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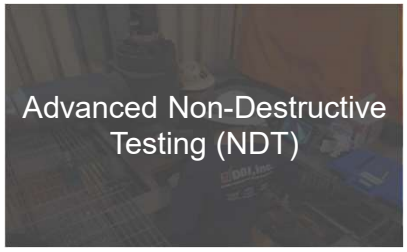
for a safe, reliable & compliant tomorrow

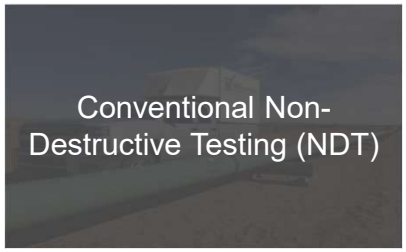
AWMA-RMSS October 2025

Maximizing Your LDAR Program for Upstream & Midstream Oil & Gas

October 15, 2025 – Lunch & Learn

PROtect - RELIABILITY DIVISION





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PROtect – RISK & COMPLIANCE DIVISION

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Agenda

- ✓ Monitoring Requirements
  - Applicability
  - Definitions
  - Frequency
- ✓ Practical Ways to Manage Your LDAR Schedule
- ✓ Maximizing your LDAR Program
- ✓ Monitoring Methods
- ✓ Recordkeeping
- ✓ Reporting
- ✓ Common Gaps
- ✓ Q&A

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Federal Changes & Reconsiderations

What's changed or could change?

- **NSPS OOOOb – fugitive monitoring (other items also under reconsideration)**
  - For fugitive emissions monitoring at well sites, centralized production facilities, and compressor stations – **nothing has changed, the rule is in effect and enforceable**
  - For NG processing plants, the repair requirements for valves (replace with low-e) are **delayed** until 1/22/27
  - The inspection requirements for no identifiable emissions (NIE) for CVS are **delayed** until 1/22/27
  - Super Emitter Program (SEP) implementation **delayed** until 1/22/27
- **GHGRP Subpart W**
  - There is a proposal to suspend reporting under Subpart W until 2034, this won't be finalized in 2025, so it won't be known until after the reporting year ends whether data needs to be reported for RY2025 or not – keeping it business as usual is the safest for compliance

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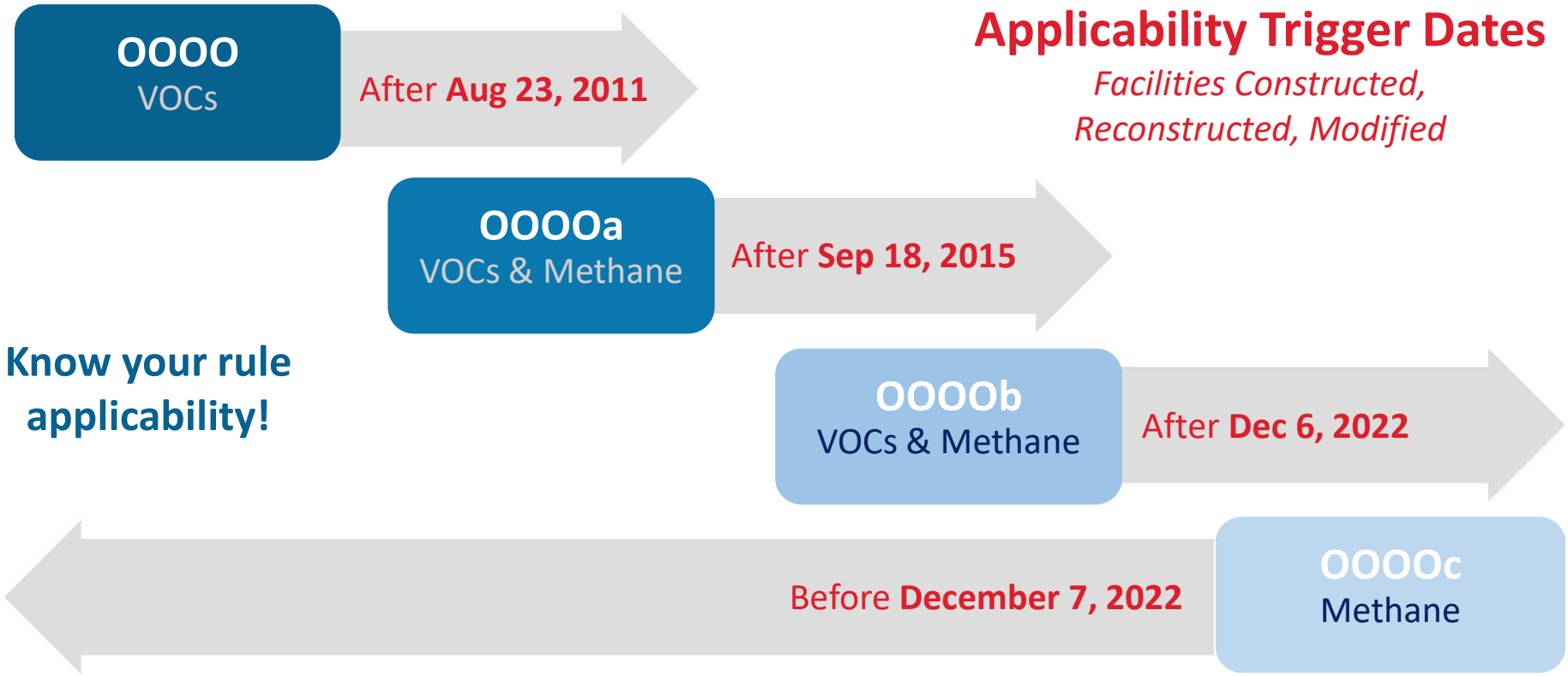
Monitoring Requirements – Federal



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Monitoring Requirements - Colorado

Facility Type	Citation	Location	VOC Emissions	Monitoring Method	Frequency*
Well Production**	Reg 7 Part B I.L	NAA area + North Weld	>1 and <6 tpy	AIMM	Annual
			>6 tpy		Semiannual
	Reg 7 Part B II.E.4 (Table 5)	DIC or 1000' of occupied area or ozone control area	>0 and <2 tpy		Semiannual
			≥2 and ≤12 tpy		Bimonthly
			>12 tpy		Monthly
	Reg 7 Part B II.E.4 (Table 5)		>0 and <2 tpy		Annual
			≥2 and ≤50 tpy		Quarterly
	Reg 7 Part B II.E.4 (Table 5)	Without storage tanks	>20 tpy		Monthly
		With storage tanks	>50 tpy		Monthly

* Use whichever frequency is the most stringent based on all characteristics of the facility.
** **Proposed rule** to include wellhead only sites into the definition of Well Production Facility, making wellhead only sites subject to the same monitoring requirements listed above. Anticipated to be adopted in February 2026.

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Monitoring Requirements - Colorado

Facility Type	Citation	Location	VOC Emissions	Monitoring Method	Frequency*
Compressor Station	Reg 7 Part B I.L	NAA area + North Weld		AIMM	Quarterly
	Reg 7 Part B II.E.3 (Table 3)	DIC or 1000' of occupied area	>0 and ≤50 tpy		Bimonthly
			>0 and ≤12 tpy		Quarterly
			>12 and ≤50 tpy		Quarterly
			>50 tpy VOC		Monthly
Centralized Oil Stabilization	Reg 7 Part B I.L	NAA area + North Weld			Quarterly

* Use whichever frequency is the most stringent based on all characteristics of the facility.

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Monitoring Requirements – Know Your Modification Triggers

Definition of modification for the purposes of fugitive emissions monitoring

40 CFR 60.5365b(i)	Modification/Reconstruction Triggers
Fugitive Emissions Well Site	• A new well is drilled at an existing site • An existing well is hydraulically fractured or refractured
Fugitive Emissions Centralized Production Facility	• A well sending production to the CPF is modified or reconstructed • A well subject to OOOOb sends production to an existing CPF
Fugitive Emissions Compressor Station	• An additional compressor is installed • One or more compressors is replaced by a compressor of > HP • NOTE: like-kind or smaller HP replacements do not trigger modification

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Monitoring Requirements – Know Your Facility Type

OOOOa – Wellsite		OOOOb - Wellsite	
Wellsite	**For the purposes of LDAR, a well site is:** one or more surface sites that are constructed for the drilling and subsequent operation of any oil well, natural gas well, or injection well; well site also means a separate tank battery surface site collecting crude oil, condensate, intermediate hydrocarbon liquids, or produced water from wells not located at the well site (e.g., centralized tank batteries)	**Wellsite – Single wellhead only**	• Wellhead only well site
		Wellsite – Multi-wellhead only	• Two or more wellheads on a single pad, no additional equipment or tanks
		Wellsite – Small site	• No more than one piece of certain major production and processing equipment, and associated meters and yard piping. Small well sites cannot include any controlled storage vessels (or controlled tank batteries), control devices, or natural gas-driven pneumatic controllers
		Wellsite – with major production & processing equipment	• One or more controlled storage vessels or tank battery • One or more control devices • One or more NG-driven process controllers or pumps • 2 or more pieces of major production/processing equipment not specified above (compressors, separators, dehydrators, heater/treaters)

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Monitoring Requirements – Know Your Facility Type cont.

OOOOa		OOOOb	
Centralized Production Facility (CPF)	N/A	**Centralized Production Facility (CPF)**	One or more storage vessels and all equipment at a single surface site used to gather, for the purpose of sale or processing to sell, crude oil, condensate, produced water, or intermediate hydrocarbon liquid from one or more **offsite** natural gas or oil production wells. A centralized production facility is located upstream of the natural gas processing plant or the crude oil pipeline breakout station and is a part of producing operations
Compressor Station	means any permanent combination of one or more compressors that move natural gas at increased pressure through gathering or transmission pipelines, or into or out of storage. This includes, but is not limited to, gathering and boosting stations and transmission compressor stations. The combination of one or more compressors located at a well site, or located at an onshore natural gas processing plant, is not a compressor station for purposes of § 60.5397a	**Compressor Station**	means any permanent combination of one or more compressors that move natural gas at increased pressure through gathering or transmission pipelines, or into or out of storage. This includes but is not limited to gathering and boosting stations and transmission compressor stations

Monitoring Requirements – Know Your Monitoring Frequency

Monitoring frequency is determined by the facility's applicability and type

Facility Type	OOOOa		OOOOb	
	AVO	**OGI**	**AVO***	**OGI**
Well Site – OOOOa definition	N/A	**Semiannual**		
Well Site – Single wellhead/small site	N/A	N/A	**Quarterly**	N/A
Well Site – Multi-wellhead	N/A	N/A	**Quarterly**	**Semiannual**
Well site with major production/processing equipment	N/A	N/A	**Bimonthly**	**Quarterly**
Centralized Production Facility	N/A	N/A	**Bimonthly**	**Quarterly**
Compressor Station	N/A	**Quarterly**	**Monthly**	**Quarterly**

* Conduct an inspection using auditory, visual, olfactory, **or any other detection method, after the initial survey (e.g. OGI).**

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Monitoring Requirements – Federal + Colorado

Monitoring frequency is determined by the facility's applicability and type

Facility Type	Colorado (Tables 3,4,5)		OOOOb	
	AVO	**OGI**	**AVO***	**OGI**
Well Site – Single wellhead/small site	Monthly	Annual	**Quarterly**	N/A
Well Site – Multi-wellhead	Monthly	Semiannual	**Quarterly**	**Semiannual**
Well site with major production/processing equipment	Monthly	Quarterly/ **Monthly**	**Bimonthly**	**Quarterly**
Centralized Production Facility	Monthly	Quarterly/ **Monthly**	**Bimonthly**	**Quarterly**
Compressor Station	Not specified	Quarterly/ Bimonthly/ **Monthly**	**Monthly**	**Quarterly**

* Conduct an inspection using auditory, visual, olfactory, **or any other detection method, after the initial survey (e.g. OGI, ATM).**

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Practical Ways to Manage Your LDAR Schedule

Scenario A – Contractor for OGI / Ops for AVO (Maximum # of Inspections)

Facility Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oa-SA-OGI		O						O				
Oa-SA-OGI					O						O	
Oa-Q-OGI		O			O			O			O	
Oa-Q-OGI		O			O			O			O	
Ob-Q-AVO	A			A			A			A		
Ob-Q-AVO	A			A			A			A		
Ob-Q-AVO+SA-OGI	A	O		A			A	O		A		
Ob-Q-AVO+SA-OGI	A			A	O		A			A	O	
Ob-BM-AVO+Q-OGI	A	O	A		A/O		A	O	A		A/O	
Ob-BM-AVO+Q-OGI	A	O	A		A/O		A	O	A		A/O	
Ob-M-AVO+Q-OGI	A	A/O	A	A	A/O	A	A	A/O	A	A	A/O	A

KEY: SA – Semiannual Q – Quarterly BM – Bimonthly M – Monthly

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Practical Ways to Manage Your LDAR Schedule

Scenario B – In-house OGI / Ops for AVO (Count OGI toward AVO requirements)

Facility Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oa-SA-OGI	O						O					
Oa-SA-OGI				O						O		
Oa-Q-OGI	O			O			O			O		
Oa-Q-OGI	O			O			O			O		
Ob-Q-AVO		A			A			A			A	
Ob-Q-AVO		A			A			A			A	
Ob-Q-AVO+SA-OGI	O			A			O			A		
Ob-Q-AVO+SA-OGI	O			A			O			A		
Ob-BM-AVO+Q-OGI	O		A	O	A		O		A	O		A
Ob-BM-AVO+Q-OGI												
Ob-M-AVO+Q-OGI	O	A	A	O	A	A	O	A	A	O	A	A

KEY: SA – Semiannual Q – Quarterly BM – Bimonthly M – Monthly

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Practical Ways to Manage Your LDAR Schedule

Scenario C – All OGI (substitute OGI for AVO requirements)

Facility Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oa-SA-OGI	O						O					
Oa-SA-OGI				O						O		
Oa-Q-OGI	O			O			O			O		
Oa-Q-OGI	O			O			O			O		
Ob-Q-AVO	O			O			O			O		
Ob-Q-AVO	O			O			O			O		
Ob-Q-AVO+SA-OGI	O			O			O			O		
Ob-Q-AVO+SA-OGI	O			O			O			O		
Ob-BM-AVO+Q-OGI		O		O		O		O		O		O
Ob-BM-AVO+Q-OGI		O		O		O		O		O		O
Ob-M-AVO+Q-OGI	O	O	O	O	O	O	O	O	O	O	O	O

KEY: SA – Semiannual Q – Quarterly BM – Bimonthly M – Monthly

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Practical Ways to Manage Your LDAR Schedule

Scenario D – Alternative Periodic Monitoring (≤ 10 kg/hr) w/ Annual OGI

Facility Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Oa-SA-OGI (Table 2)			ATM		O		ATM				AVO	
Oa-SA-OGI (Table 2)			ATM		O		ATM				AVO	
Oa-Q-OGI (Table 1)	ATM		ATM		O		ATM		ATM		ATM	
Oa-Q-OGI (Table 1)	ATM		ATM		O		ATM		ATM		ATM	
Ob-Q-AVO (Table 2)	ATM				O				ATM		AVO	
Ob-Q-AVO (Table 2)	ATM				O				ATM		AVO	
Ob-Q-AVO+SA-OGI (Table 2)	ATM				O				ATM			
Ob-Q-AVO+SA-OGI (Table 2)	ATM				O				ATM			
Ob-BM-AVO+Q-OGI (Table 1)	ATM		ATM		O		ATM		ATM		ATM	
Ob-BM-AVO+Q-OGI (Table 1)	ATM		ATM		O		ATM		ATM		ATM	
Ob-M-AVO+Q-OGI(Table 1)	ATM		ATM		O		ATM		ATM		ATM	

KEY: SA – Semiannual Q – Quarterly BM – Bimonthly M – Monthly Table 1 Table 2

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Using an EPA ATM for State Compliance

- Is that alternative method approved by the state?
  - Colorado has its own Alternative AIMM application and approval process. See here for a list of approved technologies.
  - New Mexico has its own approval process. See here for a list of approved technologies.
  - Wyoming hasn't made any moves to create a process to allow for advanced technologies
- What is written in the permit?
  - Does it incorporate OOOOa by reference?
  - Does it have specific monitoring requirements?
  - Do you need to revise your permit to allow for using an ATM?

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Maximizing Your LDAR Program

Other monitoring required in OOOOb that can be completed in conjunction with an OGI or AVO inspection:

- **Compressor Rod Packing Monitoring** (60.5380b and 60.5385b) – **OGI**
  - Annual Flow Rate Measurement starts with using OGI to detect emissions
  - If no visible emissions, assume the flow rate is zero
  - If emissions, schedule a flow rate measurement and complete maintenance/repair within 90 days
- **Cover and Closed Vent System Inspections** (60.5416b) – **OGI, AVO or Alt Tech**
  - Initial inspection within first 30 days after startup
  - Annual visual inspection
  - AVOs & OGI at frequency specified for fugitive emissions components located at the same type of site – different repair timeline requirements

SEP delayed till 1/22/27

Every documented AVO/OGI/M21 inspection is a bookend for a super emitter event

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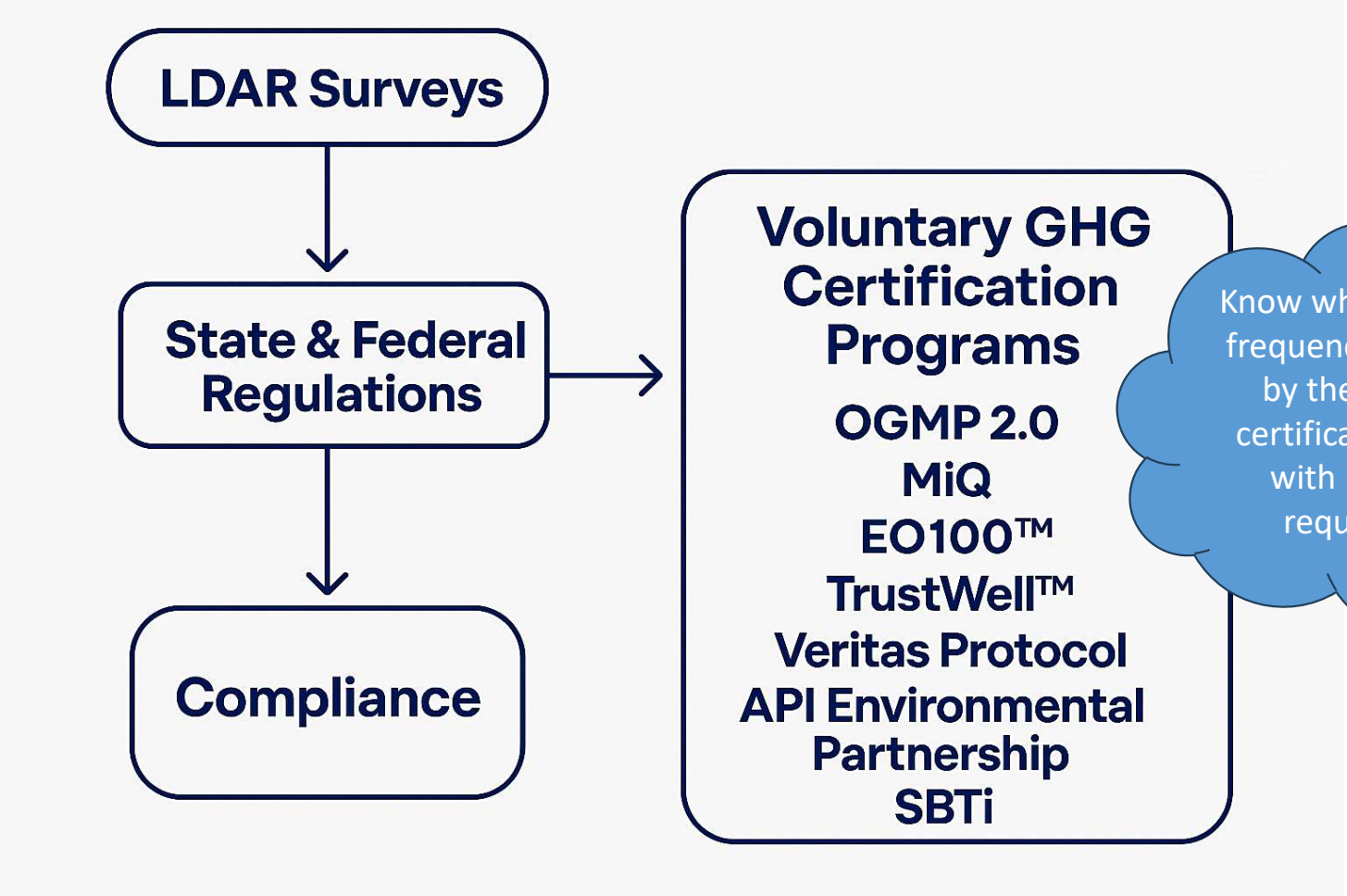
Using Your LDAR for Voluntary Certifications



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Monitoring Methods

OGI – same for both OOOOa & OOOOb

- Your optical gas imaging equipment must be capable of imaging gases in the spectral range for the compound of highest concentration in the potential fugitive emissions
- Your optical gas imaging equipment must be capable of imaging a gas that is half methane, half propane at a concentration of 10,000 ppm at a flow rate of ≤60g/hr from a quarter inch diameter orifice

Method 21 – same for both OOOOa & OOOOb

- Follow Method 21 of Appendix A-7. A fugitive emission is defined as an instrument reading of 500ppm or greater

AVO (Audio, Visual, Olfactory)

- For sites with tanks and separators, must include visual inspection of thief hatches and dump valves

Alternative Technologies (60.5398b)

- Periodic monitoring
- Continuous monitoring
- Must be EPA approved (https://methane.app.cloud.gov/approved)

Monitoring Method	OOOOa	OOOOb
OGI	X	X
Method 21	X	X
AVO		X
Alternative Methods	X	X

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Alternative Technologies – Periodic Monitoring

Use to fulfill monitoring and inspection requirements for fugitive emissions components, covers & CVS

Comply with notification, recordkeeping, and reporting requirements specific to alternative monitoring

Mix & Match: monitor at the frequency required for the highest aggregate detection threshold

Table 1 – Alternative Technology Periodic Screening Well Sites, CPFs, Compressor Stations With Quarterly OGI/M21 Monitoring		**Table 2 - Alternative Technology Periodic Screening** Well Sites subject to AVO inspections and/or Semiannual OGI/M21 Monitoring	
Frequency	**Min. Detection Threshold**	**Frequency**	**Min. Detection Threshold**
Quarterly	≤ 1 kg/hr	Semiannual	≤ 1 kg/hr
Bimonthly	≤ 2 kg/hr	Triannual	≤ 2 kg/hr
Bimonthly + Annual OGI	≤ 10 kg/hr	Triannual + Annual OGI	≤ 10 kg/hr
Monthly	≤ 5 kg/hr	Quarterly	≤ 5 kg/hr
Monthly + Annual OGI	≤ 15 kg/hr	Quarterly + Annual OGI	≤ 15 kg/hr
		Bimonthly	≤ 15 kg/hr

https://www.ecfr.gov/current/title-40/part-60/subpart-OOOOb#p-60.5398b(b)

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Alternative Technologies – Continuous Monitoring

EPA has not approved any CM technologies yet

Continuous Monitoring means *the ability of a methane monitoring system to determine and record a valid methane mass emissions rate or equivalent of affected facilities at least once for every 12-hour block*

Use to fulfill monitoring and inspection requirements for fugitive emissions components, covers & CVS

Comply with notification, recordkeeping, and reporting requirements specific to alternative monitoring

Facility Type	90-day Rolling Action Level	7-day Rolling Action level
Wellhead only well site	1.2 kg/hr	15 kg/hr
Well site with any production equipment	1.6 kg/hr	21 kg/hr
Centralized Production Facility		
Compressor Station		

https://www.ecfr.gov/current/title-40/part-60/subpart-OOOOb#p-60.5398b(c)

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Recordkeeping

Quality recordkeeping is an essential piece to a successful LDAR program. Knowing the requirements and ensuring records are created/obtained allows for demonstration of compliance and easier reporting.

Recordkeeping Requirement	OOOOa	OOOOb
Date of startup of production or date of startup after modification	X	X
Date of removal or addition of major production & processing equipment at a well site	X	X
Facility type (if a wellsite, what type of well site)		X
Monitoring plan	X	X
Records of each survey* (see next slide)	X	X
If utilizing an AMEL under §60.5399a/b, records specific to AMEL	X	X
Well closure activities		X
If utilizing an alternative technology under §60.5398b, maintain records specified and additional records under §60.5424b	X	X

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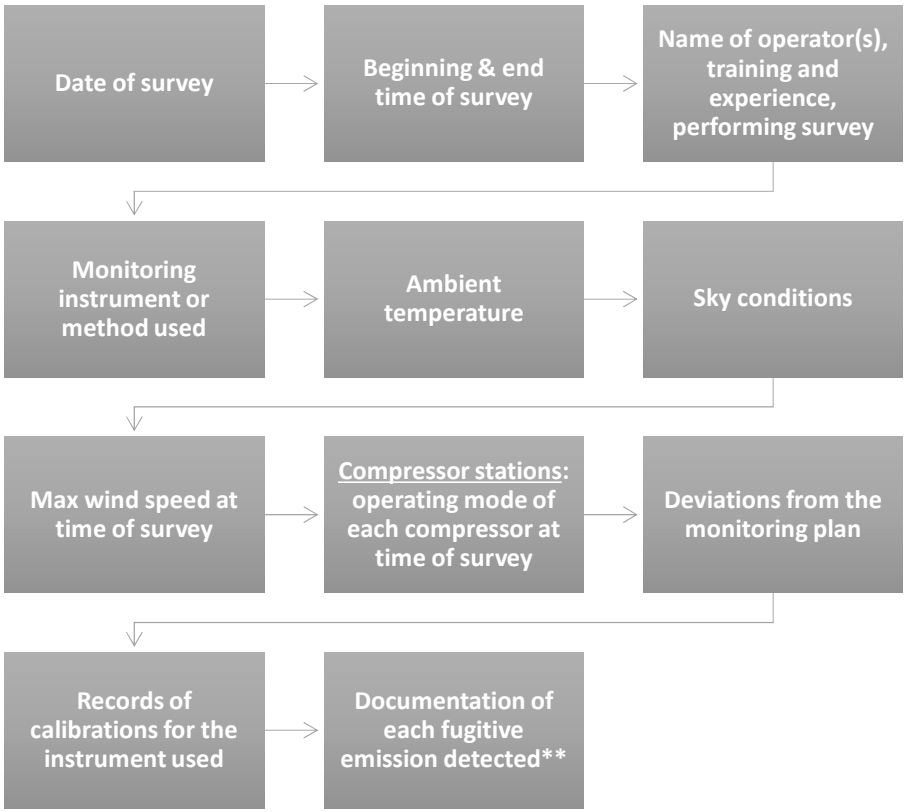
Recordkeeping – Survey Details*



****Fugitive Emission Details:**

- Location
- Type of component
- Photo/video of component
- Date of 1st Attempt at repair
- Date of successful repair, including resurvey to verify repair
- Identification of components placed on DOR
  - Date added to list
  - Date of planned shutdown
  - Reason for DOR
  - Date parts ordered (if applicable)
  - Anticipated date of part delivery
  - Actual date part delivery

You may have additional recordkeeping requirements for state or enforcement actions

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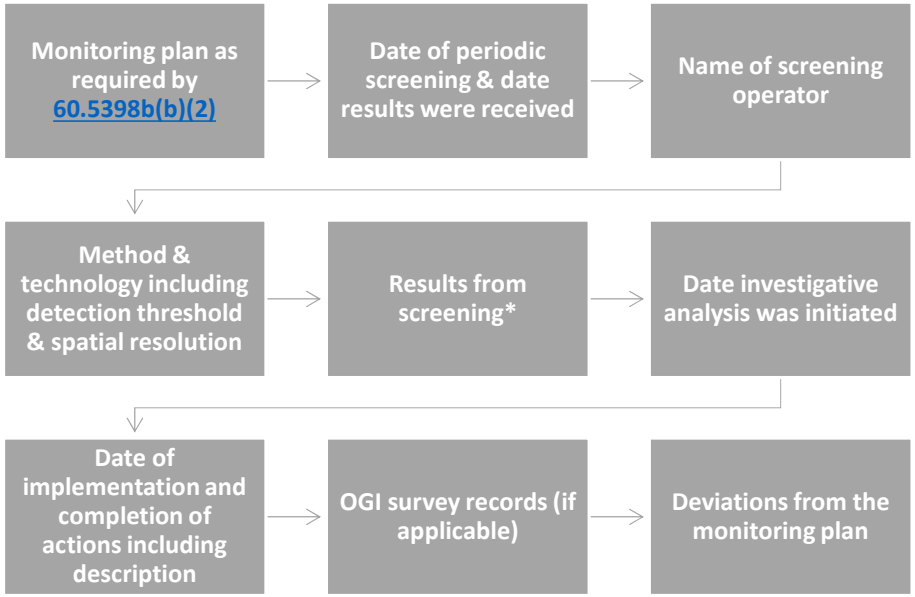
Recordkeeping – Alternative Technology



*Results from Screening:

- Date of inspection
- Name of operator performing survey
- Monitoring instruments used
- Calibration records
- Each fugitive emission component
  - Location and unique identifier
  - If a cover or CVS, description of defect
  - Date of repair
  - Records of components placed on DOR – see DOR recordkeeping requirements on previous slide

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Don’t Forget Your Monitoring Plan

- Commonly overlooked piece of LDAR programs
- Required by both OOOOa and OOOOb (and state programs)
- Is the backbone for your LDAR program
- Should be reviewed and updated at least annually, or after acquisition or divestment of facilities
- Utilizing Alternative Technologies requires additional Monitoring Plan(s) (See §60.5398b(b)(2))

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Annual Reporting – CEDRI

OOOOa – Aug 2 to Aug 1 reporting period
Report due by October 31

- Make sure you have the latest version that was released in July 2024 (24 tabs)
- 10 tabs pertain to fugitives and alternative technology

OOOOb – May 7 to May 6 reporting period
Report due by August 4

- Released May 2024 (36 Tabs)
- 11 tabs pertain to fugitives and alternative technology

Can petition to have reporting periods aligned

- It's much more than just reporting on your LDAR program
- Don't wait till the end of the reporting period to investigate recordkeeping
- Initiate data requests as soon as the reporting period ends
- Formatting is a critical detail
- Give yourself some buffer for submittal

https://www.epa.gov/electronic-reporting-air-emissions/cedri-list-rules#60

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Mind the Gap!

Common LDAR Program Gaps

- Missing records for repair attempts/verification
- Missing inspections – incorrectly scheduled, not scheduled, missed
- Operations removes tags after repair attempt before leak repair has been verified
- Incomplete records for DORs (do you have ALL the different dates and supporting details documented?)
- Outdated or missing monitoring plans
- “Our ops do an AVO every day”
  - Do they really?
  - Is it documented?
  - If it isn’t documented, it didn’t happen

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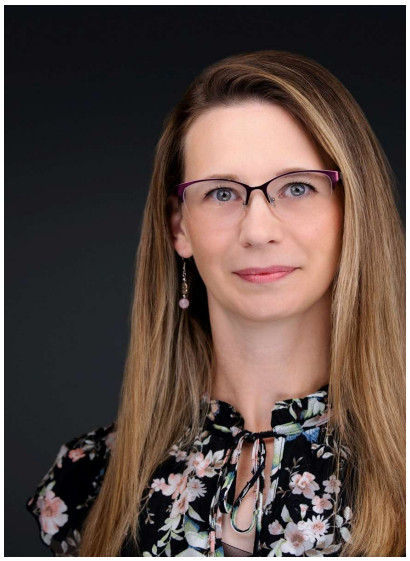

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