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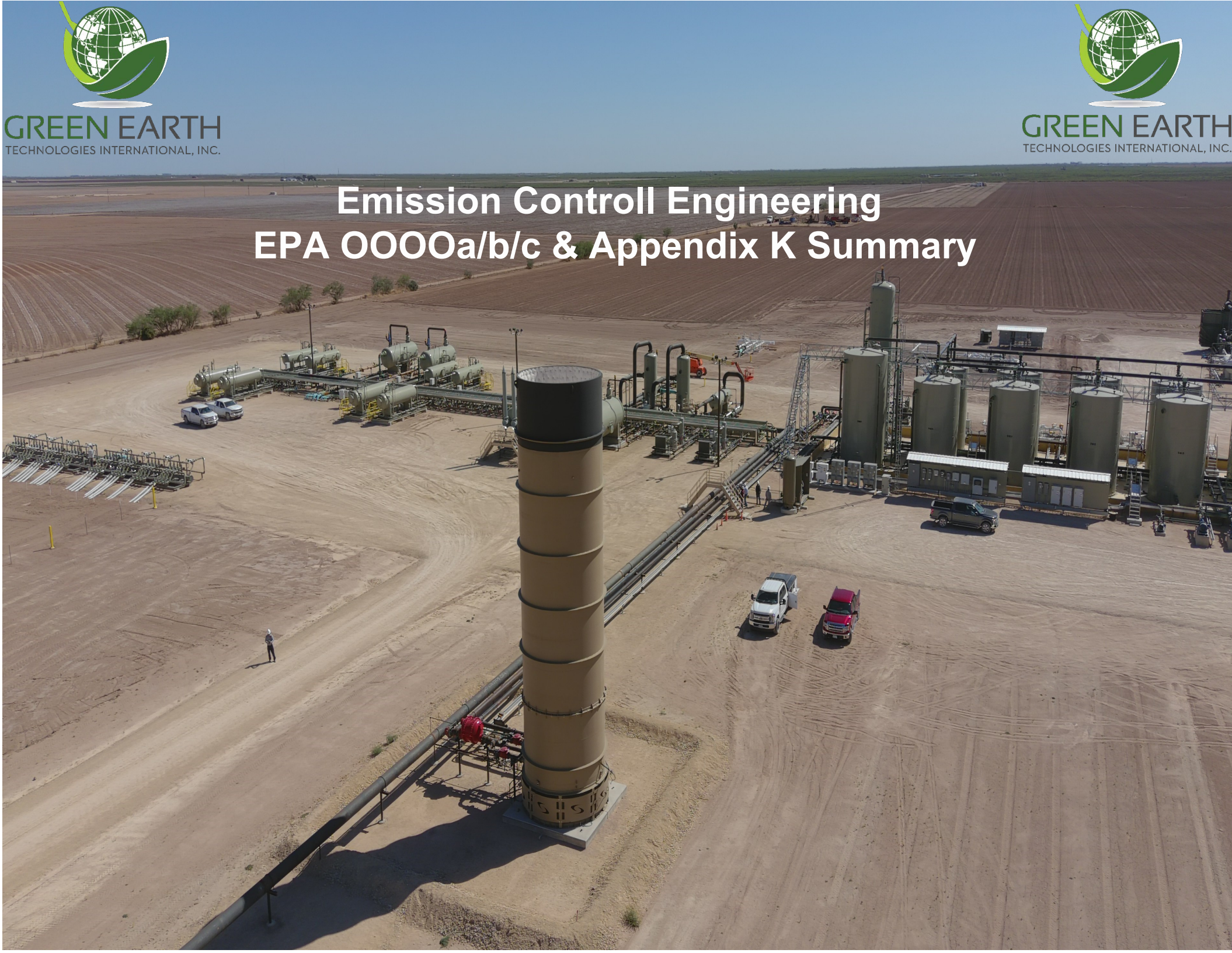
Emission Controll Engineering
EPA OOOOa/b/c & Appendix K Summary



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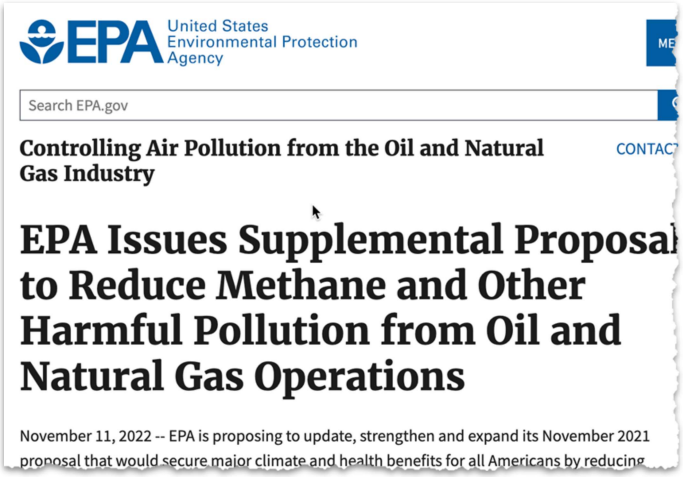
Preface


EPA United States Environmental Protection Agency

Search EPA.gov

Controlling Air Pollution from the Oil and Natural Gas Industry

CONTAC

EPA Issues Supplemental Proposal to Reduce Methane and Other Harmful Pollution from Oil and Natural Gas Operations

November 11, 2022 -- EPA is proposing to update, strengthen and expand its November 2021 proposal that would secure major climate and health benefits for all Americans by reducing

Overview

On November 8, 2022, the EPA released an update of their new air regulations called EPA OOOO b/c and Appendix K.

What's Inside:

Each section has a summary chart (aka "cheat sheet") so you can quickly scan the new requirements and see the differences between the current & new regulations.

DISCLAIMER: Crimson Energy, LLC is providing this information for educational purposes only.
The research and summaries provided in this presentation was provided CleanConnect.ai.
Our goal is to help operators understand the new rules and regulations, as well as, provide a solution for meeting the new ECD emissions requirements under EPA OOOOb/c.
For more information, please contact Steve Hogue at 720.862.6862 or Steve@crimsonenergyllc.com.

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This analysis has been composed from the following documents:

- Overview Fact Sheet (9 pages)
- Preamble (504 pgs)
- OOOOb (323 pgs)
- OOOOc (288 pgs)
- Appendix K (20 pgs)
- Inflation Reduction Act (274 pgs)
- EPA Comment Solicitation (20 pgs)
- **Total: 1,438 pages**

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EPA Column Definitions

The following charts compare these current and future regulations:

1

OOOOa

Current EPA Regulation

This is the current regulation that governs LDAR inspections for sites that were constructed, modified, or reconstructed after 9/18/2015.

2

OOOOb

New Sites after 11/15/2021

This impacts any upstream and/or downstream facility that was constructed, modified or reconstructed after 11/15/2021. Subpart W increases the number of equipment categories you need to inspect at a source level.

3

OOOOc

Sites Built On Or Before 11/15/2021

This impacts any site put into production on or before 11/15/2021.

In short, every site is now covered by the same requirements as OOOOb.

4

CDPHE (CO) Regulation 7

Colorado Current Regulation

We included CDPHE Regulation 7 because it is considered to be the strictest oil & gas air regulations in the US.

Colorado is considered the "R&D" lab for the EPA. Many of the new OOOOb/c rules have already been in place in CO for years.

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1. Comparing EPA OOOOa/b/c and CDPHE (CO) Regulation 7

Requirement	Current EPA OOOOa	Proposed EPA (OOOOb)	Proposed EPA (OOOOc)	Current CO Reg7 Rules
Applies to Site with:	3tpy	Complex Site (site w/more than one wellhead)	Complex Site	1 tpy VOC's
LDAR Frequency:	Every 6-months	Quarterly	Quarterly	Monthly if within 1,000 ft of community
Pre-production through completion	N/A	Recover gas & liquids during pre-production. Separator required.	n/a	Continuous VOC monitoring through 6-months of production
Repair	1st attempt within 30-days of detection. Final repair within 30-days of 1st attempt at repair.	1st attempt within 30-days of detection. Final repair within 30-days of 1st repair.	1st attempt within 30-days of detection. Final repair within 30-days of 1st repair.	7-days 1st attempt; 30-days final repair
BSER (Best system of emission reduction)	OGI or Method21	OGI (Appendix K)	OGI (Appendix K)	OGI (Appendix K)
Normal Leak definition	60 g/hr; half methane/half propane; 10,000 PPM; 1/4 in orifice	17 g/hr - methane -AND- 18.5 g/hr butane at 2 meters and deltaT of 5C in 1 m/s wind speed out of 1/4 in orifice	17 g/hr - methane -AND- 18.5 g/hr butane at 2 meters and deltaT of 5C in 1 m/s wind speed out of 1/4 in orifice	EPA definition
Super-emitter event	n/a	100kg/hour methane. Fix within 10-days. Report root cause on public website	100kg/hour methane, Fix within 10-days. Report root cause on a public website.	EPA
Compression Station Frequency	Quarterly	Quarterly	Quarterly	Monthly

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1. Comparing EPA OOOOa/b/c and CDPHE (CO) Regulation 7 (cont.)

Requirement	Current EPA OOOOa	Proposed EPA (OOOOb)[1] (Post 11/15/2021)	Proposed EPA (OOOOc)[1] (Pre 11/15/2021)	Current CO Reg7 Rules[2]
Centrifugal compressors (Centralized production facility)	None	95% control of emissions from wet/dry seal degassing.	95% control of emissions from wet/dry seal degassing. Test annually.	EPA
Gas Processing Plant Frequency	Reference Subpart VVa (non-OGI)	OGI bi-monthly according to Appendix K	OGI bi-monthly according to Appendix K	EPA
Gas Processing Plant Repair	Reference Subpart VVa (non-OGI)	1st attempt within 5-days, final within 15-days of detection	1st attempt within 5-days, final within 15-days of detection	EPA
Zero-emitting pneumatic controllers & pumps[5]	n/a	Zero-emitting devices at new facilities	Replace natgas-pneumatics with zero-emitting devices	EPA
Liquid loadouts	none	Prove Zero-emission load outs	Prove Zero-emission load outs	Visual load-out observation -> EPA
Tank (battery) monitoring	95% reduction in emissions. Monitor to ensure < 4tpy GHG emissions	95% reduction in emissions. Monitor thief hatch openings. Monitor VOC's at the battery-level	95% reduction in emissions. Monitor thief hatch openings. Monitor VOC's at the battery-level	Only open thief-hatch 2x/year. $49k fines for violations.
Flare & ECD Monitoring Combustor - Method 22	Method22- Quarterly visual inspection (look for smoke)	No open flares. Capture gas or use 95-98% efficient ECD. Method 22 - Monthly visual inspection (look for smoke)	No open flares. Capture gas or use 95% efficient ECD Method 22 - Quarterly visual inspection (look for smoke)	No open flares. Capture gas or use 95% efficient ECD. **Weekly visual monitoring** & annual testing of combustor efficiency (Feb 2022)

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1. Comparing EPA OOOOa/b/c and CDPHE (CO) Regulation 7 (cont.)

Requirement	Current EPA OOOOa	Proposed EPA (OOOOb)[1] (Post 11/15/2021)	Proposed EPA (OOOOc)[1] (Pre 11/15/2021)	Current CO Reg7 Rules[2]
Approved Instrument Measurement Method (AIMM) for LDAR & Methane Intensity Measurement[4]	AMEL approval process by basin & operator (technology + method) - LDAR equivalent	AMEL alternative means of emission limitations application process for technology in U.S. (270-day process)	MEL alternative means of emission limitations application process for technology in U.S. (270-day process)	Alt-AIMM approval of technology for use in CO by any operator would defer to EPA
Methane Intensity measurement	None	OGI. 95% reduction. 0.2% methane intensity	OGI. 95% reduction. 0.2% methane intensity	EPA
Baseline fugitive emission calculations	Use "model plant"	Use actual site-specific measurements using OGI or AIMM (p289)	Use actual site-specific measurements using OGI or AIMM (p289)	EPA
Methane Intensity Reporting requirements	Manual using EPA formulas	Methane Intensity Reporting w/methane tax starting in 2024	Methane Intensity Reporting w/methane tax starting in 2024	Emissions inventory + Regulation 22 required GHG intensity reporting

2. Super-Emitter Events

100 kg/hour emission event - notice and response regulation

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1

Day 1:
Notice

Notice by 3rd-party

EPA is partnering with 3rd-party:

- Satellites that fly the US every day
- Planes
- Mobile detection

2

Day 5:
Detection

Find the fugitive emission

- Detect using OGI or Method 21.
- Determine the duration of the emission

3

Day 10:
Fix

Fix The Problem

- Cold venting – fines $100k x days since last LDAR
- Tanks PRV open
- Thief hatch opening
- Etc.

4

Day 25:
Report

Problem & Fix Public Posting

- Report to EPA within 15-days of fixing the problem
- If you can't prove that you're innocent, the super-emitter event report will be posted publicly on a new EPA super-emitter website

3. Appendix K – Process for Manual LDAR

With the Nov 2022 update, this *only* **applies to gas processing plants**. All others use previous EPA LDAR process

01

Inspection Process

Mandates field of view, dwell times minimums, 10-second recording times for leaks, 5-minute inspection overview recordings, and delta-T requirements.

02

Required LDAR Training

- **Senior operator** with 500 surveys or 140 hours of experience.
- **Junior operator** required 32-hours of training under supervision of Senior operator

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4. Emissions Inventory 2.0

Possible future emission inventory and GHG intensity reporting based on EPA + Inflation Reduction Act.
You can avoid the methane tax if you comply with OOOO b/c.

Methane Intensity*

Colorado Regulation 22 is a good example, although the tax is based on CO2e intensity, not methane intensity.

Future Methane Taxes*

- **2023:** $900/ton methane
- **2024:** $1,250/ton methane
- **2025:** $1,500/ton methane

See page 11 for complete breakdown

LDAR Report

You can use your LDAR report to prove fugitive leak durations. More frequent LDAR – lower leak durations.

Top Down

You'll need to match the time sequence of your bottom's up to reconcile with top down. Flyovers won't count.

Throughput

You'll need throughput by site to determine methane / CO2e Intensity.

Bottoms Up

You can use a combination of emissions factors and empirical data to produce an emissions inventory.

4.1 Methane Intensity Tax Breakdown

Currently, the EPA requires every operator to submit a GHG emission inventory report annually based on Subpart W rules. Operators use EPA emissions factors to produce the inventory and turn it in.

The inflation reduction act (IRA) legislation plus the 2022 update to EPA Subpart W (source performance standards) introduced several new factors that I'm calling Emission Inventory 2.0:

Methane Intensity Numbers

- Upstream - 0.2% methane
- Midstream pipeline - 0.11% methane intensity
- Midstream processing, gathering, boosting, LNG - .05% methane intensity

Future Methane Tax Amounts

- **2023:** $900/ton methane above 0.2% methane intensity (upstream)
- **2024:** $1,250/ton methane
- **2025:** $1,500/ton methane

Example Scenario

- Let's say you turn in an emissions inventory 2.0 for 100 sites x 36/tons of methane per site on your annual emissions inventory report (1,200 tons)
- Multiply that by $900/ton methane tax (2023) and write a check to the EPA for $3,240,000.
    - However, the IRA basically says the methane tax doesn't apply if you meet OOOOb/c. So, upstream operators will be focused on compliance to the new rules as a way to avoid fines, methane tax, and consent decrees.

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5. Manual LDAR vs. Autonomous LDAR

CleanConnect.ai autonomous LDAR was recently certified by Colorado as an alternative approved instrument monitoring method or Alt-AIMM. To complete CDPHE's Alt-AIMM requirements, CleanConnect.ai achieved six key milestones in the application, including:

Source-level Detection

Demonstrate visual source-level leak detection of emissions, including the ability to distinguish between fugitive and permitted emissions.

Blind Testing

Demonstrate detection performance with blind testing at various distances and leak sizes on a production facility.

Equivalency

Prove emissions reduction equivalency against current CO (Regulation 7) regulatory monthly LDAR requirements.

Alt Work Practice

Provide an automated LDAR work practice that demonstrates how we detect, enable operators to diagnose and fix any problem found. Diagnosing and fixing leaks remotely is acceptable & encouraged.

Operator Endorsement

Colorado operators provided letters of support for the Alt-AIMM application and participated in actual production and field data collection that was included in the application.

EPA Approval

The CleanConnect.ai system is currently engaged with the EPA for approval. EPA is adopting a very similar process to Colorado's Alt-AIMM process.

5.1 Chart comparing Manual LDAR vs. Autonomous LDAR

EPA Requirement (Appendix K)	Manual LDAR using OGI	Autonomous LDAR using OGI
Use EPA OOOOa approved OGI camera	Ex: FLIR GF320	Ex: FLIR G300a, Sierra Olympic Ventus, etc.
Check OGI camera functions	Turn it on. Verify its working.	Checked automatically every minute
Record LDAR plan for each site (Appendix K only)	Record 5-min video each day of dwell times, angles, distances, backgrounds, process, etc.	One-time setup of user-defined tour stops per site. Automated after
Record leak (store video for 5-years)	Capture 10-seconds of video, tag it for location, weather, leak source, etc.	Automatic
Record repair	In a repair work-flow	Automatic video recording. Integrated with LDAR repair workflow software - step2compliance.com
Repair	Manual, on-site	AI-assisted. Most repairs can be done remotely
Distance	Varies depending on environmental conditions and how steady a human can hold the camera. Practically speaking: 10-15 feet	Enhanced by fixed mounting 30-40 feet above ground, weather-resistant pan-tilt, longer-range lens, plus AI-enhanced imaging. Up to 120m was achieved in government-approved blind testing.
Detection limits	See a leak from multiple angles	Alt-AIMM approved detection matrix. 2.8kg/hr @ 120m, 0.2kg/hr @ 27m
Required source categories	Operator needs to manually inspect each required source category in Subpart W for every inspection.	Operator configures tour stops that meet both source categories & field-of-view requirements. This is a one-time setup. Its automated thereafter

5.1 Chart comparing Manual LDAR vs. Autonomous LDAR (cont.)

EPA Requirement	Manual LDAR using OGI	Autonomous LDAR using OGI
Field of view	Divide complex scenes into manageable subsections. Each subsection must fill half the field of view of the camera	User-defined tour stops allow you to view at equipment group or equipment-level (source-level emissions monitoring)
Minimum time to dwell	2 seconds per component in the field of view (e.g., for a subsection with 5 components, the minimum dwell time would be 10 seconds)	User-defined. Typically 2-minutes per tour stop
Leak duration	Not required to determine	Duration is tracked across multiple pan-tilt tour stops. Multiple alerts available based on leak size, duration and source
Leak determination	Subjective, based on experience of operator	AI-Assisted. Periodically blind-tested for accuracy using government-approved testing criteria
Adjust for Delta-T	Move camera to best angle. FLIR GF320 does not have the ability to cycle through Delta-T presets.	Enhanced by fixed mounting OGI camera 30-40 feet above ground. Automatically adjusts for best Delta-T based on ambient temperature & image quality.
Required inspection breaks	Human operator must rest every 30-minutes	N/A; Inspections done 24/7
Required LDAR Reporting	Manual or 3rd party software	Hybrid LDAR report from Step2Compliance. Autonomous LDAR data is pulled automatically from CleanConnect.ai AI-enhanced visual logs
Training required	Senior operators have 1,400 survey hours during their career, including 40 hours in the past 12 months. Junior operators need 32 hours of onsite inspection under supervision prior to becoming an independent LDAR operator. Quarterly audits by senior operators.	Field personnel can be effective at diagnosing leaks remotely using AI-assisted visual alert system within 8-hours of training

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6. Impacts of Regulation OOOOb/c

Many operators will need to invest heavily to maintain their manual LDAR program. OOOOb requires you to double the frequency and OOOOc requires you to inspect all of your sites built prior to 2021.

1

Staffing & Call-Out

The number of people and scheduled call-outs will increase dramatically. Literally millions of scheduled inspection will increase with corresponding safety and vehicle emissions.

2

Retrofits (OOOO c)

Replacing gas-powered pneumatics on every existing site will cost the industry millions of dollars and down-time.

3

Enforcement: Super-Emitter

Satellite technology will enable the EPA to monitor your sites 24x7x365 and 100 kg/hour leaks will be easy to spot.

4

Reporting: Methane Tax

The inflation reduction act introduces the concept of a methane tax. You can avoid it for now by complying with OOOO b/c for now, but you can expect a methane intensity tax in the future.

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For additional information on how Crimson Energy can help you meet the new EPA OOOOb/c standards,

Please contact Green Earth Technologies at the following:

✓ **Email: contactus@green-earth-tech.com or Phone: 832-390-2699**