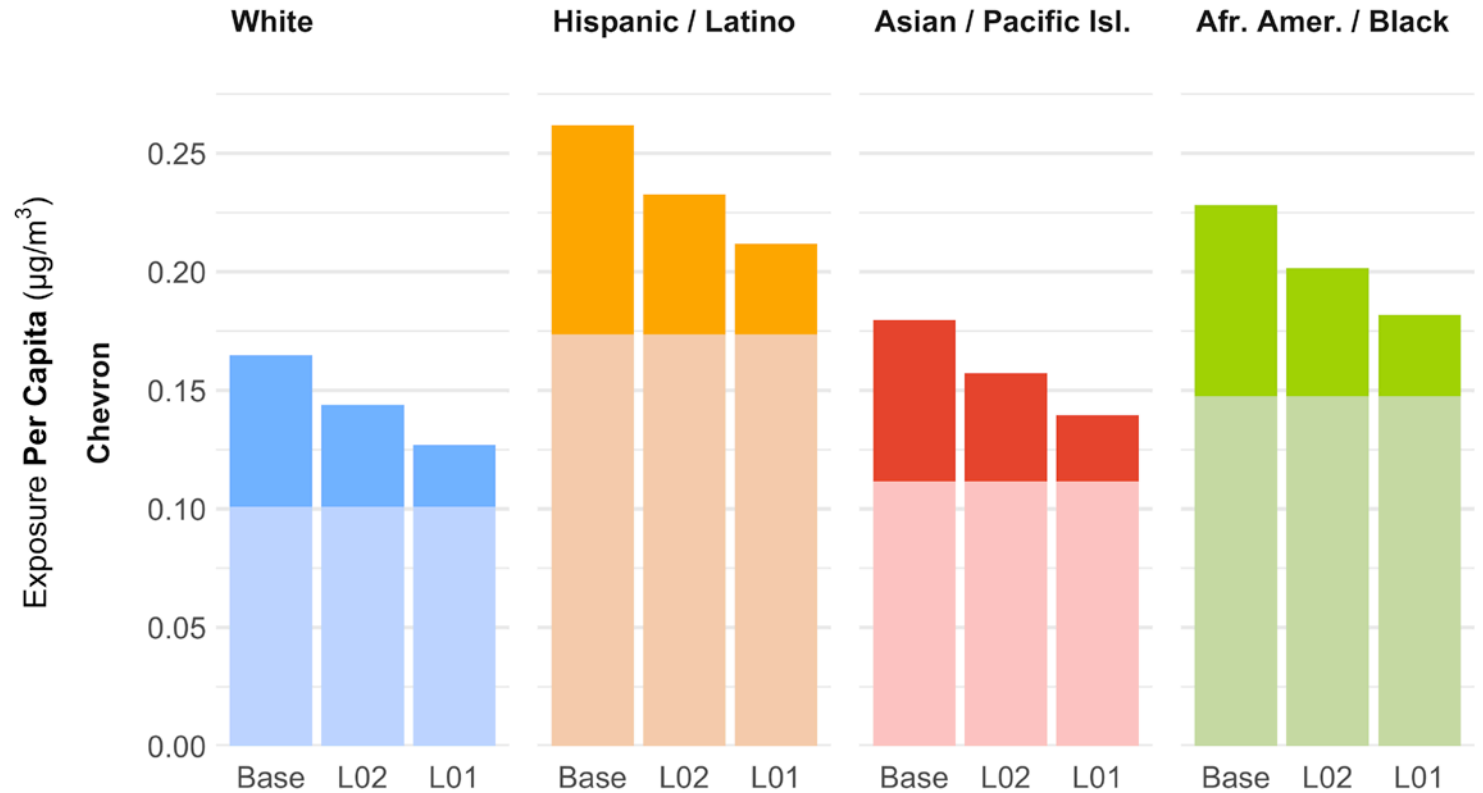


Disparities in Exposure

- On average, Hispanic/Latino and African American/Black residents are exposed to more PM_{2.5} from Chevron in all modeled scenarios

Sources other than the Fluidized Catalytic Cracking Unit (FCCU)

- Drive these disparities
- Remain significant across all modeled scenarios



*FCCU impacts shown in darker colors
Bar heights = total impacts (FCCU + Non-FCCU)*

Health Impacts and Valuations



| Estimated Baseline Health Impact from Modeled Sources (Annual) | | Valuation ¹ (Annual) | 0.020 gr/dscf | 0.010 gr/dscf |
|--|--------------------------------|---------------------------------|-----------------------------|------------------------------|
| Cardiovascular | 0.5–4.3 heart attacks | \$63k–600k | -13% | -22% |
| | 1.0 hospital admissions | \$47k | -13% | -22% |
| Restricted Activity | 4,800 days | \$360k | -12% | -21% |
| Lost Work | 820 days | \$190k | -12% | -21% |
| Asthma | 200 exacerbations ³ | \$12k | -12% | -21% |
| | 4 emergency room visits | \$2k | -12% | -21% |
| | 0.1 hospital admissions | \$1k | -12% | -20% |
| Respiratory Illness² | 140 upper tract ³ | \$5k | -12% | -20% |
| | 100 lower tract ³ | \$2k | -12% | -20% |
| | 8 bronchitis ³ | \$4k | -12% | -20% |
| | 0.2 chronic lung disease | \$5k | -12% | -21% |
| Mortality | 5.1–11.6 deaths ⁴ | \$52.5M–118M | -13% | -23% |
| | | | \$6.8M to \$15.2M/yr | \$12.2M to \$27.4M/yr |



¹ Conventional EPA valuations, in 2015 US dollars

² Other than asthma

³ Subset of pediatric (≤18 years)

⁴ Including infant mortality

Cost-Benefit Comparisons



Estimated Costs and Benefits from Application of Proposed Limits to Chevron

| Baseline Emissions ¹ | Proposed Limit | Emission Reduction | Annualized Cost | Cost Effectiveness ¹ | Annual Benefit ^{2,3} |
|---------------------------------|----------------|--------------------|-----------------|---------------------------------|-------------------------------|
| 245 ton/yr | 0.020 gr/dscf | 80 ton/yr | \$4.5M/yr | \$56k/ton | \$6.8M to \$15M/yr |
| | 0.010 gr/dscf | 160 ton/yr | \$31M/yr | \$194k/ton | \$12M to \$27M/yr |

¹ PM_{10} from FCCU. Modeled $PM_{2.5} / PM_{10}$ ratio for the Chevron FCCU is approximately 95%.

² Based on conventional valuations of health impacts for which valuations are available.

³ Valuations are in 2015 USD, calculated using the US EPA BenMAP system.