

**Proposed Amended Rule 1173** - Control of Volatile Organic Compound Leaks and Releases from Components at Petroleum Facilities and Chemical Plants

> WORKING GROUP MEETING #3 JUNE 12, 2024 – 9:00 AM

Zoom Meeting: <u>https://scaqmd.zoom.us/j/95683547797</u> Meeting ID: 956 8354 7797

# Agenda

Recap of Working Group Meeting #2

**Responses to Feedback** 

Leak Standard BARCT Assessment

**OGI Inspection Frequency BARCT Assessment** 

**Other Rule Concepts** 

**Next Steps** 

### Recap of Working Group Meeting #2



Source: https://www.hpc-industrial.com



• Responses to comments, including:

- Delay of repair for critical components/essential equipment
- Lowering leak thresholds
- Optical Gas Imaging (OGI) concerns including inaccessible leaks and frequency
- Completed technology assessment, learning:
  - Basin wide quarterly leak ratio of 0.17% for 2023 Q4
  - 990 tons of VOC emissions associated with Rule 1173 reported to Annual Emissions Reporting (AER) in 2022
  - Leak rate limits range statewide from 100 ppm to 1000 ppm
- Public stakeholder feedback received regarding:
  - Alternatives to OGI, such as enhanced Method 21 LDAR
  - Concerns of pace of rulemaking and thoroughness
  - Applicability of metal finishing operations

https://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/par-1173/final-par-1173-wgm2.pdf

#### Best Available Retrofit Control Technology (BARCT)

- In Working Group Meeting (WGM) #2, staff completed the technology assessment:
  - Components
  - Smart LDAR
  - OGI Inspection Frequencies
- WGM #3 will complete the PAR 1173 BARCT analysis:
  - Proposals for initial BARCT limits and other considerations
  - Cost-Effectiveness and Incremental Cost-Effectiveness analyses
  - Establish BARCT emission limits



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### Enhanced Method 21 Inspections

#### Feedback

 Instead of OGI inspection, facilities should be able to implement enhanced Method 21 inspections or other alternatives

#### Response

- The 2022 Air Quality Management Plan (AQMP) control measures and AB617 Community Emission Reduction Plans (CERPs) objectives commit South Coast AQMD to implement smart LDAR strategies, like OGI
- PAR 1173 will allow smart LDAR alternatives to handheld OGI inspections if approved by U.S. EPA
  - Smart LDAR includes open path methods or continuous gas sensors



# High Cost of OGI Equipment



#### Feedback

 Purchase of an OGI camera will be a high financial and resource burden for small facilities

#### Response

- The costs of OGI, including capital costs and recurring costs, will be examined later in this presentation
- Facilities may choose to purchase OGI equipment or contract with service providers

### Weather Concerns

#### Feedback

• OGI equipment can be affected by adverse weather conditions like rain

#### Response

 Staff will consider adverse weather conditions and ensure flexibility in OGI inspection schedules for safety, consistent with the approach in Rule 1178 and proposed in PAR 463



### Metal Finishing Operations



#### Feedback

• Concerns metal finishing operations may be included within the scope of PAR 1173

#### Response

- Staff is not increasing the applicability of PAR 1173 in this rulemaking to include metal finishing operations
- Definitions of facility types will be updated to ensure clarity

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#### Leak Standard Comparative Analysis



#### Fittings, Valves, and "Others"



- Comprise over 99% of all components in South Coast AQMD
  - 1,720,410 fittings (connectors and flanges)
  - 498,644 valves
  - 122,390 others (diaphragms, hatches, sight-glasses, meters, etc.)
- Lowest leak ratios under existing 500 ppm rule limit
  - Fittings 0.13%
  - Valves 0.24%
  - Others 0.29%

https://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/par-1173/final-par-1173-wgm2.pdf

- 400 ppm leak standard
  - San Joaquin Valley APCD Rule 4455 for gas/vapor service
- 200 ppm leak standards
  - South Coast AQMD BACT/LAER
  - San Joaquin Valley APCD Rule 4455 for liquid service
- 100 ppm leak standards
  - Bay Area AQMD Rule 8-18
  - Santa Barbara County APCD BACT for oil and gas facilities
  - San Joaquin Valley APCD BACT for refineries and natural gas plants

### **Pumps and Compressors**

- 8,598 identified units in VOC (light liquid or gas/vapor) service in South Coast AQMD
  - 150 leaks found in 2023 Q4
  - Quarterly leak rate of 1.77%
- 100 ppm leak standards:
  - South Coast AQMD for heavy liquid pumps
  - Santa Barbara County APCD BACT standard for new equipment at oil and gas sites
  - San Joaquin Valley APCD BACT standard for refineries and compressor seals at natural gas processing plants



### Pressure Relief Devices (PRDs)



- Currently 6,348 PRDs, including atmospheric process PRDs, in South Coast AQMD
  - 35 leaks from PRDs detected in 2023 Q4
  - Quarterly leak rate of 0.55% at 200 ppm standard
- 100 ppm PRD leak standards:
  - San Joaquin Valley APCD Rule 4455 in liquid service
  - San Joaquin Valley APCD BACT for refineries and natural gas processing plants
  - Santa Barbara County APCD BACT for oil and gas sites

#### Assessment of Lower Leak Standards

- Reducing a leak standard is expected to:
  - Increase the number of leaks detected and increase maintenance and repair expenditures
  - Decrease baseline fugitive VOC emissions
- For each proposed leak standard, staff to evaluate the Cost-Effectiveness and Incremental Cost-Effectiveness
  - Cost-Effectiveness is the net cost divided by expected annual emission reductions
  - When there is more than one control option, Incremental Cost-Effectiveness is calculated between control options
  - 2022 AQMP set Cost-Effectiveness threshold at \$36,000 per ton of VOC reduced
    - The current inflation-adjusted threshold is **\$40,168** per ton of VOC reduced



### Data Analysis of Leak Counts *Fittings, Valves, and "Others"*



- Examined 2023 Q4 leak reports and counted leak rates by hundreds
  - Range: 500 to 11,000 ppm
- Observed power trendline:
  - Leak count = 10<sup>6</sup> x (value)<sup>-1.351</sup>
  - R<sup>2</sup> value of 0.9484
    - High confidence in trendline
- Using trendline generated from data, the number of additional leaks detected can be estimated

### Forecasted Leak Counts: *Fittings, Valves, and "Others"*

Value (ppm)	Estimated Additional Quarterly Leaks	Estimated Additional Leaks Annually	Estimated Leak Ratio
500	Current leak standard		0.16%
400	305	1,220	0.17%
300	755	3,020	0.19%
200	1,534	6,136	0.22%
100	3,520	14,080	0.31%
50	8,586	34,344	0.53%



### Data Analysis and Forecasted Leak Counts *Pumps and Compressors*



#### Data Analysis and Forecasted Leak Counts PRDs



### **Estimating Cost of Repair**



FINAL DRAFT STAFF REPORT

Proposed Amendments to Rule 4401 (Steam-Enhanced Crude Oil Production Wells)

Proposed Amendments to Rule 4409 (Components at Light Crude Oil Production Facilities, Natural Gas Production Facilities, and Natural Gas Processing Facilities)

Proposed Amendments to Rule 4455 (Components at Petroleum Refineries, Gas Liquids Processing Facilities, and Chemical Plants)

Proposed Amendments to Rule 4623 (Storage of Organic Liquids)

Proposed Amendments to Rule 4624 (Transfer of Organic Liquid)



- The 2023 San Joaquin Valley APCD Staff Report for their VOC rule amendments contains Table C-4: *Constant in Quantifying Repairing and Replacing Components* 
  - Itemized component replacement costs, percentage needing repair versus replacement, repair labor costs, and average repair or replacement times

#### https://ww2.valleyair.org/media/vptf4eg2/gb-item.pdf

• Applying the SJVAPCD method to the distribution of leaks detected in South Coast AQMD for 2023 Q4 yields:

Valves, Fittings, and "Others"	Pumps and Compressors	PRDs
\$697.25	\$5,486.10	\$5,541.40

### Annual Additional Repair Cost Estimates

Cost estimates rounded to nearest thousand	Valves, Fittings, and "Others"	Pumps & Compressors	PRDs
500 ppm	Current Leak Standard	Current Leak Standard	
400 ppm	\$851,000	\$329,000	
300 ppm	\$2,106,000	\$746,000	
200 ppm	\$4,278,000	\$1,339,000	Current Leak Standard
100 ppm	\$9,817,000	\$2,370,000	\$244,000
50 ppm	\$23,946,000	\$4,169,000	\$598,000

• Calculated by applying the estimated cost of repair multiplied by the expected number of additional repairs for each leak standard in a year

### **Baseline VOC Emissions**

Guidelines for Reporting VOC Emissions from Component Leaks



FEBRUARY 2015

- Estimated using South Coast AQMD Annual Emission Reporting (AER) document *Guidelines for Reporting VOC Emissions from Component Leaks*, revised February 2015
  - Method 2 Correlation Equation Method
  - Based on CAPCOA-revised 1995 U.S. EPA equations
  - Provides specific correlation equations based on component type and screening value
- Developed more refined predicted emission rates based on weighted average of predicted leak counts

# Baseline Annual VOC Emissions: Fittings, Valves, and "Others" Components

- Component counts from 2023 Q4 leak reports
  - 1,720,410
     fittings
     (assumed 90%
     threaded
     connectors and
     10% flanges)
  - 498,644 valves
  - 122,390 others

Leak Standard (ppm)	Calculated Emission Rate (ppm)	Baseline VOC Emissions (tons per year)	VOC Emission Reduction (tons per year)
500	112	1,529.2	Current leak standard
400	101	1,419.3	109.9
300	90	1,306.0	223.2
200	78	1,177.0	351.2
100	64	1,021.4	507.8
50	50	855.0	674.2

### Baseline Annual VOC Emissions: *Pumps and Compressors*

Leak Standard (ppm)	Calculated Emission Rate (ppm)	Baseline VOC Emissions (tons per year)	VOC Emission Reduction (tons per year)
500	169	96.3	Current leak standard
400	136	84.1	12.2
300	114	75.4	20.9
200	91	65.5	30.8
100	68	54.7	41.6
50	50	45.1	51.2

- Component counts from 2023 Q4 leak reports
  - 7,954 pumps in light liquid service
  - 644

compressors

### Baseline Annual VOC Emissions: PRDs

- Component counts from 2023 Q4 leak reports
  - 6,348 PRDs, including atmospheric process PRDs

Leak Standard (ppm)	Calculated Baseline VOC Emission Rate Emissions (ppm) (tons per year)		VOC Emission Reduction (tons per year)
200	103	10.5	Current leak standard
100	70	8.2	2.3
50	50	6.6	3.9

# Cost-Effectiveness: Fittings, Valves, and "Others" Components

	400 ppm	300 ppm	200 ppm	100 ppm	50 ppm
Estimated cost per year	\$851,000	\$2,106,000	\$4,278,000	\$9,817,000	\$23,946,000
VOC Emission Reduction (tons per year)	109.9	223.2	351.2	507.8	674.2
Cost- Effectiveness (per ton VOC)	\$7,700	\$9,400	\$12,200	\$19,300	\$35,500
Incremental Cost- Effectiveness (per ton VOC)		\$11,100	\$17,000	\$35,400	\$84,900

Cost-Effectiveness threshold: \$40,168/ton VOC

## Cost-Effectiveness: Pumps and Compressors

	400 ppm	300 ppm	200 ppm	100 ppm	50 ppm	
Estimated cost per year	\$329,000	\$746,000	\$1,339,000	\$2,370,000	\$4,169,000	JACCE.
VOC Emission Reduction (tons per year)	12.2	20.9	30.8	41.6	51.2	
Cost- Effectiveness (per ton VOC)	\$27,000	\$35,600	\$43,500	\$56,900	\$81,500	
Incremental Cost- Effectiveness (per ton VOC)		\$47,700	\$60,100	\$94,900	\$189,000	
Cost-Effectiver	ness threshold: \$	40,168/ton VOC				

#### Cost-Effectiveness: PRDs

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	100 ppm	50 ppm
Estimated cost per year	\$244,000	\$598,000
VOC Emission Reduction (tons per year)	2.3	3.9
Cost-Effectiveness (per ton VOC)	\$106,500	\$154,200
Incremental Cost- Effectiveness (per ton VOC)		\$223,100

Cost-Effectiveness threshold: \$40,168/ton VOC

#### Leak Standard BARCT Assessment

	Project	Valves & Fittings (Connectors/Flanges)	Others	Pumps & Compressors	Pressure Relief Devices (PRDs)
	PAR 1173	<b>100 ppm</b> 500 ppm 200 ppm		400 ppm	200 ppm (unchanged)
South Coast	Rule 1173				200 ppm
AQMD	BACT/LAER			Defe	Defers to Rule 1173
BAY AREA AIR QUALITY MANAGEMENT DISTRICT	Rule 8-18	100 ppm			500 ppm
	Rule 4409		500 ppm		L: 200 ppm G/V: 400 ppm
San Joaquin Valley	Rule 4455	L: 200 ppm G/V: 400 ppm	0 ppm L: 500 ppm G/V: 1,000 ppm		L: 100 ppm G/V: 200 ppm
	BACT	100 ppm			
air pollution control district Rule 3			1,000	ppm	
apco santa barbara county	BACT	100 ppm			

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# **OGI Inspection Frequency Comparison**

Rule	Applicability	Inspection Frequency (Proposed in italics)
PAR 1173	Refineries, chemical plants, re-refiners, marine terminals, oil & gas sites, natural gas plants, pipeline transfer stations	To be determined
Rule 1178	Storage tanks located at petroleum facilities that have emitted more than 20 tons of VOC per year	Weekly
PAR 1148.1	Wellheads, well cellars, and product handling at oil and gas production facilities	Monthly
PAR 463	All organic liquid storage tanks located above certain size or potential to emit thresholds	Every two weeks

# **Estimating OGI Costs**

- Per manufacturers, OGI cameras are capable of evaluating more than 10,000 components per day
  - Assuming 5,000 components evaluated per day per camera
  - Rule 1173 2023 Q4 reports identify **2,358,596** components within South Coast AQMD
  - OGI cameras required for implementation:

Every two months	Monthly	Every two weeks	Weekly
11	22	47	94

- Capital cost of camera approximately \$120,000
- Expected 10 year life span of camera
- Operating and maintenance cost estimated at \$1,500 per year per camera
- Labor cost estimated at \$400 per operating day



# Discounted Cash Flow (DCF)



- South Coast AQMD uses the Discounted Cash Flow method to account for capital costs
- Present Value = Capital Costs + (Annual Operating Costs \* Present Value Factor)
- Present Value Factor =  $(1 \frac{1}{(1+r)^n})/r$ 
  - Interest rate (r) of 4%
  - Life of equipment (n) of 10 years
  - PVF<sub>(4,10)</sub> = 8.11
- Present Value of each OGI camera used over 10 years calculated at **\$949,745**

### **Inspection Frequency Costs**

Rounded to the nearest thousand	Every Two Months	Monthly	Every Two Weeks	Weekly
OGI cameras required	11	22	47	94
Total cost over 10 years (\$)	\$10,661,000	\$20,894,000	\$45,858,000	\$91,716,000
Annual cost (\$)	\$1,066,000	\$2,089,000	\$4,586,000	\$9,172,000

- Total cost calculated by multiplying the Present Value of each OGI camera by the number of OGI cameras needed for implementation
- Annual cost calculated by dividing the total cost of each implementation schedule by the estimated life of the OGI camera

## **Estimating VOC Emissions from Leaks**

Guidelines for Reporting VOC Emissions from Component Leaks



FEBRUARY 2015

- Estimated using AER guidelines:
  - Method 2 Correlation Equation Method
  - Based on CAPCOA-revised 1995 U.S. EPA pegged factor
  - Provides specific leak emission factors based on component type
- Utilized the lower, more conservative leak emission factors
  - Valves  $\rightarrow$  0.141 lb/hr
  - Pump seals → 0.196 lb/hr
  - Connectors → 0.066 lb/hr
  - Flanges → 0.209 lb/hr
  - Others → 0.181 lb/hr
    - Includes compressors and PRDs

# Estimating VOC Emissions (continued)

	Connectors	Flanges	Valves	Pump Seals	Other	Compressors	PRDs
Annual Leaks	2,286	254	928	100	436	44	28
Emission Factor (lb/hr)	0.066	0.209	0.141	0.196	0.181	0.181	0.181
Emissions (tons/year)	81.5	28.7	70.7	10.6	42.6	4.3	2.7

- Leak counts extrapolated from 2023 Q4 leak reports
  - Identified leaks greater than 5,000 ppm per OGI camera capabilities
- Assumes leaks persist for one-half of the time between inspections, or 45 days
  - Current Method 21-based LDAR inspection frequency is quarterly (every 90 days)
- Total fugitive VOC emissions associated with leaks greater than 5,000 ppm estimated at 241.0 tons/year

### Estimating Emission Reductions with OGI

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Current fugitive VOC emissions due to leaks: **241.0 tons/year** 

	Every Two Months	Monthly	Every Two Weeks	Weekly
Leak Emissions (tons/year)	160.7	80.3	37.5	18.8
Emission Reduction (tons/year)	80.3	160.7	203.5	222.3
Incremental Reduction (tons/year)		80.3	42.8	18.8

### Inspection Frequency Cost-Effectiveness

	Every Two Months	Monthly	Every Two Weeks	Weekly	•
Annual Cost (\$)	\$1,066,000	\$2,089,000	\$4,586,000	\$9,172,000	•
Annual emission reductions (tons per year)	80.3	160.7	203.5	222.3	
Cost- Effectiveness (\$/ton)	\$13,300	\$13,000	\$22,500	\$41,300	•
Incremental Cost- Effectiveness (\$/ton)		\$26,000	\$107,000	\$489,200	

Cost-Effectiveness Threshold: \$40,168/ton VOC

- Monthly OGI inspection is both Cost-Effective and Incrementally Cost-Effective
- OGI inspection every two weeks is Cost-Effective but is not Incrementally Cost-Effective

## Inspection Frequency BARCT Assessment

Rule	Applicability	Inspection Frequency (Proposed in italics)
PAR 1173	Refineries, chemical plants, re-refiners, marine terminals, oil & gas sites, natural gas plants, pipeline transfer stations	Monthly
Rule 1178	Storage tanks located at petroleum facilities that have emitted more than 20 tons of VOC per year	Weekly
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# **Contingency Measures**

#### Concept





- The 2022 AQMP calls for contingency measures (CMs) to be included in rulemaking projects
- CMs must take effect within 60 days of being triggered and resulting reductions to occur within 1 to 2 years per U.S. EPA guidance document

#### Analysis

• Control measures deemed possible but not Cost-Effective or not Incrementally Cost-Effective could be identified as contingency measures

#### **Rule Consideration**

- Lower **50 ppm leak standard** for fittings, valves, and other components potential CM
- Lower **300 ppm leak standard** for pumps in light liquid service and compressors in gas/vapor service also potential CM
- More frequent OGI inspection frequency of every two weeks another potential CM

# Essential Equipment/Critical Components

#### Concept

• Delay of repair for essential equipment or critical components, such as control valves, allowed in other air districts to reduce emissions associated with shutdown and startup operations

#### Analysis

- Staff reviewed all 21 variance petitions submitted to South Coast AQMD Hearing Board seeking relief from Rule 1173 between 2003 and 2024.
- No variances sought delay of repair for essential equipment or critical components

#### Consideration

 Delay of repair for essential equipment or critical components appears unnecessary

#### **Electronic Submittals**

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#### Rules Recently Adopted, Amended, or Repealed

This page has a clean and underline/strikeout version of recently adopted or amended rules

Please note: an underline/strikeout version of a rule which was approved by the Board without edits, will be available immediately following a Board meeting, and paired with a "clean" version as soon as possible following internal review to ensure accuracy. Rules passed by the Board with edits will be available as soon as practicable following internal review.

#### April 5, 2024

#### Rule 1118

Control of Emissions from Refinery Flares (Clean Version)(PDF, 419 kb) (Underline/Strikeout Version)(PDF, 523 kb)

#### Concept

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 Facilities currently submit to South Coast AQMD via certified mail at considerable cost and inconvenience

#### Analysis

• Many South Coast AQMD rules recently amended allow electronic submittal via email, such as Rules 1118, 1405, and 1178

#### **Rule Consideration**

 PAR 1173 will update requirements to incorporate electronic submittal via email or other methods approved by the Executive Officer

### Inaccessible Leaks Detected by OGI

#### Concept

• During an OGI leak inspection, leaks may be found without safe access to component and it may take several days to safely erect scaffolding before being able to begin repair

#### Analysis

 Under Method 21 inspection, scaffolding is already in place, but under OGI inspection, lack of safe access is a possibility

#### **Rule Consideration**

 PAR 1173 will incorporate notification to South Coast AQMD via electronic submittal of an inaccessible leaking component detected via OGI and allow additional time for access



## Natural Gas Facility Applicability



Source: https://socalgas.com

#### Concept

• Certain natural gas facilities are not currently within the scope of Rule 1173

#### Analysis

- Natural gas facilities are regulated by CARB's Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities
- Recently amendments include smart LDAR including OGI or gas sensors

#### Consideration

 Including additional natural gas facilities within PAR 1173 would be duplicative and will not be pursued

### Natural Gas Exemption

#### Concept

• The 2022 AQMP references co-benefits for GHG programs such as methane, the chief component of natural gas

#### Analysis

 Components in natural gas service would likely be inspected via OGI inevitably due to their close proximity to VOC components, adding de minimus burden

#### **Rule Consideration**

- PAR 1173 will require leaks from components in natural gas service detected during OGI inspection be repaired
- PAR 1173 will utilize term "total organic compounds" (TOC), which includes methane
- PAR 1173 would not require Method 21 inspections for components in natural gas service



# Stringency



#### Concept

• Ensure PAR 1173 is at least as stringent as state or federal regulations, including the National Emission Standards for Hazardous Air Pollutants From Petroleum Refineries, known as Subpart CC, last amended on 4/4/2024

#### Analysis

 Rule 1173's requirements for PRDs are more stringent than Subpart CC except with respect to when a "failure analysis" (referred to as a "root cause analysis and corrective action analysis" in Subpart CC) must be performed

#### **Rule Consideration**

 Replace the 500 pounds of VOC threshold with a trigger of "any pressure release event" to conduct a failure analysis to align with Subpart CC

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# Next Steps

Milestone	Projected Date	
Working Group Meeting #4	June 2024	
Public Workshop	July 2024	
Set Hearing	September 2024	
Public Hearing	October 2024	

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