IMPROVING SAFETY
MAXIMIZING PROFITS
REDUCING EMISSIONS
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TARGET
EMISSION SERVICES

LDAR Case Study Comparison of Conventional Method 21 vs Alternative Work Practice (Optical Gas Imaging)

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OVERVIEW

- **AWP Components/Requirements**
- **AWP vs Conventional Comparison**
- **Case Study Data**

METHOD 21 AWP

- **Released in 2008 to address new technology - Optical Gas Imaging (OGI)**
- **Allows facilities to identify leaking equipment using an OGI instrument instead of a leak monitor prescribed in 40 CFR part 60, Appendix A-7 (i.e., a Method 21 instrument)**
- **Provide for emissions reductions at least as equivalent as the current work practice**
- **Document provides instructions and requirements for using OGI**

DETECTION TECHNOLOGIES

OGI:

FLIR GF 320 or OPGAL EYECGAS

- Uses infrared absorption principles of hydrocarbon gases
- Allows user to actually see the gas images

Conventional:

Gas Detector (EC, FID, PID) & Snoop

- Selection based on compound of interest
- Provides ppm level detection of gas leaks
- Can be used for leak confirmation

AWP REQUIREMENTS

- **Modified Monitoring Frequencies**
  - **Bi-monthly on all components**
- **OGI Performance Testing**
  - **Daily performance test to determine minimum detection level at maximum camera distance**
- **Data Recording**
  - **Must record video of entire inspection**
- **Leak definition**
  - **Not based on PPM**
- **Requires conventional assessment once annually**

FREQUENCY

M21 –various leak definitions based on parts per million (ppm) and corresponding monitoring frequencies (monthly, quarterly, or annually)

AWP – Entire facility, based on detection sensitivity level:

Monitoring Frequency per Subpart[a]	Detection Sensitivity Level
Bi-Monthly	60
Semi-Quarterly	85
Monthly	100

"increased frequency of monitoring to detect larger leaks to compensate for the camera's inability to detect small leaks"

OGI DETECTION LIMIT

- Reference rate of 60 grams/hour
- Tests show rates as low as 0.8 grams/hour using methane
- TARGET – average leaks detection minimum ranges from:
  - 300 to 1500 PPM (2.5 g/hr to 10 g/hr)
- Environmental conditions have impact on limit (wind speed, delta T, background scene)

3RD PARTY MDLR

- **Minimum Detected leak rate (MDLR)**

- 1-Pentene - 5.6g/hr
- Benzene - 3.5g/hr
- Butane -0.4g/hr
- Ethane - 0.6g/hr
- Ethanol - 0.7g/hr
- Ethylbenzene - 1.5g/hr
- Ethylene - 4.4g/hr
- Heptane - 1.8g/hr
- Hexane - 1.7g/hr
- Isoprene - 8.1g/hr
- MEK - 3.5g/hr
- Methane - 0.8g/hr
- Methanol - 3.8g/hr
- MIBK - 2.1g/hr
- Octane - 1.2g/hr
- Pentane - 3.0g/hr
- Propane - 0.4g/hr
- Propylene - 2.9g/hr
- Toluene - 3.8g/hr
- Xylene - 1.9g/hr

METHOD 21 VS AWP

FACTOR	CONVENTIONAL	AWP
EQUIPMENT	Hand-held monitors to detect ppm levels of VOC	Optical Gas Imaging to detect visible image of VOC leaks
WEATHER LIMITS	High rain, wind and humidity	Rain, fog, wind and extreme cold
LEAK DEFINITION	500 – 10,000 ppm	Visible leak (no quantification)
ACCESSIBIITY	Maximum 3 meters with probe extension	Maximum over 30 meters with lens
ACCURACY	High instrument accuracy but prone to technician errors and leak locating errors (one centimeter difference in analyzer position equated to a 57% chance of missing an actual leak)	Very high accuracy as exact leak source can be seen Lower accuracy at conc. below 1500 ppm
EFFICIENCY	250 – 600 components per day	5000 – 15,000 components per day
FREQUENCY	Monthly, Quarterly, Annual	Bi-monthly, Annual (conventional)
COST	Higher due to increased time onsite	Approximately 15-30% lower

M21 PITFALLS

Staffing

- Highly competitive mature market has led to low wages and reflects on hiring standards
- Significant inconsistency in performances
- High turnaround and minimal training

Short Cuts

- LDAR industry continuously battles cheating methods
- Monotonous tasks

Tag Program Gaps

- Challenge to keep inventory updated

AWP BENEFITS

- Provides equivalent control and is less burdensome to implement
- Length of assessments lower (less $)
- Able to scan components that were previously unsafe or inaccessible (reduce scaffolding / manlift requirements)
- Can see leak source, preventing leak and repair errors, eiminates “ghost leaks”
- Video image of leak sources and full video record for auditing
- Eliminates the need to calculate different monitoring requirements for different devices simplifying the process
- Greater probability of medium and large leaks being detected sooner
- **Amount of emissions released by smaller leaks possibly missed by OGI surveys are offset by the faster identification (and repair) of larger leaks when surveys are conducted on a more frequent basis**.

AWP BENEFITS

Example:

One medium to large connector leak (100,000 ppm or 0.35 cfm) - equal to approximately 100 - 200 leaks in the 500-1000 ppm range

AWP **– maximum time before detection = 60 days leaking = 22,680 cf emitted**

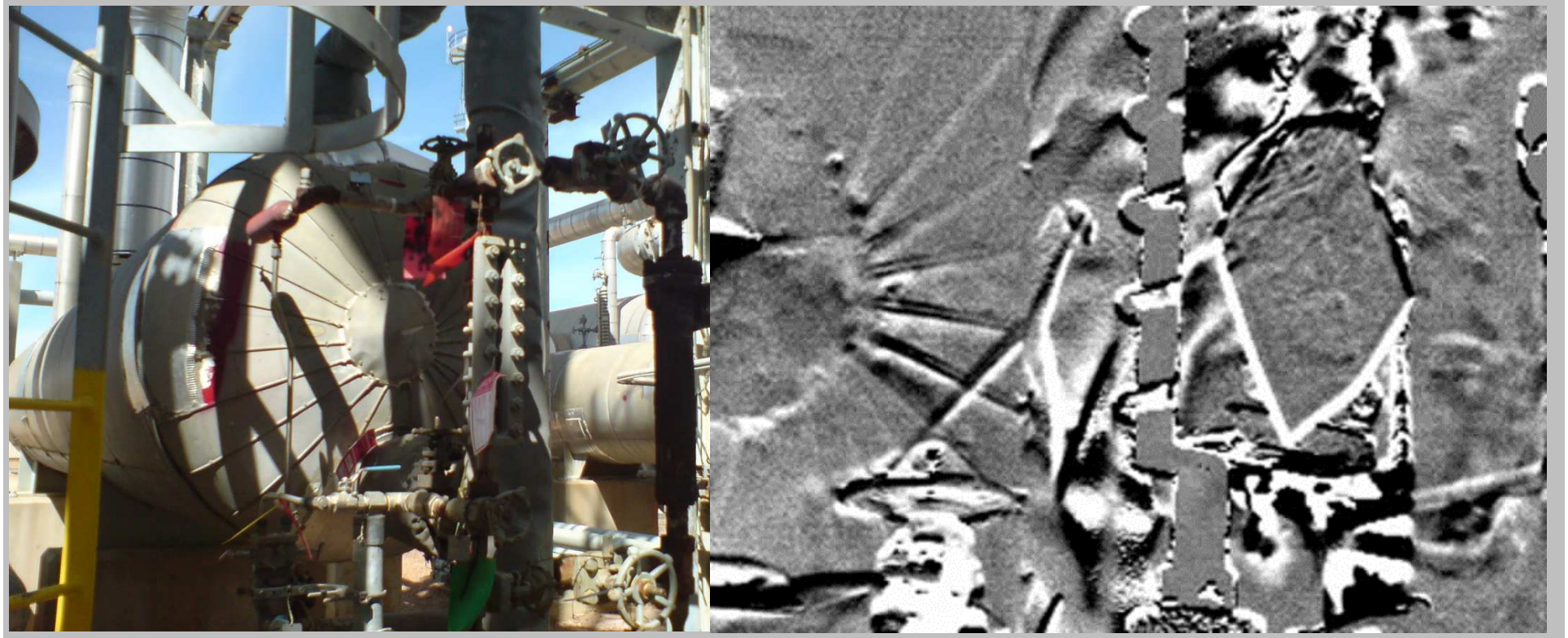
M21 **– maximum time before detection = 365 days = 189,960 (8 X the emission volume)**

– average time before detection = 180 days = 90,720 (4 X the emission volume)

The volume of medium/large leaks found sooner by AWP significantly (1000X+) outweigh the volume from smaller leaks that may be below camera detection limit

METHOD 21
CONVENTIONAL VS AWP

METHOD 21
CONVENTIONAL VS AWP



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EPA KKK & OOOO

- **LDAR regulations that applied to NG Processing Facilities**

Requirement	KKK	OOOO
Applicable	commence construction, modification or reconstruction before August 23, 2011	commence construction, modification or reconstruction after August 23, 2011
Components	Excludes connectors	Includes connectors
Leak Definition	10,000 ppm	500 ppm

- **New OOOO in draft form, CH4 inclusion**

CASE STUDY

- **Regulatory Requirement: EPA Subpart OOOO**
- **6 process units**
- **Over 16,796 components**

CASE STUDY COMPONENTS		M21	AWP
Compressor	**14**	Q	BM, A
Connector	**10500**	A	BM, A
Press Relief Device	**146**	Q	BM, A
Pump	**35**	M	BM, A
Valve	**6101**	Q	BM, A
TOTAL	**16796**	**12 trips**	**6 trips**

CASE STUDY

Crew, Equipment and Reporting Costs

METHOD	M21	M21 AWP - OGI	TOTAL DAYS/ YEAR	CREW AND EQUIPMENT	% SAVINGS
	A,Q,M	BI-MONTHLY			
AWP	14	2	24	$70,000	30%
M21	40	0	40	$100,000	

Assumes a 40% higher crew and equipment cost for OGI
Does not include indirect repair costs savings
Removing annual M21 requirement would change to 58% cost savings

METHOD	TRAVEL AND SUBSIS. TOTAL	% SAVINGS
AWP	$44,400	**28%**
M21	$62,000	

METHOD	Leak Count
AWP	569
M21	498

OF LEAKS

Plant 1

METHOD	Leak Count
AWP	561
M21	555

Method	Leak Count	Volume
OGI	37%	90%
M21	63%	10%

75% of Rate Connectors

Plant 2

METHOD	Leak Count
AWP	335
M21	329

Method	Leak Count	Volume
OGI	54%	98%
M21	46%	2%

75% Rate Connectors

OGI USAGE

- **EPA Subpart W – recommended and most common technology used**
- **EPA OOOOa – Compressor stations and well sites required to perform OGI LDAR Program**
- **State Level – numerous State requirements enlisting OGI**
- **Inspection Tool – Federal and State Regulators using OGI for facility inspections**

OGI FUTURE

- ERG Draft Technical Support Document
  - OGI history, technology, research, observations, etc.
  - Discusses results of detection limit tests
- A protocol for applying OGI technology will be codified at 40 CFR part 60, appendix K
  - prescriptive procedures for source characterization and compliance
  - Replace AWP?

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