2026 A&WMA Spring Conference

Beyond Regulatory Compliance: From Reactive Emissions to *Risk-Informed Operations*

Improving Compliance Outcomes Through Early Emissions Detection

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With reliance on present-day passive VOC emissions programs,
Refinery and chemical plant operators are assuming more risk than necessary

Historic programs (LDAR, time-integrated fenceline) are optimized for periodic data collection, not for managing event risk.

Features of current LDAR and passive, time-integrated fenceline programs:

- Passive sampling methodology → 14-day integration of samples
- Reactive sampling & analysis: → 2-3 week result delay
- Reactive, compliance-driven posture
- Lacking intelligence - no proactiveness
- Cannot distinguish onsite vs offsite contributions
- Overspend on unnecessary Root-Cause Analysis and Corrective Actions

2-3 Weeks	>$1m	Compliance & Operational Risk (HON/MACT)
delayed insight	avg. annual overspend	

Cadence ≠ Control

Regulatory pressures are increasing, with *increased Refinery MACT CC enforcement and the HON rule*

Refineries and chemical plant increasingly expected to monitor, manage and mitigate VOC emissions in real time.

HON Rule Updates (Chemical Manufacturing Plants)

- Targeting 6 HAPs: Benzene, 1,3-Butadiene, Chloroprene, Ethylene Oxide, Vinyl Chloride, Ethylene Dichloride
- May 2024 amendments: process vents, storage vessels, wastewater, heat exchanger systems and equipment leaks
- RCA initiation: 5 days
- RCA Completion: 45 Days
- **Phase 1: January 2026**

Applies to **Major-source chemical manufacturing plants** that make or use **listed organic hazardous air pollutants** in their production processes. (see 40 CFR 63 Subpart H).

Refinery MACT CC (Major-source Petroleum Refineries)

- Targeting Benzene - Action Level: 9µg/m3
- Fenceline exceedances are now gateways to facility-wide investigations (LDAR, benzene waste operations, flares, tanks)[1]
- Linkage to storage tanks, marine loading operations, wastewater
- RCA initiation: 5 days
- RCA Completion: 45 Days
- **Compliance Status: In Effect**

Applies to **major-source petroleum refineries** and all associated equipment and operations that emit or handle hazardous air pollutants, including benzene (see 40 CFR Subpart CC)

[1]EPA Targets Benzene Emissions in Refinery Enforcement Alert, https://natlawreview.com/article/its-deja-vu-all-over-again-epas-first-enforcement-alert-targets-benzene-emissions#google_vignette

The current scenario: A 45-Day stepwise, delayed process that produces compliance artifacts, not emission intelligence

Time-blind. No event timing or duration

Masking of True Risk. Critical events averaged away

No Source of Causal Insight. Reduced ability to improve

Reactive operating model. Chasing, not preventing

Passive benzene monitoring process example.

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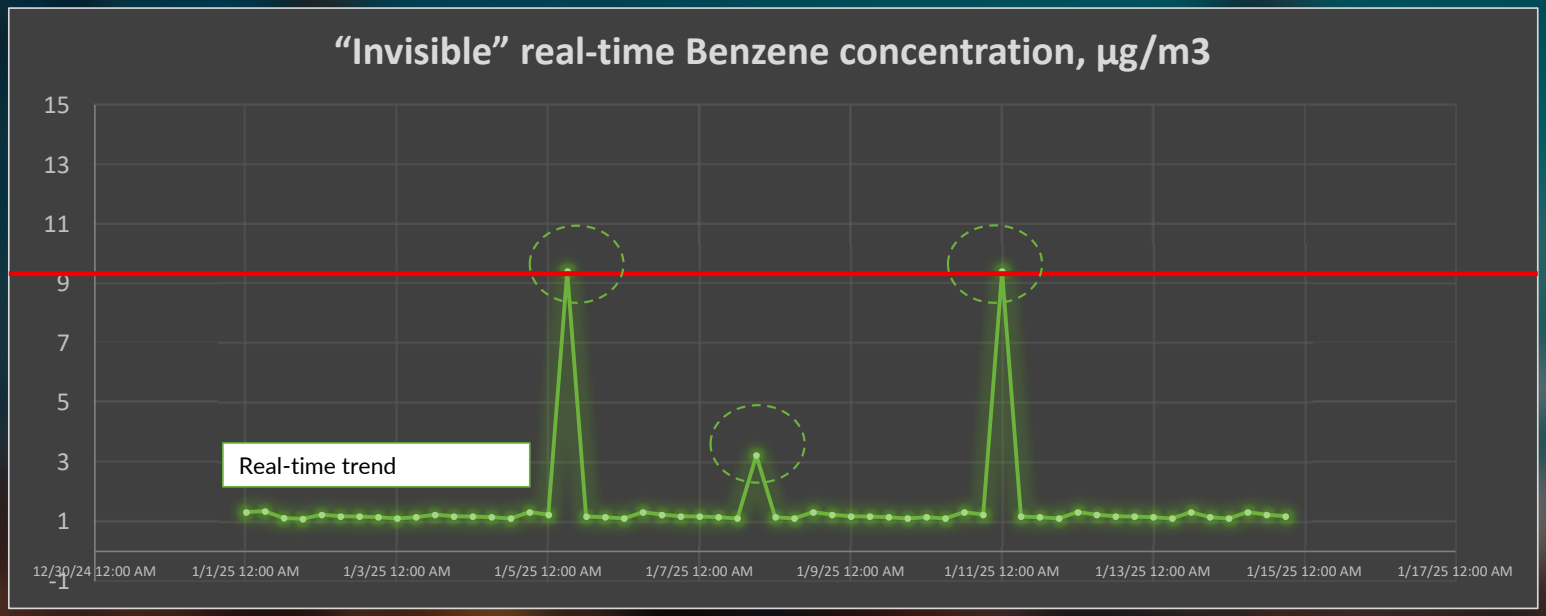
Operators, HSE and risk teams are unable to demonstrate and explain causality

*The most important emissions occur in intermittent high-impact events – **causality is virtually invisible with passive methods***



Illustrative example figures only.

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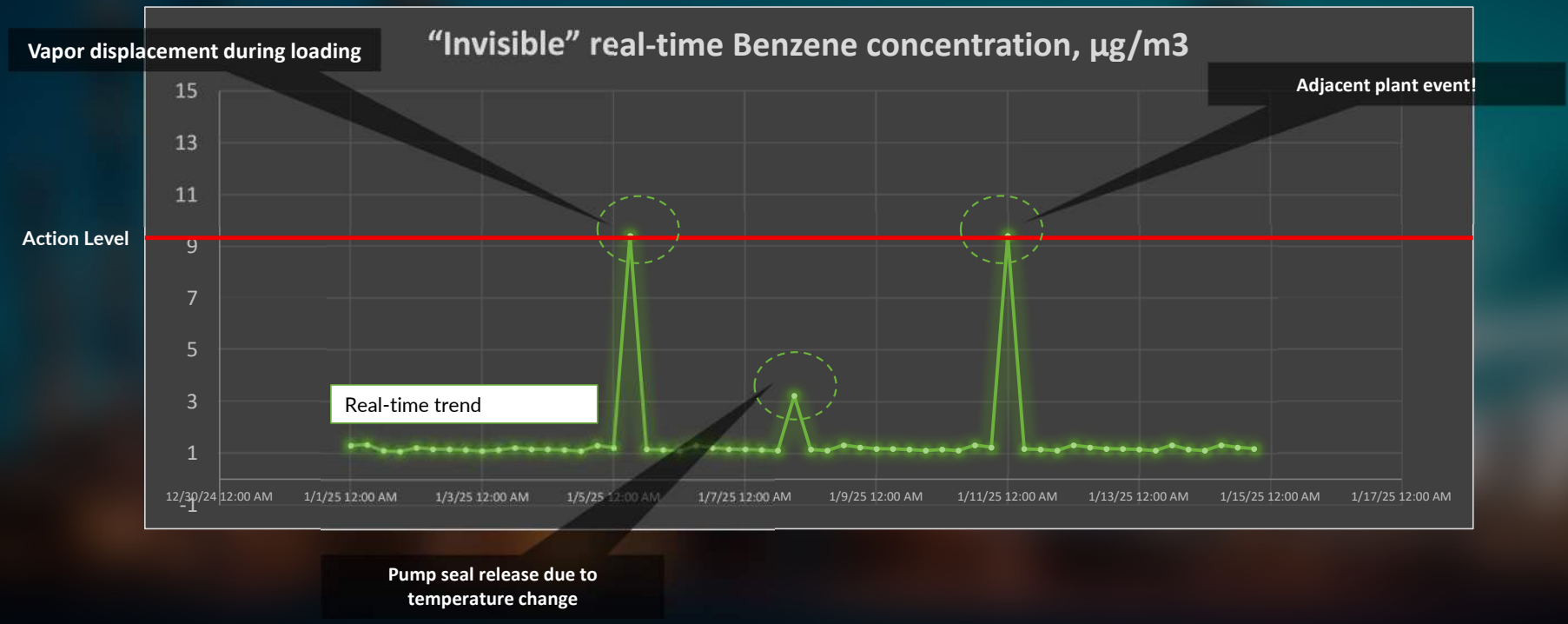

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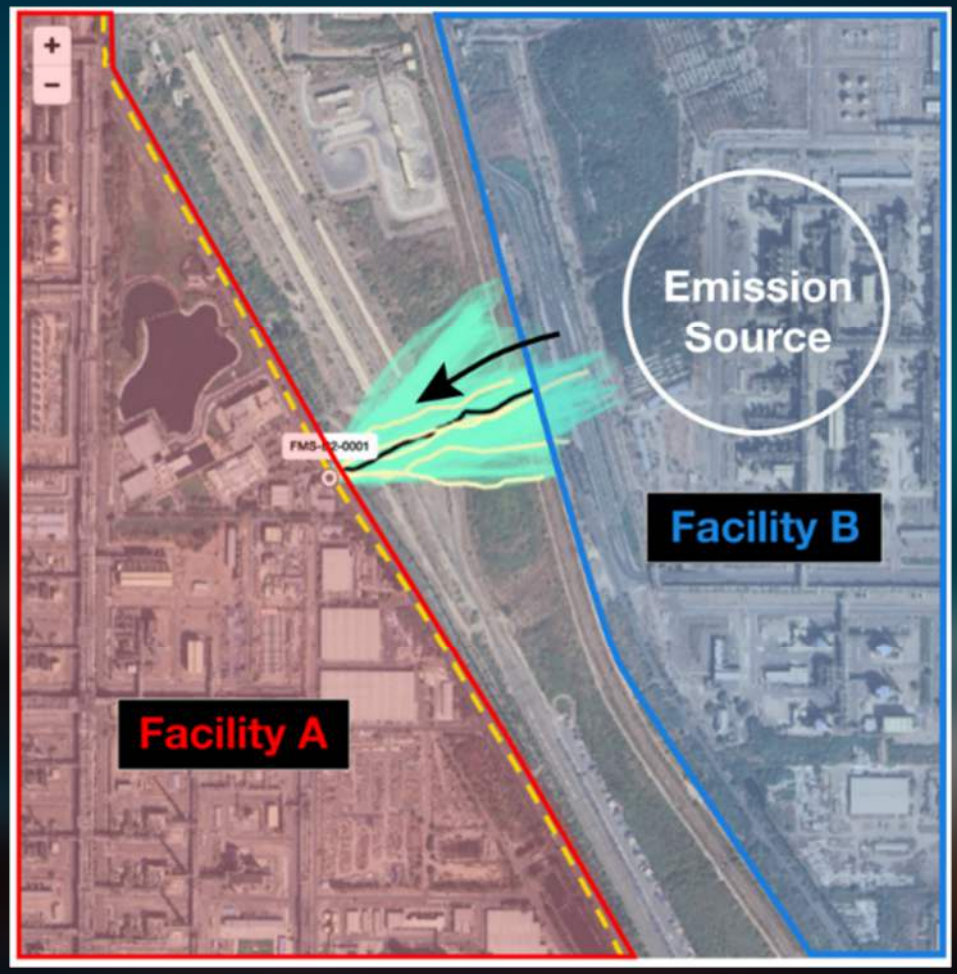
The Source Attribution Challenge:

How to distinguish between *internal and external emissions contributions*



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Real-time compliance:
Concentrations under control

Integrated RCA workflow:
Detection through mitigation

Enabling the *system-wide, risk-informed operating model*

System-wide
risk-informed environment

Correlation with plant
operations and condition

PILOT RESULTS

Gulf Coast deployments *prove the model.*

Fenceline stations, Cloud Data Platform, and AMLD mobile surveys delivered measurable results at early adopters.

3 NESHAP Rules

- Refinery Sector (MACT CC)
- Chemical Sector (HON)
- Chemical Area Sources (CMAS)

12 Months of field validation test

- EPA Method 301 – comparison again Method 325 A/B & Method 327
- Method Detection Limits for 6 Compounds - 1/3rd & 1/10th of Action Level
- Bias & Precision Statistical Analysis & Long-term Drift Assessment

✓ EPA Method 301 Validated

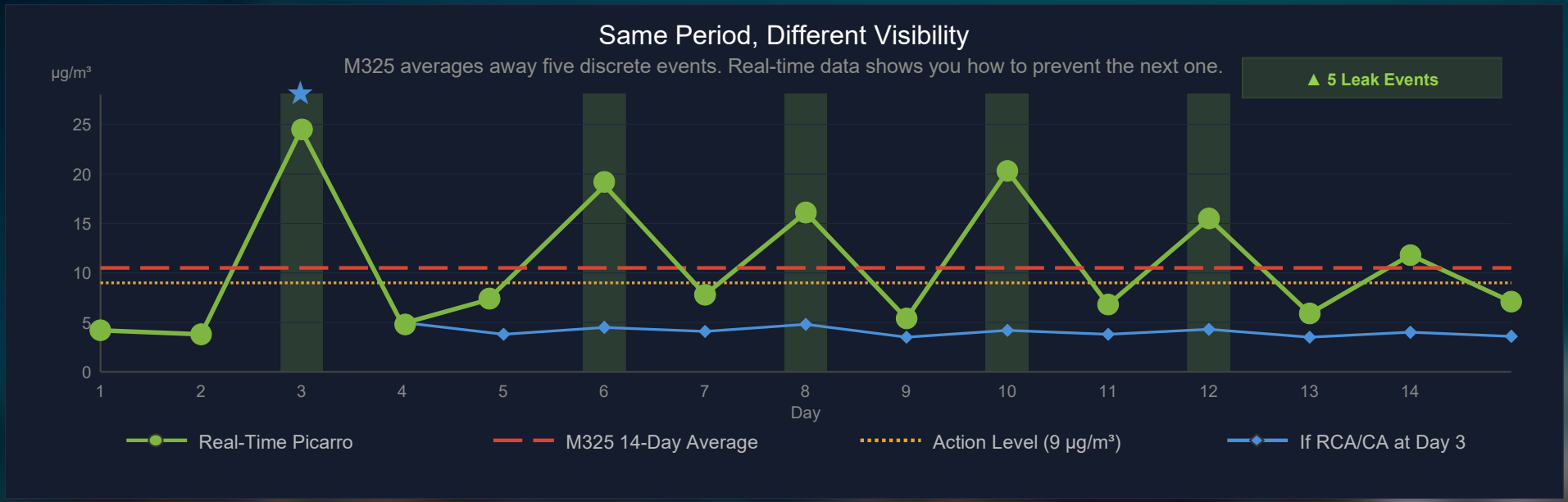
Picarro Fenceline Monitoring Systems based on Broadband Cavity Ring-Down Spectroscopy (BB-CRDS)

650+	<90 ppt	<40 ppt	6 VOCs
Spectral Library	Benzene LOD	EtO LOD	Regulated HAPs
Compounds identified in real time	100× below action level	25× below action level	Benzene, EtO, VCM, EDC, BD, CP

THE BLINDSPOT

Blinded by 1990s methods. *Real-time shows why.*

Same 14-day period. Passive sampling reports one number. Continuous data reveals a proactive opportunity to prevent future events.



★ Why This Matters

The first event (★ **Day 3**) was detectable in real time. Had corrective action started there, subsequent events could have been prevented — dropping the period average below action level. Instead, all five compounded undetected. **Early detection creates the window for prevention.**

Illustrative example figures only.

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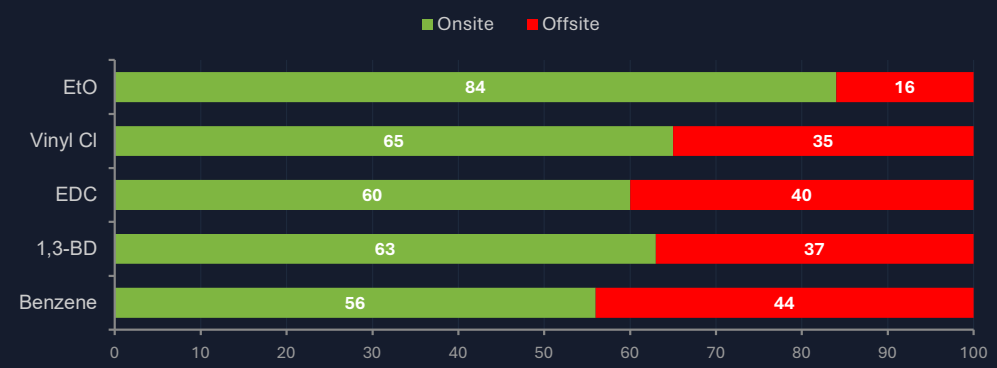
CASE STUDY 1

Your emissions *or your neighbor's?*

Petrochemical surrounded by chemical plants and refineries. Passive samplers charged 100% against the operator.

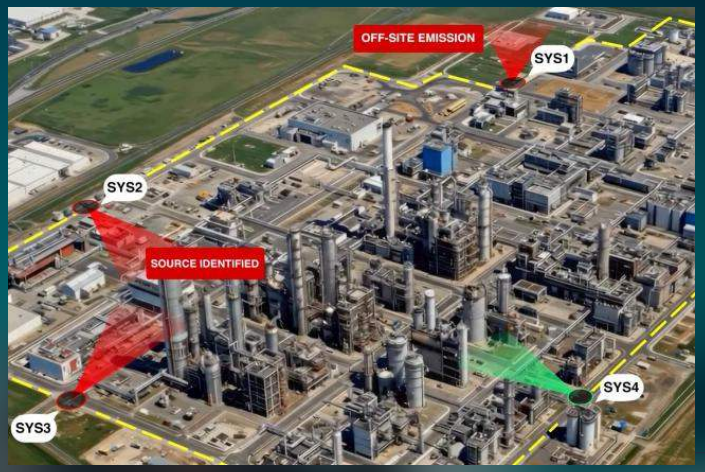


KEY FINDINGS

>40%	Benzene attributed to offsite sources	↓	Reduced public & regulatory scrutiny
>30%	Average offsite contribution for 5 VOC's	40%	Lower LDAR & Fenceline compliance costs
4	Near-field sources continuously excluded	↑	Improved risk profile & confidence

The impact of knowing your neighbors

A network of high-precision, time-synced spectral and meteorological data revealed that an average of >30% of measured fenceline concentrations originated from near-field sources—contributions invisible to passive samplers but critical for accurate ΔC reporting, regulatory defensibility, eliminating false alarms.



Illustrative example figures only.

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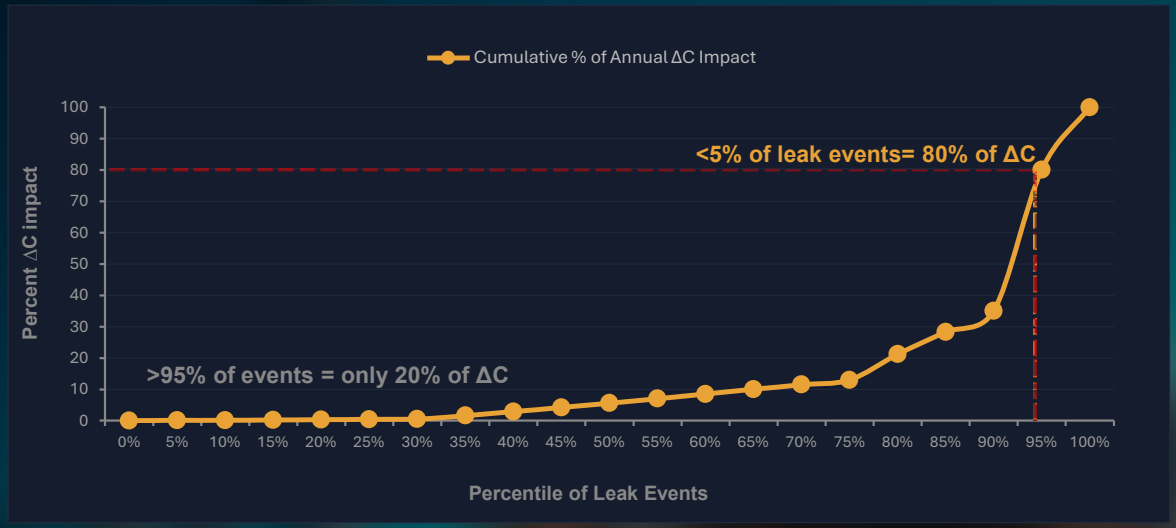
CASE STUDY 2

The critical few: *power law in leak events.*

Less than 5% of leak events account for 80% of cumulative annual ΔC reporting — previously hidden by passive programs.

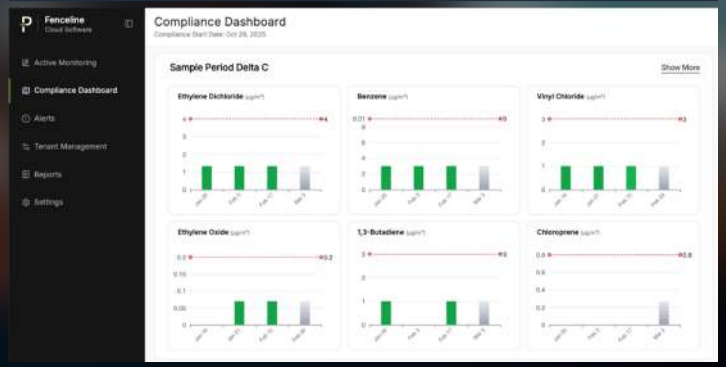


IMPACT DISTRIBUTION

<5% Of leak events drive 80% of annual ΔC

20% Of events drive 80% of total impact

9x Mean-to-median impact ratio



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THE SOLUTION

Detect. Attribute. Resolve. *Before ΔC non-compliance.*

Three integrated solution layers replace disconnected workflows with a single system of record — from fenceline event to documented corrective action.

LAYER 1

Fenceline Network

Continuous compound-specific detection with onboard sonic anemometry. 5-second data resolution across all regulated HAPs, 24/7/365.

LAYER 2

Picarro LINK Cloud Platform

Back-trajectory source attribution, geospatial boundary mapping, automated ΔC calculations, event risk-ranking, and intelligent RCA notifications.

LAYER 3

AMLD Mobile Survey

GPS-mapped mobile confirmation of source location. Transition from fenceline alert to documented corrective action in a single shift.

MEASURED OUTCOMES — GULF COAST PILOTS

40%	Same Day	34%	<5%
OPERATIONAL SAVINGS	ROOT-CAUSE ANALYSIS	EMISSIONS REDUCTION	CRITICAL FEW LEAK EVENTS

Prevent it. *Don't explain it.*

From reactive compliance to risk-informed operational control.

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