Perspectives and Successes in Mitigating Methane Emissions from Energy Pipelines

Robert Smith
Research Manager & Climate Change/Methane Actions SME

Methane Emissions from California's Natural Gas System: Challenges and Solutions
Sacramento, CA – June 6-7, 2016

PHMSA's Charge

We develop and enforce regulations for the safe, reliable and environmentally sound operation of:

<u>Approximately</u>

- **2.6 M pipeline miles (4 M KM)**
- **2,600 pipeline operators**
- **1M daily hazmat shipments**
  - By land, sea and air

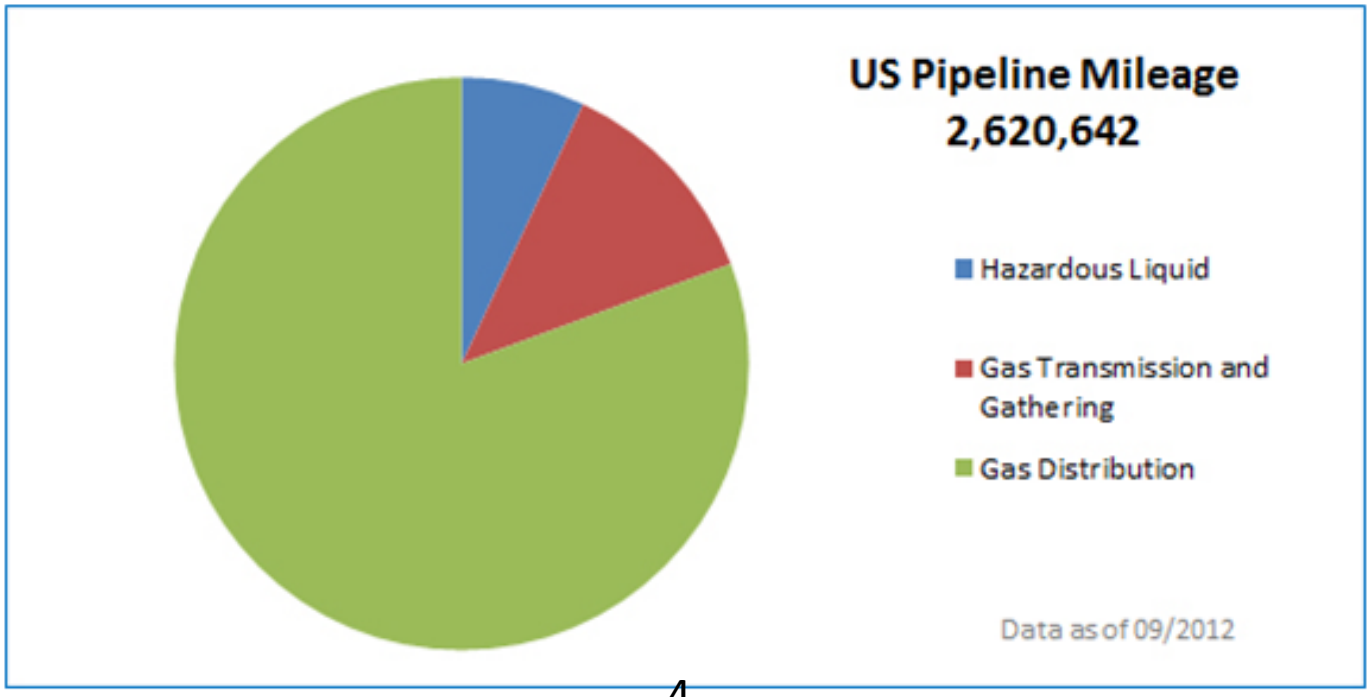
http://www.phmsa.dot.gov/pipeline

PHMSA Jurisdiction NOTES:

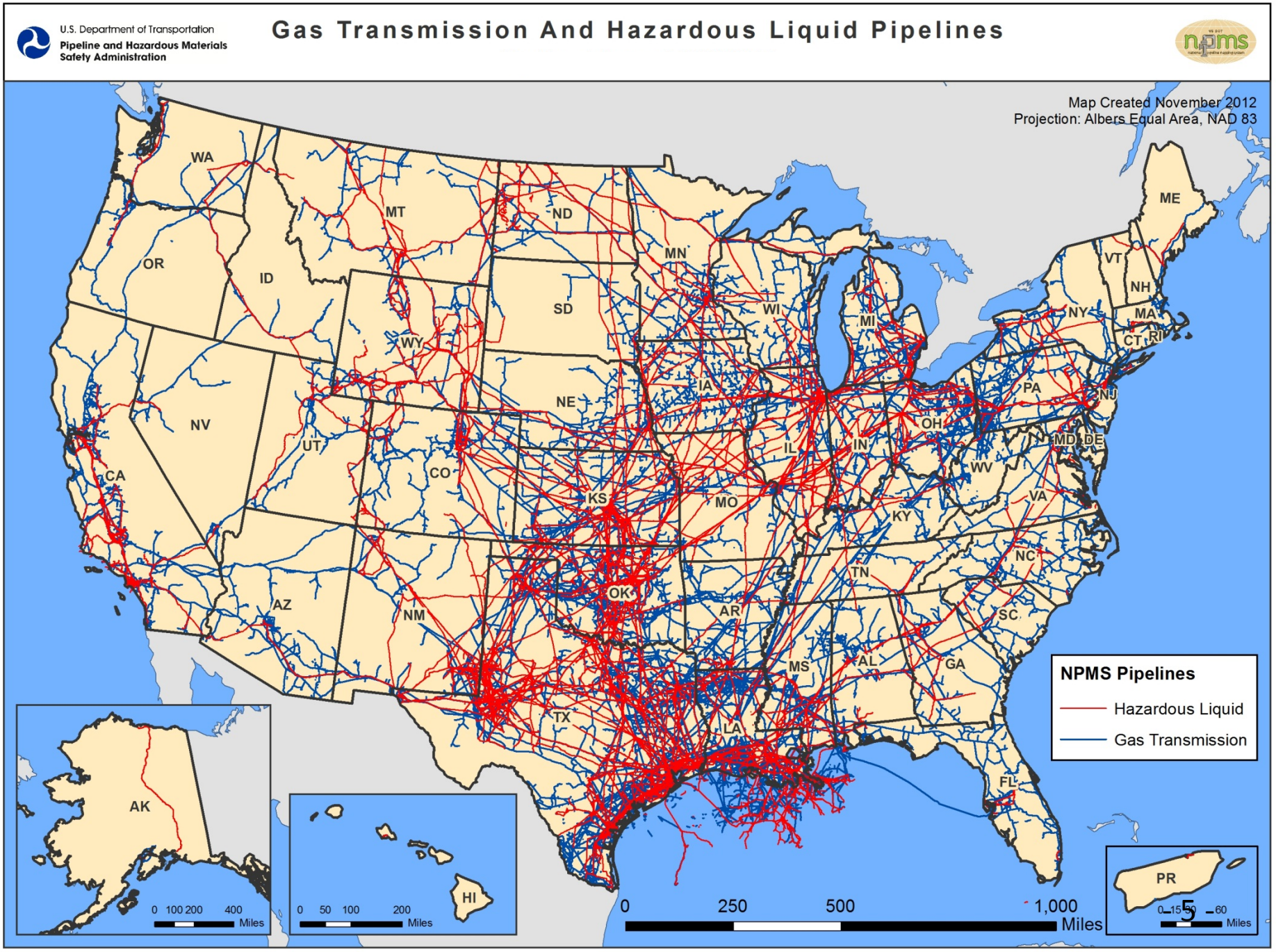
- **Mission primarily focused on Safety**
- **Limited environmental authority for natural gas**
  - PHMSA currently has limited authority to issue regulations for gas pipelines for the purpose of addressing climate change.
  - No authority over drilling/production facilities.
- **No Economic Mission**
- **No Permit or Siting of new construction**

What We Regulate

National Pipeline System Components				
Pipeline	**Mileage**	**% Total**	**Operators**	**% Total**
Hazardous Liquid	182,166	7	350	13
Gas Transmission and Gathering	324,832	12	1,034	39
Gas Distribution	2,113,643	81	1,285	48
Main line	*1,232,266*	*47*		
Service line	*881,378*	*34*		
Total	**2,620,642**	**100**	**2,669**	**100**



U.S. Pipeline Transportation System



Administration Interest in Decreasing Greenhouse Gas Emissions

- **New "Social Cost of Carbon/Methane" OMB Requirements on Data/Rulemaking**
  - Quantifying the amount of escaped gas from reportable incidents
  - Determining the gas composition to calculate Global Warming Potential
  - Calculating Savings/Increases as part of any Regulatory Impact Analysis*

* Executive Order 12866 – May provide PHMSA some basis to conduct rulemaking by quantifying benefit to reduce burdens of related methane reduction actions.

Fugitive/Vented Methane

- **PHMSA closely following issues and policy development by others**
  - White House, Congress, EPA, DOE Quadrennial Energy Review and Industry Trade Organizations
- **Coordinating with EPA with data share/meetings and PHMSA participation at EPA Gas Star Program events**
- **Coordinating with DOE (ARPA-E/NETL) on research strategy proposal reviews and invites to PHMSA tech demonstrations**
- **Coordinating with the Environmental Defense Fund efforts: Pipeline Advisory Committee**
- **Reviewing natural gas regulations to understand leak paths and possible actions germane to our statutory mission**
  - However, safety case largely already made in support of hazardous leak reductions
  - Remaining non-hazardous leaks generally economic in nature
    - NARUC, FERC and the Congress

Methane Related PHMSA Actions

- **Overall Regulatory Program –** Keeping product in the pipeline and preventing leaks has the ancillary benefit of reducing emissions
- **Transmission Integrity Management –** Enhanced transmission industry programs to prevent leaks and ruptures by addressing risk since 2004
- **Distribution Integrity Management –** Requirements to find and fix leaks in distribution systems since 2011

Methane Related PHMSA Actions

- **Excess Flow Valves –** Mandatory installation of EFVs on new and replaced residential service
- **Excavation Damage Prevention –** Implementing and proposing policies that save lives and prevent releases of methane through damage prevention enforcement
- **Research & Development –** A collaborative and co-funded program since 2002 is bringing several technology solutions to market
  - Leak Detection but also in damage prevention, anomaly detection and robotic inspection devices for unpiggable gas lines

Potential Methane Leak Paths

- **Natural Gas Gathering, Transmission, Distribution and LNG systems**
  - Piping, Flanges, Gaskets, Meters, Line Valves
  - Rotating Equipment - Compressors
  - Pipeline Operations – Purging/Blow-Down, Relief Valves, Pig Runs, Pneumatic controllers
  - Leak rates vary due to…
    - Gas pressure, temperature, etc. & opening size
    - Gas quality

Related Rulemakings/Notices

April 8, 2016 - Notice of Proposed Rulemaking

Docket No. PHMSA–2011–0023

Pipeline Safety: Safety of Gas Transmission and Gathering Pipelines

This NPRM proposes to revise the Pipeline Safety Regulations applicable to the safety of onshore gas transmission and gathering pipelines. PHMSA proposes changes to the integrity management (IM) requirements and proposes changes to address issues related to non-IM requirements. This NPRM also proposes modifying the regulation of onshore gas gathering lines.

Safety of Gas Transmission and Gathering Pipelines

Notable Methane Reduction Aspects:

1. Further Strengthening Requirements to Implement Preventive and Mitigative Measures for Pipeline Segments in High Consequence Areas
2. Leak Detection Systems (identified to be addressed in separate rulemaking)
3. Valve Spacing and the Need for Remotely or Automatically Controlled Valves (to be addressed in separate rulemaking), however comments are requested regarding proposed changes to the requirements for sectionalizing block valves
4. Underground Gas Storage - comments requested regarding establishing requirements within part 192 applicable to underground gas storage in order to help assure safety of underground storage and to provide a firm basis for safety regulation. However, PHMSA considering separate rulemaking to further elaborate.

Related Rulemakings/Notices

February 5, 2016 – Notice; Issuance of Advisory Bulletin

Docket No. PHMSA–2016–0016

Pipeline Safety: Safe Operations of Underground Storage Facilities for Natural Gas

Advisory bulletin issued to remind all owners and operators to review their operations to identify the potential of facility leaks and failures caused by corrosion, chemical damage, mechanical damage, or other material deficiencies in piping, tubing, casing, valves, and associated facilities and the importance of reviewing the location and operations of shut-off and isolation systems and reviewing and updating emergency plans as necessary.

DOE/DOT Partnership
Natural Gas Storage

ENERGY.GOV

PUBLIC SERVICES | SCIENCE & INNOVATION | ENERGY SAVER | ABOUT ENERGY.GOV

Home » Working Together to Address Natural Gas Storage Safety

Working Together to Address Natural Gas Storage Safety

April 1, 2016 - 11:15am

Tweet G+1 Pin it

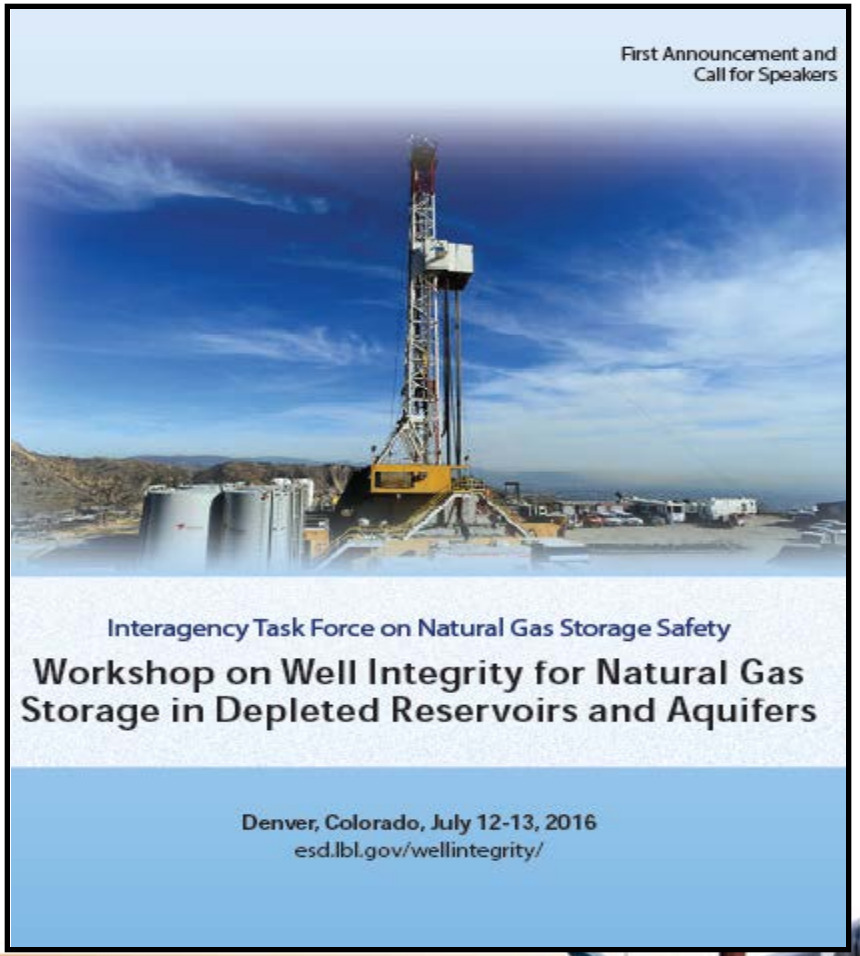
Franklin (Lynn) Orr
Under Secretary for Science and Energy

Marie Therese Dominguez
Administrator, U.S. Department of Transportation's Pipeline and Hazardous Materials Safety Administration

As a part of the Administration's ongoing commitment to support state and industry efforts to ensure the safe storage of natural gas, the Department of Energy (DOE) and the Department of Transportation's Pipeline and Hazardous Materials Safety Administration (PHMSA) are announcing that today we will formally launch a new Interagency Task Force on Natural Gas Storage Safety.

Industry actions that led to the recent natural gas leak at California's Aliso Canyon site underscored the serious risk that these storage facilities can pose. Shortly after the Aliso Canyon leak was controlled, we were able to visit the site of the leak to hear from local officials and experts. The visit allowed us to see the magnitude and gravity of this situation, and how it impacted people in California and the environment. It was incredible to see the spirit of partnership and collaboration between State and local agencies across California – along with support from Federal partners – to respond to this incident and to ensure it was resolved safely. Even so, the fact that this leak happened in the first place, the length of time that it took to fix, and the disruption that it caused for so many people are very concerning. That's why we are launching this interagency Task Force, to help companies ensure that no community has to go through something like that again.

Specifically, DOE will hold workshops with industry, state and local leaders, and other interested stakeholders to support them in the development of best practices for ensuring well integrity and proper response plans, safe operations of storage facilities, and assess the potential



PHMSA Public Event

- Held next day after DOE event and same hotel
- Focus on safety requirements

PHMSA Public Workshop on Underground Natural Gas Storage Safety

Register Here...

http://primis.phmsa.dot.gov/meetings/

Meeting Information	
Status	Scheduled
Starts	Jul 14, 2016 at 8:00 AM
Ends	Jul 14, 2016 at 4:30 PM
Location	Renaissance Boulder Flatiron Hotel, Broomfield, Colorado
Virtual Information	This workshop will be webcast. Connection information for viewing the webcast will be provided here in advance of the meeting. If you plan to join the webcast, please register for the workshop from this page.
On-Line Registration	Register Here...
Purpose & Summary	This workshop will bring stakeholders, including federal and state agencies, industry, and interested members of the public together to participate in shaping a future of 49 CFR 192 safety regulations for underground natural gas storage. The 1-day workshop is free of charge and will be webcast live.
Agenda	
The workshop agenda will be posted here in advance of the meeting.	

Register Here...

PHMSA Home | Pipeline Safety Website | Feedback | Privacy Policy | FOIA

Pipeline Safety RD&T

Program Mission:

To sponsor research and development projects focused on providing near-term solutions that will improve the safety, reduce environmental impact, and enhance the reliability of the Nation's pipeline transportation system.

Key Points

- We employ a collaborative approach to address mutual challenges
- We help remove technical barriers on a given challenge
- We measure our research results/impacts
- We are transparent - http://primis.phmsa.dot.gov/rd/

Pipeline Safety Improvement Act of 2002 established our modern program

RD&T Program Objectives

Developing Technology	Strengthening Consensus Standards	Promoting Knowledge
Fostering the development of new technologies so that pipeline operators can improve safety performance and more effectively address regulatory requirements.	Targeting and feeding new knowledge into the process of keeping standards relevant to their purpose.	Generating and promoting general knowledge to decision makers.

Methane Leak Detection Research*

- Program Objective: Research in this area will develop new or improved tools and technology solutions for reducing the volume of product released into the environment and with identifying leaks before they lead to catastrophic ruptures.
- PHMSA's Research Portfolio:
  - 8 Awarded Projects since 2002
  - $5.1M PHMSA + $6.3M Resource Sharing
  - 3 Commercialized Technologies
  - **60% Technology Investment Success Rate in Researching the Market
- Success with new/improved technology to locate methane leaks.

* PHMSA funds research on liquid pipeline leak detection as well

** 3 tech commercializations divided by the sum of 8 total tech projects – 3 active tech projects

Methane Leak Detection Tech Research

	Project ID and Title	Status	Contractor	PHMSA	Commercialized?
1.	DTRS56-01-X-0023, Airborne LIDAR Pipeline Inspection System (ALPIS) Mapping Tests	Closed	LaSen and U.S. Air Force Research Laboratory	$2,245,204	Yes
2.	DTRS56-04-T-0012, Hazardous Liquids Airborne Lidar Observation Study (HALOS)	Closed	ITT Industries Space Systems, LLC	$553,114	Yes
3.	DTPH56-08-T-000007, Development of a Free-Swimming Acoustic Tool for Liquid Pipeline Leak Detection Including Evaluation for Natural Gas Pipeline Applications	Closed	Arizona State University	$388,332	Yes
4.	DTPH56-10-T-000022, Development and Field Testing of a Highly Sensitive Mercaptans Instrument	Completed	Northeast Gas Association	$246,496	TBD
5.	DTPH56-13-T-000005L, Advanced Development and Technology Transfer of a Methane/Natural Gas Microsensor	Completed	Northeast Gas Association	$412,388	TBD
6.	DTPH5615T00012, Emissions Quantification Validation Process	Active	Northeast Gas Association	$144,670	TBD
7.	DTPH5615T00015, Natural Gas Pipeline Leak Rate Measurement System	Active	Physical Sciences Inc.	$226,794	TBD
8.	DTPH5615T00016, Rapid Aerial Small Methane Leak Survey	Active	Ball Aerospace & Technologies Corp.	$849,866	TBD
			Total:	$5,066,864	

Research Coordination

- Sharing strategies, multi agency merit review of proposals, invitations to tech demos and final project de-briefs.
- State PUCs, EPA, DOE, DOI, EDF, California Energy Commission and the Interstate Technology Regulatory Council

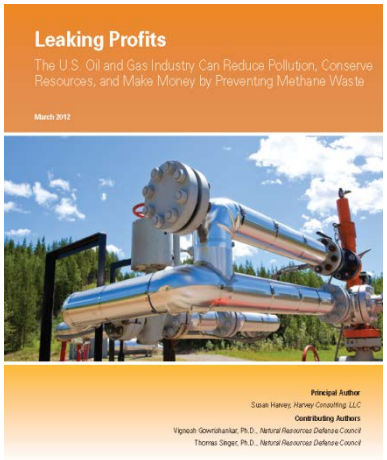
2016 Pipeline R&D Forum

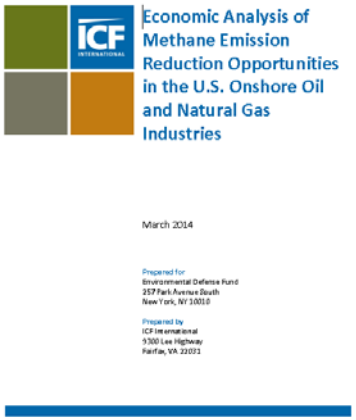
Fall 2016 venue city TBD – Announced in the Federal Register

Working Groups:

1. **Threat/Damage Prevention**
2. **Leak/Line Break Detection/Mitigation -** This group will discuss line break sensors and their components and leak detection technology development from any deployment platform/understanding capabilities and limitations. Discussions around pipeline sensing/line break detection systems to minimize unintended valve closures are also anticipated. It is also anticipated that a heavy focus will be placed on solutions for hazardous liquid pipelines.
3. **Anomaly Detection/Characterization**
4. **Natural Gas Underground Storage -** This group will discuss a wide range of challenges for gas underground storage facilities. They include anything from well design – casing, tubing, wellheads, and safety valves to well integrity and inspection to assessing operations and maintenance programs to safety device testing – flow through tubing, casing or both – threat identification, risk assessment, preventative & mitigative measures, and remediation measures - location/frequency/valve life expectancy and mechanical integrity testing – type (pressure test, logging, or other), frequency, and remediation measures to odorant programs and down hole and facility leak detection to security – well, facility, and other and issues for emergency response and preparedness.
5. **Liquefied Natural Gas**

Broad Research Suggestions



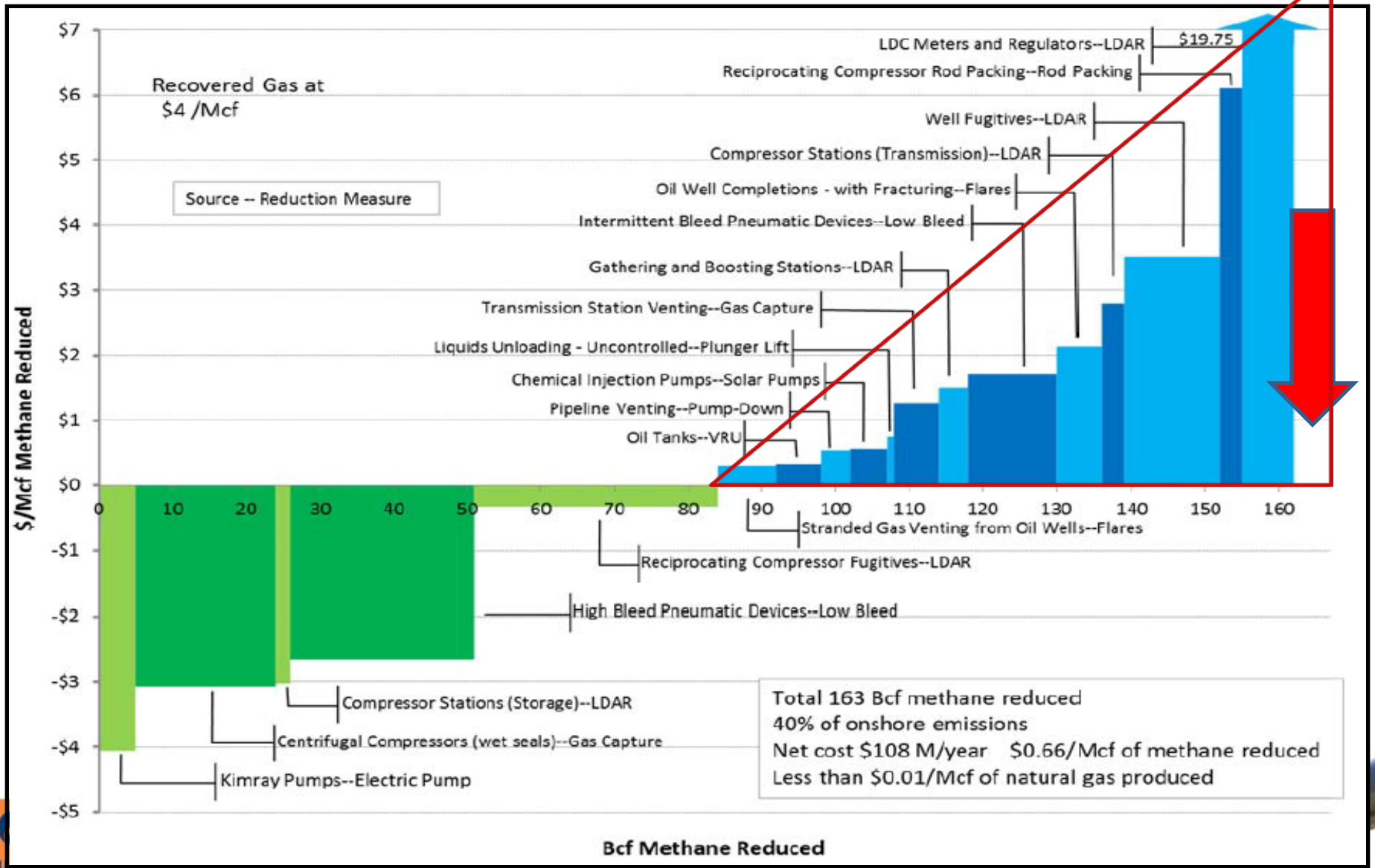


- Questionable value of much more methane detection research
  - Dozens of companies now offering accurate services – Google it and see!
  - Leverage prior/ongoing PHMSA, Industry tech successes and factor ARPA-E coming investments
- These two reports via the EDF and ICF spell out a variety of energy supply chain options for reducing methane
- Research in these suggested areas can:
  - Improve economics of existing products/technology
  - Develop new technology and more options for the industry to consider

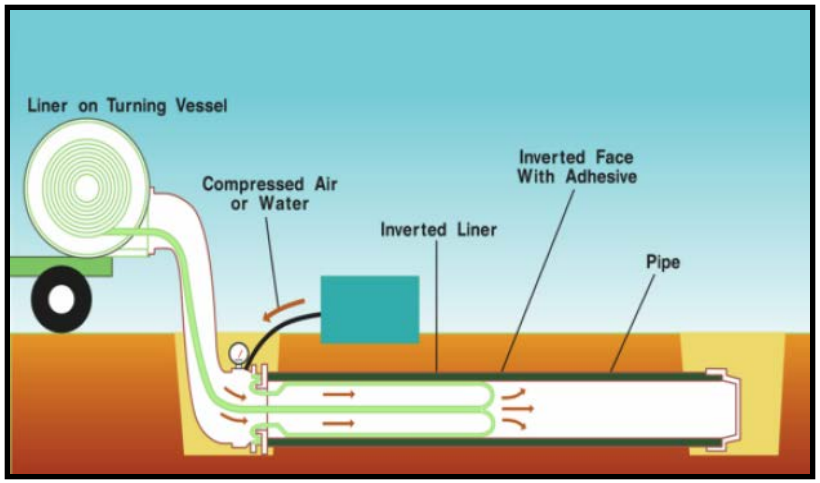
EDF – Leaking Profits Report

1. **Green Completions** to capture oil and gas well emissions
2. **Plunger Lift Systems** or other well deliquification methods to mitigate gas well emissions
3. **Tri-Ethylene Glycol (TEG) Dehydrator Emission Controls** to capture emissions from dehydrators
4. **Desiccant Dehydrators** to capture emissions from dehydrators
5. **Dry Seal Systems** to reduce emissions from centrifugal compressor seals
6. **Improved Compressor Maintenance** to reduce emissions from reciprocating compressors
7. **Low-Bleed or No-Bleed Pneumatic Controllers** used to reduce emissions from control devices
8. **Pipeline Maintenance and Repair** to reduce emissions from pipelines
9. **Vapor Recovery Units** used to reduce emissions from storage tanks
10. **Leak Monitoring and Repair** to control fugitive emissions from valves, flanges, seals, connections and other equipment

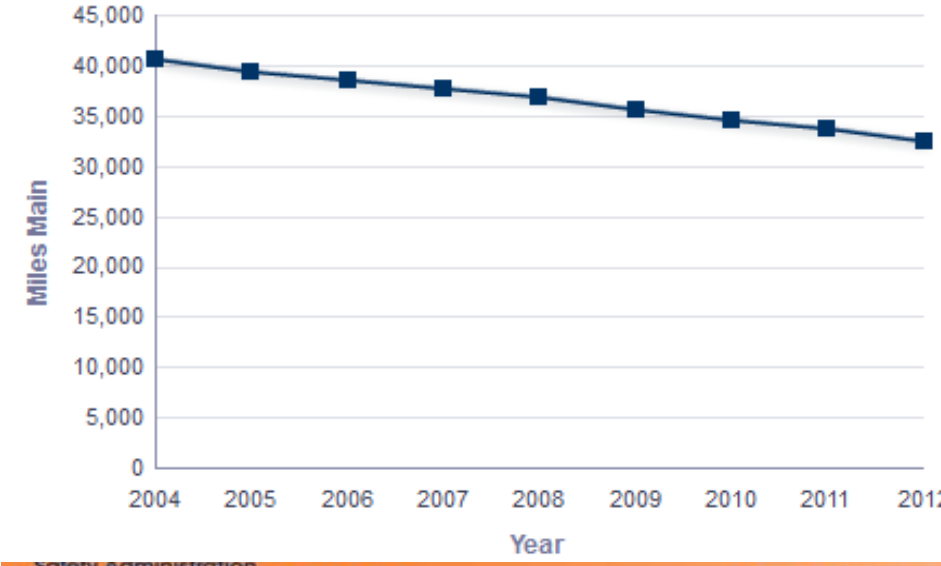
EDF – Economic Analysis Report



Challenge: Cast Iron



Gas Dist. Cast/Wrought Iron Main Miles



Pipe Material	Calendar Year	MAIN		SERVICES	
		Total Miles	% of Miles	Total Miles	% of Miles
IRON	2015	28,344.9	2.22	130.6	0.01
	2014	29,983.8	2.37	152.3	0.02
	2013	31,575.9	2.52	167.7	0.02
	2012	33,136.5	2.66	187.0	0.02
	2011	34,419.0	2.78	214.5	0.02
	2010	35,375.5	2.88	227.2	0.03

Final Thoughts

- **Uniform Picture – Do we have one?**
- **Technology Solutions - Detection good; quantifying leak rate not as good** (R&D in progress)
- **Cost Recovery – Will cost impact be leveraged or incentivized? (rate recovery mechanisms)**
- **Regulatory Authority – Who would regulate the industry? (including the role of states)**
- **Resources – Consideration needs to be given to funding and human capital needed**
- **Pipeline Safety – Would the lack of incentives impact pipeline safety?**

Thank You!/Program Contacts

Kenneth Lee
Director – Engineering & Research
Department of Transportation
Pipeline & Hazardous Materials Safety Administration
Office of Pipeline Safety
P(202) 366-2694
Email kenneth.lee@dot.gov

Jim Merritt
Department of Transportation
Pipeline & Hazardous Materials Safety Administration
Office of Pipeline Safety
P(303) 638-4758
Email james.merritt@dot.gov

Robert Smith
Department of Transportation
Pipeline & Hazardous Materials Safety Administration
Office of Pipeline Safety
P(919) 238-4759
Email robert.w.smith@dot.gov

Joshua Arnold
Department of Transportation
Pipeline & Hazardous Materials Safety Administration
Office of Pipeline Safety
P(202) 366-6085
Email joshua.arnold@dot.gov

PHMSA RD&T Providing/Supporting:

http://www.phmsa.dot.gov/pipeline/research-development

Project Database: https://primis.phmsa.dot.gov/matrix/