



BAY AREA  
AIR QUALITY  
MANAGEMENT  
DISTRICT



# Update on Monitoring Activities at Refineries and in Nearby Communities

Stationary Source Committee Meeting

April 29, 2019

Jerry Bovee, P.E., QSTI

Acting Director

Meteorology and Measurements Division

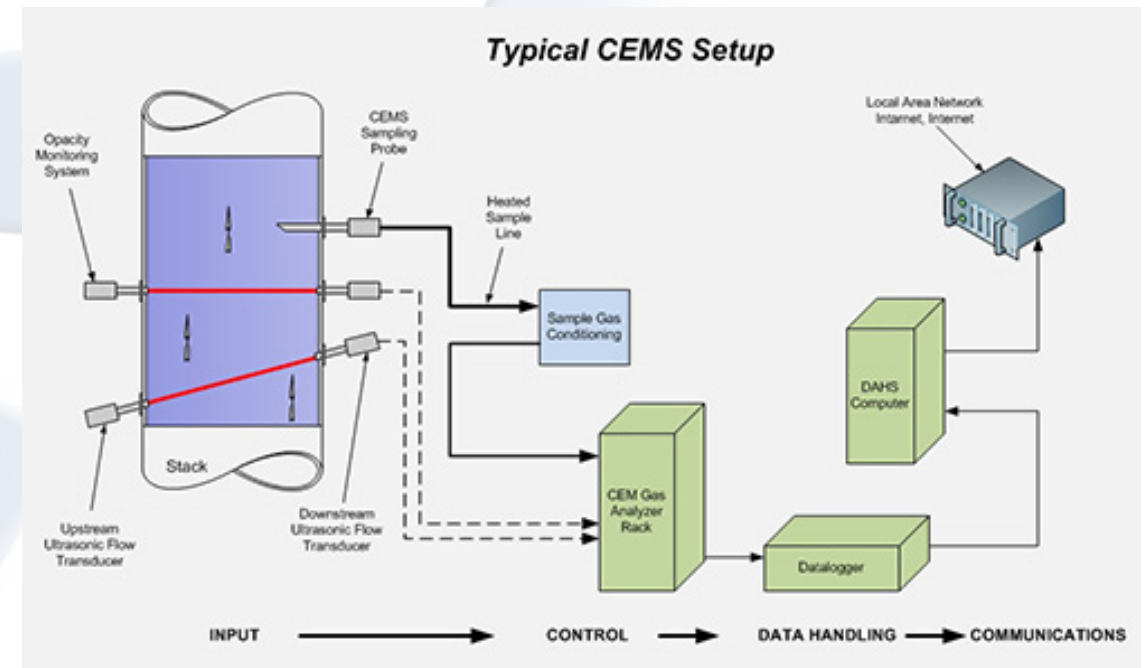
## Brief Regulation 12, Rule 15 (Rule 12-15) Monitoring Background

- Established first of its kind monitoring requirements at refinery fence-lines
- South Coast Air Quality Management District and State regulatory monitoring requirements were developed based on Rule 12-15
- Leverages advanced open path measurement technologies to expand areas of fence-line coverage
- Driving installation, and Air District operation, of Air Monitoring Stations focused on refinery communities



# Air District Refinery Monitoring Efforts Established Prior to Rule 12-15

- In Facility Monitoring
  - Continuous Emission Monitoring Systems (CEMS)
  - Source Testing
  - Leak Detection and Repair
- Monitoring at Fence-Lines
  - Ground Level Monitors (GLMs)
  - H<sub>2</sub>S and SO<sub>2</sub>
- Air Monitoring Network Sites
- Incident Response



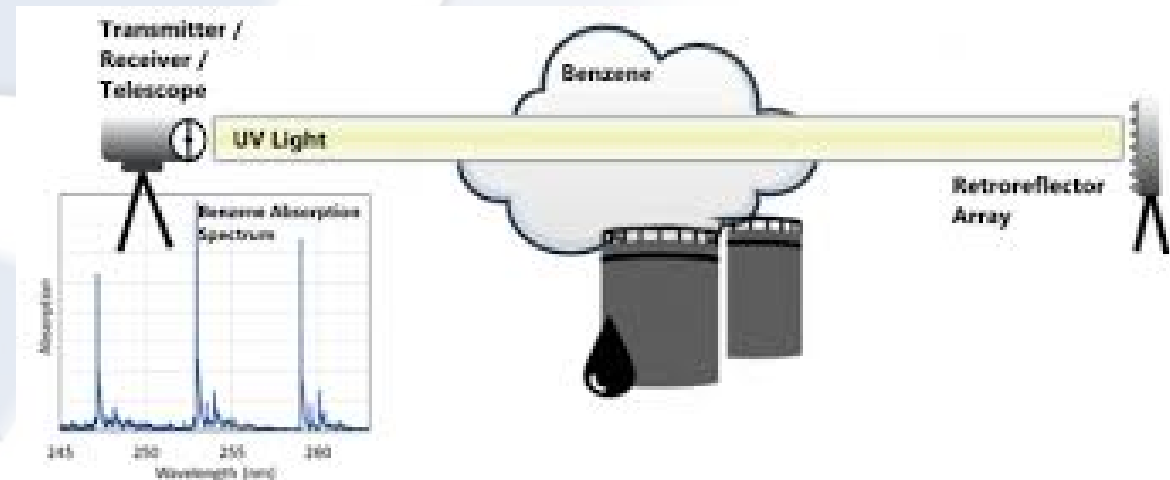
# Current Facility Emissions Monitoring

## Source monitoring

- Defined composition and emission parameters from individual sources (CEMS and source testing)
- Can identify both normal and upset conditions, but *only for measured compounds at a particular source*

## GLM and Current Fence Line Monitoring

- Defined chemicals and emissions produced near ground level from a facility
- Best for steady state conditions with non-heated emission sources near ground level (fugitive emissions)
- Affected by other nearby emissions sources other than the refinery facilities



# Regulation 12, Rule 15 Monitoring

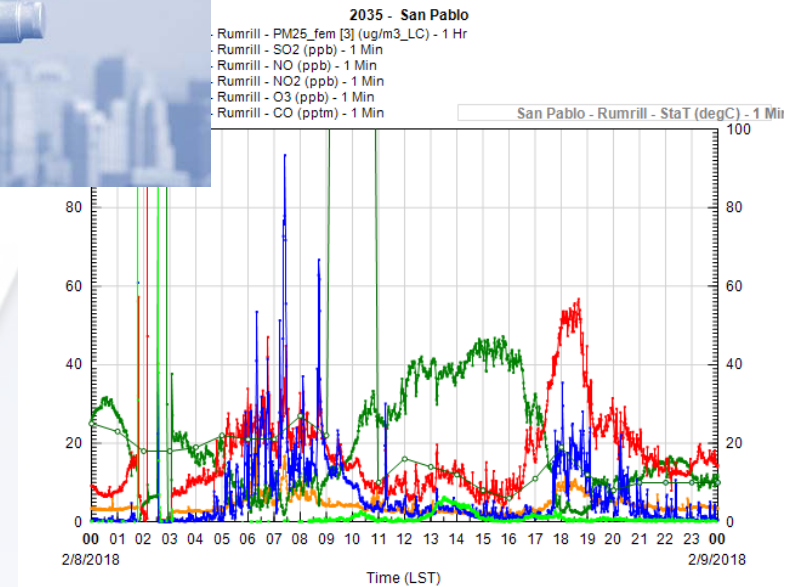
- **Fence-line monitoring requirements**
  - Benzene, toluene, ethyl benzene, and xylenes (BTEX) and H<sub>2</sub>S are required
  - SO<sub>2</sub>, alkanes, 1-3 butadiene, and NH<sub>3</sub> must be considered
  - Air District released guidelines for Monitoring Plans and network design
  - Monitoring Plans must include an approved Quality Assurance Project Plan (QAPP) prior to implementation
  - Importance of publicly available data, including context
- **Community ambient air monitoring systems**
  - Not part of Rule 12-15 and will be established and operated by the Air District under a separate standard



# Ambient Air Pollution

Levels of air pollution in a community are affected by:

- Natural background
- Emissions from a combination of common (cars, home heating, restaurants, etc.) and unique sources (refineries, cement plants, etc.)
- Transport from other areas in our air basin and outside our air basin
- Meteorology
- Chemical reactions
- Topography



Air pollution levels are characteristics of complex mixtures that widely vary in time and space

Air monitoring station usefulness is maximized when it is designed, and the site is selected, with specific data use objectives in mind

# Factors that Affect Ambient Monitoring Measurements (Representativeness)

- Location and obstructions
- Source contributions and distance from those sources
- Meteorological conditions over time, including prevailing wind speed and direction
- Topography
- Chemical composition
- Specific pollutants of concern

## Other considerations

- Ability to remain in the monitoring location for long periods of time (years to decades)
- Power
- Security
- Access



# Monitoring in Refinery Communities

- Instrumentation focused on refinery emissions
  - Organic compounds (alkanes, aromatics, PAH)
  - NO<sub>2</sub>
  - CO
  - PM
  - H<sub>2</sub>S
- Focus on locations that are currently not represented and likely to be impacted by refinery emissions on a regular basis that have the following:
  - Security
  - Meets power requirements
  - Long term lease available
  - Representative of the refinery community





## Fence-Line Monitoring Timelines and Issues

- Fence-line systems must be operational in June 2019 unless there are obstacles beyond the refineries control
- Three refineries operate fence-line systems that are not currently regulated as part of Rule 12-15 (Phillips, Chevron and Valero)
- Monitoring Plans have been approved
- Currently reviewing QAPP documents

## Ensuring Proper Performance

- Working with manufacturers to address needs and technical issues related to implementation
- Working with refineries to define operational parameters and quality objectives



# Air Monitoring Stations in Refinery Communities

- Held community meetings in February and March of 2018 to get community input and provide information
- Priority is to place stations in communities currently not being monitored (Benicia)
- Leveraging activities associated with AB 617 in other communities
- Leverage upcoming AB 617 monitoring in Richmond to provide additional information and gain Steering Committee input

## Gathering Existing data and Information

- Looking at emissions and meteorology
- Identifying areas of likely impact to start looking for station acquisition and build out, focusing on location representativeness
- Site selection analysis near completion for all refinery communities except Richmond
- Currently working to finalize site selection in Benicia

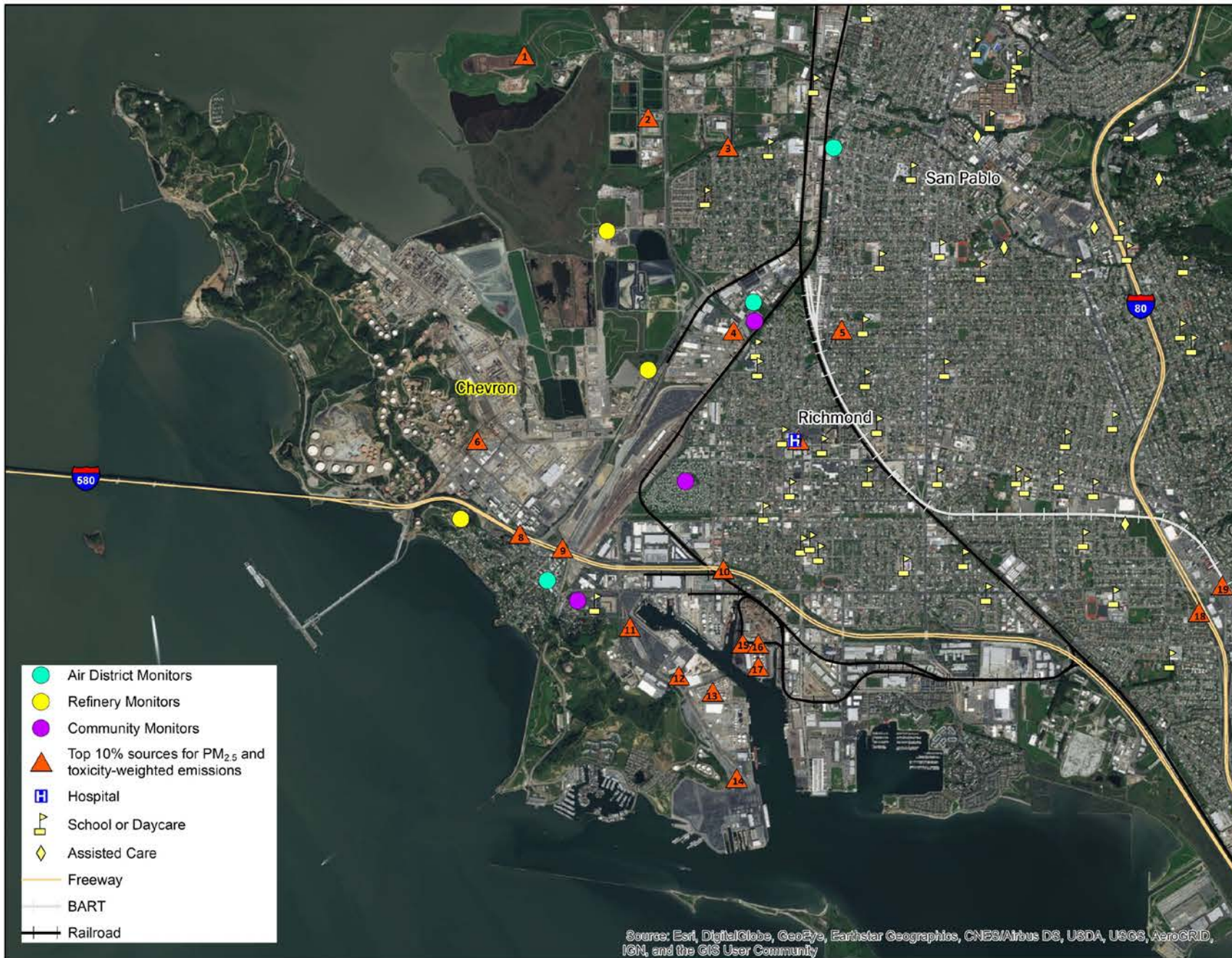


# A Quick Word About Assembly Bill (AB) 617

This legislation dovetails with monitoring in refinery communities

- Expand and use all approaches to identify and characterize localized pollutants and where they originate (screening, special studies, traditional ambient monitoring)
- Results may be used to develop an Action Plan to reduce and ultimately eliminate disparities in air quality from place to place
- Work with communities to identify shared vision and to develop a plan for Community Air Monitoring Campaign and/or Action Plans



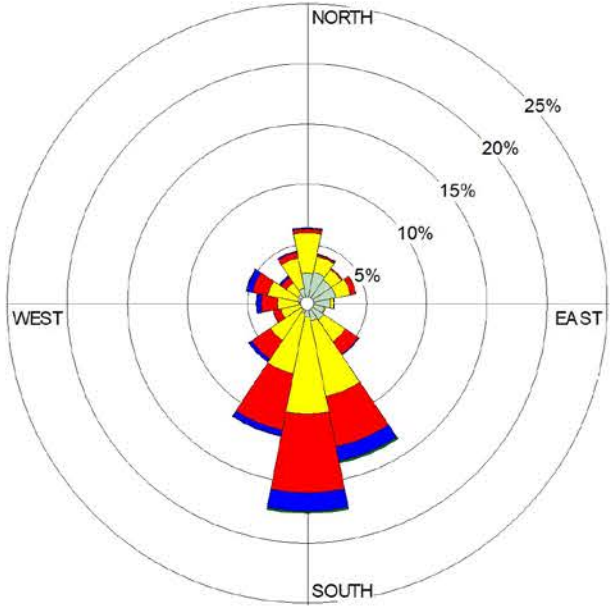
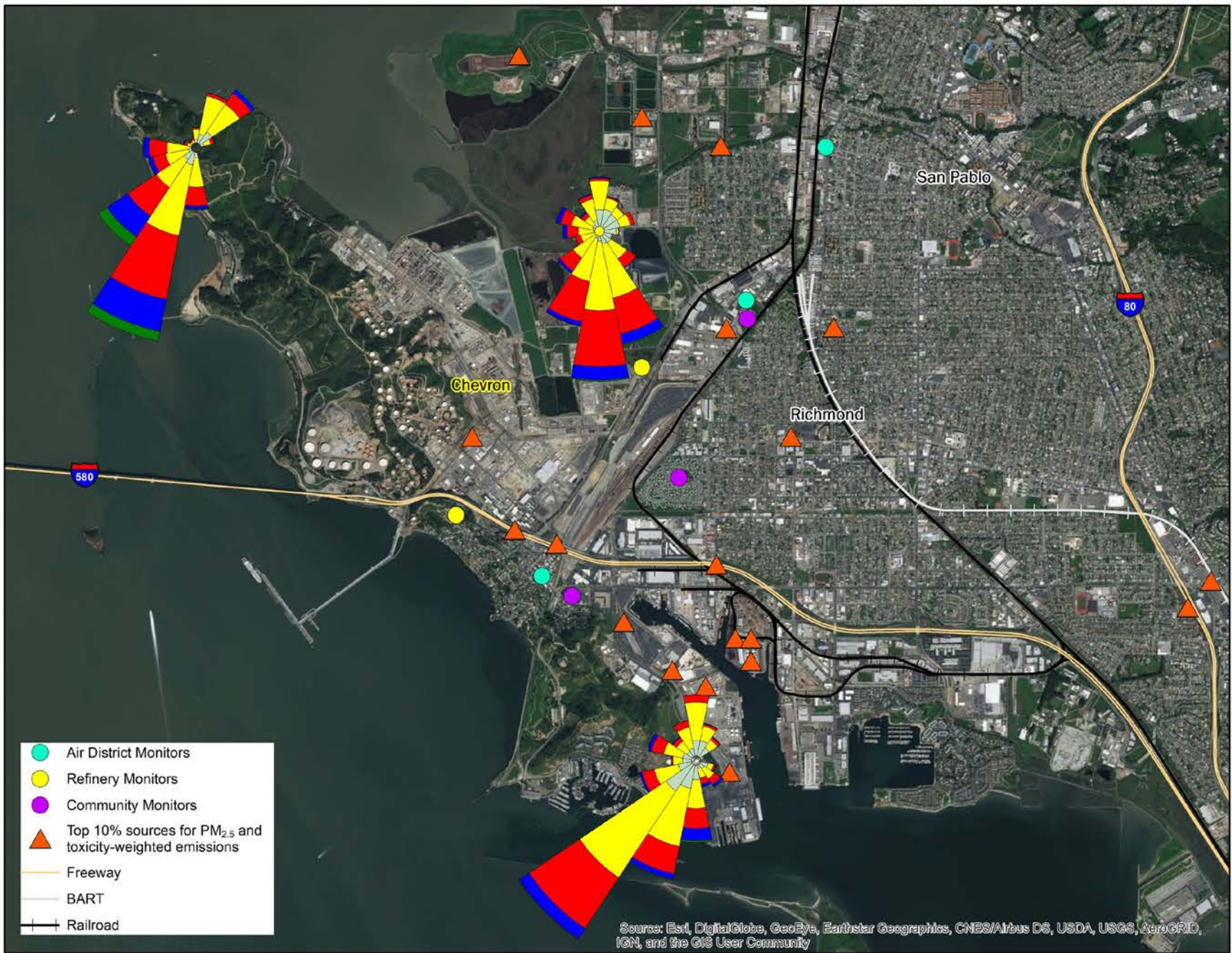


- Air District Monitors
- Refinery Monitors
- Community Monitors
- ▲ Top 10% sources for PM<sub>2.5</sub> and toxicity-weighted emissions
- H Hospital
- ▧ School or Daycare
- ◆ Assisted Care
- Freeway
- BART
- +— Railroad

**▲ Point Sources Legend**

- 1 – West Contra Costa County Landfill
- 2 – West County Wastewater District
- 3 – West County Resource Recovery
- 4 – BNSF Railway Company
- 5 – Richmond BART
- 6 – Chevron Products Company
- 7 – Kaiser Permanente
- 8 – Chevron Richmond Technology Center
- 9 – Chemtrade West US LLC
- 10 – East Bay Batch
- 11 – City of Richmond Water Pollution Control
- 12 – Brenntag Pacific
- 13 – Phillips 66 Company
- 14 – New NGC, Inc
- 15 – Cemex
- 16 – Plains Products Terminals LLC
- 17 – Levin Richmond Terminal Corporation
- 18 – IMTT Richmond
- 19 – El Cerrito del Norte BART

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



WIND SPEED (m/s)

- >= 10.00
- 7.50 - 10.00
- 5.00 - 7.50
- 2.50 - 5.00
- 0.00 - 2.50

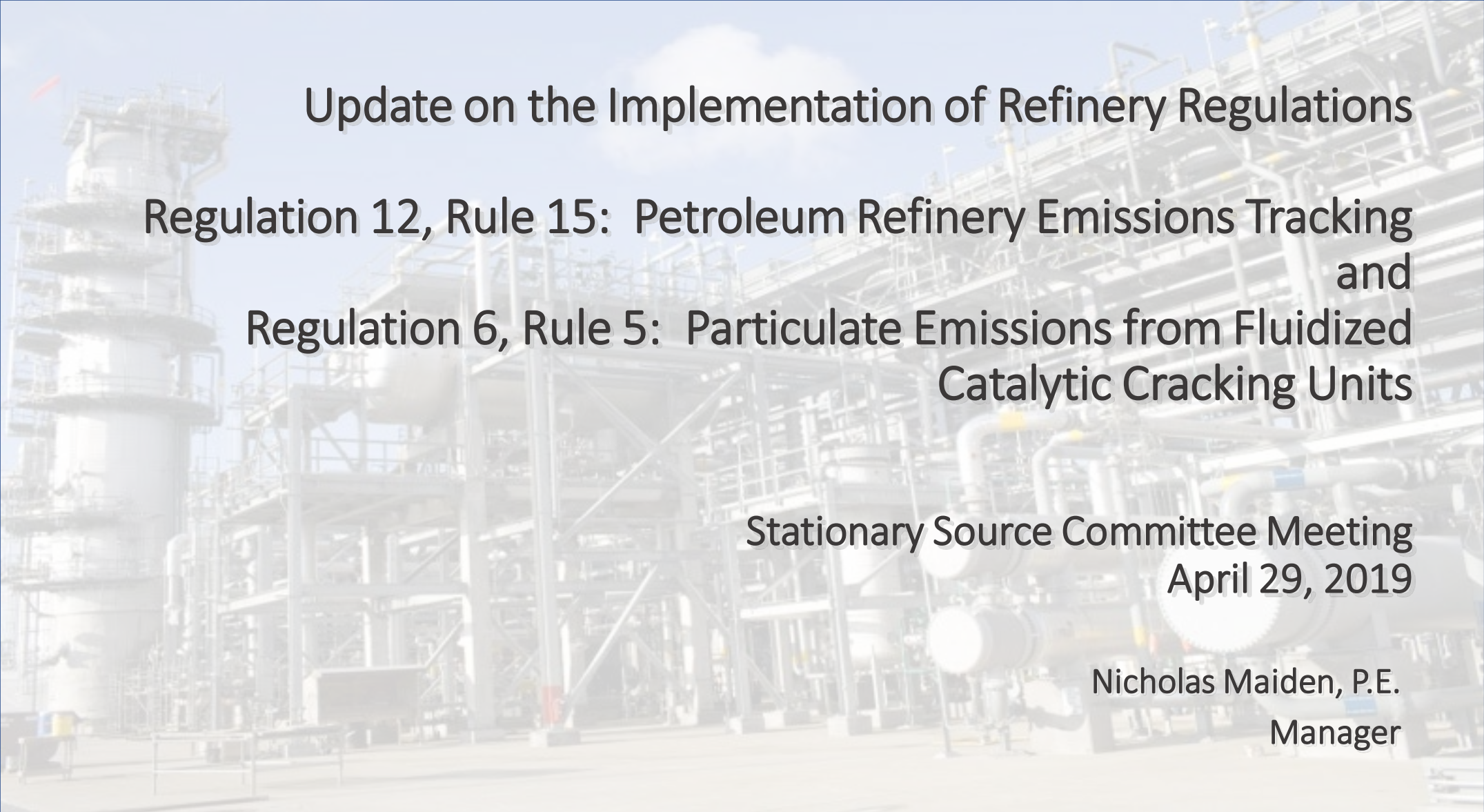


**Questions?**



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AGENDA: 5

A faded background image of a large industrial refinery complex with numerous towers, pipes, and scaffolding under a blue sky with light clouds.

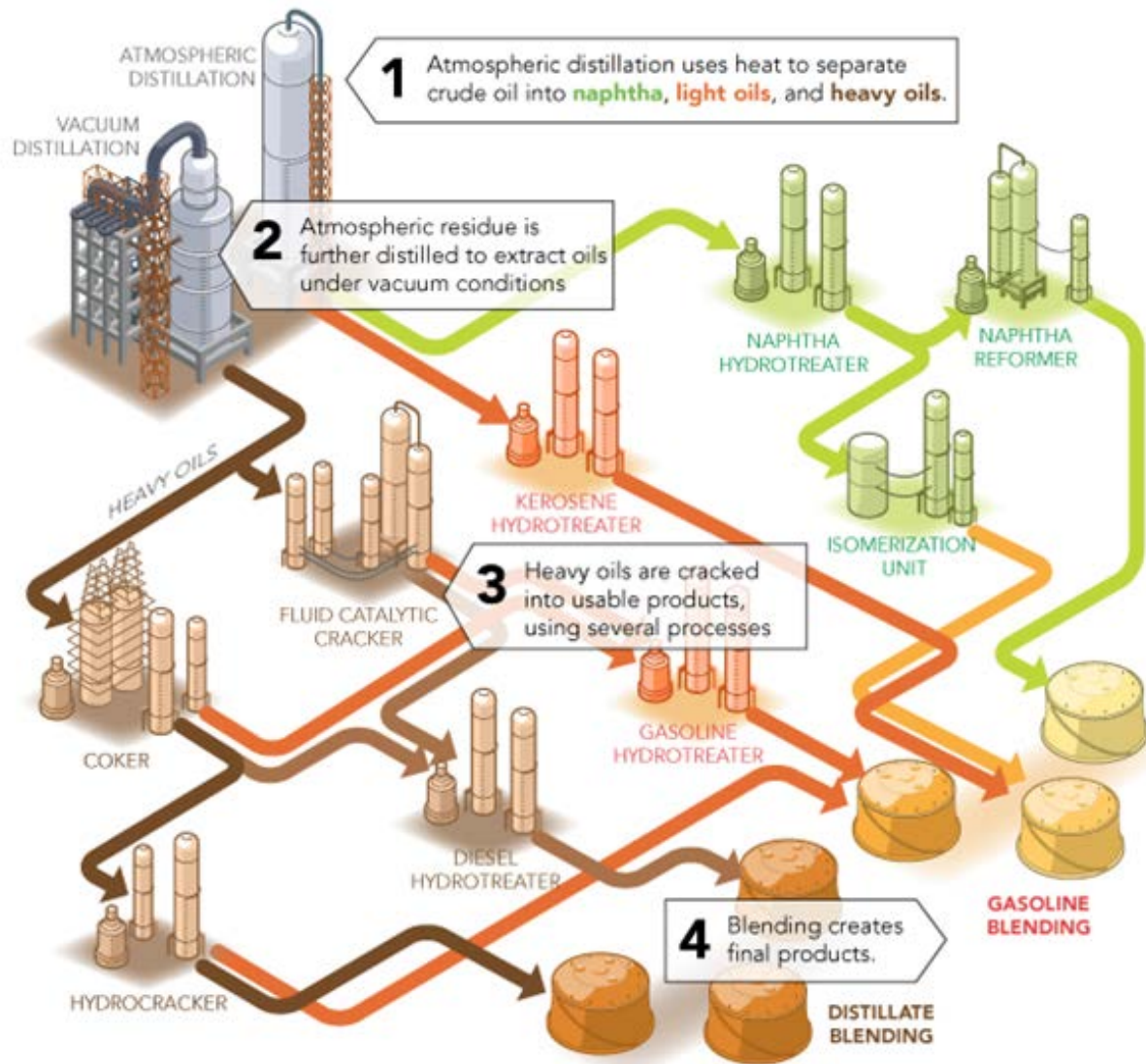
# Update on the Implementation of Refinery Regulations

## Regulation 12, Rule 15: Petroleum Refinery Emissions Tracking and Regulation 6, Rule 5: Particulate Emissions from Fluidized Catalytic Cracking Units

Stationary Source Committee Meeting  
April 29, 2019

Nicholas Maiden, P.E.  
Manager

# Crude Oil Refining



## Emission Sources

- Combustion (gas turbines, furnaces, boilers, engines)
- Flares
- Storage Tanks
- Process Units (with exhaust stacks)
- Equipment Leaks (valves, flanges, pumps, pressure relief)
- Miscellaneous (wastewater, loading, cooling towers)



# Crude Oil



Light  Heavy

Processing Effort

API Gravity



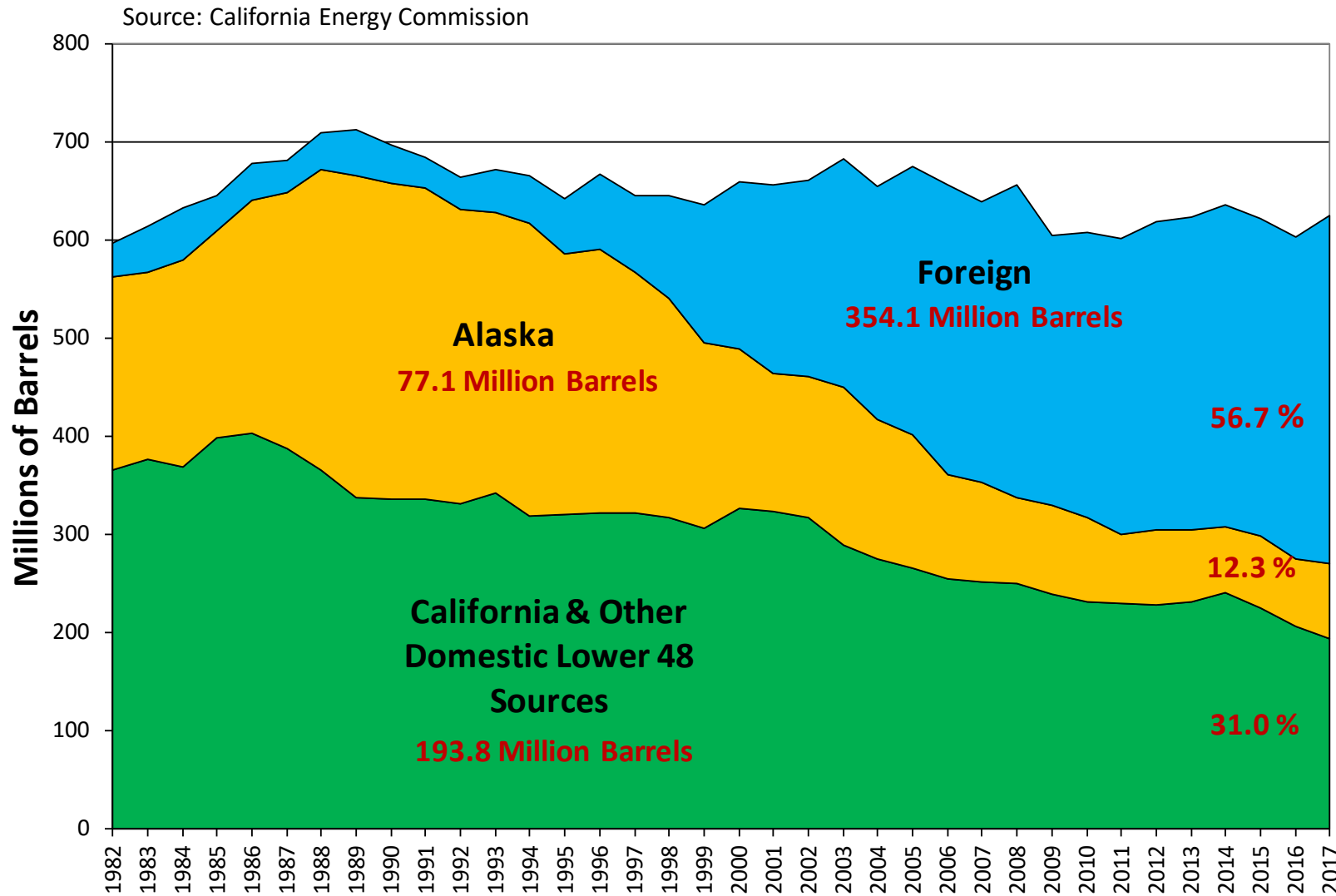
Sulfur Content

Wide Variety in Composition  
Even from Same Oil Field!

Same-day deliveries of Eagle Ford  
crude to a refinery (Source; Digital Refining.com)



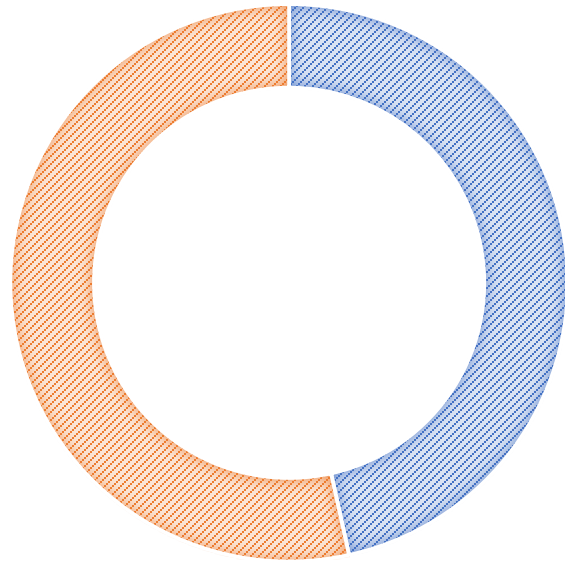
# California Refinery Crude Oil Sources



# Bay Area Crude Oil Sources

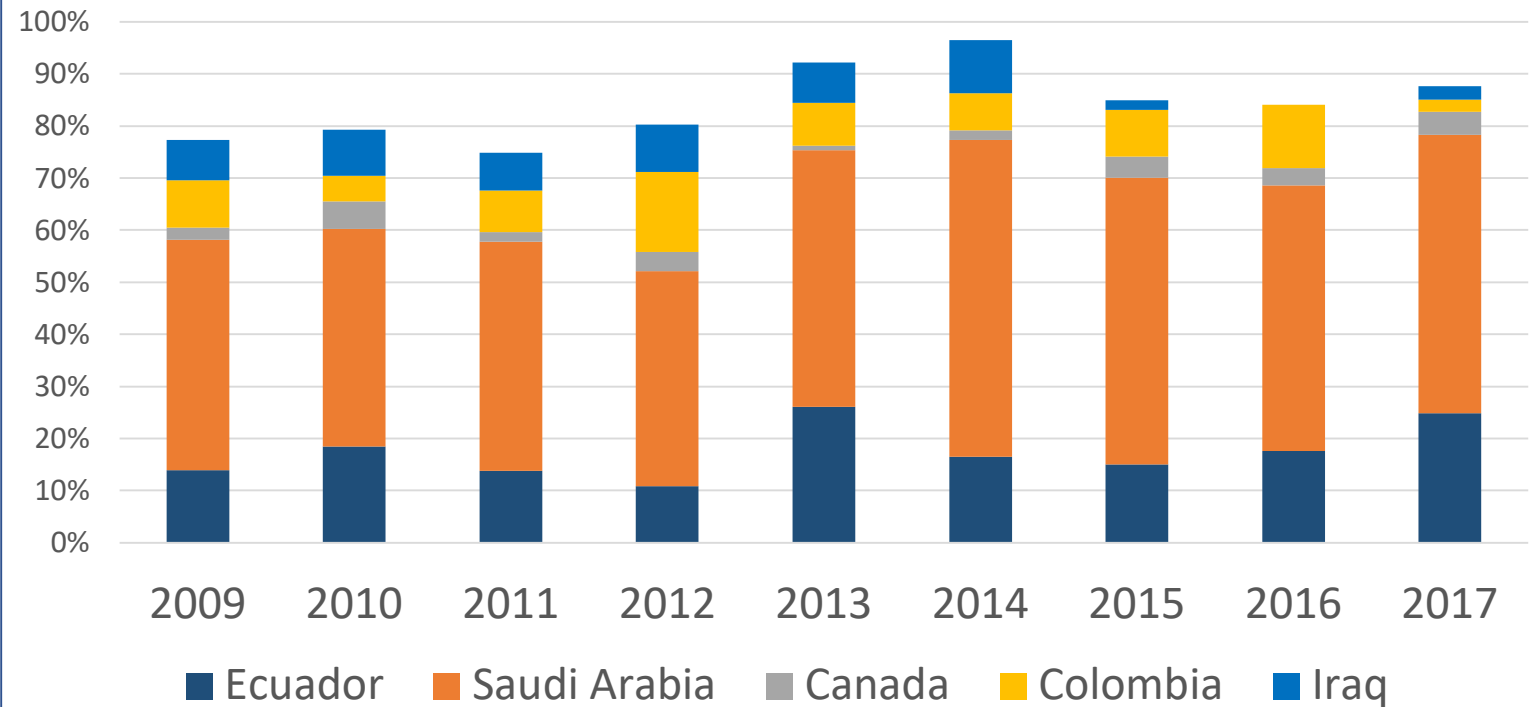
## BAY AREA AVERAGE CRUDE SOURCE

Foreign Crude U.S. Crude



(2009 to 2016)

## FOREIGN CRUDE OIL SOURCES



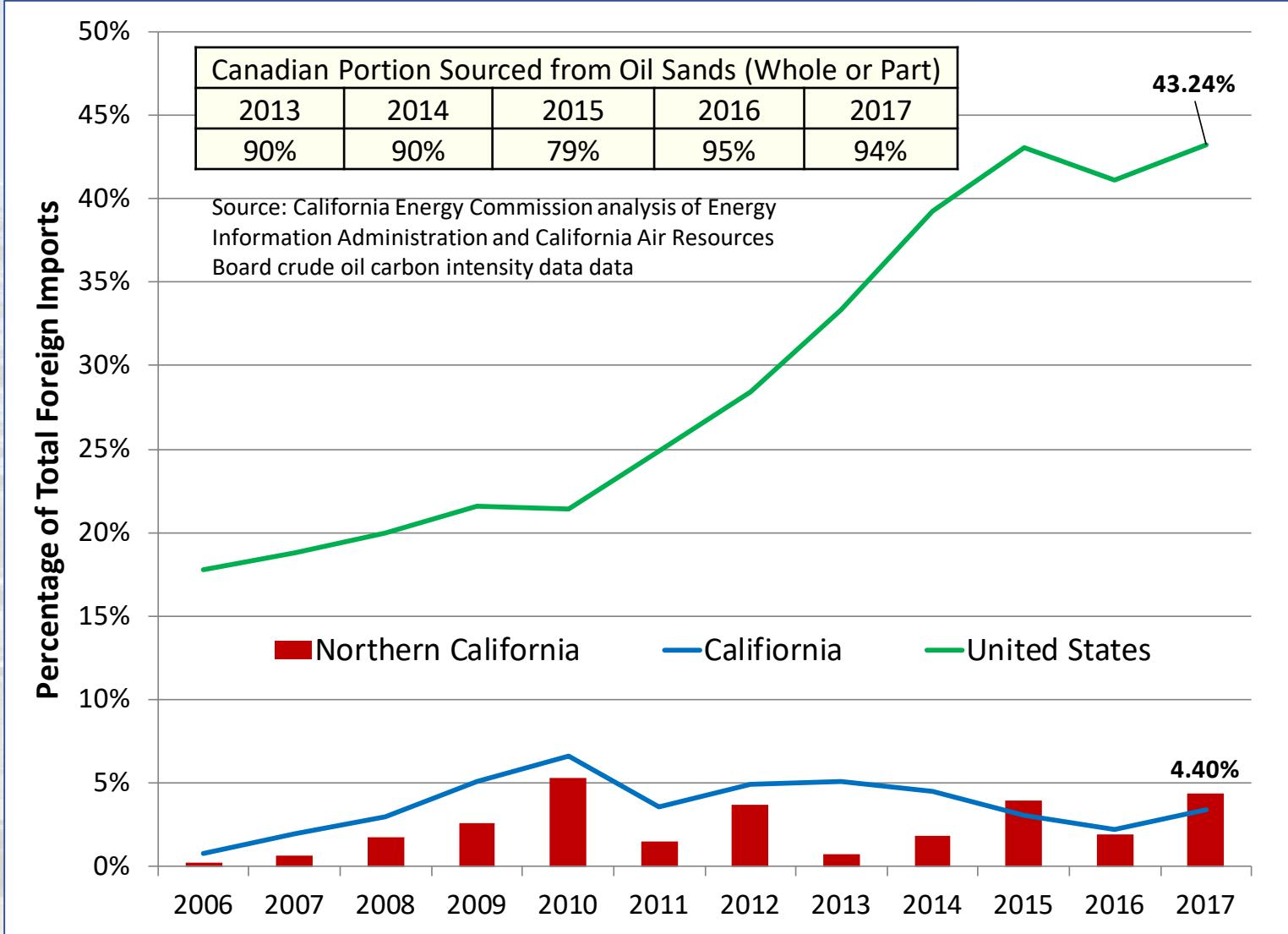
Foreign Crude Oil Data Source:

U.S. Energy Information Agency: Publicly-Available Crude Imports by Refinery (Volumes, API Gravity, Sulfur Content)

[https://www.eia.gov/petroleum/imports/browser/?src=-f8#/?d=0&dt=RF&vs=PET\\_IMPORTS.WORLD-US-ALL.A](https://www.eia.gov/petroleum/imports/browser/?src=-f8#/?d=0&dt=RF&vs=PET_IMPORTS.WORLD-US-ALL.A)

<https://www.eia.gov/petroleum/imports/companylevel/archive/>

# Canadian Crude Oil Imports



For calendar year 2017:

- 43% of total crude oil imported into the U.S. was from Canada
- local refineries imported 57% from foreign sources
- of the 57%, local refineries imported 4.4% from Canada
- of total crude oil (U.S. and foreign), local refineries imported 2.5% from Canada

# Regulation 12, Rule 15

Annual Emissions Inventory

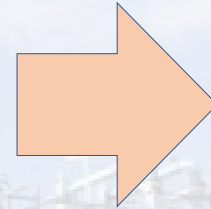
Crude Oil Composition

Fence-Line Monitoring

“Track air emissions and crude oil composition characteristics from Petroleum Refineries and Support Facilities over time ... establish air monitoring systems ... along refinery boundaries.”

# Regulation 12, Rule 15 (cont'd)

Annual Emissions Inventory



Crude Oil Composition

Fence-Line Monitoring

Due Every June 30<sup>th</sup>

- Air District looking at potential rule change due to Assembly Bill (AB) 617 reporting requirements

Criteria and Toxic Air Pollutants, Greenhouse Gases

All Stationary Sources

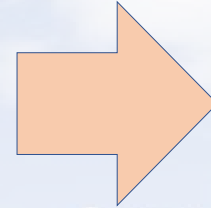
(continuous, intermittent, predictable, and accidental\*)

\* If reportable per a Federal Risk Management Plan

45 days to identify and address any deficiencies

# Regulation 12, Rule 15 (cont'd)

Annual Emissions Inventory



Crude Oil Composition

Fence-Line Monitoring

## Five Petroleum Refineries

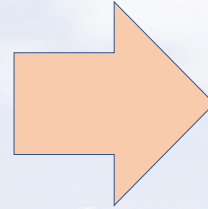
- Chevron (Richmond)
- Marathon (Martinez)
- Phillips 66 (Rodeo)
- Shell (Martinez)
- Valero (Benicia)

## Three Support Facilities

- Air Liquide (Rodeo)
- Air Products (Martinez)
- Chemtrade West (Richmond)

# Regulation 12, Rule 15 (cont'd)

Annual Emissions Inventory



Crude Oil Composition

Fence-Line Monitoring

- Calendar Year 2016 (reported in 2017)
  - Calendar Year 2017 (reported in 2018)
  - Calendar Year 2018 (due June 30, 2019)
- Final approval and posting pending Heavy Liquid Fugitive Study in 2019



# Regulation 12, Rule 15 (cont'd)

Annual Emissions Inventory

Crude Oil Composition

Fence-Line Monitoring

Monthly Crude Slate Report

Crude Unit

(American Petroleum Institute (API), sulfur, vapor pressure, iron, nickel, vanadium)

Fluidized catalyst processing unit

(API, sulfur, iron, nickel, and vanadium)

# Regulation 12, Rule 15 (cont'd)

Annual Emissions Inventory

Crude Oil Composition

Fence-Line Monitoring

Considered confidential business information

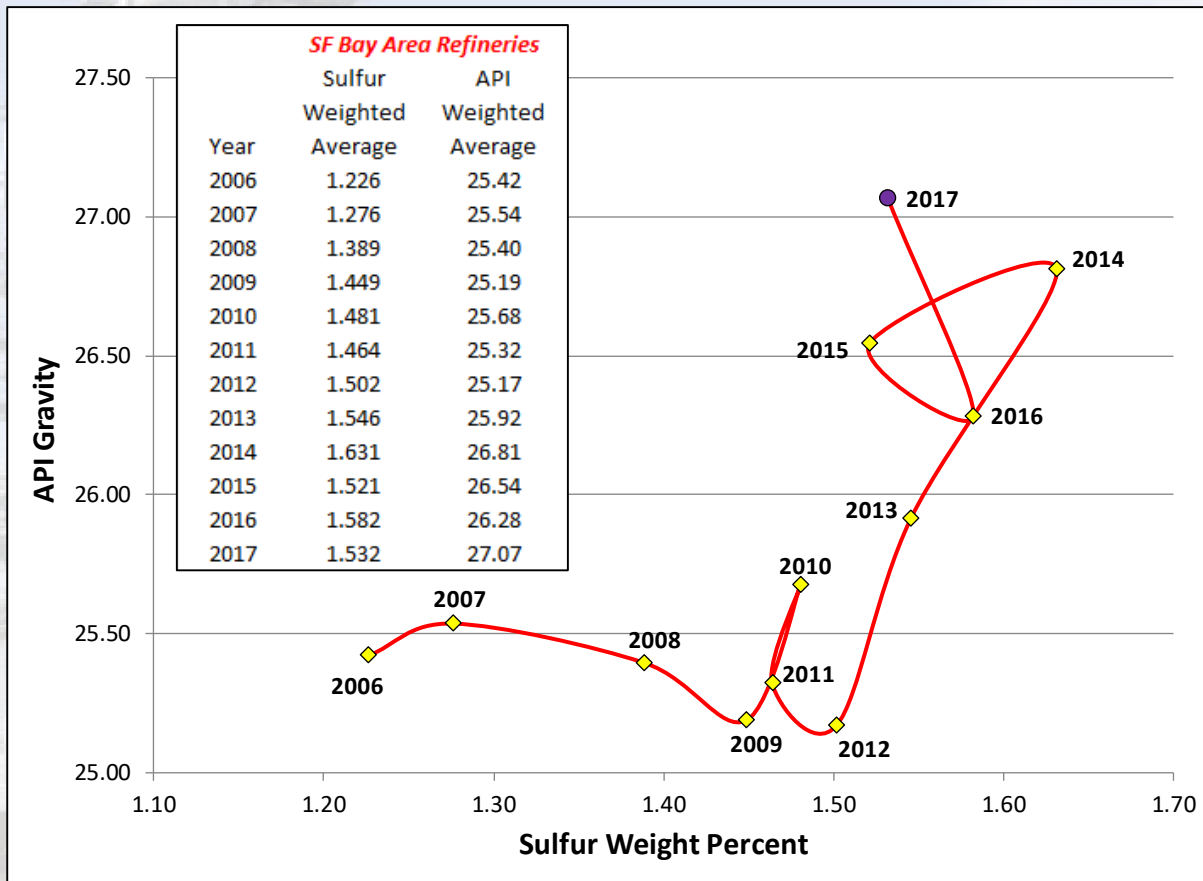
Baseline (2013 through 2016)

Reviewing 2017 and 2018 data

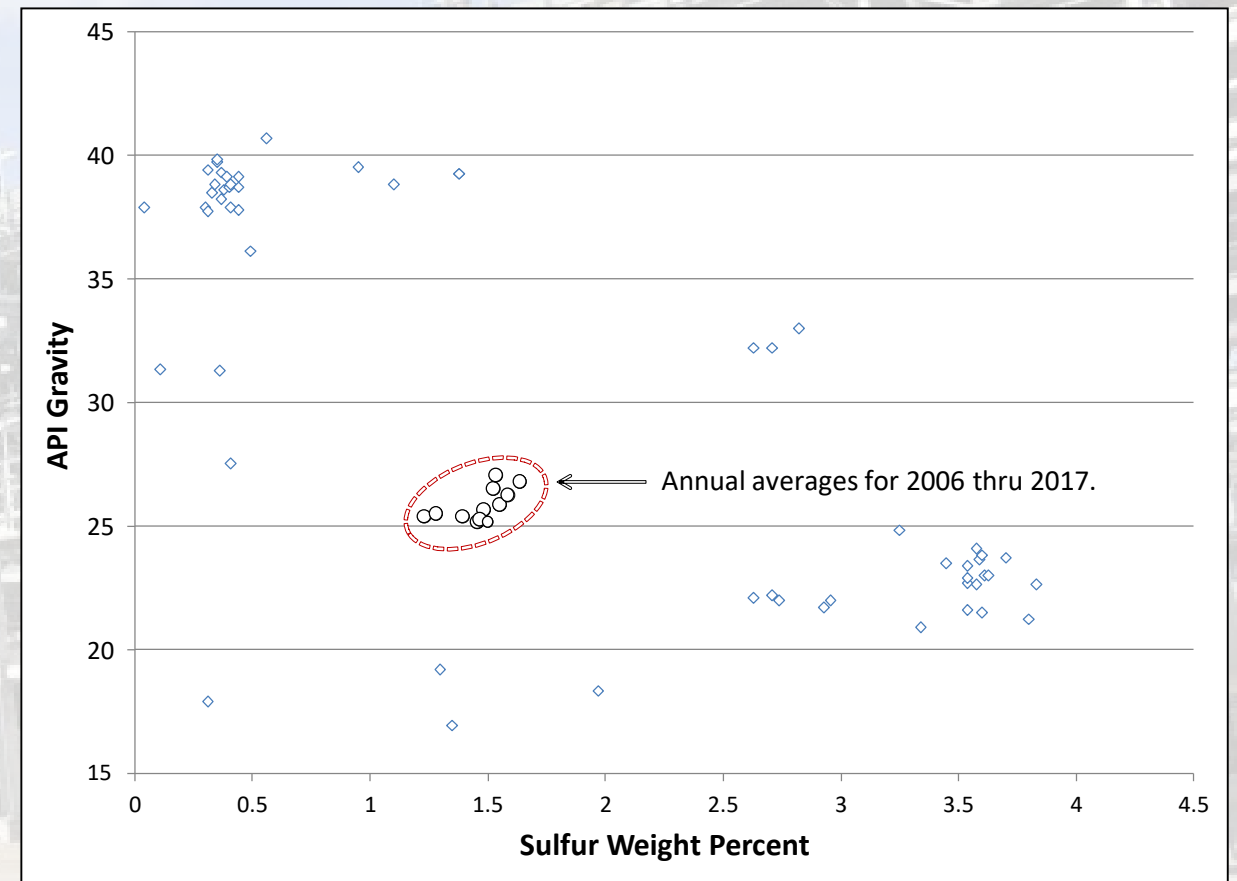
- Crude data
- Emissions data

# Crude Oil Properties

## Bay Area Annual Refinery Variability

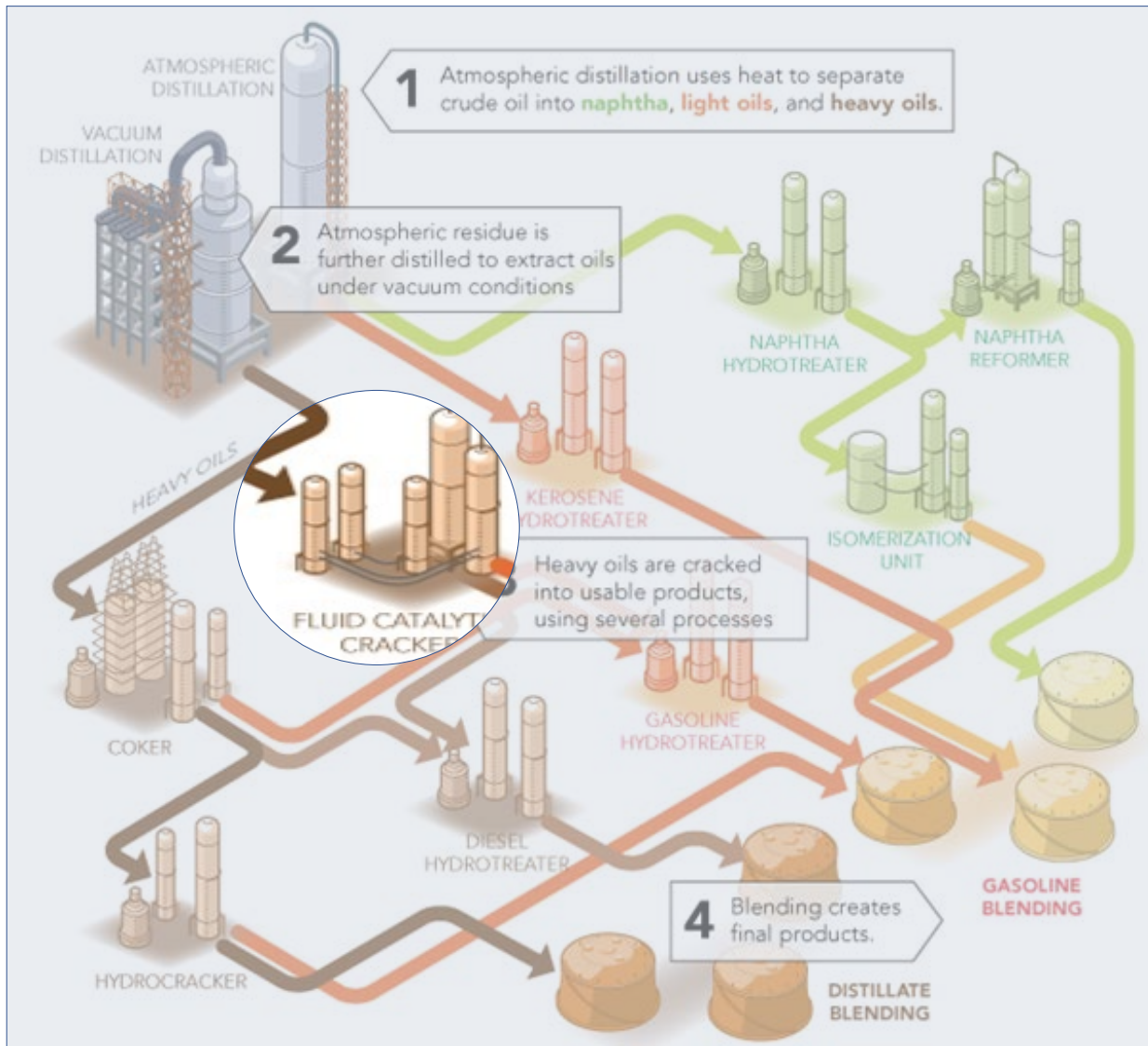


## Imported Canadian Crude Oil Properties versus Bay Area Annual Refinery Variability



Source: California Energy Commission analysis of PIIRA (Petroleum Industry Information Reporting Act) data.

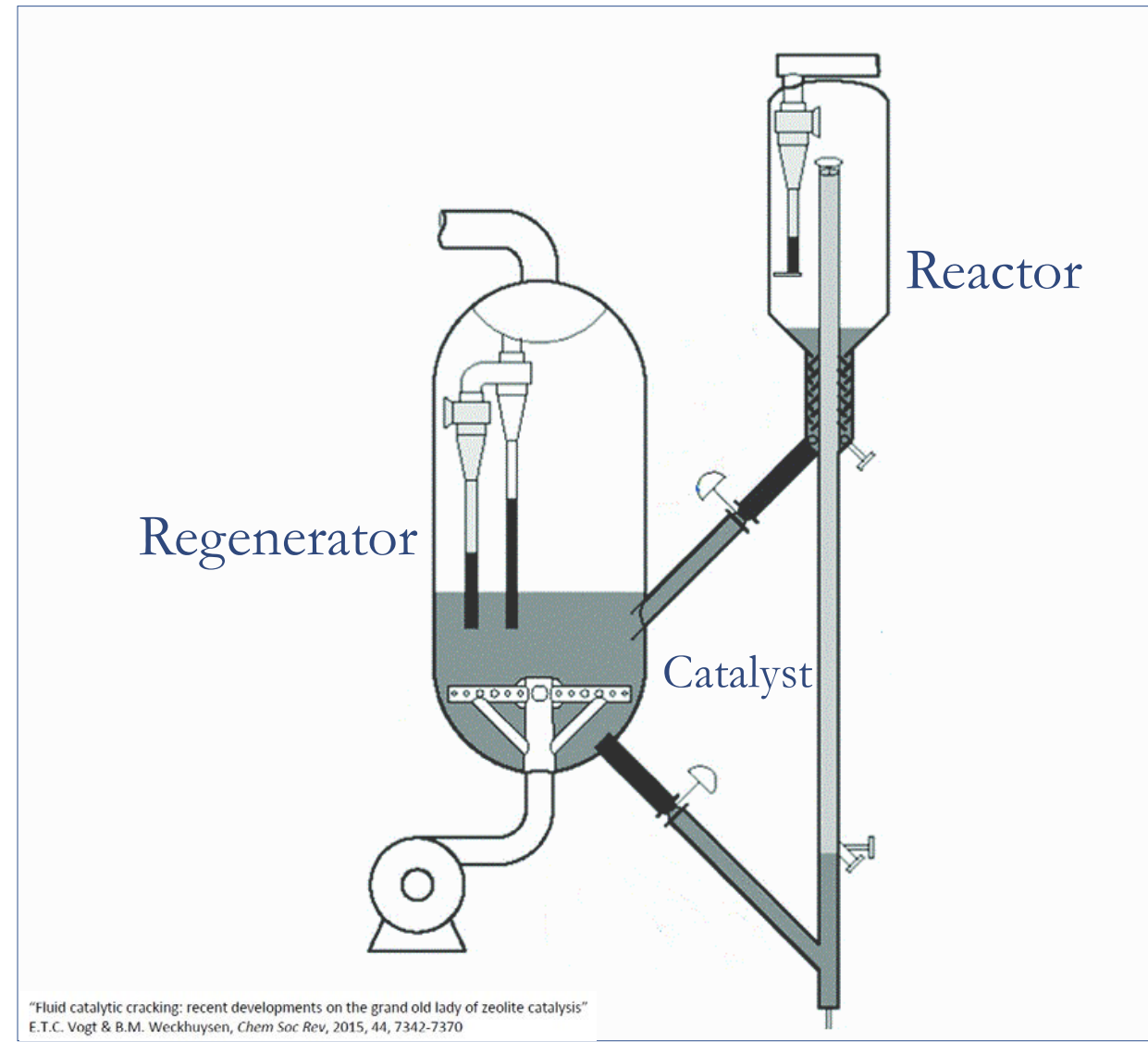
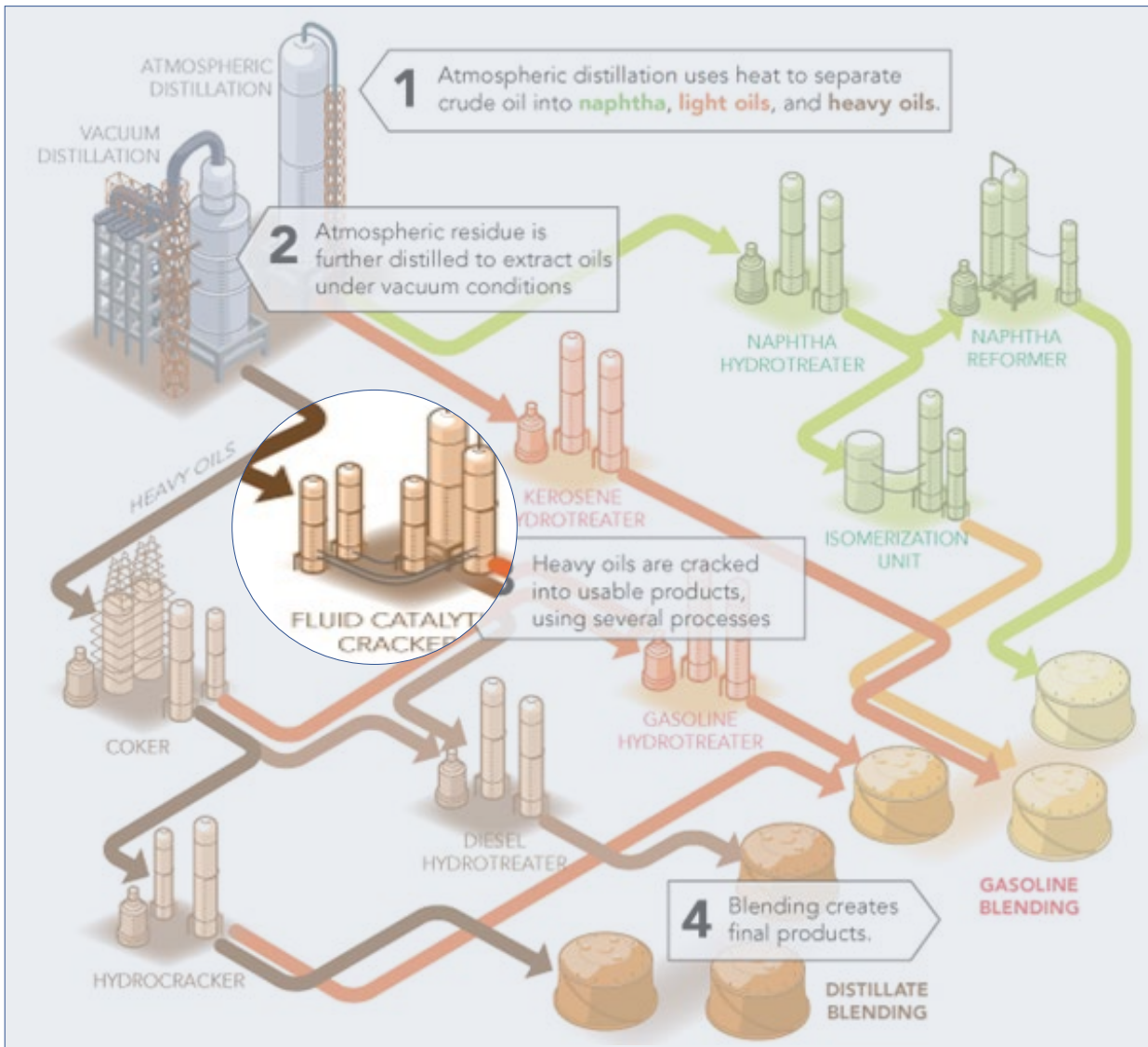
# Fluidized Catalytic Cracking Unit (FCCU)



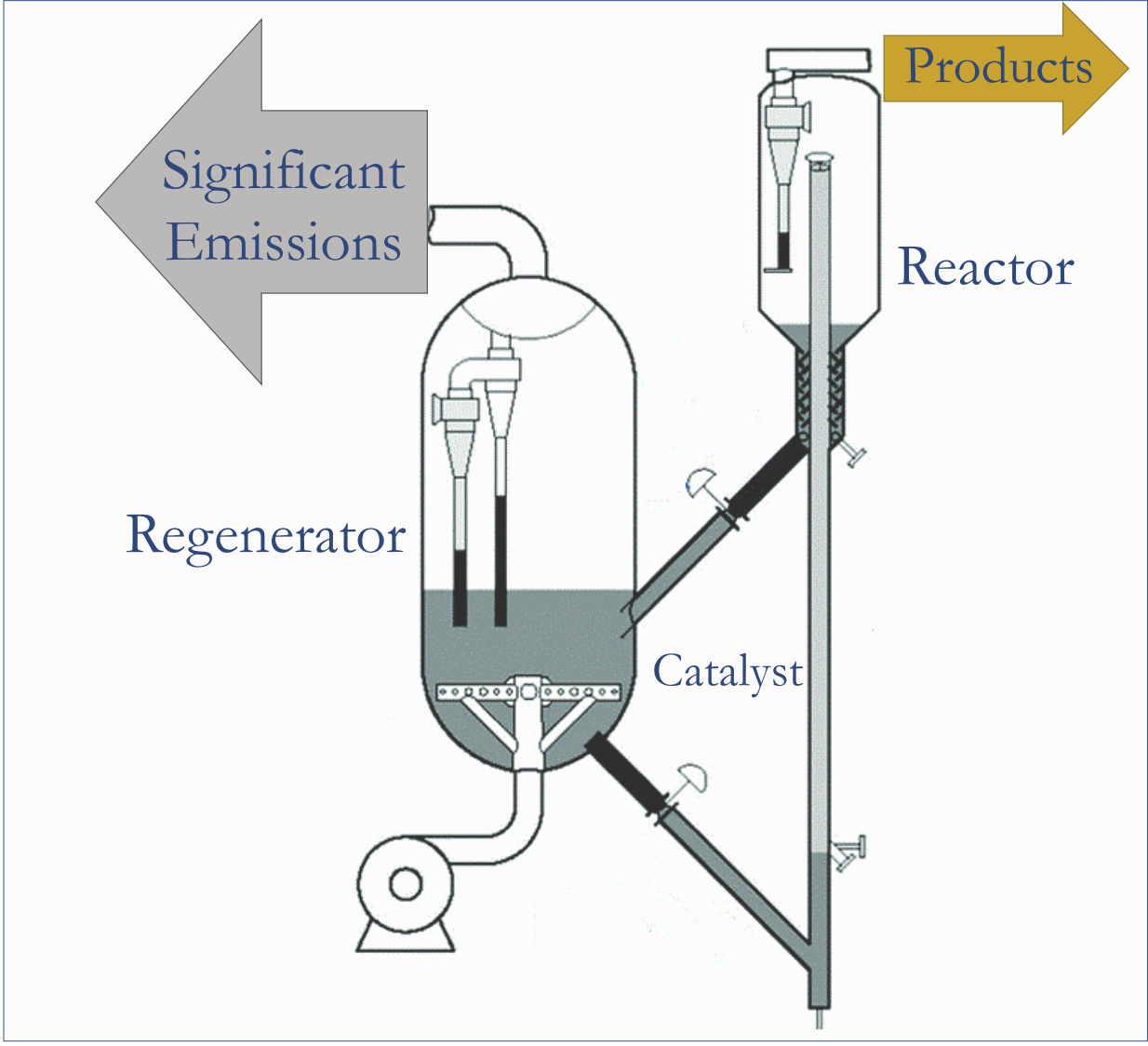
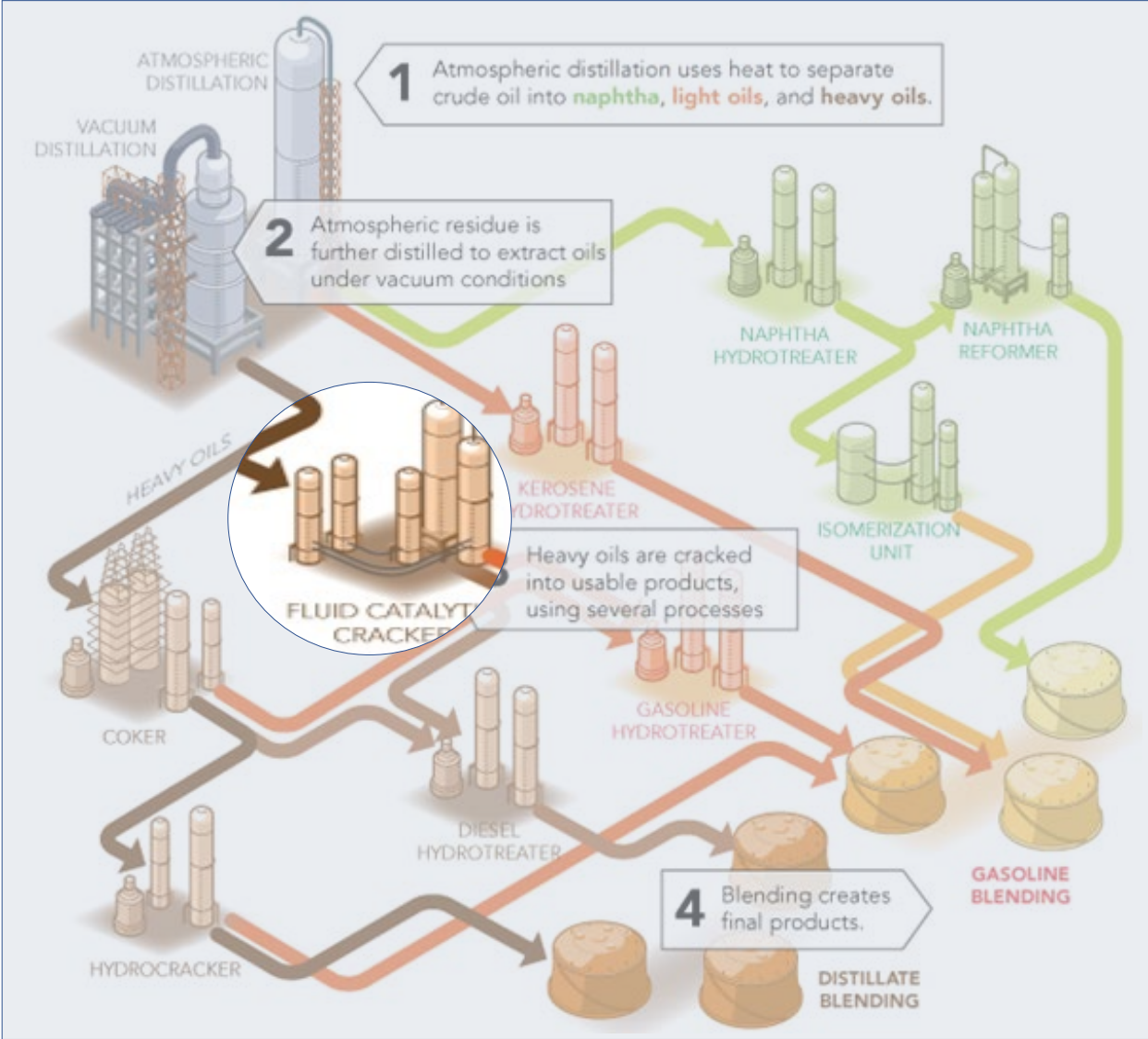
Largest Emitting Source

Up to  
70%

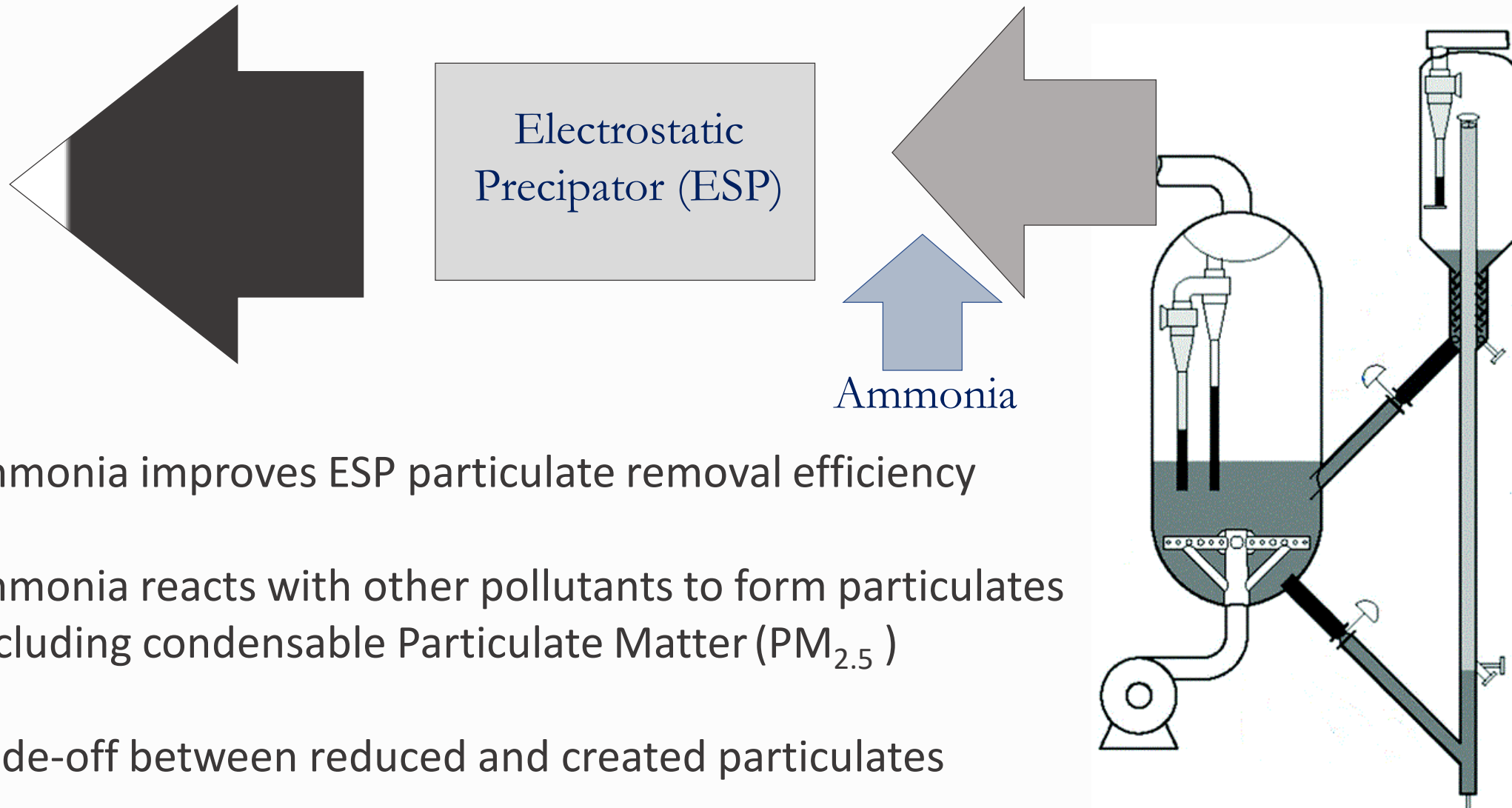
# Fluidized Catalytic Cracking Unit (cont'd)



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# Fluidized Catalytic Cracking Unit (cont'd)



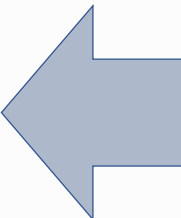
Ammonia improves ESP particulate removal efficiency

Ammonia reacts with other pollutants to form particulates (including condensable Particulate Matter (PM<sub>2.5</sub>))

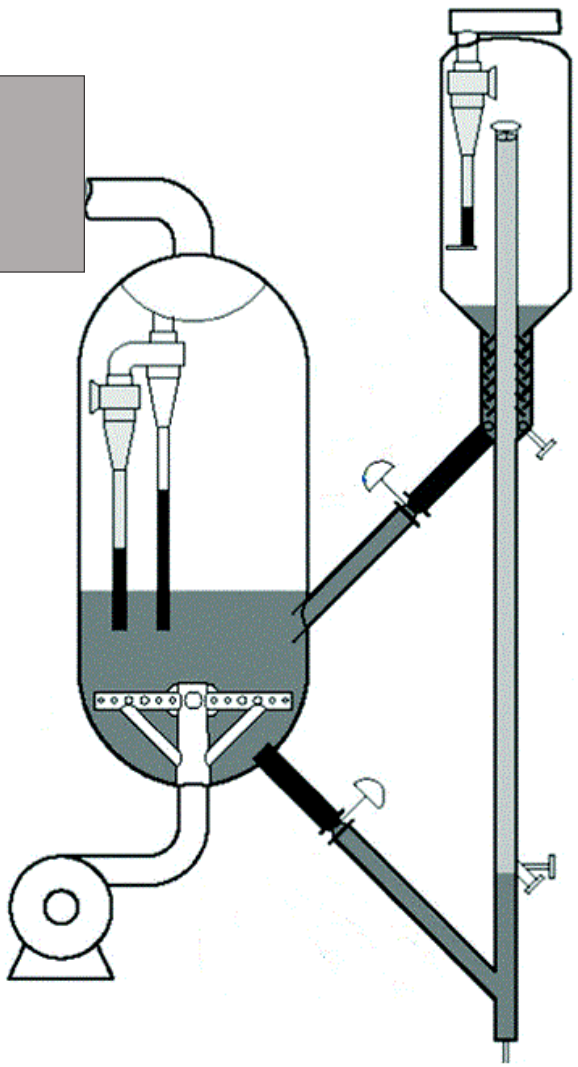
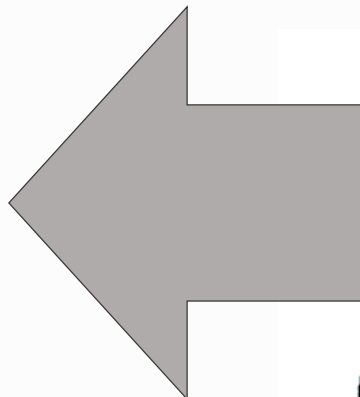
Trade-off between reduced and created particulates

# Regulation 6, Rule 5

Ammonia  
(10 ppm @ 3% O<sub>2</sub>  
daily average  
or  
optimized limit)



Electrostatic  
Precipitator



Ammonia emissions monitoring

Ammonia Optimization

Minimum ammonia injection rate necessary to minimize total PM<sub>2.5</sub> emissions (including all condensable PM)



# Regulation 6, Rule 5 (cont'd)

Phillips 66 not subject to rule (does not have an FCCU)

Valero exempt from rule (has a Wet Gas Scrubber)

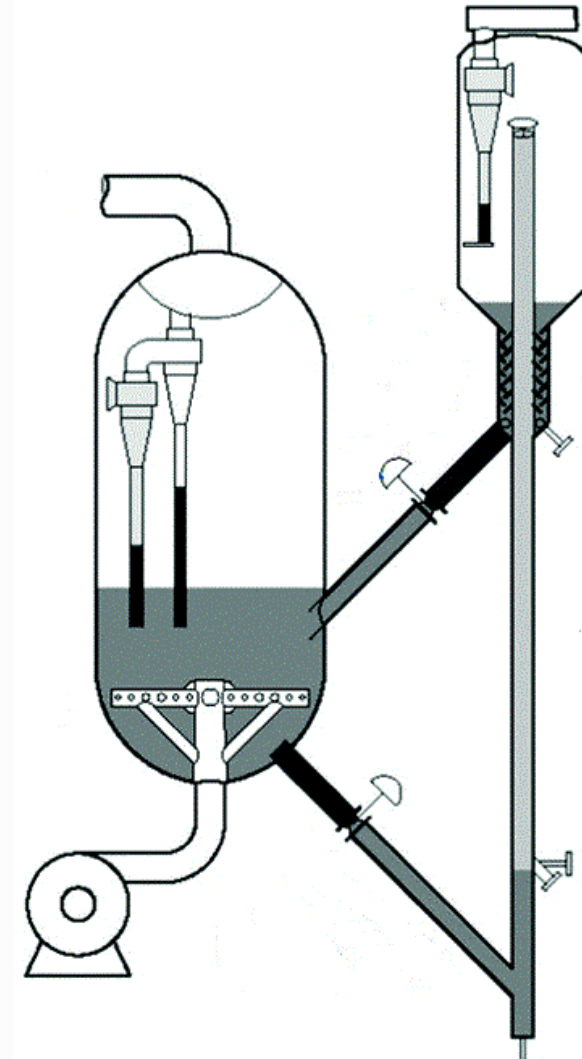
Marathon opted to comply with 10 parts per million volume (ppmv) daily limit

Chevron conducted optimization testing

Preliminary data shows potential for significant PM reductions

Shell conducted optimization testing

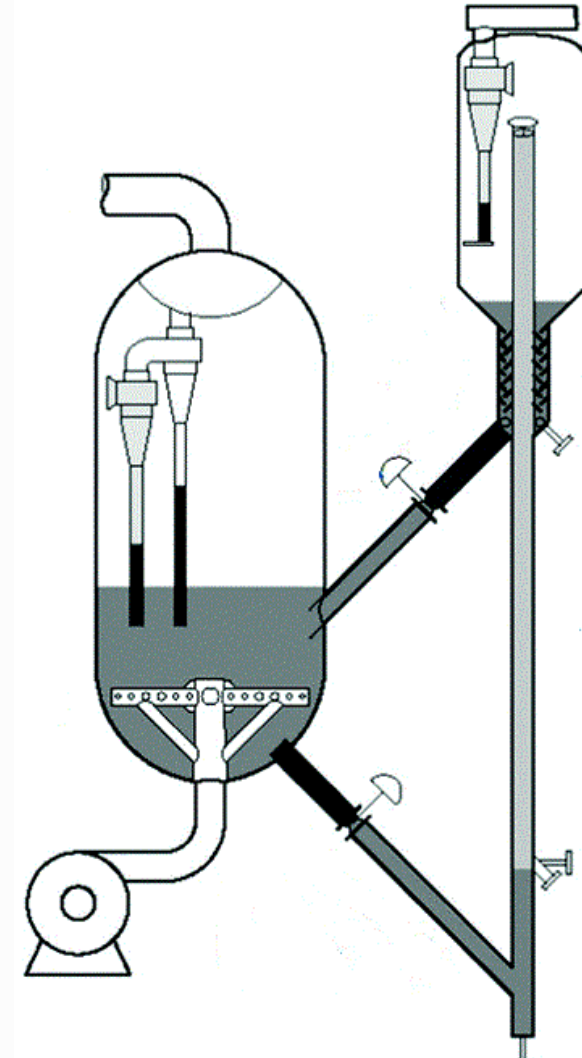
Air District reviewing submitted information



# Regulation 6, Rule 5 (cont'd)

## Current Rule Development for Regulation 6, Rule 5

- Identified in AB 617 Expedited Best Available Retrofit Control Technology (BARCT) Implementation Schedule to further address PM emissions
- Technical assessment / Stakeholder engagement and outreach
- Anticipated workshops in early 2020
- Board Hearing by end of 2020



# Questions?

