Western Conference 2017

Gas Storage & Pipeline Safety

Distribution and Pipeline Safety R&D Update

Western Conference of Public Service Commissioners

May, 2017

Ron Edelstein

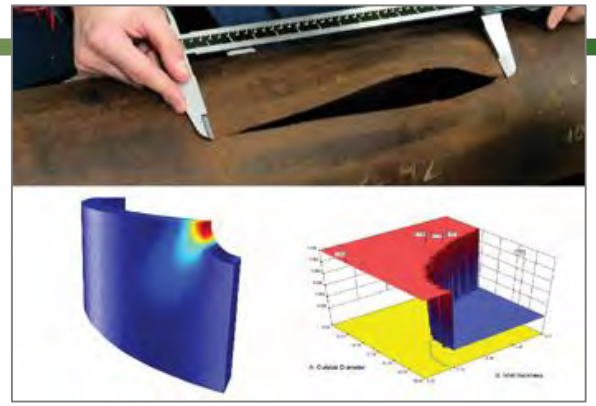
GTI

gti

GTI Energy Delivery R&D Programs

Inspection and Verification

Intelligent Utilities



Risk and Decision Analysis

Construction Techniques

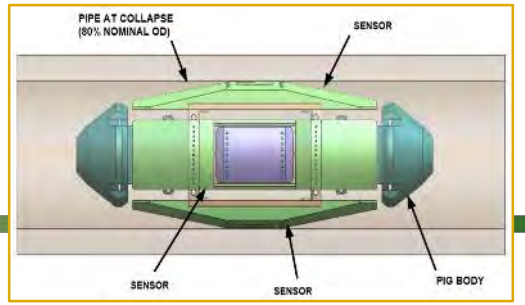
Methane Emissions and Detection

Grid Resilience

Safety, Integrity & Operational Efficiencies

- 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.

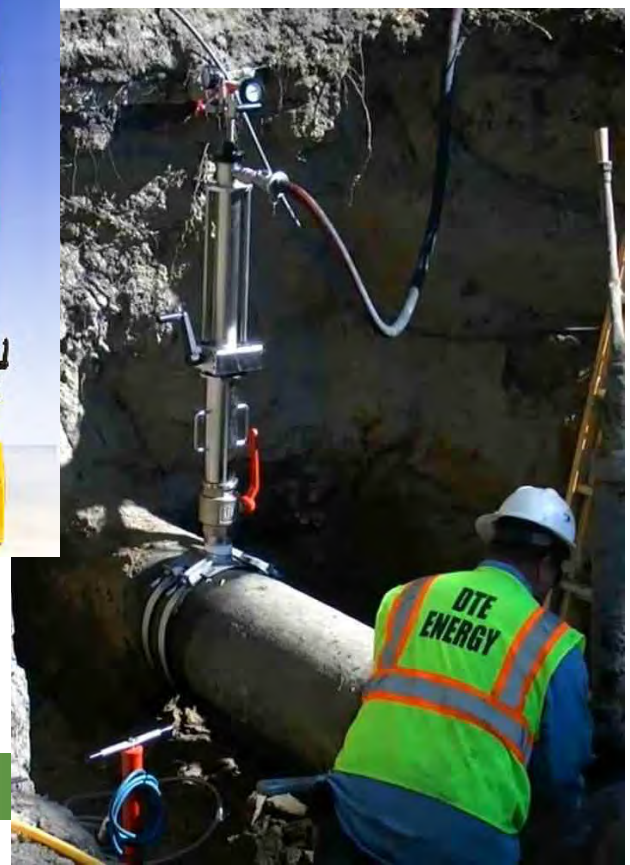
Breakaway Fitting Installed at Utility Site

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)

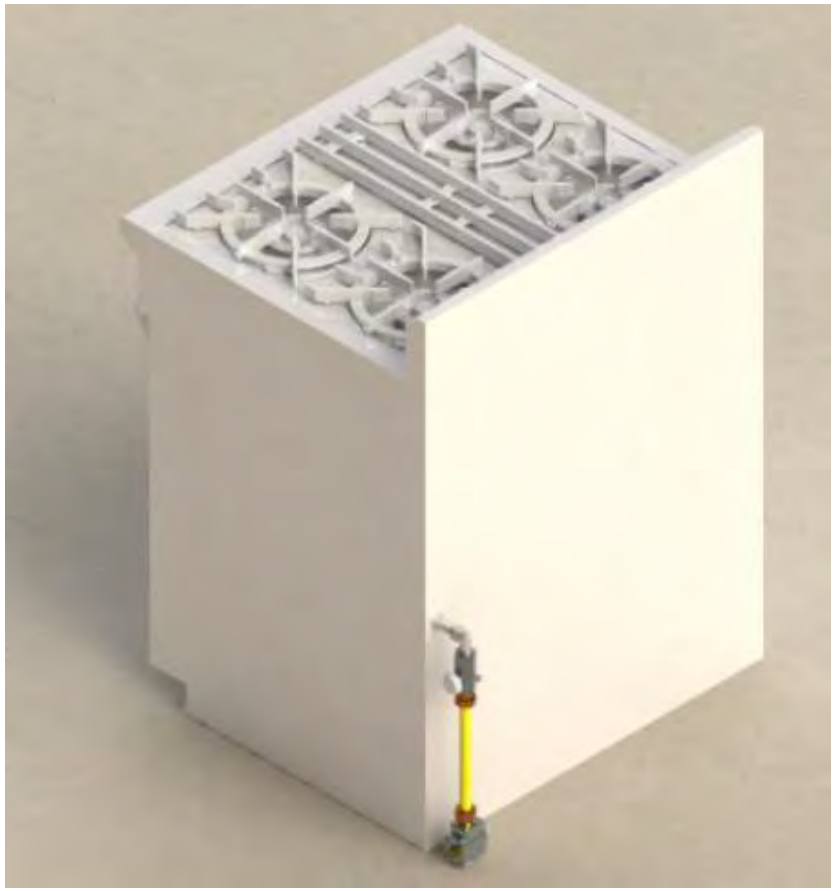
- Developing an Integrated Intelligent Safety System (IISS) (Lorax Valve) to mitigate the risk of gas leaks due to third party damage on commercial, multi-family, and small industrial service lines by shutting off the flow of gas.
- Intelligent safety shutoff device that will shut off the flow of gas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

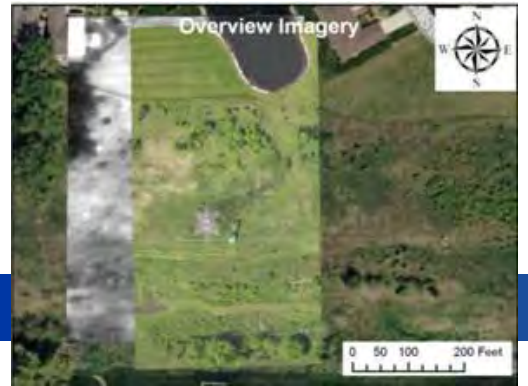
Line Guardian – Inside Piping

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



Appliance / Gas grill connectors

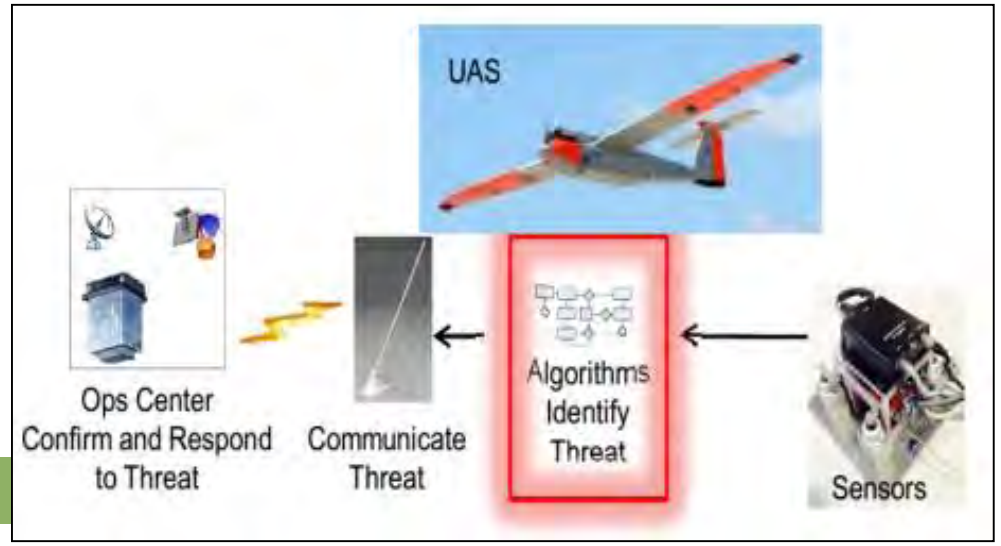
UAV Applications for Pipeline Integrity Management



- 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



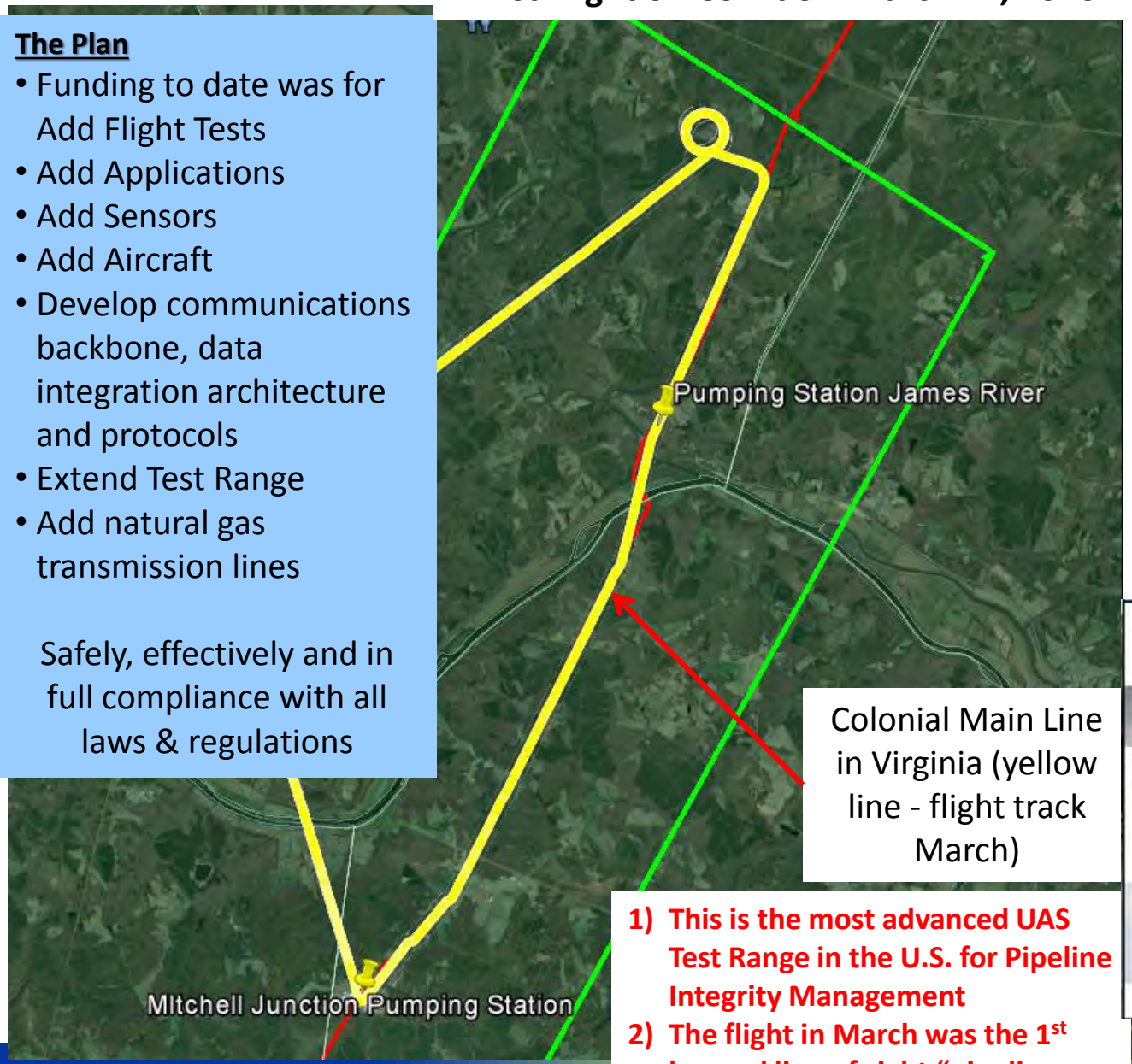
The Plan

UAV Project
First Flight on Corridor: March 17, 2016

The Plan

- 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



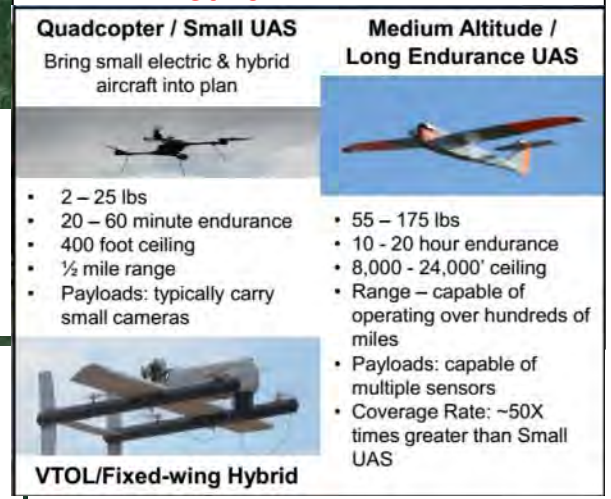
Colonial Main Line in Virginia (yellow line - flight track March)

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.**

Buckingham COA

> **2014-ESA-133**
  - Test Site COA
  - RS-16 UAS™
  - 185 Square Miles
  - 3,000 ft ceiling
  - **Expires Oct. 26, 2016**

> **Pipeline: 27+ mi**
  - 1M Barrels/Day
  - Part of 5,500 mile network



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

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

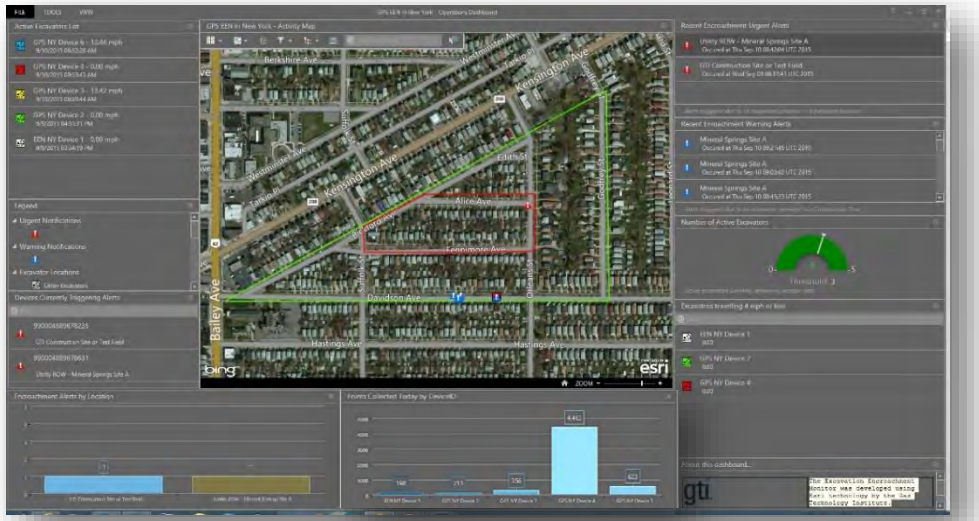
- Black Box device installed in excavators
  - > Cellular, GPS and 9DoF (motion sensors)
- Algorithmic/Machine Learning Process to characterize activity

* 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

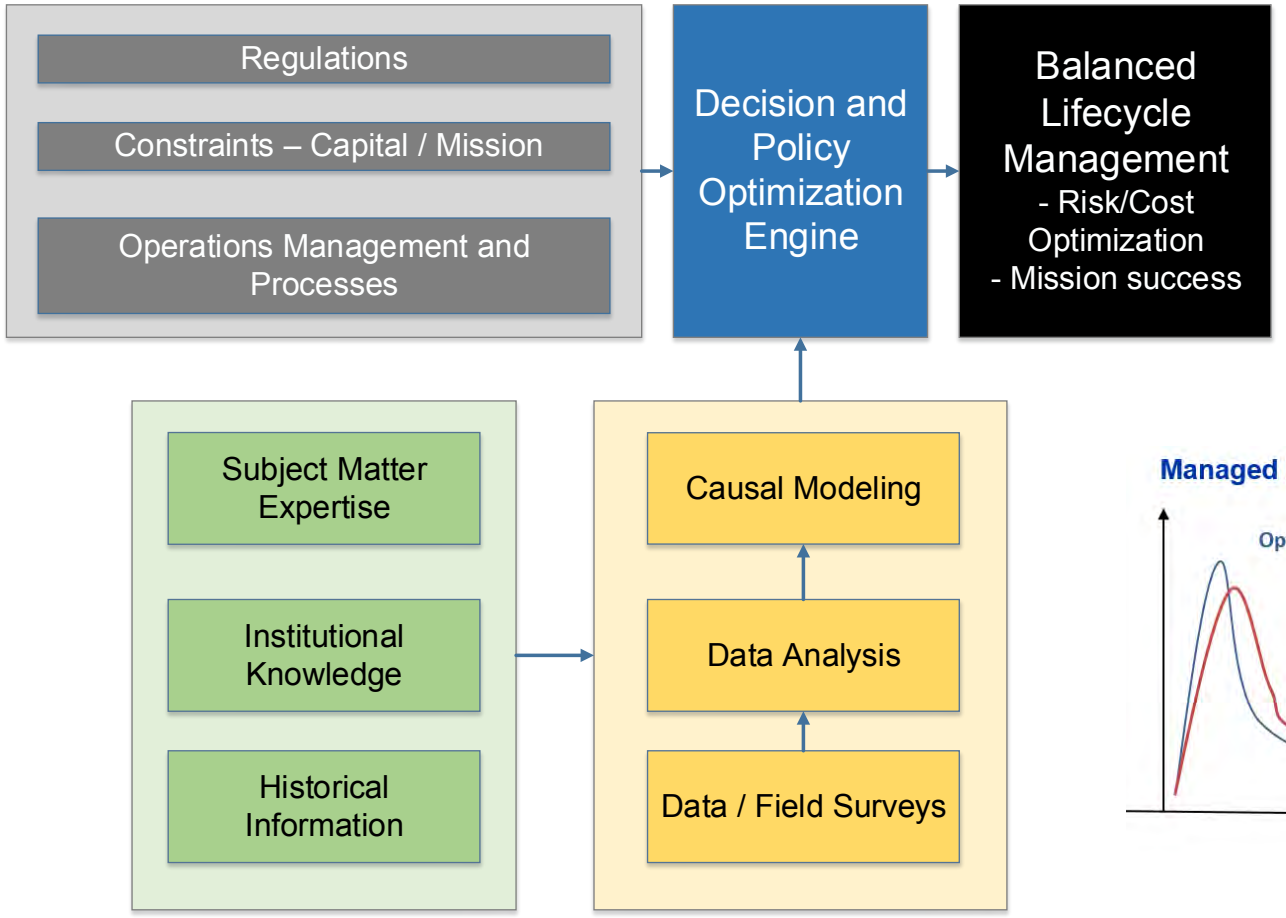
Sensor data collected from Excavator activity

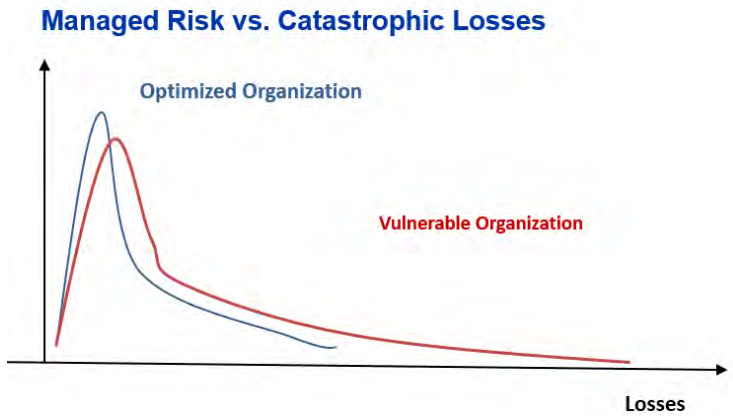


Deployment of 150 devices as a springboard to commercialization

Enterprise Decision Support System (EDSS)

Policy Optimization for Balanced Lifecycle Management (OTD)





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.

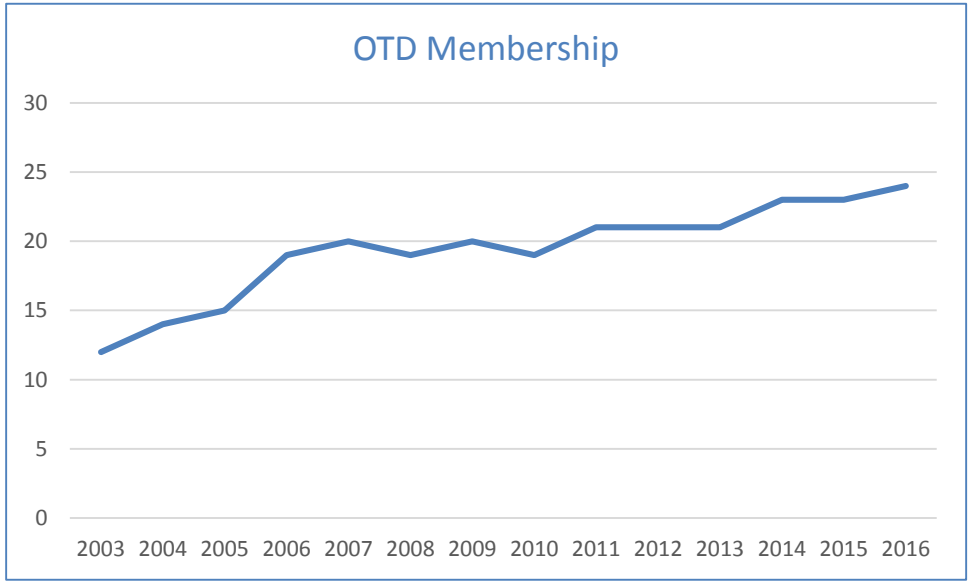
Component Failure Rates. Develop a set of quantitative probabilities/likelihoods of failure of storage field *components* with associated uncertainties.

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.

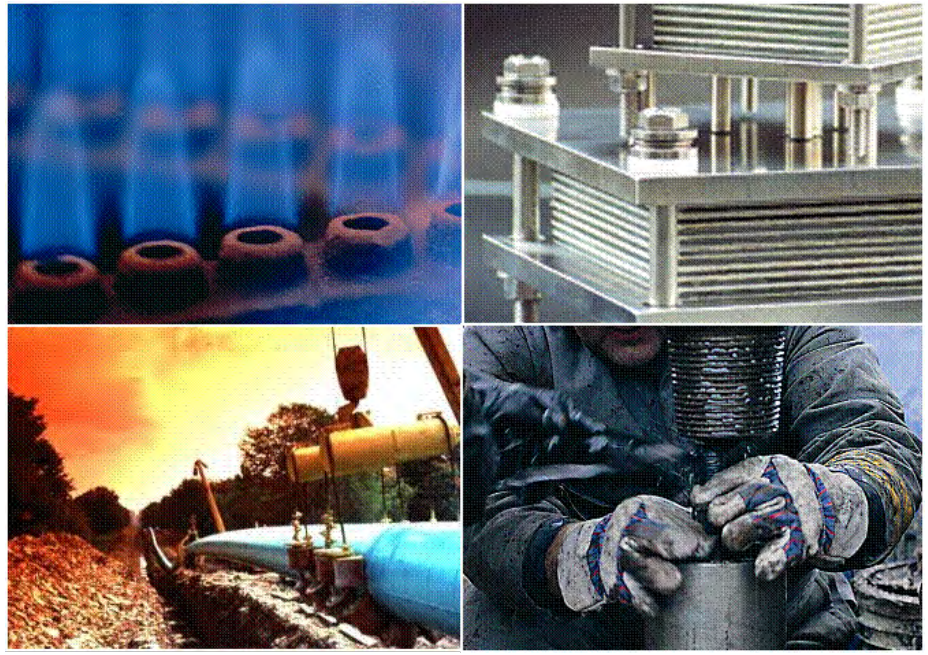
How is this R&D paid for?
OTD Membership – 24 Members

2003	2004	2005	2006	2007	2009	2011	2012	2014	2016	2017
Alagasco	Atmos	MLGW (05-07 only)	Avista	Enbridge	LA RDC (Atmos, Entergy, Center-Point)	Peoples Gas	Piedmont	PG&E	Ameren	PSNC
APGA RF	NW Natural		Intermountain			PECO (2011 Only)	WGL	Duke		Columbia VA
ConEd			Nicor Gas (06-11 only)							
CSU (03-05 only)			Oklahoma Natural Gas							
National Fuel			SW Gas							
National Grid										
NiSource										
NYSEG/RGE										
PSE&G (03-09 only)										
Questar										
SoCal										
TECO										



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…



…"the Energy to Lead"

Contact information

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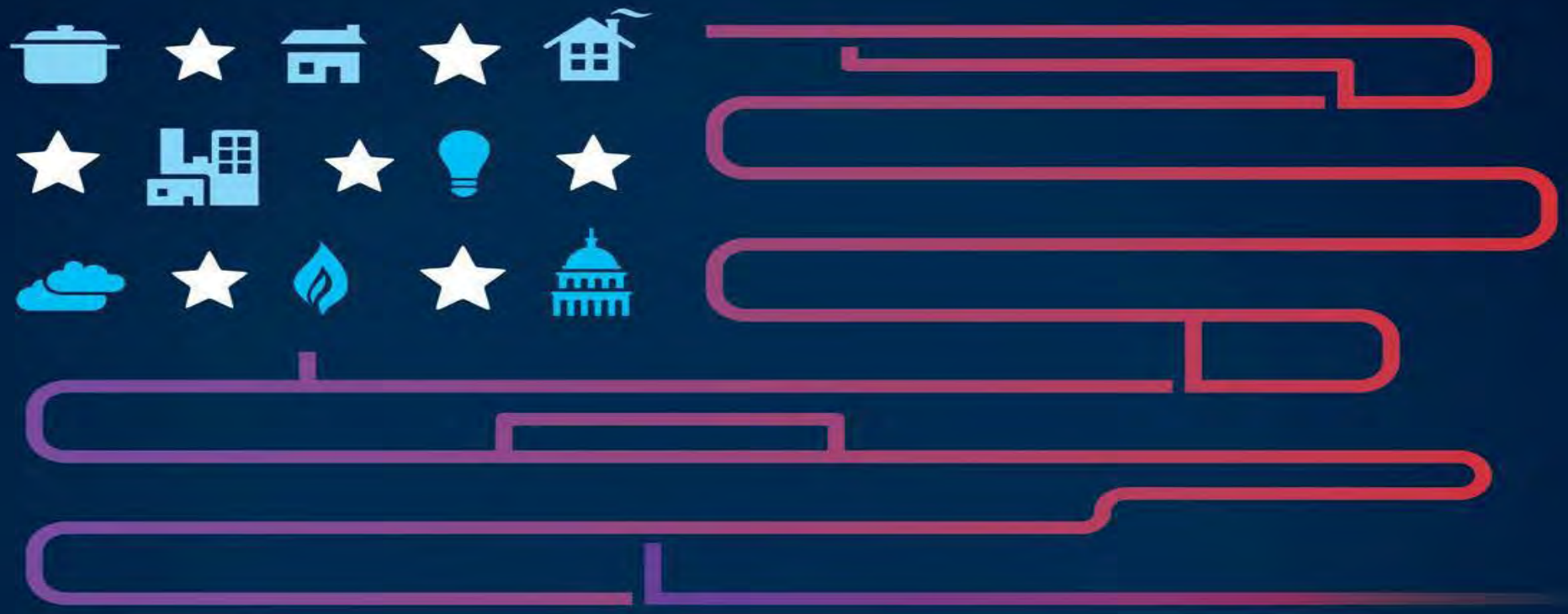


May 2017

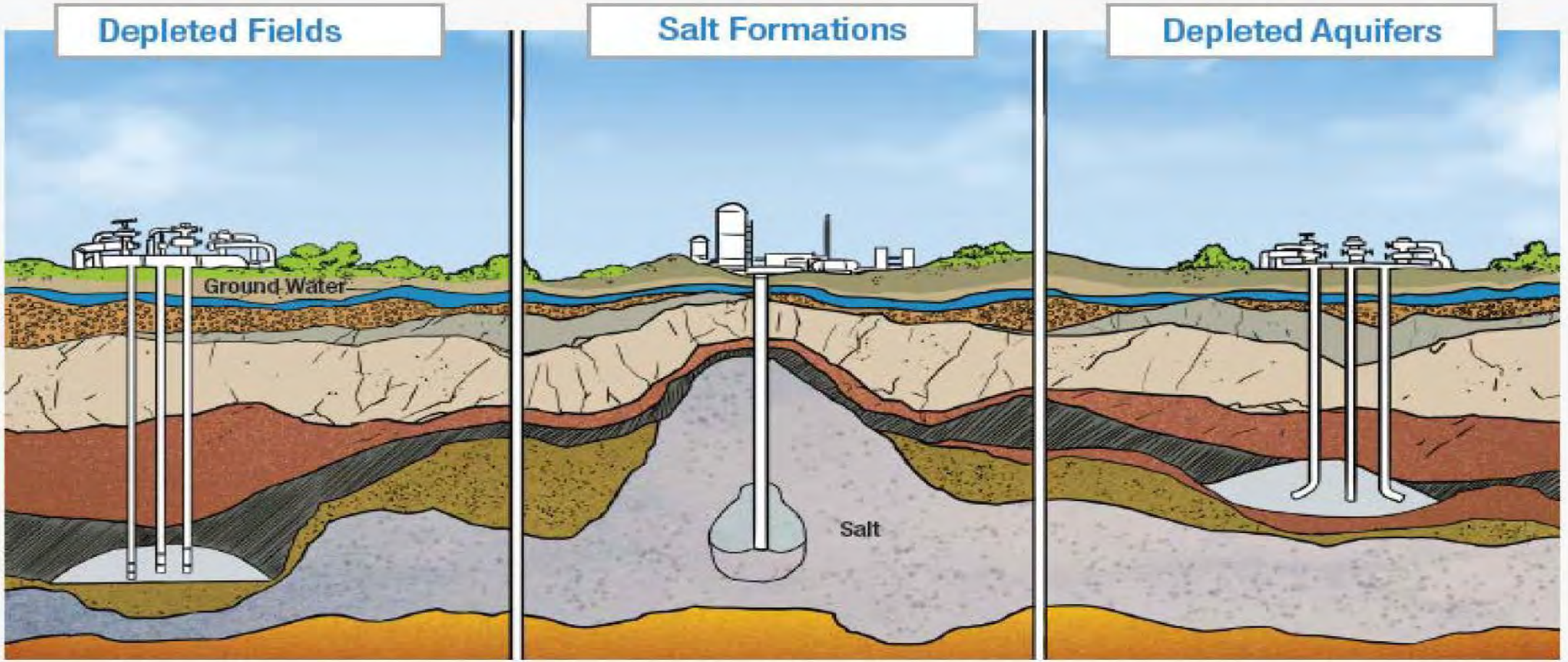
Underground Storage Natural Gas

AGA
American Gas Association

Discussion Overview:

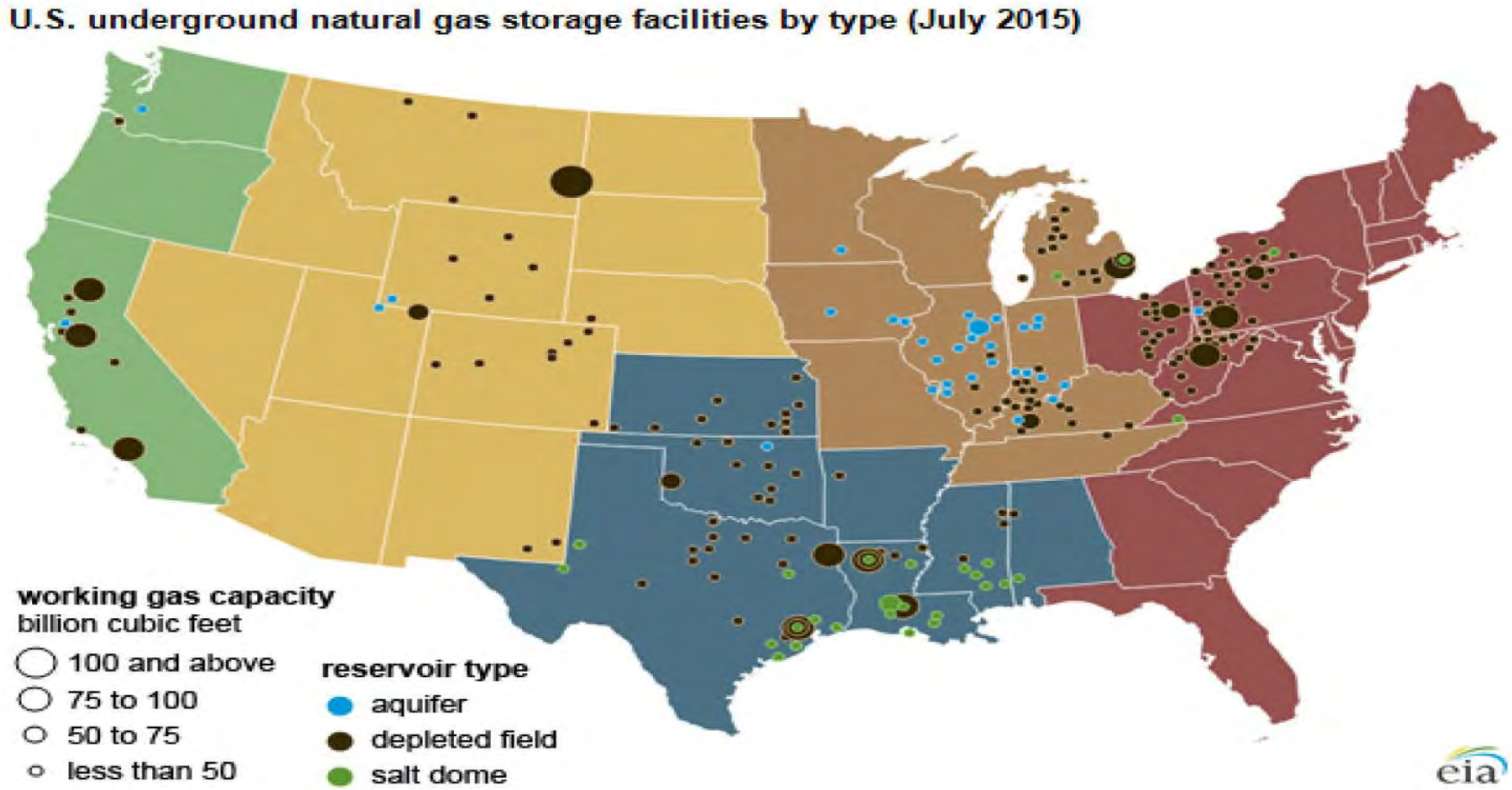
- What is Underground Storage
- Industry standards
- Current Regulatory Authority
- Legislative Action
- Industry Efforts
- Concluding Remarks

What is Underground Storage?



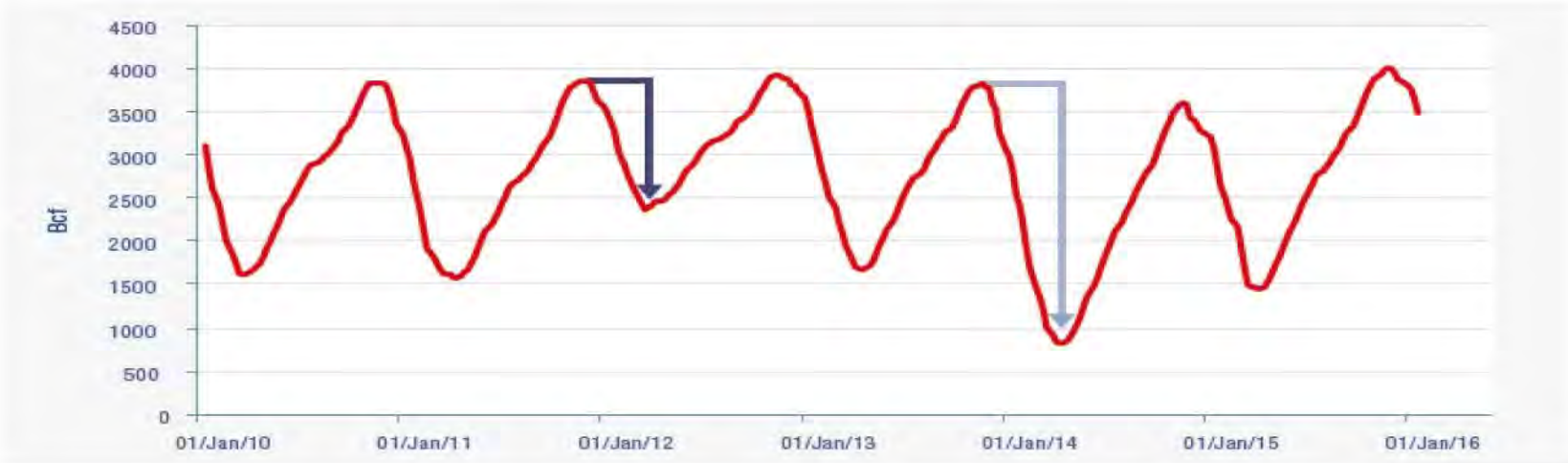
Source: Modified from AGA

US Underground Storage Facilities By Type



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 states 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)

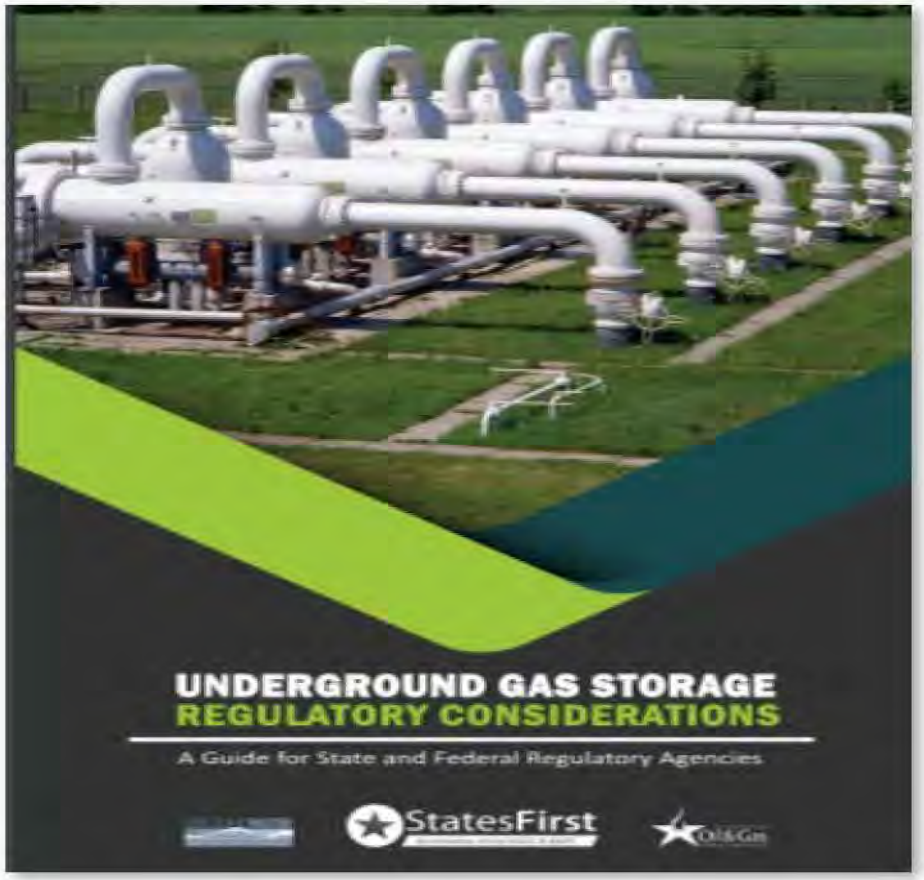
- Incorporates API 1170/1171 by reference, with modification
- Requires operators to meet verification, monitoring, threat and hazard identification, assessment, remediation, site security, emergency response and preparedness, and recordkeeping requirements of standards
- Deadline January 18, 2018
- 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

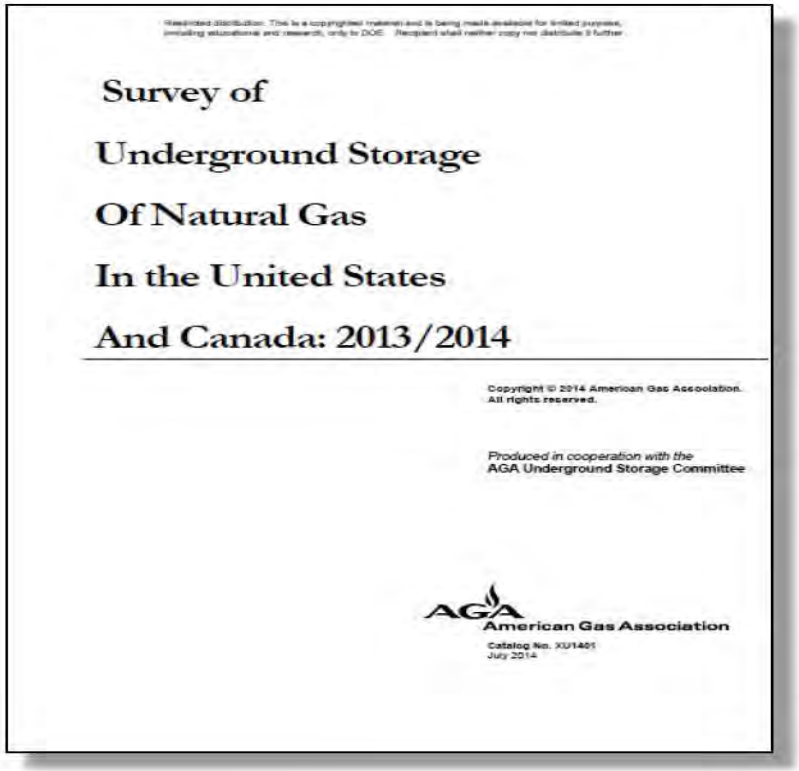
StatesFirst: Underground Gas Storage Regulatory Considerations

- 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.



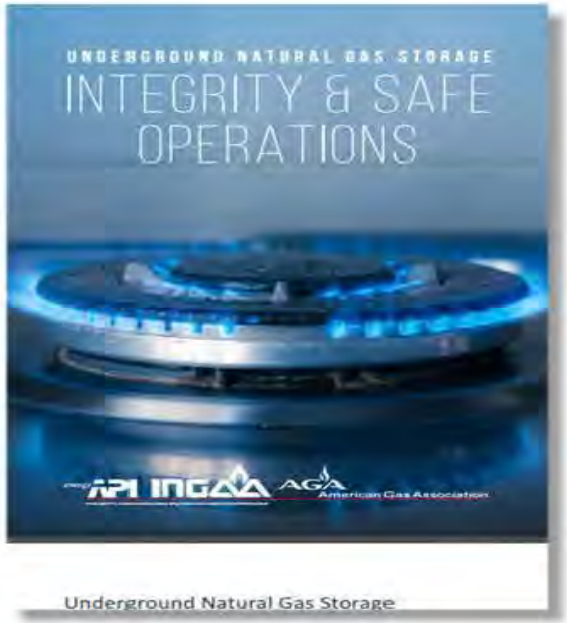
AGA Underground Storage Committee

- 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
- *Underground Natural Gas Storage: Integrity & Safe Operations*: http://www.energyinfrastructure.org/energy-101/natural-gas-storage



AGA American Gas Association

energy API AMERICAN PETROLEUM INSTITUTE

INGAA

API RP 1170/1171 – More Info

- Both are available for download on the API website
- http://www.techstreet.com/products/1902237 (RP 1171)
- http://www.techstreet.com/products/1897754 (RP 1170)
- Overview available here: https://www.aga.org/sites/default/files/oiln_g_storage_standards_talking_points_final.pdf

Questions?

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