

the Energy to Lead

What's New in R&D

2015 Pipeline Safety Conference

Virginia Beach, VA

October 21, 2015

Paul Armstrong

Gas Technology Institute

Company Overview

ESTABLISHED 1941

- > Independent, not-for-profit established by the natural gas industry
- > Providing natural gas research, development and technology deployment services to industry and government clients
- > Performing contract research, program management, consulting, and training
- > Wellhead to the burner tip including energy conversion technologies



OUR STAFF

272
employees



60%
scientists/
engineers

44%
advanced
degrees

Addressing Key Issues Across the Energy Value Chain

REDUCING CARBON EMISSIONS TO THE ENVIRONMENT

SUPPORTING SUSTAINABLE ECONOMIC GROWTH



Expanding the supply of clean, abundant, and affordable natural gas

Transforming natural resources into clean fuels, power, and chemicals

Ensuring a safe and reliable energy delivery infrastructure

Promoting the clean and efficient use of energy resources

Working with Customers

- > Partnering at every phase of the technology development cycle, from concept to commercialization

ENERGY
SOLUTIONS...
DELIVERED



Our Sponsors



U.S. Department of Transportation
Pipeline and Hazardous Materials
Safety Administration



National Fuel



nationalgrid



NW Natural



Oklahoma Natural Gas
A Division of ONE Gas



Pacific Gas and Electric Company



Washington Gas



Southern California Gas Company



SOUTHWEST GAS



Asset Lifecycle Tracking & Traceability

- > Provides **component level traceability** with high accuracy GPS to locate specific fittings (manufacturer, lot #, etc.)
- > Captures **critical fusion parameters**
- > Captures **pictures, sketches** and other relevant installation data for complex configurations
- > Streamlines operations
 - Improves the **quality and efficiency** of data collection
 - **Eliminates GPS post-processing**
- > **Enables regulatory compliance**
 - DIMP “Know Your System”
 - Plastic Pipe Rule NPRM



Asset Lifecycle Tracking & Traceability

Information	Mfg. Values
Lot Number	1234567
Production Date	1/4/2010
Material Type	PE2708
Component Type	Electrofusion tapping tee with a stab outlet
Component Size	2" IPS SDR 11 x 1" IPS SDR11



Create GIS Features in the Field

Post to Enterprise GIS

Integrate Data into GIS System of Record

Natural Gas Distribution Standard

> Algorithm and ASTM Standard

- Unique identifier for distribution asset tracking and traceability
- ASTM F2897-11a
- Manufacturer implementation through barcoding
- ~50% vendor compliance

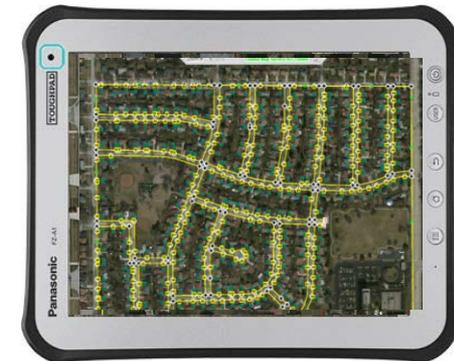
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Character Number	Source	Description of Information	Character	Information
1	www.componentid.org	Name of component manufacturer	A	Corresponds to list on www.componentid.org
2			C	
3	Component Manufacturer's lot code	Information which can help ascertain relevant traceability information upon request	5	Corresponds to the mfg lot number input of 1234567
4			b	
5			a	
6			n	
7	Component production date code per 5.3	Date of manufacture of given component	0	Corresponds to production date of 1/4/2010
8			6	
9			C	
10	Component material type per Table 3	Material used for component	B	PE 2708
11	Component Type per Table 4	Component type	8	Electrofusion tapping tee with a stab outlet
12			F	
13	Component size per 5.6	Component size	2	Corresponds to size code of 2" IPS SDR11 x 1" IPS SDR11
14			m	
15			X	
16	www.componentid.org	Reserved for future use	0	Default value

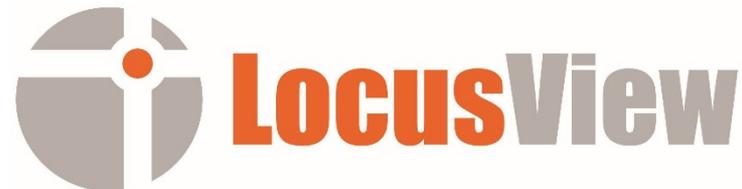
GTI's Asset Traceability Technology

- > GIS-based solutions for mapping new construction with traceability for pipes, fittings, and fusions
- > Technology
 - Mobile GIS software
 - Tablets and smartphones
 - Barcode scanning
 - High accuracy GPS
 - Real time spatial data correction
 - Disconnected editing capability
 - Cloud hosting
- > Fusion
 - Captures critical fusion parameters, seamlessly archives data in GIS, creates bar code label with 50 year life



Supporting Implementation

- > GTI spinout, LocusView Solutions, created to provide implementation services for advanced geospatial technologies
- > Provides field tested, customer validated, commercial products
- > Turn-key implementation services including hardware, software, hosting, training, and IT support



RFID Marker Ball Program



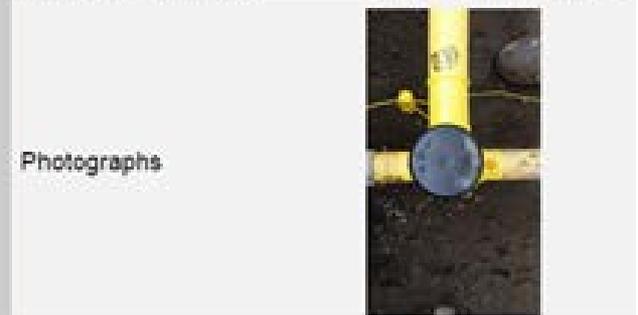
- > Reduce excavation damage by enhancing the ability of locators to properly identify the location of underground facilities
 - Overcomes many of the issues of tracer wire including broken connections and limited access
 - No signal, interference from nearby structures, poor GPS signal
 - Provides a mechanism to locate facilities where traditional locating tools don't work
- > Decrease the cost of collecting and managing marker ball data through advanced mapping technologies

LocusForm

- > Mobile applications with customized regulatory inspection forms
- > GPS, sketches, pictures, and audio records
- > Codes, standards, and procedures stored on the tab
- > Inspection results compiled into a database for reporting and export



ID	95
Name of Inspector	C. Gumble
Employee or Contractor #	435030
Date	2015-06-25
Depth of Cover	40 inches
Map Grid	24573.28
Type of Joint	Electrofuse
Material	MDPE
Type	Main
Size	2 inch
Status	Accepted
Town or Borough	Union
On Street	E. Main Street
Nearest House Number	3009 e. Main Street
Cross Street	Burt ave.
GPS Location	Latitude:42.10650573, Longitude:78.87102108 10:29:08 EDT
Additional Comments	2 Inch x 2 Inch h.v. tee a



Sketch



GPS Enabled Leak Surveying

> Objective

- Develop a system that uses GPS to track the route of leak surveys to verify compliance and reduce paper work associated with leak survey documentation

> Status

- Integrated with multiple leak detection devices
- Full implementations on-going
- Commercially available



ROW Monitoring with GPS

> Value

- Provides situational awareness of potential excavation damage, allowing time for pre-emptive actions

> Objective

- Develop technology that uses GPS to track excavation activity and provide warnings of encroachment



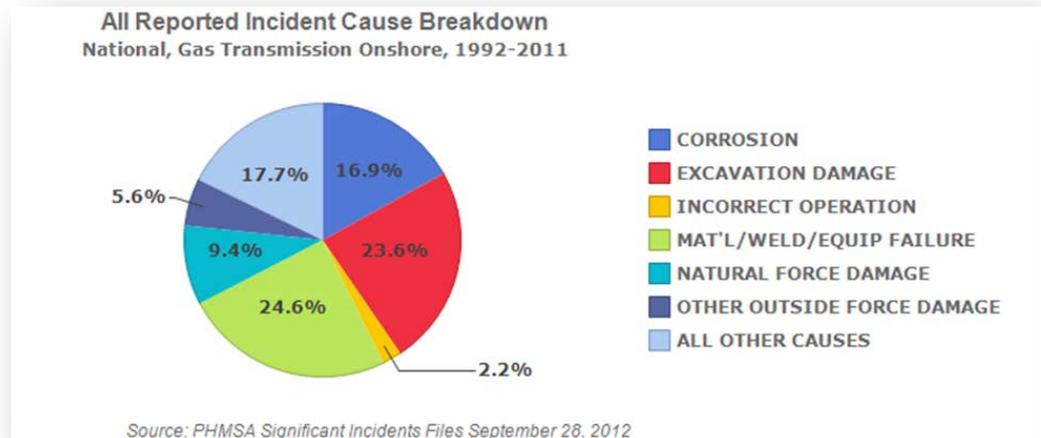
> Deliverable

- Commercially available smartphone tracking software and GIS-based monitoring software
- Pilot projects in California, New York, and Texas

ROW Monitoring with GPS

Project Background

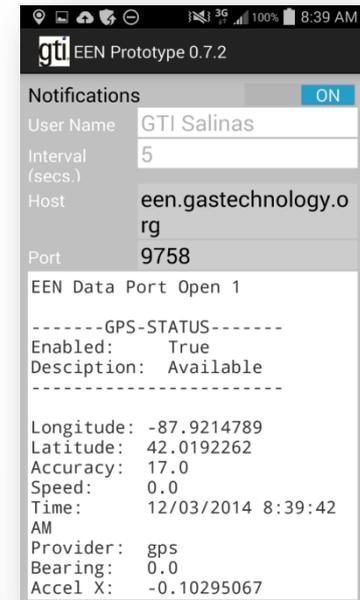
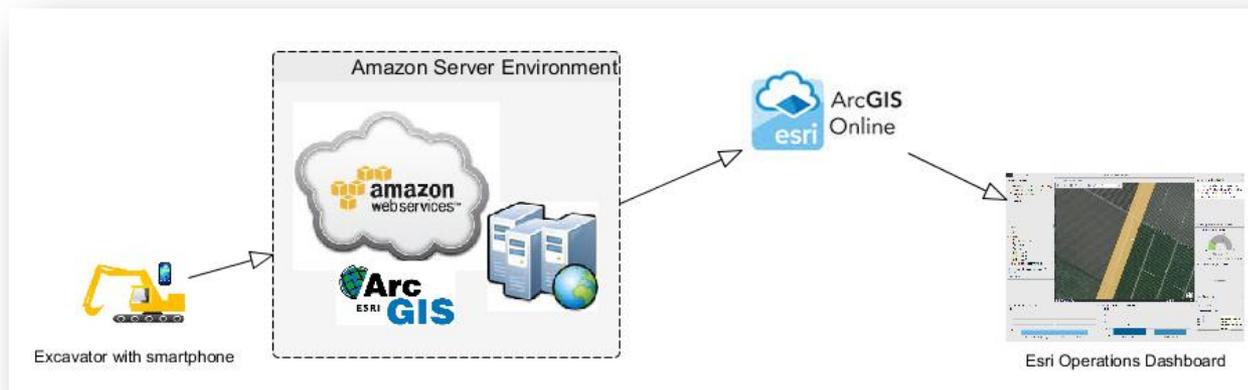
- > Goal was to detect risk of excavation damage to buried gas facilities
 - Attempted to characterize excavator behaviors by analyzing data from a low cost smartphone
 - Increase awareness of construction equipment activity
- > GTI completed a three month pilot project with PG&E



ROW Monitoring with GPS

System Architecture

- > Amazon Web Services
 - ArcGIS Server
 - GeoEvent Processor
- > Samsung Galaxy S4
 - Android 4.4.2
 - Custom app to stream sensor data



Data Collection and Processing

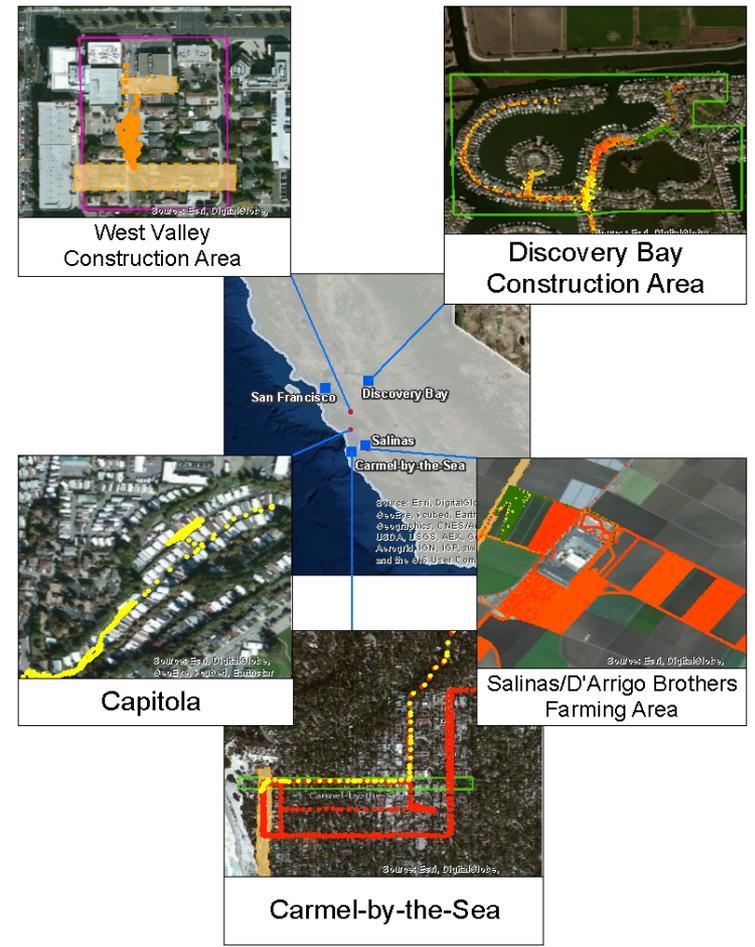
> GeoEvent Processing Model

- Monitors TCP port on server
- Collects and processes incoming data according to model
- Stores historical data
- Uses map services to make the data available to viewers
 - > Operations Dashboard
 - > Mobile clients
- Sends alerts and provides awareness
- Monitors locations of excavators in relation to One-Call/ROW boundaries

ROW Monitoring with GPS

Data Collection and Processing

- > Mounted smartphones on excavators/other construction equipment
- > Collected data at multiple locations during the pilot



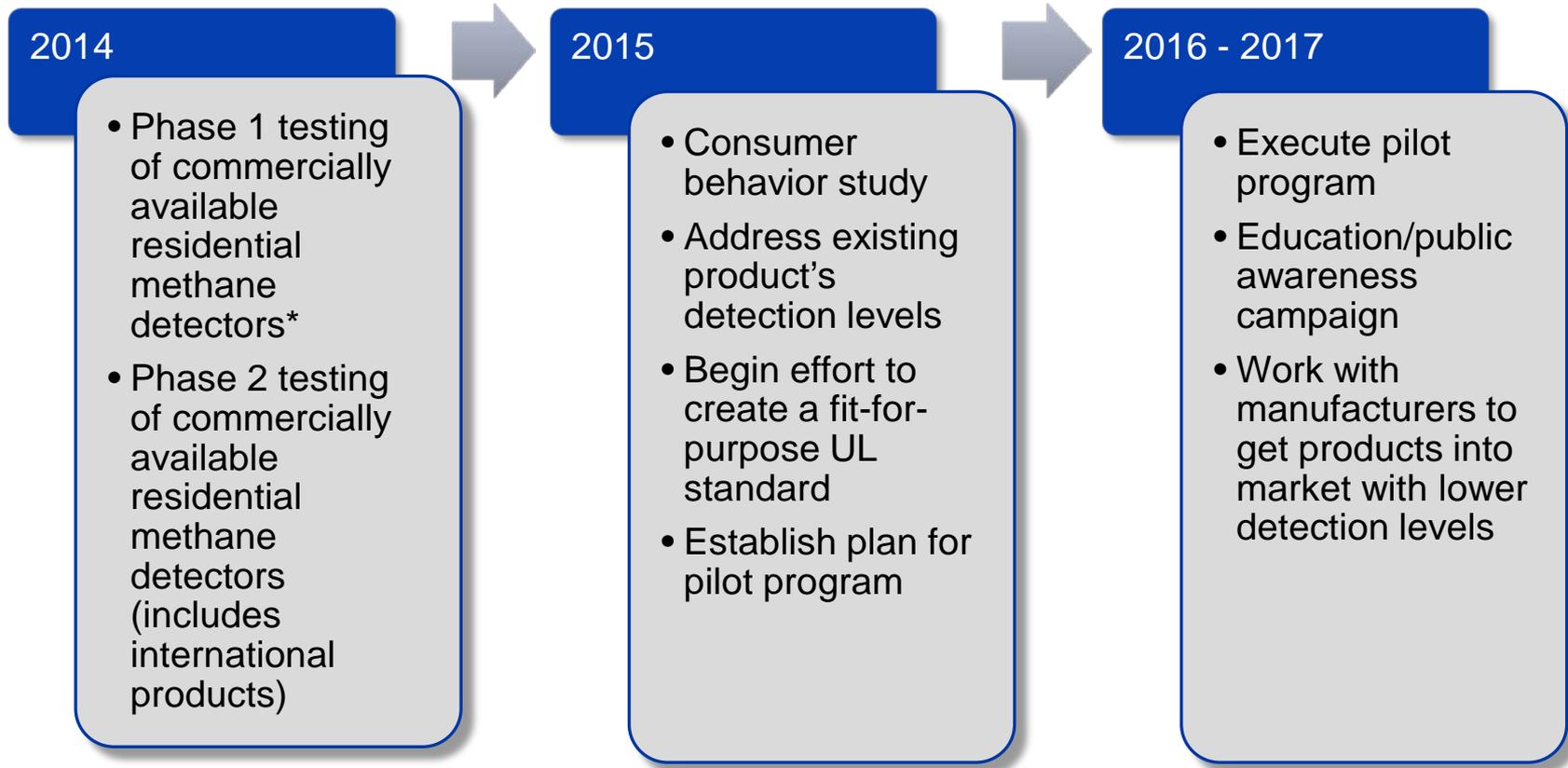
Conclusion

- > Technology and infrastructure exists to monitor and alert based on activity
- > Low cost smartphones paired with backend processing is a feasible approach
 - Smartphone app could potentially be enhanced to have more intelligence
- > Additional research is required including:
 - Dedicated devices
 - Higher accuracy GPS
 - Enhanced tracking algorithm to determine when the excavator is digging

Residential Methane Detectors - Overview



Residential Methane Detectors – Program and Timeline



*testing was done in 2010

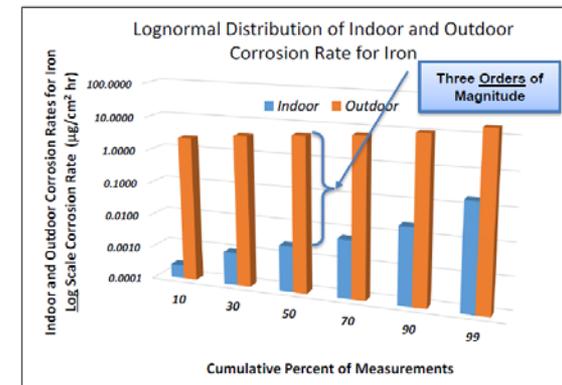
Remote Gas Sensing and Monitoring

- > Objective: To create a device to **remotely monitor the level of gases during emergency gas leak situations**
- > Need: 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 on-site personnel, providing concentration levels in real time**
- > This approach will enhance the safety of first responders and also the general public



Atmospheric Corrosion & Leak Survey Considerations for Indoor Pipe

- > Independent technical review of risk considerations related to atmospheric corrosion and leaks on indoor piping.
- > Explores a practical risk-based approach to inspections, especially in challenging urban environments, including the **opportunity for extended inspection intervals as part of a Distribution Integrity Management Program.**
- > **GTI White Paper** topics and findings:
 - Atmospheric Corrosion Theory; Outdoor vs. Indoor Piping; Peer-Reviewed Studies
 - Statistical Data – Atmospheric Corrosion & Leak Surveys
 - Risk-based Considerations
 - Indoor atmospheric corrosion rates are up to three orders of magnitude lower than outdoor corrosion rates.
 - Phase 2 – detailed study throughout NY planned for 2016.



Mitigating the Risk of Cross Bores

- > **Cross Bore Best Practices Guide** - single source of information for natural gas operators to investigate and remediate existing cross bores as well as prevent future cross bores.
- > **Cross Bore Outreach & Education Program**
Information to effect positive changes in attitude, practices and operations.
- > **Technology Development**
 - Acoustic Pipe Locator
 - Mechanical Spring
 - Cleanout Safety Device
- > Additional information at www.otd-co.org



Cross Bore Program - Technology

> Acoustic Pipe Locator (APL)

- All pipe materials. Commercialized by Sensit Technologies in 2013

> Cross Bore Detection – Mechanical Spring

- Detects voids such as intersecting another pipe when directional drilling
- Designed prototype for 4-inch drill head
- Undergoing field testing now, followed by further modifications based on results

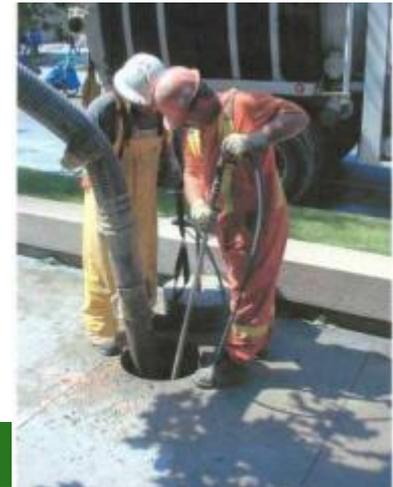
> Obstacle Detection for Directional Drilling

- Acoustic sensor at drill head for detection of obstacles in drill path
- Working closely with HDD equipment OEM



GTI's Keyhole Program

- > Long-standing GTI Program ~ 10 Years
- > Members include Utilities and Manufactures
- > Addresses technology development needs and market barriers to keyhole adoption
- > Communications
 - Sharing of information to accelerate implementation
 - Meetings and demo's
- > Current efforts include:
 - Jurisdictional Acceptance
 - Keyhole Guidelines and “how to” videos
 - Training
 - Tooling (scrapers, specialty tooling, wire connectors)



Breakaway Fittings for Meter Safety

- > Breakaway disconnect / shutoff fitting for meter set assemblies (MSA) and other aboveground gas systems.
- > Reduce the risk from vehicle collision or ice/snow falling from a building.
- > Commercially available Q4 2015 – Q1 2016
 - OPW Engineered Systems

OPW
ENGINEERED SYSTEMS
A DOWER COMPANY

gti[®]

OTD
Operations
Technology
Development



gti[®]

Kleiss Flow Stopping System

- > **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**
 - > **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
- > **Commercially available now through Mainline Control Systems (MCS)**



Emergency Main Stop-Off Station

- > **Value:** Create the capability to achieve a **rapid shutdown of gas flow in large diameter, low-pressure mains** in the event of an emergency at a fraction of the cost of installing large diameter valves.
- > **Project Summary:** Develop a double-block and bleed bag stop system with **permanent, quick-entry tap for 16" – 36" piping systems.**
- > **Status:** Prototype systems complete and being tested



Portable Flash Fire Suppression System

Objective:

- > To develop a portable system that can **detect a flash fire just after ignition and begin immediate suppression** to allow workers the time needed to egress a worksite.

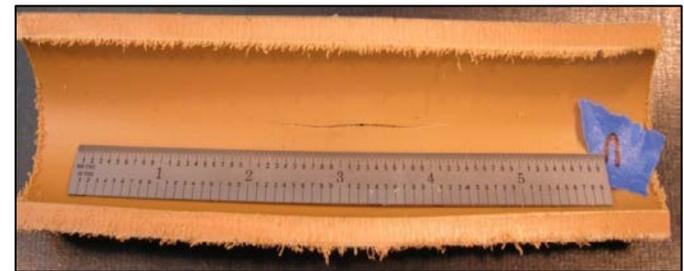
Focus:

- > The development of the PFFSS is focusing on four key areas of design: Portable device, detection camera, suppression system, and autonomous unit



Risk Analysis of Vintage PE Pipe

- > Failure analysis on piping systems to assist utilities in identifying:
 - Component defects
 - Operator error
 - Material defects / aging
 - Etc.
- > Vintage pipe lifetime prediction to assist utilities in determining risks/remaining life with PE piping systems
 - Vintage pipe prone to brittle like cracking
 - Additional information to put into risk models



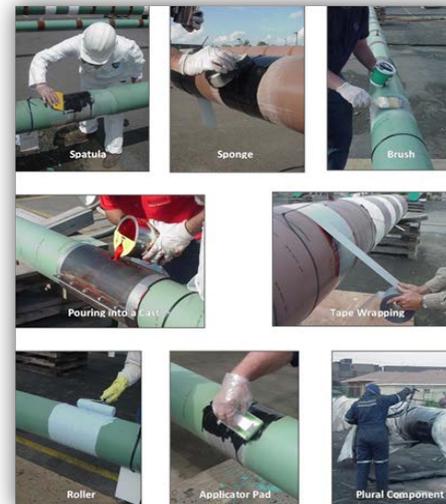
Qualifying & Enhancing PE Joining Procedures

- > **Value:** Optimizing and standardizing aspects of PE fusion procedures will create a more robust PE piping system and minimize the opportunity for field errors.
 - Surface preparation, cleaning and scraping
- > **Objective:** To bring the industry together to gain knowledge, understanding, and focus to the issues related to robust and qualified joining procedures and develop a consensus on a quality framework with which to address PE joining.
- > **Status:** Initiated in 2015.

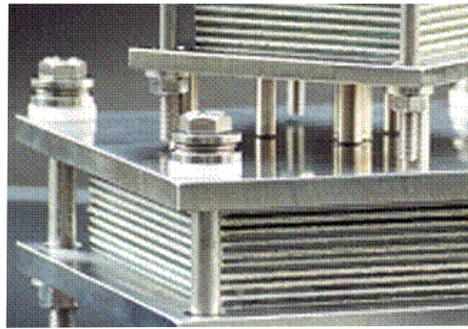
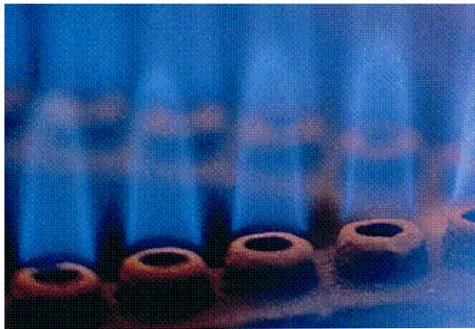


Field Applied Pipeline Coatings

- > **Value:** Minimize risk of pipeline failure, extend useful of assets & minimize remedial measures necessitated by failure of field applied coatings.
- > **Project Summary:** Establish an unbiased, third-party basis for operators to select girth weld coatings which are appropriate for their particular application requirements, and to provide the long coating life demanded by the industry. Project work was in excess of \$6M.
- > **Status:** Project complete. Results available through Project Report or Workshop



Tackling Important Energy Challenges and Creating Value for Customers in the Global Marketplace



Paul Armstrong

Director Business Development, GTI
paul.armstrong@gastechnology.org
781-449-1141

www.gastechnology.org



   @gastechnology