



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

WORKING GROUP MEETING #2
APRIL 24, 2024 – 1:00 PM

Zoom Meeting: <https://scaqmd.zoom.us/j/95683547797>

Meeting ID: 956 8354 7797

Agenda

Recap of Working Group Meeting #1

Responses to Feedback

Technology Assessment – Components

Technology Assessment – Smart LDAR

Technology Assessment – OGI Inspection Frequency

Next Steps

Recap of Working Group Meeting #1



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



Source: <https://flir.com>

- Background on Rule 1173 and related documents
 - Existing requirements, including Leak Detection and Repair (LDAR) Program
 - 2022 Air Quality Management Plan (AQMP)
 - State Assembly Bill 617 (AB 617) and Community Emissions Reduction Plans (CERPs)
- Introduction of Concepts to be Explored, including:
 - Smart LDAR, including Optical Gas Imaging (OGI)
 - Leak Thresholds, including Best Available Control Technology (BACT)
- Public stakeholder comments received regarding:
 - Contingency measures and CERP objectives
 - Applicability of refineries using alternative fuels

<https://www.aqmd.gov/docs/default-source/rule-book/Proposed-Rules/par-1173/final-par-1173-wgm-1.pdf>

Best Available Retrofit Control Technology (BARCT)

- In Working Group Meeting (WGM) #1, staff reported on:
 - Existing regulatory requirements
 - Emission limits for existing units
 - Comparison to regulatory requirements in other jurisdictions
- WGM #2 will complete the PAR 1173 technology assessment
- Future WGMs will complete the BARCT assessment:
 - Proposals for BARCT limits and other considerations
 - Cost-effectiveness and incremental cost-effectiveness analyses where appropriate



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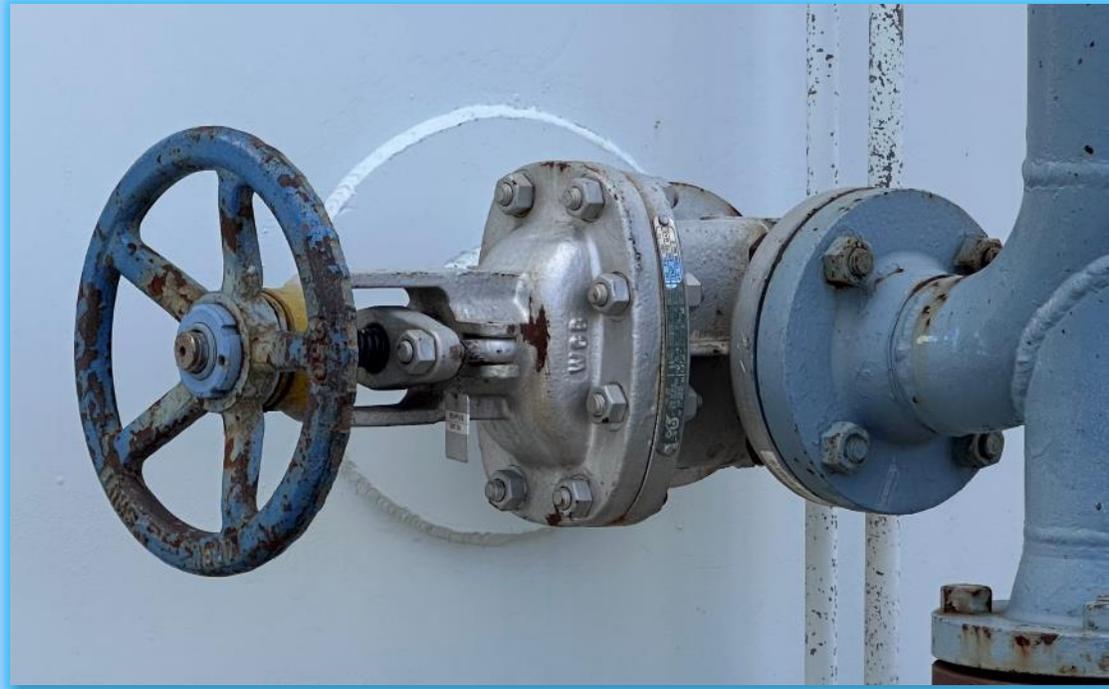
Technology Assessment – Components

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Critical Components



Feedback

- Delay of repair for essential equipment or critical components, such as control valves, allowed in:
 - Bay Area AQMD
 - San Joaquin Valley APCD
 - Santa Barbara County APCD
- Emissions associated with unit shutdown and startup far exceed emissions associated with small leaks

Response

- Staff is considering delay of repair provision on critical components for PAR 1173

Lowering Leak Thresholds

Feedback

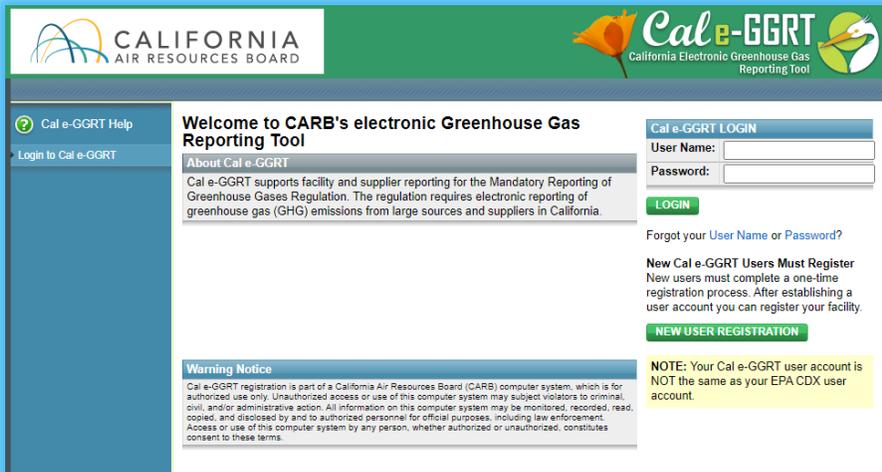
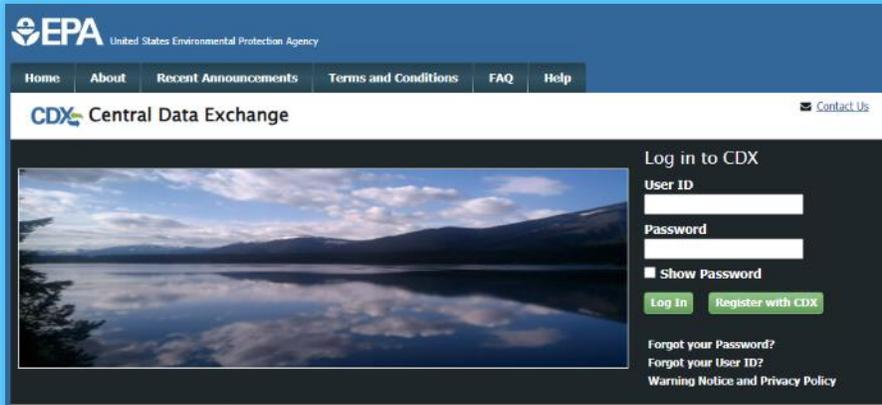
- Lowering the leak threshold below 500 ppm would have impacts by causing more frequent shutdowns and startups
- One facility reported that 23% of all components leak between 200 and 500 ppm
- Shutdown and startup to correct minor leaks would result in more net VOC emissions

Response

- Staff is still considering lower leak thresholds
- 23% figure appears inconsistent with leak ratios presented later in this presentation
- Options may include delaying repairs on leaks below 500 ppm to planned maintenance periods



Electronic Reporting



Feedback

- U.S. EPA and CARB allow for leak reports to be submitted electronically online
- Facilities currently submit to South Coast AQMD at high cost and inconvenience:
 - CD-ROMs via certified mail
 - Hand-written paper records
- With OGI being considered, even more reporting will be generated

Response

- PAR 1173 will update procedures to incorporate streamlined electronic reporting as an option

Component Upgrades

Feedback

- Facilities should replace, not repair, leaking components
- Outdated components should be upgraded:
 - Traditional valves for bellow-sealed valves
 - Sealed pumps for seal-less pumps like magnetic-drive pumps or canned-motor pumps
 - PRDs connected to a closed vent system

Response

- Staff will evaluate cost-effectiveness of replacement of components and incremental cost-effectiveness versus other control strategies
- Staff is also aware of logistic issues
 - Bellow-seals valves have larger footprints
 - Seal-less pumps not approved for some applications



Bellow-sealed valve



Magnetic-drive pump

Smart LDAR Strategies

Feedback

- Smart LDAR strategies other than OGI such as continuous gas sensors and open path methods are referenced in:
 - Objectives in the Wilmington, Carson, West Long Beach (WCWLB) CERP
 - Control Measure FUG-01 in the 2022 AQMP

Response

- Staff will evaluate multiple smart LDAR strategies including continuous gas sensors and open path methods later in this presentation



Source: <https://draeger.com>



Source: <https://cerex.com>

OGI Inspection Frequency



Feedback

- Facilities may also be subject to other South Coast AQMD rules that have their own OGI inspection frequencies

Response

- Later in this presentation, other equipment-specific or site-specific OGI inspection frequencies will be presented
- Staff will evaluate cost-effectiveness and incremental cost-effectiveness of various OGI inspection frequencies in a future Working Group Meeting

Inaccessible Leaks Detected by OGI

Feedback

- With Method 21 leak inspections:
 - Facilities first build scaffolding to reach inaccessible, difficult to monitor components
 - When leaks are found, component is already accessible
- With OGI leak inspections:
 - Leaks may be found without safe access to component
 - It may take several days to safely erect scaffolding before being able to begin repair

Response

- Staff will consider inaccessible components in the repair schedule for OGI-detected leaks



Verifying Repair of OGI-Detected Leaks



Feedback

- Facilities may have an OGI camera onsite but do not have Method 21 equipment such as a toxic vapor analyzer (TVA)
 - Rely on contractors for Method 21 leak inspections
- Other rules and jurisdictions require leaks detected via OGI to have repairs verified by Method 21

Response

- Staff will consider allowing facilities to repair leak found by an OGI camera without quantifying

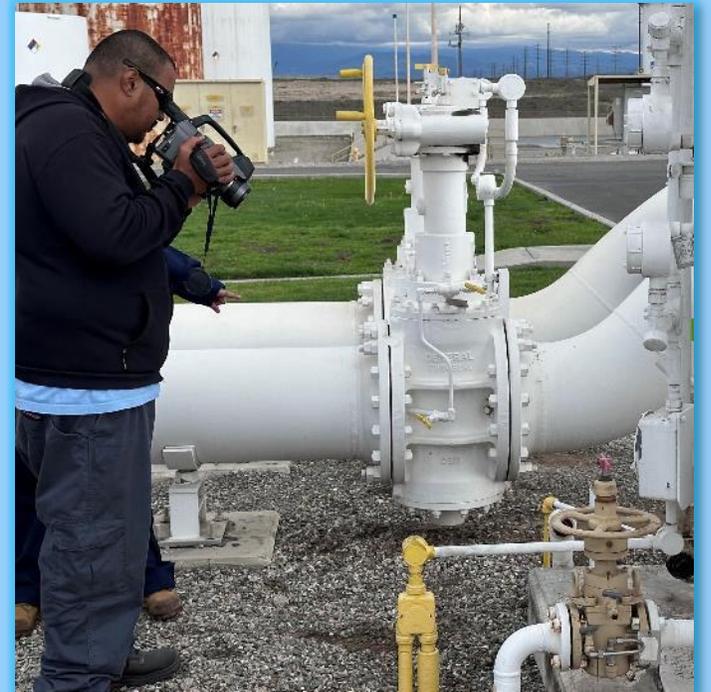
Additional OGI Concerns

Feedback

- Facilities raised other concerns regarding OGI:
 - OGI training and re-training requirements
 - Interference from steam and extreme heat
 - Safety concerns of walking while observing
 - Supply chain issues with OGI cameras
 - Stranded assets with advances in OGI technology

Response

- Staff appreciates this feedback and will consider these concerns when developing rule language for timelines and use of OGI



Rule Language Ambiguity



Source: <https://tubetech.com>

Feedback

- Rule 1173 is unclear in some areas:
 - Air cooled heat exchangers (fin fans)
 - Heavy liquids versus light liquids
 - 8-hour work shift versus 12-hour work shift
 - Refinery definition includes alternative fuels
 - Fittings associated with pumps or other components required to be individually tagged
 - Phrase “Leak Threshold” used but not defined

Response

- PAR 1173 will revise and update rule language to ensure clarity and consistency

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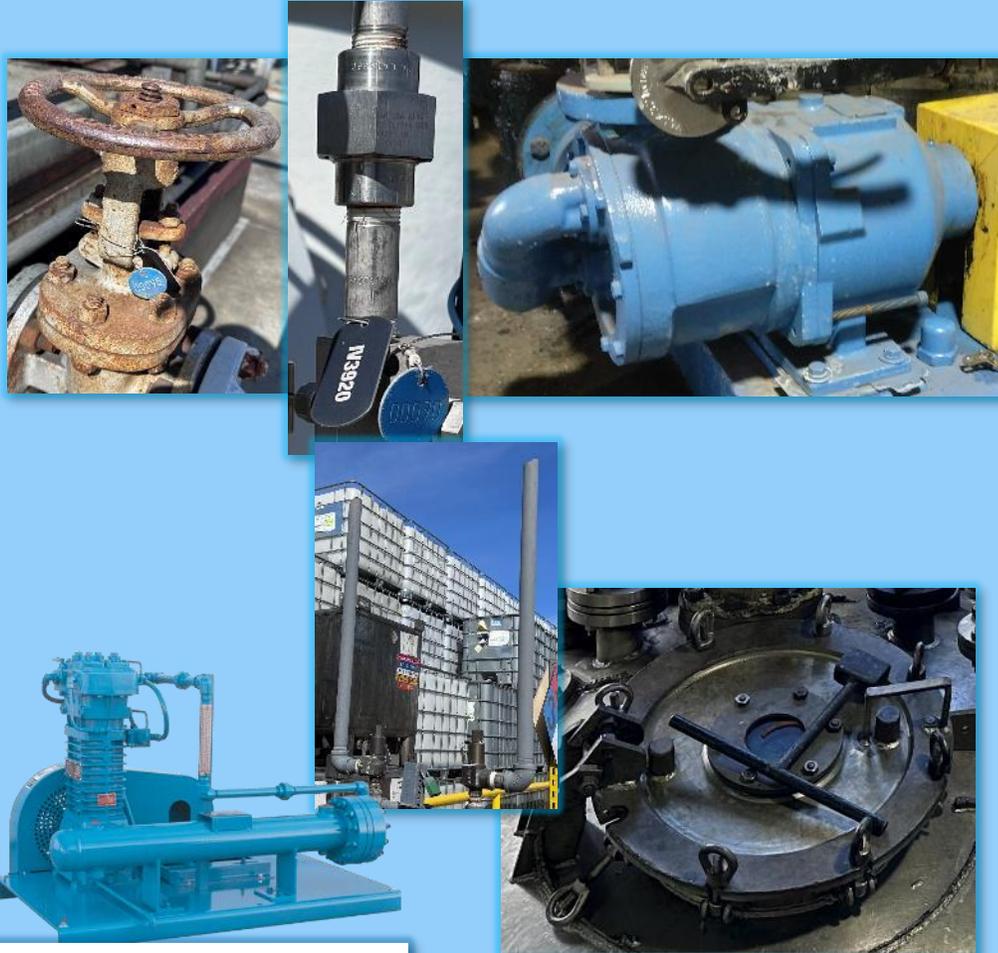
Technology Assessment – Components

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Component Background



Rule 1173 defines “COMPONENT” as any of the following in VOC service:

- **Valve** (gate, ball, bellow-seal)
- **Fitting** (flanges, threaded connectors, etc.)
- **Pump** (both heavy and light liquids)
- **Compressor** (gas/vapor service)
- **Pressure Relief Device (PRD)**
- **Diaphragm, Hatch, Sight-glass, Meter**
 - Referred to as OTHER in Rule 1173 reporting

Component Leak Data (2023 Q4)*



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HL

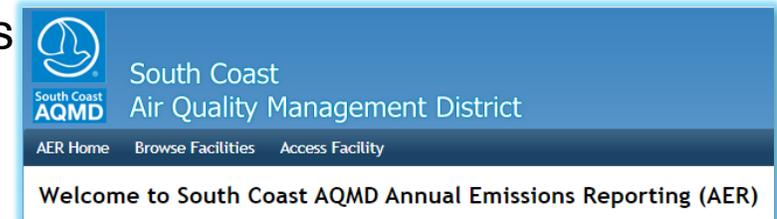


Type	Fittings	Valves	Others	Pumps - Light Liquid	PRDs	Pumps - Heavy Liquid	Compressors	Total
Method 21 Checks	1,720,410	498,644	122,390	7,954	6,348	2,207	644	2,358,597
Leaks	2,176	1,193	355	132	35	7	20	3,918
Leak Ratio	0.13%	0.24%	0.29%	1.66%	0.55%	0.32%	3.11%	0.17%
Avg Leak Rate (ppm)	10,171	5,486	6,640	5,034	3,500	355	7,295	8,322

* Component leak data compiled from submitted 2023 – Quarter 4, Rule 1173 reports

Emission Inventory from Annual Emission Reporting (AER)

- All facilities subject to Rule 301(e) and 301(l)(10) are required to track and report their annual emissions, including VOCs, using the AER WebTool
 - Facilities pay fees based on their reported emissions
 - Submitted data provides a valuable source of information regarding air contaminants within South Coast AQMD
- Facilities may use standard emission factors (EFs) based on generally-accepted leak rates for various component types or develop site-specific EFs based on leak data
- For 2022, **162** facilities reported fugitive VOC emissions associated with components subject to Rule 1173
- Rule 1173 VOC emissions totaled **990.77 tons** or **2.71 tons/day**



AER Fugitive VOC Emission Data (2022)



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Type (AER Type)	Fittings (Connectors and Flanges)	Valves	Others	Pumps - Light Liquid (Double Mechanical / Tandem Seal)	PRDs (PRVs)	Pumps - Heavy Liquid (Single Mechanical Seal Pumps)	Compressors	Total
VOC (tons)	615.48	193.43	155.35	14.40	4.87	4.32	2.92	990.77

Leak Standard Comparative Analysis

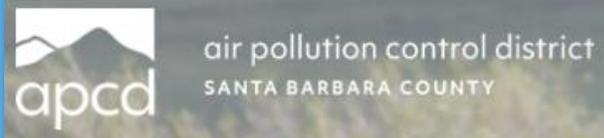
Proposed Updates to BACT Guidelines

Board Meeting

February 2, 2024



- During Working Group Meeting #1, highlighted various jurisdictions and differing leak standards and repair schedules:
 - South Coast AQMD BACT/LAER* Determination
 - Applies to new or modified units at Rule 1173 major sources
https://www.aqmd.gov/docs/default-source/bact/bact-guidelines/bact-guidelines-2024/part-b---paramount-petroleum_477619_fugitive-leak_200ppm.pdf
 - Bay Area AQMD Rule 8-18
 - Refineries, chemical plants, bulk plants, bulk terminals
 - San Joaquin Valley APCD Rule 4409
 - Oil and gas production facilities
 - San Joaquin Valley APCD Rule 4455
 - Refineries and chemical plants
 - Santa Barbara APCD Rule 331 and BACT Guideline 1.2
 - Refineries, chemical plants, oil and gas production site, etc.



*Lowest Achievable Emissions Rate, applies to major polluting facilities

Leak Threshold Comparative Analysis



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Type	Valves & Fittings (Connectors/Flanges)	Others	Pumps & Compressors	PRDs	Component in Heavy Liquid Service
Rule 1173	◇: 500-10,000 ppm ◇◇: 10,000-25,000 ppm ◇◇◇: Greater than 25,000 ppm			◇: 200-25,000 ppm ◇◇◇: Greater than 25,000 ppm	◇: 100-500 ppm ◇◇◇: Greater than 500 ppm
BACT/LAER	Greater than 200 ppm		See above		
Rule 8-18	Greater than 100 ppm		Greater than 500 ppm		N/A
Rule 4409	◇ Minor: 500*-10,000 ppm ◇◇ Major: 10,000-50,000 ppm ◇◇◇: Greater than 50,000 ppm			*Liquid (L): 200 ppm *Gas/Vapor (G/V): 400 ppm	N/A
Rule 4455	◇ Minor: 200*-10,000 ppm - ◇◇ Major: 10,000-50,000 ppm - ◇◇◇: Greater than 50,000 ppm				N/A
	*G/V: 400 ppm	*L: 500 ppm	*G/V: 1,000 ppm	*L: 100 ppm	
Rule 331	◇ Minor: 1,000-10,000 ppm - ◇◇ Major: 10,000-50,000 ppm - ◇◇◇: Greater than 50,000 ppm				N/A
BACT	Minor: Greater than 100 ppm				N/A



South Coast AQMD



Repair Period Comparative Analysis



HL

Type	Valves & Fittings (Connectors/Flanges)	Others	Pumps & Compressors	PRDs	Component in Heavy Liquid Svc
Rule 1173		◇: 7-14 days to repair ◇◇: 2-5 days to repair ◇◇◇: 1 day to repair		◇: 2-5 days ◇◇◇: 1 day	◇: 7-14 days ◇◇◇: 1 day
BACT	14 days			See above	
Rule 8-18		7 days*		15 days*	N/A
Rule 4409		◇ Minor: 7 days** - ◇◇ Major: 3-5 days** - ◇◇◇: 1 day**			N/A
Rule 4455		◇ Minor: 7-14 days** - ◇◇ Major: 3-5 days** - ◇◇◇: 1 day**			N/A
Rule 331		◇ Minor: 14 days** - ◇◇ Major: 5 days** - ◇◇◇: 1 day**			N/A
BACT		N/A			N/A



* BAAQMD: may delay essential equipment repair to scheduled turnaround, up to 5 years, if less than 10,000 ppm

** SJVAPCD/SBCAPCD: may delay essential equipment or critical component repair to turnaround, up to 1 year

Liquid Leak Comparative Analysis

	Liquid Type	Standard	Repair Period
 Rule 1173	Heavy	> 3 drops/minute	7 days
	Light	> 3 drops/minute	1 day
 Rule 8-18	All	> 3 drops/minute	7 days
 Rule 4409	All	> 3 drops/minute	1 day*
Rule 4455			
 331	All	> 3 drops/minute	1 day*

* SJVAPCD/SBCAPCD: may delay essential equipment or critical component repair to turnaround, up to 1 year

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Smart LDAR Background



- Smart LDAR and advanced leak detection technologies include:
 - **Optical Gas Imaging (OGI)** visualizes leaks on handheld cameras using thermal infrared imaging
 - **Open path (OP)** detects specific fugitive emission concentrations along boundaries using Fourier transform infrared (FTIR), differential optical absorption spectroscopy (DOAS), and others
 - **Gas sensors** continuously monitor fixed individual units using shortwave infrared (SWIR) or other technology
- Traditional LDAR strategy:
 - U.S. EPA Method 21 using a handheld analyzer equipped with flame ionization detector (FID), photo ionization detector (PID), or others

Optical Gas Imaging (OGI)

OGI utilizes thermal IR technology to visualize leaks of VOC

- Handheld units available from at least three manufacturers
- Capable of detecting leaks in the range of 5,000 ppm
 - New models claim 2,000 ppm or lower
- Able to visualize up to 10,000 components in an operating day by trained operator
- In use under Rule 1178 and under consideration in PAR 463 and 1148.1

Current challenges:

- Interference from steam and extreme heat
- Confidence in leak quantification



Open Path (OP)



Open Path devices produce a beam across an area and quantify targeted emissions including VOC across path

- Long range across multiple boundaries
- Continuous monitoring
- Very low levels of detection, in ppb range
- In use under Rule 1180 *Refinery Community and Fenceline Air Monitoring*

Current challenges:

- Unable to identify sources of leaks at the component level

Gas Sensors

Gas sensors collect and measure concentrations of air contaminants including VOC at fixed locations, such as operating units

- Continuous monitoring
- Very low levels of detection, in ppb range
- In use under CARB's *Greenhouse Gas Emission Standards for Crude Oil and Natural Gas Facilities*

Current challenges:

- Unable to identify sources of leaks at the component level



Smart LDAR Comparative Analysis



	OGI	Open Path	Gas Sensor	Method 21
Lower detection limit	Between 2,000 and 5,000 ppm	Well below 100 ppm	Well below 100 ppm	<i>Below 100 ppm</i>
Throughput	Up to 10,000 components/day	One or more boundaries continuously	One operating unit continuously	<i>Fewer than 1,000 components/day</i>
Able to identify source of leak at component level	Yes	No	No	Yes

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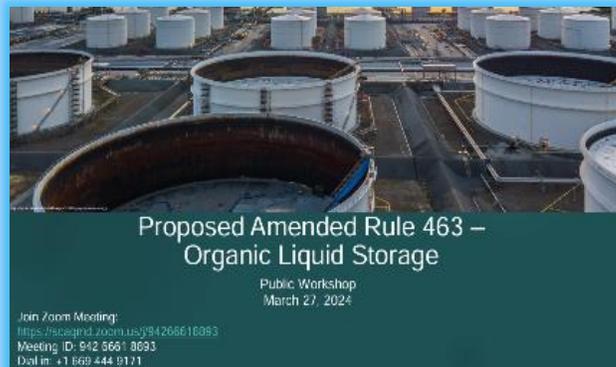
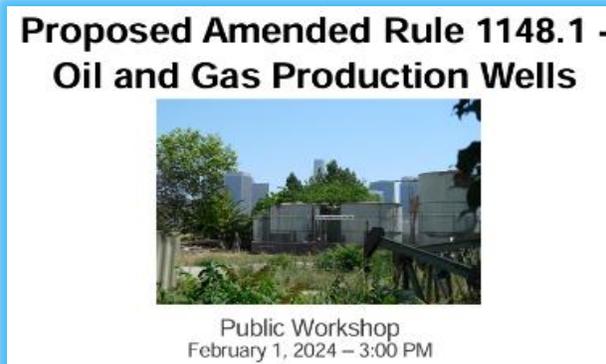
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OGI Inspection Frequency Background

- At least three different South Coast AQMD rules require or propose to require OGI monitoring to detect leaks, each with differing inspection frequency
 - Rule 1178, amended in September 2023
 - PAR 1148.1, forecast to be presented at the June 2024 Governing Board meeting
 - PAR 463, also forecast to be presented in June 2024
- Rule 1173 also applies to many of the same facilities subject to those rules



OGI Inspection Frequency Comparison

Rule	Applicability	Universe	Proposed Inspection Frequency
1178	Storage tanks located at petroleum facilities that have emitted more than 20 tons of VOC per year	30 facilities; approximately 1,100 tanks	Weekly tank farm inspections; semi-annual component inspections
1148.1	Wellheads, well cellars, and product handling at oil and gas production facilities	Over 300 facilities	Monthly
463 [*]	All organic liquid storage tanks located above certain size or potential to emit thresholds	154 facilities; approximately 1,600 tanks	Every two weeks , tank farms inspections; semi-annual component inspections
1173	Refineries, chemical plants, re-refiners, marine terminals, oil & gas sites, natural gas plants, pipeline transfer stations	Approximately 400 facilities	TBD

* PAR 463 is also proposing a **contingency** measure, triggered by U.S. EPA for non-attainment, to increase OGI inspection frequency to **weekly**

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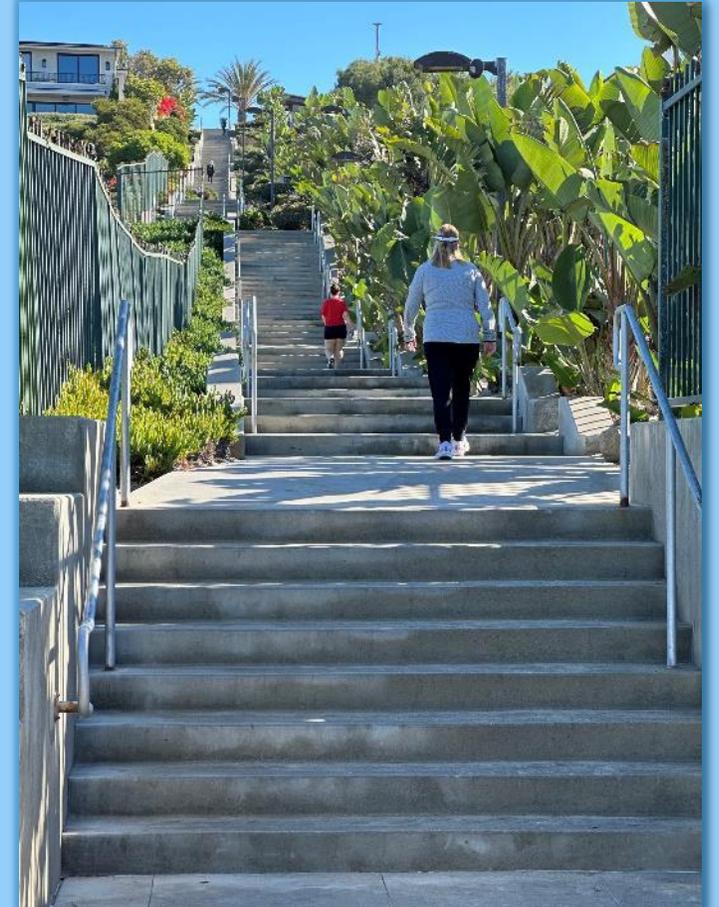
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Next Steps

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Milestone	Projected Date
Working Group Meeting #3	May 2024
Public Workshop	Summer 2024
Set Hearing	Summer/Fall 2024
Public Hearing	Fall 2024



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Rule 1173

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PAR 1173 Rule Team

	Areio Soltani Air Quality Specialist	<ul style="list-style-type: none">• (909) 396-3318• asoltani@aqmd.gov
	Rodolfo Chacon Program Supervisor	<ul style="list-style-type: none">• (909) 396-2726• rchacon@aqmd.gov
	Mike Morris Planning & Rules Manager	<ul style="list-style-type: none">• (909) 396-3282• mmorris@aqmd.gov
	Michael Krause Assistant Deputy Executive Officer	<ul style="list-style-type: none">• (909) 396-2706• mkrause@aqmd.gov



Max
Very Good Boy