BOREAL

Process Units – Common Uses

Laser Based–Open Path Gas Detection

Compressors, Pumps, & Reactors

Laser Based – Open Path Gas Detectors are **positioned around high failure frequency equipment** to protect personnel.

Problem: High Hazard Rank Application
Due to frequency of occurrence & severity of harm

Challenge: Detection of Small Seal Leaks
Most Acid Gas E-Chem's have T90 Res. >30 seconds

Opportunity: Have Early Warning of Failure
Used for passive Leak Detection & Repair (LDAR)

Solution: Find & Fix Leaks While Still Small
Is with Laser Based – Open Path Gas Detection

Heat Exchangers – Fin-Fan/Plenum

Problem: Mechanical Probability of Failure
Exchanger failure likely 3.9 in 1,000 times[1]

Challenge: Surviving in Harsh Environment
High temps/airflows harm E-Chem's/Cat. Bead's

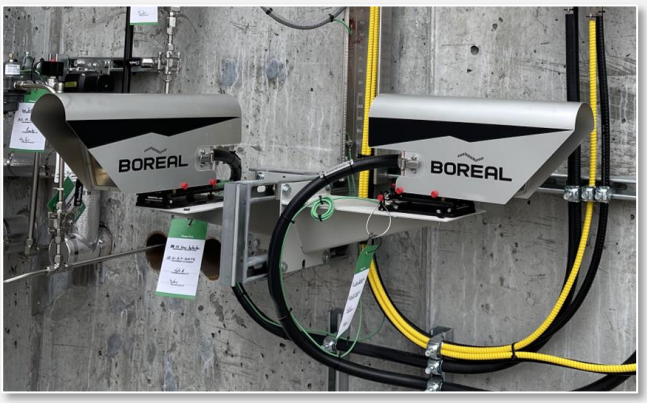
Opportunity: Protect the 'Inaccessible'
Hardware is mounted in accessible areas

Solution: Detect the 'Undetectable'
With Laser Based – Open Path Gas Detection

Reference[1]: Shell & Tube - DNV GL Failure Frequency Guide

Laser Based – Open Path Gas Detection is **positioned** over **Fin-Fan Louvers**. Due to high air velocity and the obstructions caused by the Shell & Tube Exchanger, **the air flow is sufficiently turbulent that often leak will be detection on each of the paths.**

Process Unit Perimeter Monitoring



Paths oriented around the process unit have been **proven to be effective in detecting fugitive plumes** from even small releases.

Problem: Warn Adjacent Areas of a Leak
Lethal plumes of gas extend beyond area of release

Challenge: Sufficient Detector Coverage
Large perimeter stresses the projects feasibility

Opportunity: Capital and Operational Costs
Reduce the device count, infrastructure, & cabling

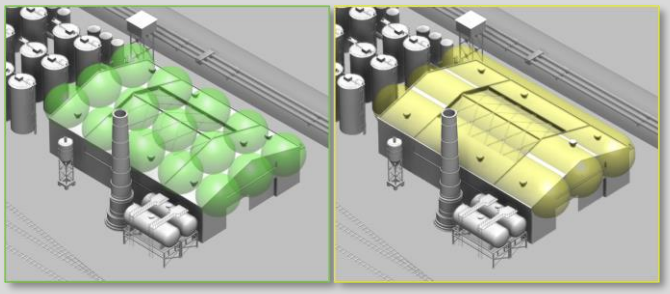
Solution: Most Economical Option Available
Is with Laser Based – Open Path Gas Detection

16646 114 Ave NW, Edmonton, AB, CA T5M 3R8 P +1.780.488.5173 E info@boreal-laser.com W boreal-laser.com REMOTE PRECISION. SURE DECISION.

Geographic Area Coverage

Definition: The fraction of the geometric area or volume of a defined monitored process area that would be detected.

Traditional – Fixed Point Gas Detectors **vs.** *Lased Based – Open Path Gas Detectors*



Laser Based – Open Path Gas Detection is the *most economically viable option* to minimize both the **Total Install Cost + Total Operational Cost (TIC-TOC)** in *High Hazard Rank Applications.*

Exceed your Area Coverage Requirements
With Laser Based – Open Path Gas Detection

Increasing the Probability of Detection
Offers the greatest Risk Reduction Factor return[1]

To Mitigate Risk in a Grade A Hazard Rank
You will need 90% Geographic Area Coverage[1]

Laser Based – Open Path Gas Detection
Easiest & most economical way to Mitigate Risk

[1]: As stated in ISA-TR84

Safety Availability

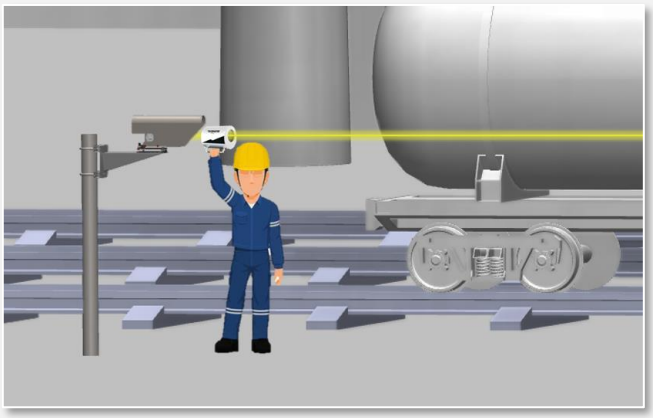
Definition: The availability of the FGS function designed to automatically mitigate the consequences of hazards.

Surpass Safety Availability Requirements
With Laser Based – Open Path Gas Detection

Survive & Continue to Detect after a Leak
Lifespan/performance not effected by exposure

Smart Fail-Safe Device + SIL2 Suitable
Only outputs gas concentrations if 'fully functional'

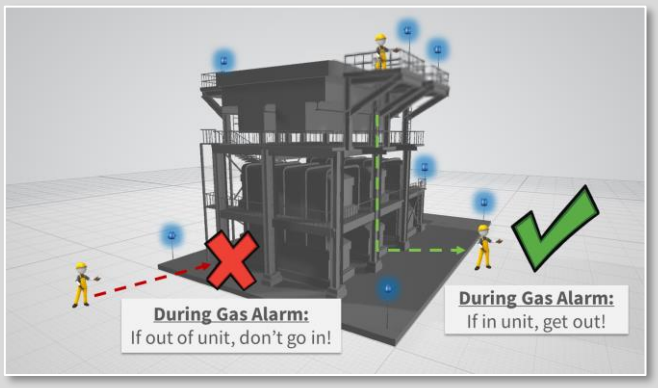
Eliminate your Maintenance Burden
No Calibration and easily perform Functional Tests



To perform **Function Test**, simply hold the **Response Cell** in the Laser Beam to '**Bump**', '**Challenge**', or '**Verify a Response**'.

Mitigation Action Effectiveness

Definition: The confidence that the final element(s) actions will successfully mitigate the consequence of the hazard.



During a Release: Prevent personnel from *entering the area* or *evacuate personnel from that area.*

Alarm Faster and at Lower Concentrations
With Laser Based – Open Path Gas Detection

Confidently Detect Incipient Level Leaks
Lowest Actionable Concentrations clearly stated

Gain an Instantaneous Response to a Leak
New and independent sample every second

Importance of Timely Personnel Evacuation
Rapid recovery actions prevent escalating event

16646 114 Ave NW, Edmonton, AB, CA T5M 3R8 P +1.780.488.5173 E info@boreal-laser.com W boreal-laser.com REMOTE PRECISION. SURE DECISION.