Proposed Amended Rule 1178 – Further Reductions of VOC Emissions from Storage Tanks at Petroleum Facilities

WORKING GROUP MEETING 4
MARCH 24, 2022

JOIN ZOOM MEETING
HTTPS://SCAQMD.ZOOM.US/J/93814044899
MEETING ID: 938 1404 4899
TELECONFERENCE DIAL-IN: 1-669-900-6833
At Working Group meeting #3, staff presented information on:

• Early leak detection technologies
• 2015 Fluxsense Study
Agenda

- Public Comments and Responses
- Control Technology
- Enhanced Leak Detection Methods
- Emission Reduction Methodology
- Next Steps
PUBLIC COMMENTS AND RESPONSES
On December 6, 2021, 6 environmental organizations submitted a collaborative comment letter providing feedback on Rule 1178 development.

Organizations include Earth Justice, Coalition for Clean Air, California Communities Against Toxics, East Yard Communities for Environmental Justice, Sierra Club, Center for Biological Diversity.

Comments addressed on slides 6-8.

## Impact from Storage Tanks and Measures to Reduce Leaks

<table>
<thead>
<tr>
<th>Comment</th>
<th>Response</th>
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</table>
| Leaking storage tanks are harmful and disproportionally impact low income communities | - Staff acknowledges storage tanks may emit vapors that affect health  
- Amendments to Rule 1178 proposed in response to community concerns expressed in AB 617 meetings  
- Goal of PAR 1178 is to reduce emissions from storage tanks throughout district and in AB 617 communities |
<p>| Amendments to PAR 1178 must include preventative and remedial measures to reduce leaks | - Staff is exploring areas of improvement in Rule 1178 including preventative and remedial measures to reduce leaks (e.g., gap allowances, doming, early leak detection) |</p>
<table>
<thead>
<tr>
<th>Comment</th>
<th>Response</th>
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<tbody>
<tr>
<td>▪ Require internal floating or domed external floating roofs</td>
<td>▪ Staff is analyzing the feasibility, associated emissions reductions and costs for these methods of control</td>
</tr>
<tr>
<td>▪ Require cable suspended floating roofs</td>
<td>▪ Cost effectiveness will be determined for feasible technologies and methods with emission reduction benefit</td>
</tr>
<tr>
<td>▪ Require vapor recovery systems with at least 98% control efficiency</td>
<td></td>
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<tr>
<td>▪ Require secondary seals</td>
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<tr>
<td>▪ Adopt stricter gap requirements</td>
<td>▪ Staff is analyzing the emission reduction benefit of stricter gap requirements</td>
</tr>
<tr>
<td>Comment</td>
<td>Response</td>
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<td>----------------------------------------------------------------------------------------------</td>
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| ▪ Require the use of updated monitoring technology such as optical gas imaging | ▪ Staff recognizes the benefit of advanced leak detection technology  
▪ Staff is presenting leak detection methods and costs in later slides |
| ▪ Increase inspection frequency (at least monthly)                      | ▪ Cost effectiveness analysis will be conducted for increasing current inspections  
▪ Costs presented in later slides                                       |
| ▪ Require re-inspections and third-party audits on leak repairs          | ▪ Staff is exploring services available from third-party monitoring companies  
▪ Services and costs presented in later slides                           |
| ▪ Adopt stricter leak thresholds                                        | ▪ Leak thresholds will be evaluated depending on the monitoring technology                    |
CONTROL TECHNOLOGY
Staff identified control technology with potential to reduce emissions

- Domes
- Cable suspended floating roofs
- Proximity switches
- Advanced pressure vacuum vents

Staff to assess vapor recovery systems in later presentation
Domes

Fixed structure reduces emissions from external floating roof tanks by minimizing effects from wind causing vapors to be carried out of tank

- ~70%-75% reduction in standing losses*

Costs

- Costs for materials, installation and shipping
- Other construction costs may apply

<table>
<thead>
<tr>
<th>Tank diameter (ft)</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 – 50</td>
<td>40,000 – 65,000</td>
</tr>
<tr>
<td>&gt;50 – 100</td>
<td>65,000 – 225,000</td>
</tr>
<tr>
<td>&gt;100 – 160</td>
<td>225,000 – 450,000</td>
</tr>
<tr>
<td>&gt;160 – 200</td>
<td>450,000 – 715,000</td>
</tr>
<tr>
<td>&gt;200 – 275</td>
<td>715,000 – 1,400,000</td>
</tr>
</tbody>
</table>

*Based on TankESP PRO software calculation for doming external floating tanks of various sizes storing crude oil with RVP 6 – RVP 9 at 80 °F, located in Los Angeles County, with standard deck fittings and seals.
Cable Suspended Floating Roofs

Reduce emissions from internal floating roofs by eliminating floating roof leg penetrations providing openings in floating roof

- Can be retrofit to some tanks depending on existing floating roof and fixed roof material and structure
- ~35% reduction in standing losses*

Costs

- Equipment and installation:
  - $200,000 – New floating roof with suspension system
  - $70,000 – Cable suspension retrofit to existing floating roof

* Based on TankESP PRO software calculation for eliminating roof legs on internal floating roof tank 70', 90' and 117' in diameter and 40' to 50' high, storing gasoline with RVP 6 and RVP 10, crude RVP 6 and RVP 10, jet kerosene at 80 °F, located in Los Angeles county, with standard deck fittings and seals
Proximity Switches

Reduce emissions from roof components not properly closed (i.e., open/unlatched hatches, malfunctioning vents)

- Alerts facility staff when switch detects open covers or vents

Costs

- $1000 – $2,000 per tank
  - Switch, transmitter, receiver and power
- Labor and construction costs may apply
Advanced Pressure Vacuum Vents

Reduced leak rates compared to other pressure vacuum vents

Industry leak rate: 1.0 scfh @ 90% of set pressure

Advanced leak rate: 0.1 scfh @ 90% of set pressure

Costs

- New install:
  - $8,000 – $12,000 (equipment)
  - $400 – $1,600 (labor*)
  - $1,000 (crane rental)
- Retrofit kits available for certain existing pressure vacuum vents
  - $1,500 – $4,000 (retrofit)
  - $400 – $1,600 (labor*)

* Assumes 4 workers paid an hourly rate of $100 and 1 - 4 hours of work

PRD with proximity switch and transmitter
ENHANCED LEAK DETECTION METHODS
Staff identified 4 methods to improve leak detection at facilities:

- Continuous monitoring systems
- Optical gas imaging self inspections
- Third party inspections
- Increased inspection frequency

Costs are discussed for each method of leak detection:
- Some methods may result in cost savings
Continuous Monitoring Systems

- 3 technologies with ability to continuously monitor storage tanks for leaks
  - Each technology has advantages and disadvantages (discussed in last Working Group meeting)

### Costs

<table>
<thead>
<tr>
<th>Gas Sensors</th>
<th>Optical Gas Imaging</th>
<th>Open Path Detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Equipment + install: $1,800/unit</td>
<td>• Equipment: $60,000-$100,000 per camera</td>
<td>• Equipment: $180,000 per unit</td>
</tr>
<tr>
<td>• O&amp;M: $4,800/unit/year (costs include automated LDAR reports)</td>
<td>• Install: 50%-150% cost of equipment (depending on existing infrastructure)</td>
<td>• Install: Undetermined at this time</td>
</tr>
<tr>
<td></td>
<td>• O&amp;M: $5,000 per year per camera</td>
<td>• O&amp;M: Undetermined at this time</td>
</tr>
</tbody>
</table>

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Optical Gas Imaging Self Inspections

- Optical gas imaging devices can enhance current visual and EPA Method 21 inspections
  - Increase effectiveness of inspection
  - Inspections of hard or unsafe to access areas (i.e., floating roof seals)
- Incorporating optical gas imaging may allow for modification to other requirements such as visual inspections and gap measurements

**Costs**

- Equipment: $100,000 per camera (operator training may be additional cost)
- Labor costs:

<table>
<thead>
<tr>
<th>Inspection type</th>
<th># Workers</th>
<th>Hourly wage</th>
<th>Tanks per hour</th>
<th>Cost per tank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optical gas imaging</td>
<td>1</td>
<td>$100/person</td>
<td>4</td>
<td>$25</td>
</tr>
</tbody>
</table>
Third Party Inspections

- Monitoring services available to perform leak surveys
- Monitoring services provide:
  - Leak surveys with one or more leak detection technologies (OGI, TVA)
  - Leak reports
  - Repair tracking systems
  - Follow up monitoring on leaking components
  - Experienced technicians
  - Quantification with high flow samplers

Costs

- $1,000/day, 10-20 tanks per day
  - Includes leak detection with OGI and TVA measurements
  - Costs may vary depending on individual facility needs (e.g., facility requires quantification)
Increased Inspection Frequency

- Increased inspections have potential to identify leaks earlier
- 3 inspections method currently required and vary depending on tank
  - Gap measurements
  - Method 21
  - Visual and LEL readings

**Costs**

- Equipment: No additional equipment
- Labor costs:

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<th>Hourly wage</th>
<th>Tanks per hour</th>
<th>Cost per tank</th>
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</thead>
<tbody>
<tr>
<td>Gap measurements</td>
<td>4</td>
<td>$100/person</td>
<td>1</td>
<td>$400</td>
</tr>
<tr>
<td>Method 21</td>
<td>2</td>
<td>$100/person</td>
<td>2</td>
<td>$100</td>
</tr>
<tr>
<td>Visual inspections + LEL readings</td>
<td>1</td>
<td>$100/person</td>
<td>4</td>
<td>$25</td>
</tr>
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</table>
7 refineries subject to Rule 1178 implement fenceline monitoring
- Does not apply to refineries with capacity of less than 40,000 barrels per day
- Fenceline monitoring currently not required for other Rule 1178 facilities (small refineries, bulk storage and bulk loading)

<table>
<thead>
<tr>
<th>Tank Location</th>
<th>Number of Tanks</th>
</tr>
</thead>
<tbody>
<tr>
<td>At refineries with fenceline monitoring</td>
<td>645</td>
</tr>
<tr>
<td>At other facilities</td>
<td>464</td>
</tr>
</tbody>
</table>

- Staff assessing capability of fenceline monitors or other existing monitoring devices to detect leaks from storage tanks
- Staff seeking information from facilities on:
  - Leaks from storage tanks detected by fenceline monitors
    - Leaks identified during inspections
    - Other leaks identified by fenceline monitors
Facility Site Visits

• Staff is conducting site visits at refineries, bulk storage and loading terminals
  • 2 refineries and 1 storage facility have been visited
  • Viewed a variety of tanks including external floating, domed external floating, internal floating and fixed roof tanks

• Staff obtaining information on existing control technologies such as vapor recovery systems, seals and other control devices, and fenceline monitoring

• Staff plans to conduct additional site visits at facilities affected by rule
EMISSION REDUCTION METHODOLOGY
Calculating Emission Reductions

• Emission reductions needed to determine cost effectiveness of implementing leak detection methods or emission controls

• Emission calculating programs can calculate reductions based on tank specifications such as the addition of a dome or vapor recovery

• Emission calculating programs do not account for leaks that may occur

• Staff identified methodologies to quantify emissions from leaks to determine cost-effectiveness of leak detection technology or emissions controls
Emission Reduction Methods

- Some emission reductions can be quantified using TanksESP with assumptions
  - Doming external floating roof tanks
  - Installing cable suspended internal floating roofs
- Some emission reductions can be quantified by using engineering calculations
  - Installing proximity switches
  - Installing advanced pressure vacuum vents
- Staff in process of developing methodology to quantify emissions from leaks
  - Emission reductions from implementing enhanced monitoring may consider information from tank emission studies and leak reports
Next Steps

- Technology Assessment
  - Vapor recovery
  - Secondary seals
- Other Requirements
  - Gap allowances
- Cost Effectiveness
  - Leak detection implementation
  - Emission reducing technology
- Site Visits
- Working Group Meeting #5
Contacts

Melissa Gamoning
Air Quality Specialist
mgamoning@aqmd.gov
909-396-3115

Rodolfo Chacon
Program Supervisor
rchacon@aqmd.gov
909-396-2726

Mike Morris
Planning and Rules Manager
mmorris@aqmd.gov
909-396-3282

Michael Krause
Assistant Deputy Executive Officer
mkrause@aqmd.gov
909-396-2706

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