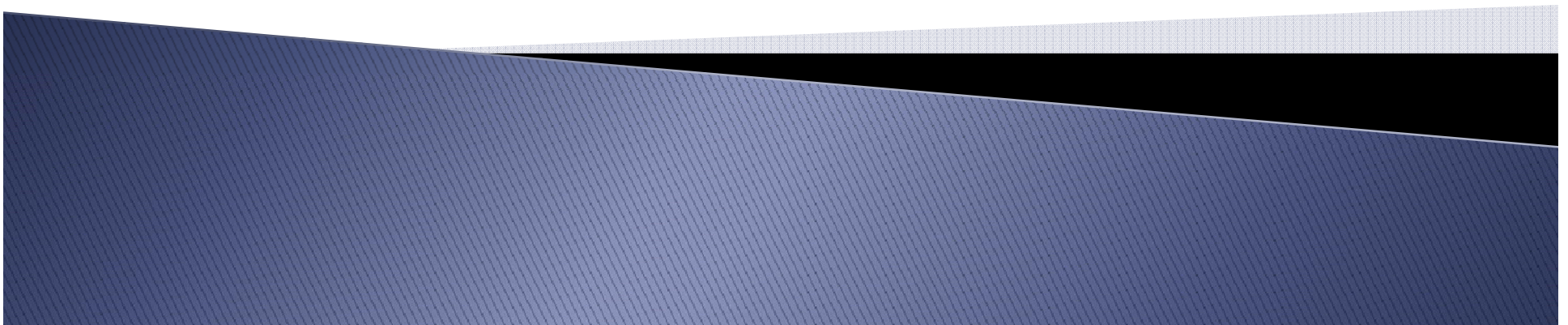


Leak Detection Systems Capabilities and Research

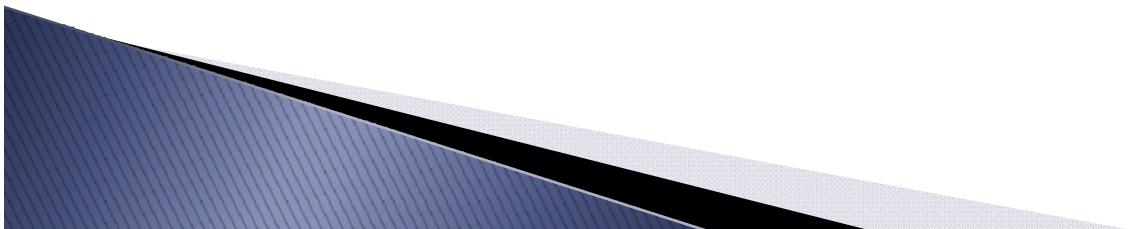
Natural Gas Pipelines

PHMSA Webinar
March 27, 2012



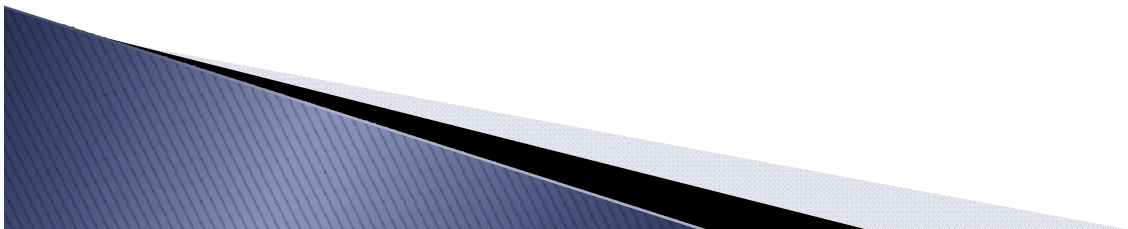
Gas vs. liquids LDS

- Internal LDS
 - Deviations analysis is harder – compressibility
 - Availability and accuracy of instrumentation
- External LDS
 - Atmospheric (optical) sensing is much easier – gas is volatile – accounts for maybe 50% of all systems
 - Soil and liquid sensing is harder
 - Acoustic sensing is specialized, but common – less sensitive than for liquids
- The principle of using multiple complementary physical principles still applies



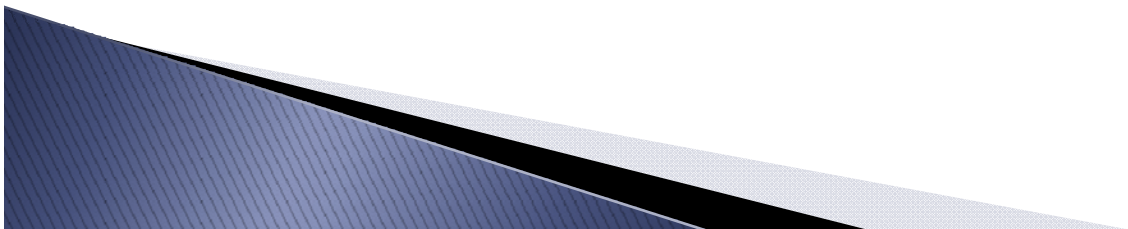
Redundancy and backup

- Gas pipelines are often engineered as critical systems
- Redundancy
 - Complimentary systems
 - Dual operational systems
- Backup
 - Failover systems
 - Visual / human inspections are sometimes too late...



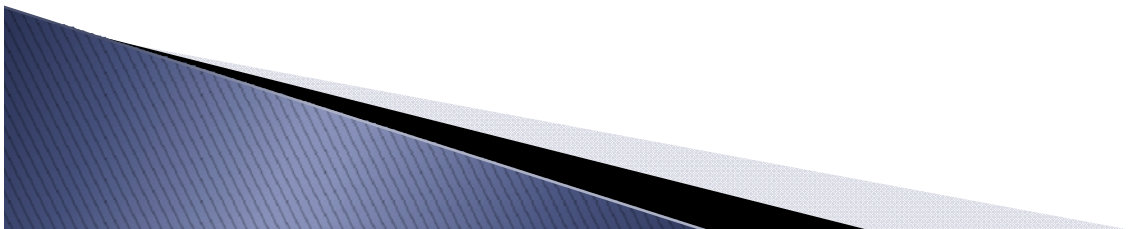
Installing/maintaining on new vs. retrofit

- Sensor-based technologies, especially remote surveillance, are easily retrofitted
- CAPEX vs. OPEX. No direct financial benefit. Tolerance for (small) leaks is high
- What is the lifecycle of an LDS?
 - What is “good enough” performance?
 - Technology now goes from R&D to field in a few years
 - Continual improvement



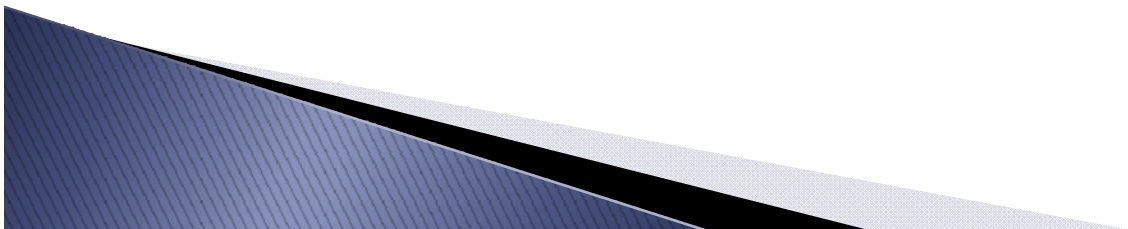
Handling false alarms / misses

- “Leak” alarms are actually *anomaly* alarms. On gas systems there can be many dozens of “anomalies” daily
- Gas LDS need careful alarm presentation in order to avoid being ignored.
- Green – yellow – red alarms:
 - Statistical likelihood rather than thresholds
 - Multiple sources of information
 - Very fast to yellow, very certain to red



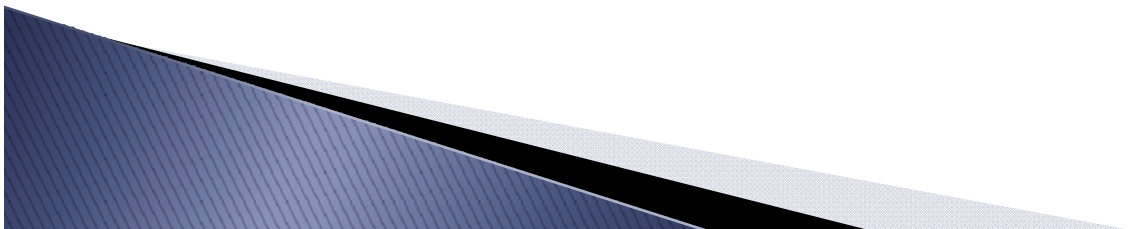
Human factors in LDS performance

- Confidence
 - Operators – false alarms, orientation and training
 - Owners – historical legacy
 - Public – pipeline disasters
- Who owns the LDS?
 - Part of the Safety System
 - Part of the IM “as-new – failure – remedy – as-new” cycle
 - Rarely considered as IM by an operator: sometimes engineering, sometimes instrumentation & control, sometimes IT / compliance



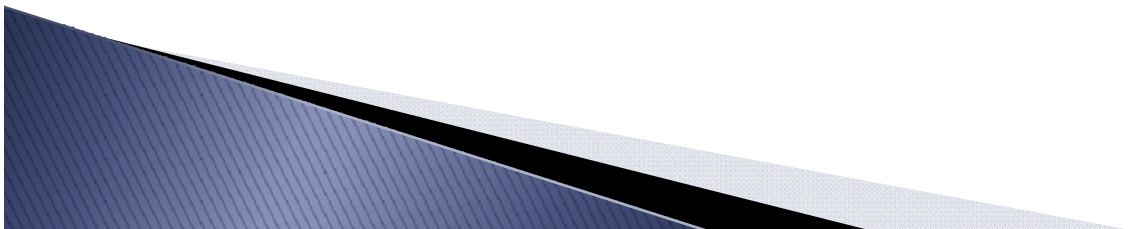
Environmental / operational impact

- Operational:
 - Compressible fluids make internal LDS much more difficult.
 - Transient operations (handling gas supply) are common.
 - Upstream operations
- Environmental
 - Sensor technologies are sensitive to atmospheric and weather conditions
 - Remote operations / poor communications
 - Very “crowded” environments (e.g. upstream operations)



Emerging technologies / current gaps

- Atmospheric, soil and liquid sensor technologies
- Sensor vehicles – drones, satellites
- Gaps:
 - Upstream
 - Transient operations
 - Very small persistent leaks, pre-existing leaks



Thank You

