Western Conference 2017

Gas Storage & Pipeline Safety
Distribution and Pipeline Safety
R&D Update

Western Conference of Public Service Commissioners
May, 2017

Ron Edelstein
GTI
GTI Energy Delivery R&D Programs

- Inspection and Verification
- Intelligent Utilities
- Risk and Decision Analysis
- Construction Techniques
- Methane Emissions and Detection
- Grid Resilience
> Natural gas utilities are part of the communities in which we operate and all live. Keeping their employees, customers, and the public - safe, secure, and informed is paramount.

> Operating and maintaining a natural gas system requires:

- Identifying and managing risks

- Following safe and best work practices

- Implementing cost-effective technologies and practices that maintain and/or improve operational continuity, efficiencies, safety, environmental stewardship, and system integrity.

> GTI’s Energy Delivery programs are focused in these areas.
EMAT Sensor for Small Diameter and Unpiggable Pipes; Prototype and Testing (U.S. DOT / OTD)

> Objective

- Starting with Phase 1 bench-scale unit, Phase 2 will build and test an Electro-Magnetic Acoustic Transducer (EMAT) sensor beta-prototype.
- Detect and quantify wall loss and longitudinal cracks in metallic small-diameter and unpiggable pipes containing fittings and other restricting features.
- The initial target pipe diameter is 8 inches, however the commercial goal is to build tools that can navigate in 6- to 12-inch pipes.

> Focus

- Establish a pipe defect/flaws test matrix and prepare pipe test samples with characterized cracks and flaws.
- Design and build the receiver and transmitter units and data management system.
- Integration and lab testing of the prototype.
- Field testing of the prototype.
Gas Situational Awareness System (U.S. DHS)

> **Objective** – Develop and deploy a data exchange methodology for critical infrastructure operators & government agencies to share information, provide situational awareness and assist with decision support during disasters.
  
  — Improves decision making related to threat identification, preparation, and restoration prioritization to prevent or reduce outages
  
  — Increases the quality and integrity of exchanged data
  
  — Reduces the amount of time required to exchange essential system status data

> **Focus** – A software system that provides the ability to assess threats and vulnerabilities, understand interdependencies and cascading effects, and hasten recovery
Remote Gas Sensing and Monitoring (OTD)

> Objective - to create a device to remotely monitor the level of gases during emergency gas leak situations.

> Focus

- First Responders need a tool that enables the monitoring of methane, CO, and other gases over a local area.
- Remote monitors can be placed in each home and confined space. The remote monitors would transmit data to the on-site providing data on gas and CO concentration in real time.
- This approach will enhance the safety of first responders and also the general public.
Breakaway Fittings for MSA’s (OTD)

Objective:
> To develop a working breakaway disconnect / shutoff fitting for meter set assemblies (MSA) and other aboveground gas systems.

Focus
> Reduce the risk from vehicle collision or ice/snow falling from a building roof.
Breakaway Fitting Installed at Utility Site

Meter set “as found”

Meter set after breakaway installed
Kleiss Flow Stopping System (OTD)

> Inflatable Stoppers: an alternative to currently employed stopping equipment for use on pipes up to 18” in diameter and pressures up to 60 psig for the following pipe types:
  > Cast iron
  > Steel
  > PE, and
  > PVC pipes
> No-blow operations
> Small fittings with taps up to 3”
> Lightweight equipment
> Alternative to squeezing PE pipe
  > Vintage PE susceptible to cracking
  > Large diameter thick-walled PE
Development of an Integrated Intelligent Safety System (IISS)

> Developing an Integrated Intelligent Safety System (IISS) (Lorax Valve) to mitigate the risk of gas leaks due to third party damage on commercial, multi-family, and small industrial service lines by shutting off the flow of gas.

> Intelligent safety shutoff device that will shut off the flow of gas in the event of line or meter set damage or failure.

> Will trip even with small pin-hole size leak

**Benefits**

> 100% Mechanical
> Detects very small to catastrophic leaks
> IoT capable
> Full control above ground
> Will halt the flow of ALL gas (no EFV bypass)
> Ported to: Regulators, Riser Valves, & Appliance Connectors
Line Guardian – Inside Piping

Service riser or “head of service”
Remote shut-off valve

Appliance / Gas grill connectors
UAV Applications for Pipeline Integrity Management

> Threat Detection
  - Machinery
  - Gas Leak (Methane)
  - Liquid Leak
  - Geotechnical Threats

> Emergency Response
  - Hurricanes, floods, ice storms
  - HazMat...

> Vegetation Management

> Encroachment Studies

> Population Studies

> Facilities Management
  - Inspections
  - Inventory
  - Construction Management
  - Security & Emergency Response
Long Endurance UAS Project Objectives

1) Demonstrate the operation of a long range, long endurance UAS carrying the RAM Technology Package (RTP) on a pipeline corridor in civilian airspace
   a) Safely, effectively and in full compliance with all federal and state laws and regulations (FAA, FCC…)

2) Evaluate the performance differences between manned & unmanned aircraft carrying the same payload

3) Establish a test range for continuing research
The Plan

First Flight on Corridor: March 17, 2016

UAV Project

Funding to date was for
- Add Flight Tests
- Add Applications
- Add Sensors
- Add Aircraft
- Develop communications backbone, data integration architecture and protocols
- Extend Test Range
- Add natural gas transmission lines

Safely, effectively and in full compliance with all laws & regulations

1) This is the most advanced UAS Test Range in the U.S. for Pipeline Integrity Management
2) The flight in March was the 1st beyond line of sight “pipeline patrol drone test” in the U.S.
Identify risk of excavation damage to buried gas facilities by:

- Characterizing excavators’ behavior by analyzing and transferring data from excavators to cloud-based GIS,
- Increasing awareness of construction equipment activity

Deliverables

- Black Box device installed in excavators
  > Cellular, GPS and 9DoF (motion sensors)
- Algorithmic/Machine Learning Process to characterize activity

* Excavation Encroachment Notification
Excavation Damage Prevention Using Real-Time GIS (GPS EEN)

- Black Box streams data for processing in real-time
- Utilizes utility GIS data to alert operator based on proximity of gas pipe
- Operations Dashboard provides real-time monitoring
- Recent field demonstrations at PG&E
  Deployment of 150 devices as a springboard to commercialization
Enterprise Decision Support System (EDSS)
Policy Optimization for Balanced Lifecycle Management (OTD)

Subject Matter Expertise
- Causal Modeling
- Data Analysis
- Constraints – Capital / Mission
- Regulations
- Data / Field Surveys
- Institutional Knowledge
- Historical Information

Operations Management and Processes

Decision and Policy Optimization Engine

Balanced Lifecycle Management
- Risk/Cost Optimization
- Mission success

Managed Risk vs. Catastrophic Losses

Optimized Organization

Vulnerable Organization
Research Needs Related to Natural Gas Storage

Operators need to understand the interaction of multiple threats that can cause storage leaks, the likelihood of failures, and their consequence in order to calculate risk and prioritize proactive actions.

Required, storage-related research to close these gaps includes:

**Interactive Threats.** Develop a compilation of storage field threats and how these could interact; provide a set of baseline fault trees and event trees that map out the failure pathways and potential incident consequences in storage fields.

**Component Failure Rates.** Develop a set of quantitative probabilities/likelihoods of failure of storage field components with associated uncertainties.

**Map out Storage Process/Practices.** Identify current state of enterprise practices related to storage assets - controls, measures, plans, procedures, and working practices; relate to and/or roll-up industry best practices of the same.

**Preventative and Mitigation Strategies.** Develop an enterprise decision program that guides operators to putting in place preventative and mitigation plans and technology to close the identified, high risk gaps.
How is this R&D paid for?
OTD Membership – 24 Members

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<th>Year</th>
<th>Members</th>
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<tr>
<td>2003</td>
<td>Alagasco, APGA RF, ConEd, CSU (03-05 only), National Fuel, National Grid, NiSource, NYSEG/RGE, PSE&amp;G (03-09 only), Questar, SoCal, TECO</td>
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<td>2004</td>
<td>Atmos, NW Natural, MLGW (05-07 only), Nicor Gas (06-11 only), Oklahoma Natural Gas, SW Gas</td>
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<td>2005</td>
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<td>2006</td>
<td>Peoples Gas, PECO (2011 Only)</td>
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OTD Members serve over 45M gas customers through the U.S. and Canada!
GTI is a company that solves important energy challenges, a company that truly has…

Contact information

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…“the Energy to Lead”
Gas Storage & Pipeline Safety
May 2017

Underground Storage
Natural Gas
Discussion Overview:

- What is Underground Storage
- Industry standards
- Current Regulatory Authority
- Legislative Action
- Industry Efforts
- Concluding Remarks
What is Underground Storage?
US Underground Storage Facilities By Type

U.S. underground natural gas storage facilities by type (July 2015)

working gas capacity
billon cubic feet

- 100 and above
- 75 to 100
- 50 to 75
- less than 50

reservoir type
- aquifer
- depleted field
- salt dome

Source: CIA
Why Underground Storage?

- Gas Production isn’t Cyclic
- Offsetting Demand
- Balancing Pipeline Flow
- Market Speculation
- Insuring Supply Against the Unforeseen
- Reducing Price Volatility and Uncertainty
Underground Storage Statistics

- Approximately 400 active storage facilities in 30 states, made up of depleted natural gas or oil fields (80%), depleted aquifers (10%) and salt caverns (10%)
- Approximately 20% of all natural gas consumed during the winter is supplied by underground storage
- Underground storage capacity increased 18.2% between 2002 and 2014
- Approximately 4 trillion cubic feet of natural gas can be stored underground, or enough to meet an average state’s residential natural gas consumption for more than 20 years
Overview of API RP 1170/1171

- Consensus standards, developed by industry and government entities
- Provide functional recommendations for facility assessments, design, operation, monitoring, and maintenance, and documentation practices
- Risk based approach emphasizes need to case-by-case and site-specific conditional assessments
Current Regulatory Authority

- Federal Energy Regulatory Commission (FERC): Authority over interstate storage operations
  - Construction/expansion
  - Terms and conditions
  - Regulate rates

- Pipeline and Hazardous Materials Safety Administration (PHMSA): Authority granted by SAFE PIPES Act granted authority to regulate transportation of natural gas

- Environmental Protection Agency (EPA): Authority to regulate methane emissions

- State-level Regulations: Vary by state
PHMSA Interim Final Rule (IFR)

• Incorporates API 1170/1171 by reference, with modification
• Requires operators to meet verification, monitoring, threat and hazard identification, assessment, remediation, site security, emergency response and preparedness, and recordkeeping requirements of standards
• Deadline January 18, 2018
• Industry noted a number of concerns with timeline and modification of non-mandatory requirements
PHMSA Next Steps

• Final Rule (TBD)
• Conducting soft audits to inform audit protocols
• PHMSA hiring team for auditing
• Individual agreements with states that wish to inspect facilities on PHMSA’s behalf
• Workshops to inform industry
StatesFirst: Underground Gas Storage Regulatory Considerations

- Organized by Interstate Oil and Gas Compact Commission (IOGCC) and Ground Water Protection Council (GWPC)
- Evaluates potential vulnerabilities at gas storage operations and identifies prospective regulatory responses for consideration by state and federal agencies.
AGA Underground Storage Committee

- One of our longest standing technical committees
- Represents 80-90 percent of underground storage operations
- Work Products:
  - Triennial Survey of Underground Gas Storage Facilities
  - Biennial Underground Storage Operators Workshop
  - Technical reports and white papers
Joint Industry Task Force (JITF)

- AGA, INGAA, API
- 15 operators
- Developed 3 communication pieces providing general background information on underground storage of natural gas: https://www.aga.org/fact-sheets/natural-gas-storage
API RP 1170/1171 – More Info

• Both are available for download on the API website
• Overview available here:
  https://www.aga.org/sites/default/files/oiln_g_storage_standards_talking_points_final.pdf
Questions?
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