Rule 1148 Series
Requirements for Oil and Gas Wells

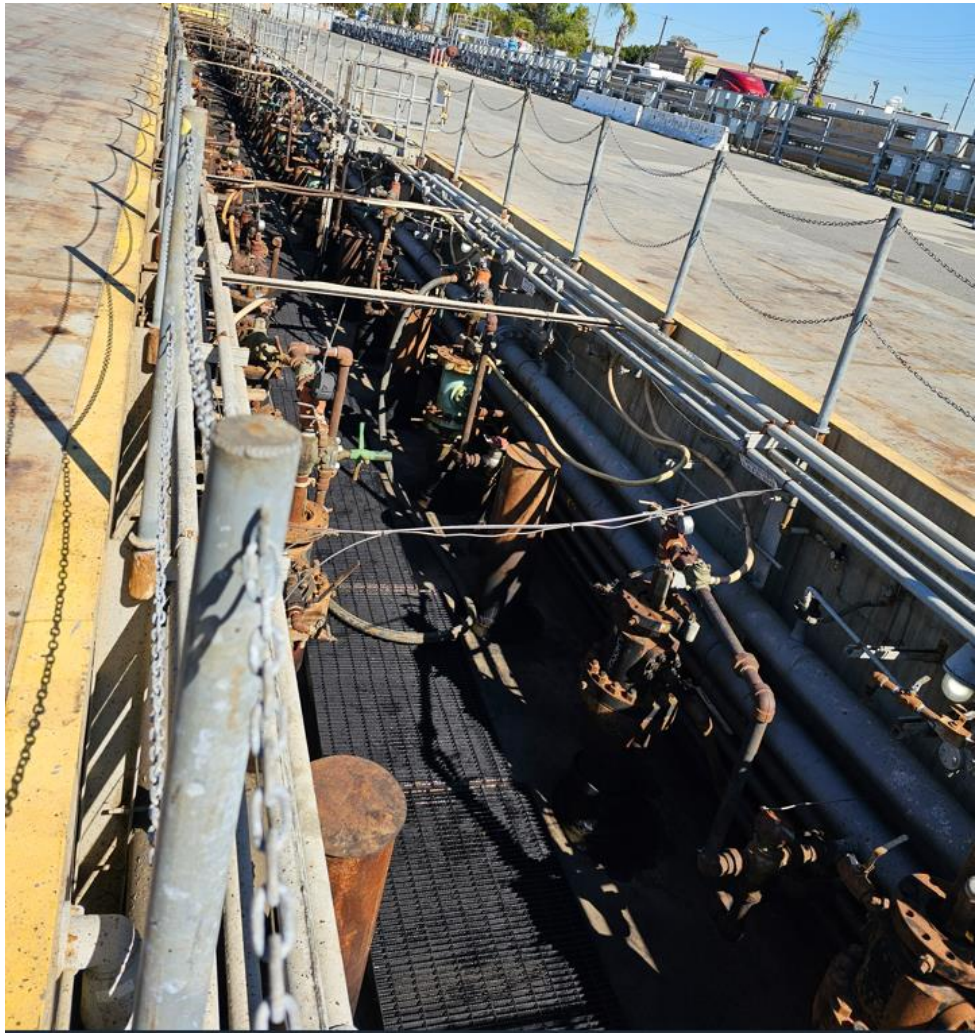
Working Group Meeting No. 3
December 14, 2023 – 1:00 pm

Zoom URL: https://scaqmd.zoom.us/j/91059546550
Dial In: 1 669 900 6833
Webinar ID: 910 5954 6550 (applies to all)

Agenda

- Summary of Working Group Meeting #2
- Update on BARCT Assessment
- Cost Effectiveness
- Next Steps

Summary of WGM #2

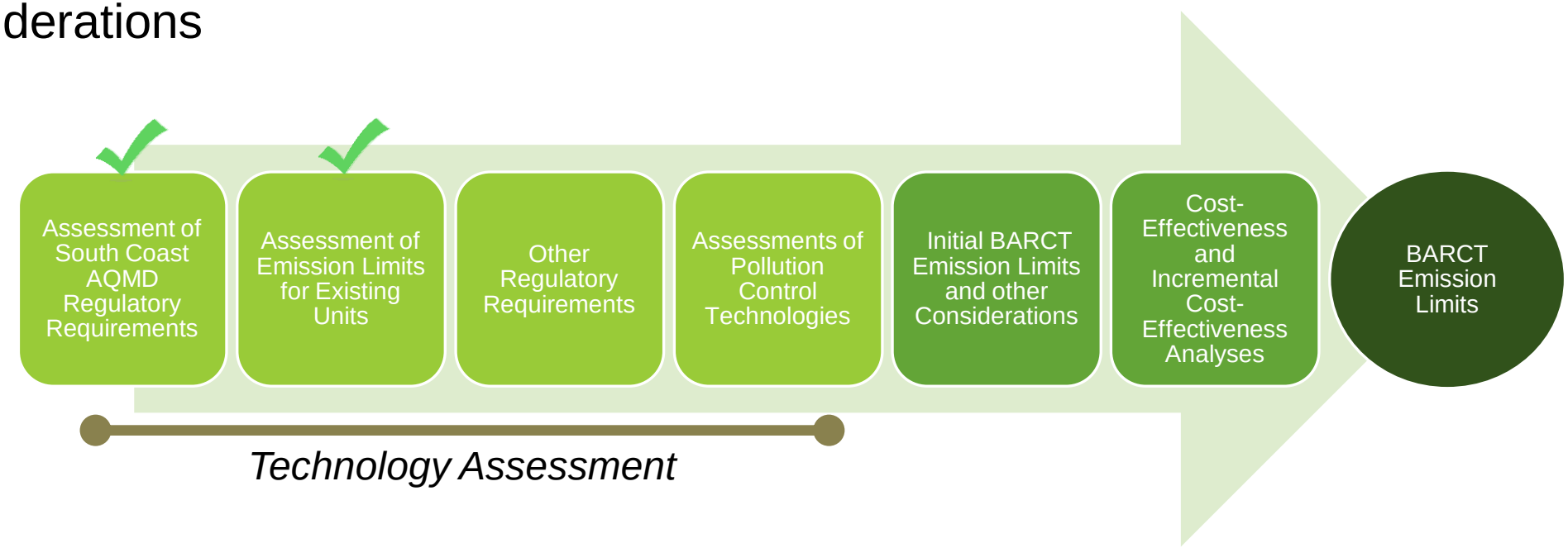


- Overview of oil wells, well cellars, wellheads, and gas handling
- Reviewed current leak standards and other rule applicability
- Discussed Best Available Retrofit Control Technology (BARCT) approach
- Reviewed Community Concerns
  - Optical Gas Imaging (OGI), Fenceline Monitoring, Electrification of Equipment & Oil Wells, Restricting Odorant Use, Additional Signage Requirements
- Provided updates on Rule 1148.2

Update on BARCT Assessment

BARCT Assessment

- In past working group meetings, staff has assessed South Coast AQMD regulatory requirements and emission limits for existing units
- In this working group meeting, staff will cover other regulatory requirements, assessments of pollution control technologies, initial BARCT emission limits and other considerations



Regulatory Requirements for OGI

- San Joaquin Valley Air Pollution Control District Rule 4401 – *Steam-Enhanced Crude Oil Production Wells* contains limited OGI requirements:
  - 6.3.3.1 states that all leaks detected with the use of an OGI instrument shall be measured using EPA Reference Method 21 within 2 days
- CalGEM Public Resources Code, Division 3. Oil and Gas Regulation
  - Allows OGI usage on idle and abandoned wells
- State of Colorado, Air Quality Control Commission (AQCC) Regulation 7 – *Control of Emissions from Oil and Gas Emissions Operations*
  - Defines “Infra-red Camera” and allows usage via aerial drones but requires operators to develop their own methodology
- EPA proposes using OGI in leak detection per 40 CFR part 60 Appendix K
  - Will apply to oil and gas upstream and downstream sectors

Other Regulatory Requirements

- Staff researched whether other agencies had rules or regulations in place for:
  - Fenceline monitoring
  - Electrification of equipment/wells
  - Electrification of workover rigs
- San Joaquin APCD, CalGEM, State of Colorado AQCC, and the U.S. EPA do not have rules or regulations in place for these activities

Assessment of Pollution Control Technologies

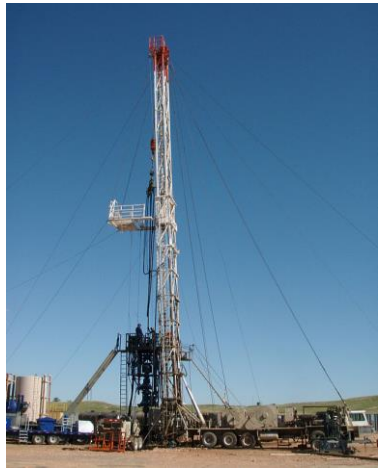
Technologies considered:

- OGI usage
- Fenceline sensors
- Electrification of workover/drilling rigs
- Electric motor replacement on wells
- Technologies to control or process gas

OGI camera

Fenceline sensors

Microturbine



Workover/Drilling rigs

Non-electric engine

Cost-Effectiveness

Cost-Effectiveness Analysis

- Cost-effectiveness is based on Present Worth Value calculation
- Measured in cost per ton of pollutant reduced
- Factors and assumptions include:
  - Total Installed Cost
  - Annual Costs
  - Assumes 4% interest rate
  - 10-year or 20-year equipment life (can vary)
  - Emission reductions

Cost Effectiveness

Cost-Effectiveness Analysis

- Cost-effectiveness to be calculated for controls and leak detection methods
- Threshold of $36,000 per ton of VOC reduced, adjusted annually, established in 2022 Air Quality Management Plan
- Threshold of $325,000 per ton of NOx, adjusted annually
- Data collected from site visits and vendors
  - Optical Gas Imaging (OGI) cost
  - Fenceline monitoring cost
  - Workover rig electrification cost
  - Oil well electrification cost

Assumptions Used for Cost-Effectiveness for Inspections Using OGI Devices

Assumptions:

- Approximately 330 oil & gas sites within AQMD's jurisdiction, ~80 companies
- 1 in 10 facilities have one major leak per year
- Leak emits 200 lbs/day of VOCs
  - 98% less than leak rate established under Rule 1178
- A leak occurs at the midpoint in time between quarterly inspections ~ 45-day interval
- With these assumptions, 148.5 tons/yr of VOC leak from 1148.1 related equipment
- Staff is considering monthly OGI inspections which would reduce VOC emissions from leaks by 99 tons/yr

Cost-Effectiveness on OGI Devices

- Cost to purchase an OGI camera = $120,000 per unit
- Equipment expected to have a 10-year lifespan
- 1 camera per company, 80 cameras
- $1,500 annual maintenance/training cost
- Labor cost = $400/day to conduct OGI inspection
- Cost-effectiveness = $12,900/ton of VOC reduced

Cost-Effectiveness for Fenceline Monitoring

Stationary gas sensor

- Fenceline monitors observed at several oil production sites:
  - Stationary gas sensors detect gas and/or VOC emissions once it makes contact with its sensor
- 330 facilities affected by this proposal
- Assuming fenceline monitor will find leak on first day
  - 148.5 tons/yr of VOC emissions reduced
- Staff received data for cost of monitor device as $3,115 per sensor with $30,000 installation cost
- Maintenance and monitoring cost of $10,000/yr
- Equipment expected to have a 10-year lifespan
- Cost-effectiveness = $34,382/ton VOC reduced

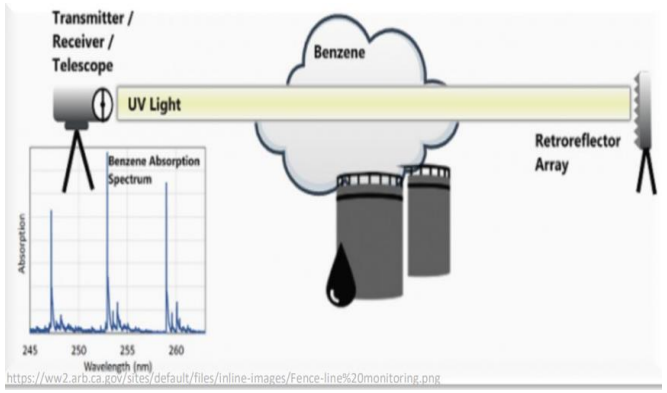
Incremental Cost-Effectiveness for Fenceline Monitoring

- Incremental cost effectiveness (IncrCE) for stationary gas sensor monitoring
  - Option 1 is OGI monitoring
  - Option 2 is stationary gas sensor monitoring
  - Considered over 10-year equipment life

	Present Worth Value ($)	Emissions Reduction (tons)
Option 1	12,726,791	990
Option 2	51,057,600	1,485

- IncrCE = $\frac{\text{Cost of Option 2} - \text{Cost of Option 1}}{\text{Benefit of Option 2} - \text{Benefit of Option 1}}$
- IncrCE = $77,436/ton VOC reduced

Cost-Effectiveness for Fenceline Monitoring



Open path sensor

- Used costs from 2023 amendment to Rule 1178
- Assuming 4 open path devices at $190,000 each
- Assuming installation cost equal to equipment cost
- Assuming fenceline monitor will find leak on first day
  - 148.5 tons/yr of VOC emissions reduced
- Equipment expected to have a 20-year lifespan
- 330 facilities required to install
- Maintenance and monitoring cost = $5,000/yr,
- Cost-effectiveness = $169,000/ton VOC reduced

Cost-Effectiveness for Workover Rig Electrification

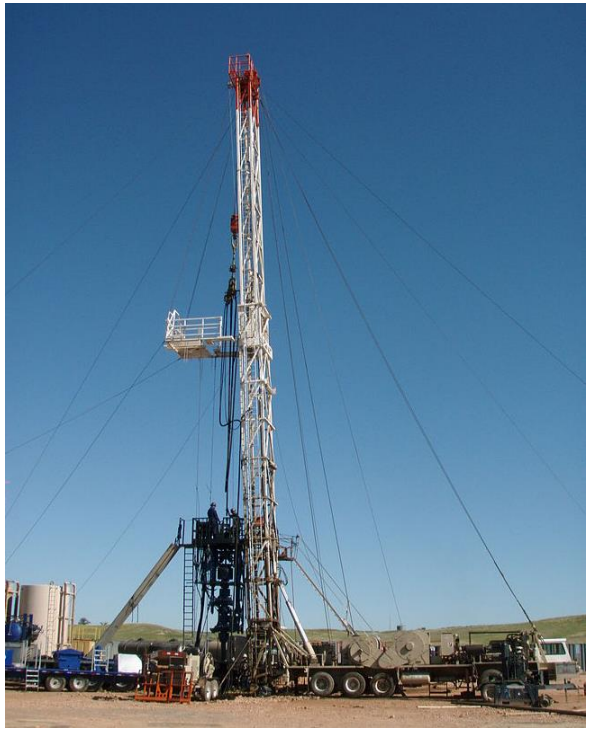
- Staff identified two electrified workover/drilling rigs operated in the South Coast AQMD and obtained cost data
  - Assuming workover rig operates 8 hrs/day, operates 4 days/week
  - Assuming workover rig at each site 4/year, 330 sites, 40 rigs
  - Workover rigs equipped with tier 2 engines at 600 hp
    - 4.992 tons/yr of NOx reduced
  - Equipment expected to have a 20-year lifespan
  - Estimated cost of $3 million for electric rig + $3 million for upgrades to each facility
- Cost-effectiveness = $11,117,788/ton NOx reduced

Additional Considerations for Workover Rigs

- Proposal to require Tier 4 Final engines on workover rigs that are operated within the South Coast AQMD's jurisdiction to be phased in over time

Cost-Effectiveness for Workover Rig Upgrade

- Assumptions:
  - Baseline emissions from a Tier 2 engine
  - Engines operate 8 hrs/day, 4 days/ week
  - Rig life expected to have a 20-year lifespan
  - Rig powered by 600 hp engine
  - 40 rigs to be used within South Coast AQMD's jurisdiction
    - 4.63 tons/yr of NOx reduced
- Cost of Tier 4 Final workover rig
  - Costs approximately $1,000,000 per rig
  - Maintenance cost of $20,000 per year
- Cost-effectiveness is $15,100/ton of NOx reduced

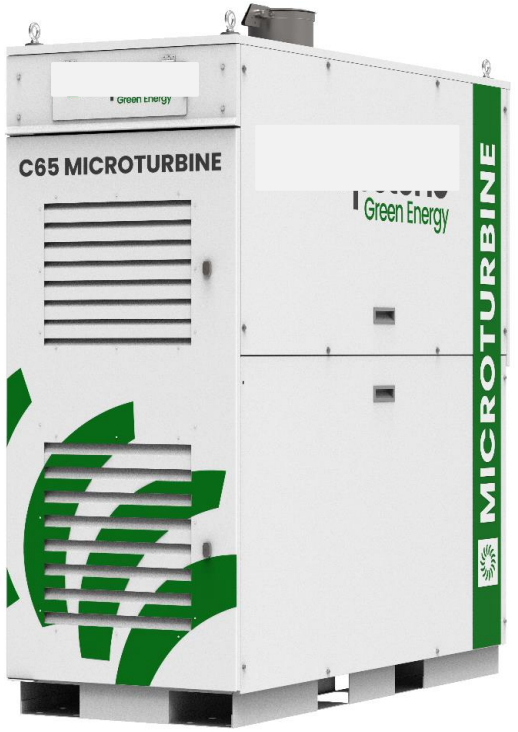


Cost-Effectiveness for Gas Engine Electrification

- Staff visited several oil field production sites and observed:
  - Majority of oil and gas wells are electrically driven; a few well were driven by internal combustion engines (ICEs) fueled by produced gas from site
- Beyond cost-effectiveness of replacing ICEs is handling the produced gas
  - Gas would need to be flared if no other way to utilize beneficially
    - Flaring is not a favorable outcome
  - Options under consideration to reduce emissions include:
    - Electrify gas engine and install a microturbine to use the produced gas to generate electricity
    - Retrofit the engines to be cleaner

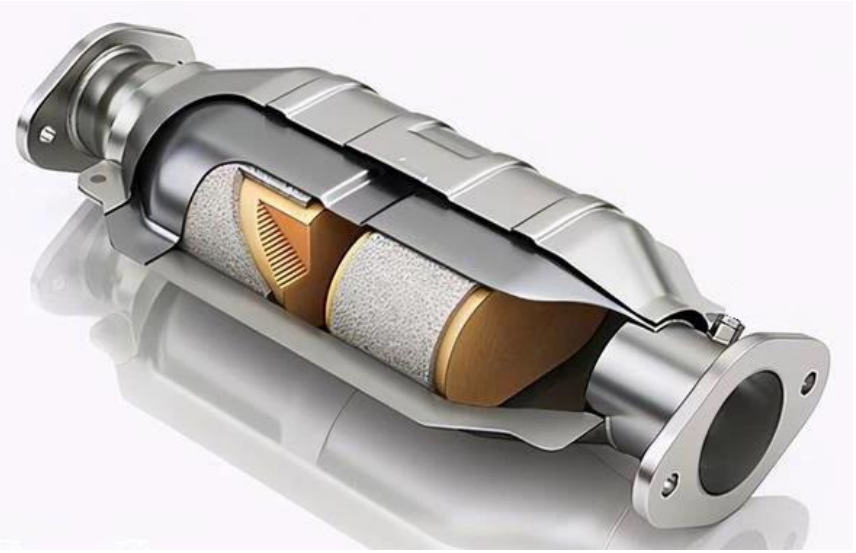
Cost-Effectiveness for Microturbines

- Assumptions:
  - Emissions from gas engine to be equivalent to spark-ignition engine requirements from CARB's PERP Regulation
  - Engines operate 24 hrs/day, 365 days/year
- Cost of microturbine obtained from a local vendor
  - Costs approximately $150,000 per microturbine
  - $300,000 for installation & infrastructure
- Cost of electric motor: ~$5,000
  - A microturbine is expected to replace three 50-hp engines
    - 1.94 tons/yr of NOx reduced
- Equipment expected to have a 10-year lifespan
- Cost-effectiveness is $29,467/ton of NOx reduced



Cost-Effectiveness for Catalyst

- Assumptions:
  - Emissions from gas engine to be equivalent to spark-ignition engine requirements from CARB's PERP Regulation
  - Engines operate 24 hrs/day, 365 days/year
- Cost of 3-way catalyst is $5,000
- Cost of air/fuel ratio controller is $1,000
- Annual maintenance of $1,000
- 3-year lifespan for 3-way catalyst
- Each engine at 50 hp
  - 1.96 tons/yr of NOx reduced for 3 engines at 50 hp
- Cost-effectiveness is $21,073/ton of NOx reduced for 3 engines at 50 hp



Odorants

- Proposing to ban odorants that are used for masking odors created at oil field production sites and facilities including mist systems
- Allow continued usage of neutralizing agents that do not create new odors and usage of mercaptans in natural gas for safety concerns
- No cost-effectiveness calculation conducted because no emissions reductions are expected from this proposal
- Ban of odorants should not result in any additional costs

Odorant mist system

Signage Considerations

- Rule 1148.1 (d)(13) already requires signage
- Staff found small signs that were only readable if standing within a foot in front of it
- Staff also found that some signs were not visible from public streets and were placed further inside facility's entrances
- Staff proposes additional signage requirements to include:
  - Instructions to AQMD's website to sign up for oil and gas notifications
  - Minimum sizing requirements
  - Location placement

Cost for Signage

- No cost-effectiveness calculation conducted because no emissions reductions are expected from this proposal, but costs are still considered
- Based on data provided by facilities, cost of a sign is approximately $150 ($50 a sign + $100 of labor for 2 people for installation)
- Total cost for proposal is $49,500

Summary of Proposals

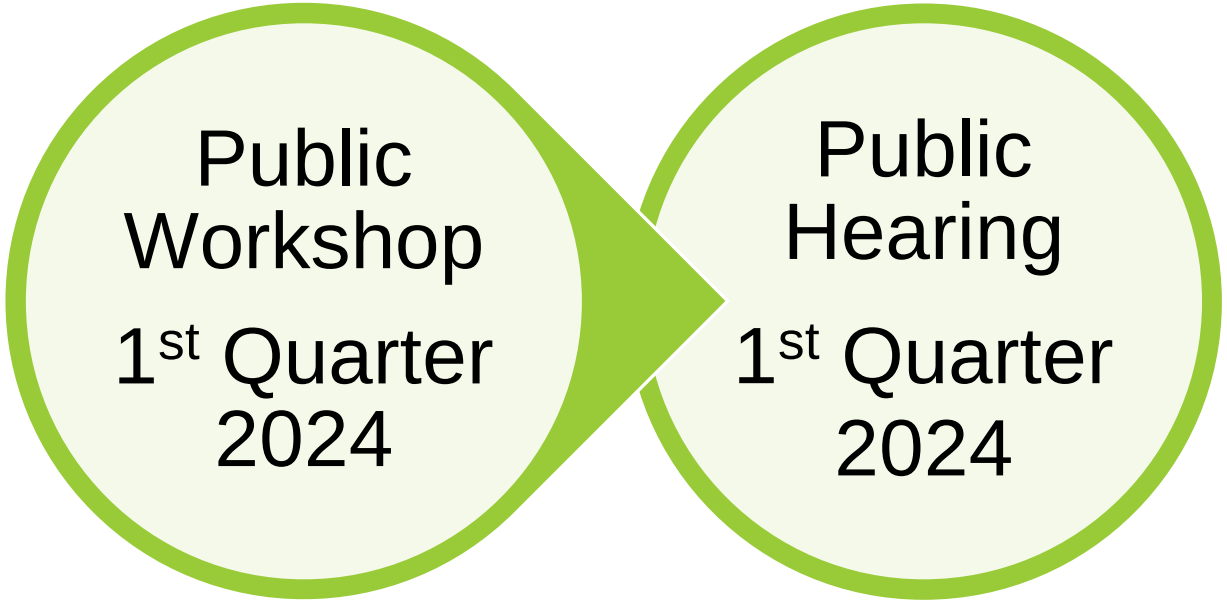
Staff recommends the following proposals for PAR 1148.1

- Monthly OGI inspections
- Tier 4 Final Workover Rigs
- Produced gas routed to:
  - Microturbines
  - Gas engine equipped with 3-Way Catalyst and Air/Fuel ratio controller
  - Storage or off-site processing
- Prohibit Odorant Use
- Improve Signage Requirements
- Other changes to improve clarity under consideration

Ongoing Efforts and Next Steps

Rule Development Process

Proposed Rule Schedule for PAR 1148.1



Staff Contacts

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