OTD
Operations
Technology
Development

PHMSA R&D Working Group #5 Methane Mitigation- Construction and Operations

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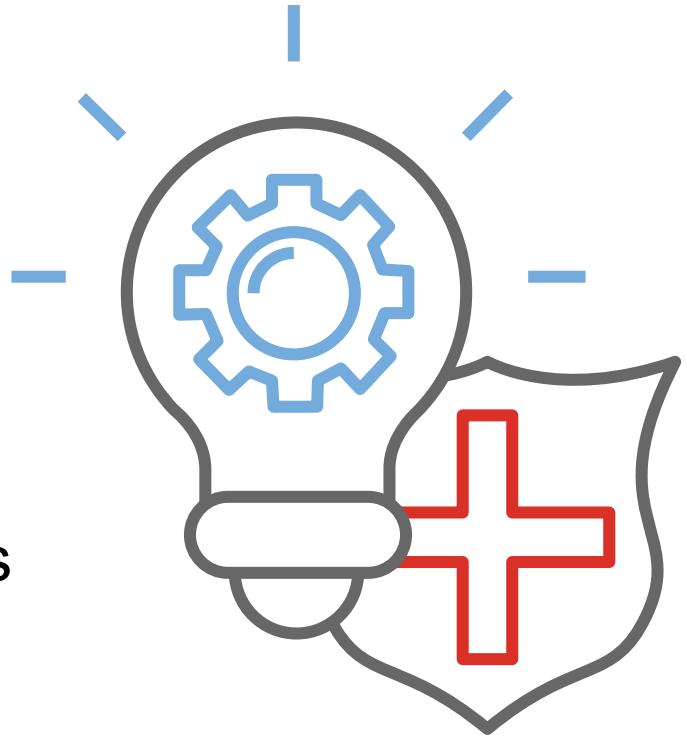
Chris Moore, Ph.D
Program Manager

OTD Mission and Goals

Mission

- Identify, select, fund, and oversee research projects resulting in innovative solutions and the improved safety, reliability, and operational efficiency of natural gas systems



Goals

- Enhance safety
- Enable operational excellence
- Minimize environmental impact
- Practice good science

Operations Technology Development (OTD) Overview

Established 2003

Stand-alone, not-for-profit, member-controlled company where gas utilities work together to develop technology solutions to common issues

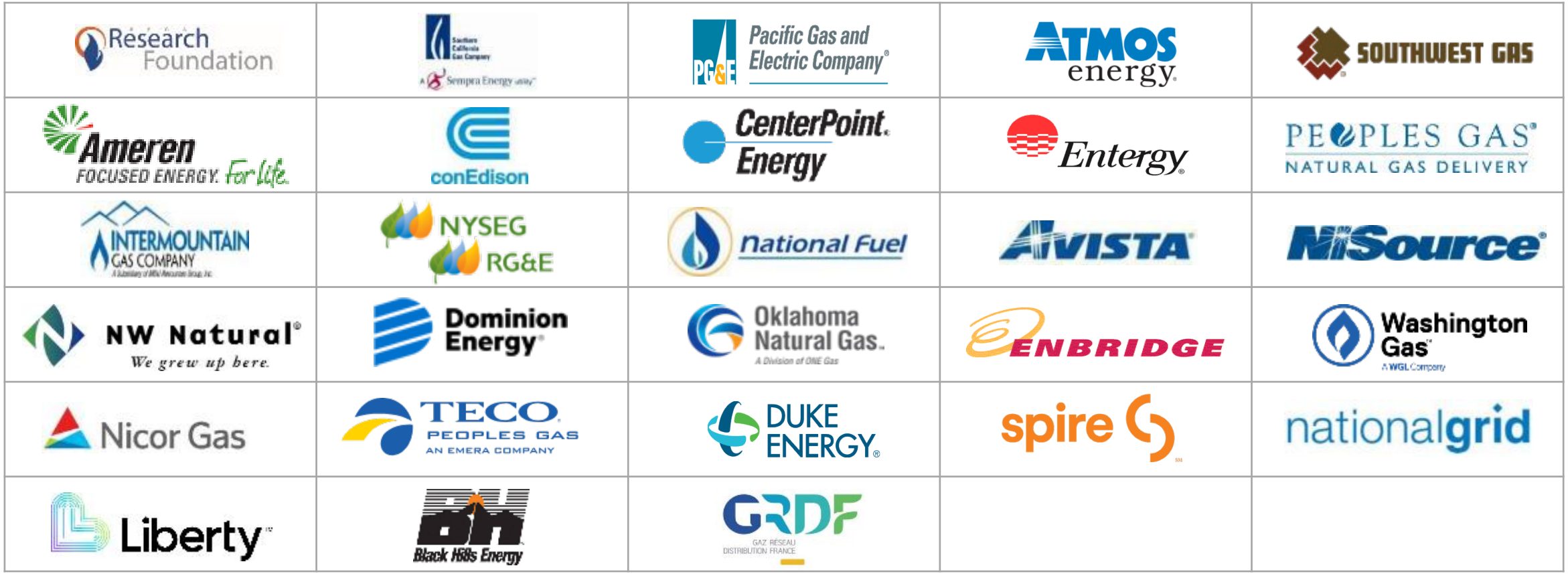
- Annual membership dues are calculated based on number of customer meters
- New projects selected by members based on needs
- Each member votes their own dollars to specific projects
- All members have access to all project information

28 Members

$12M annual dues	**$150-$750k** member/yr	**$0.50** meter/yr

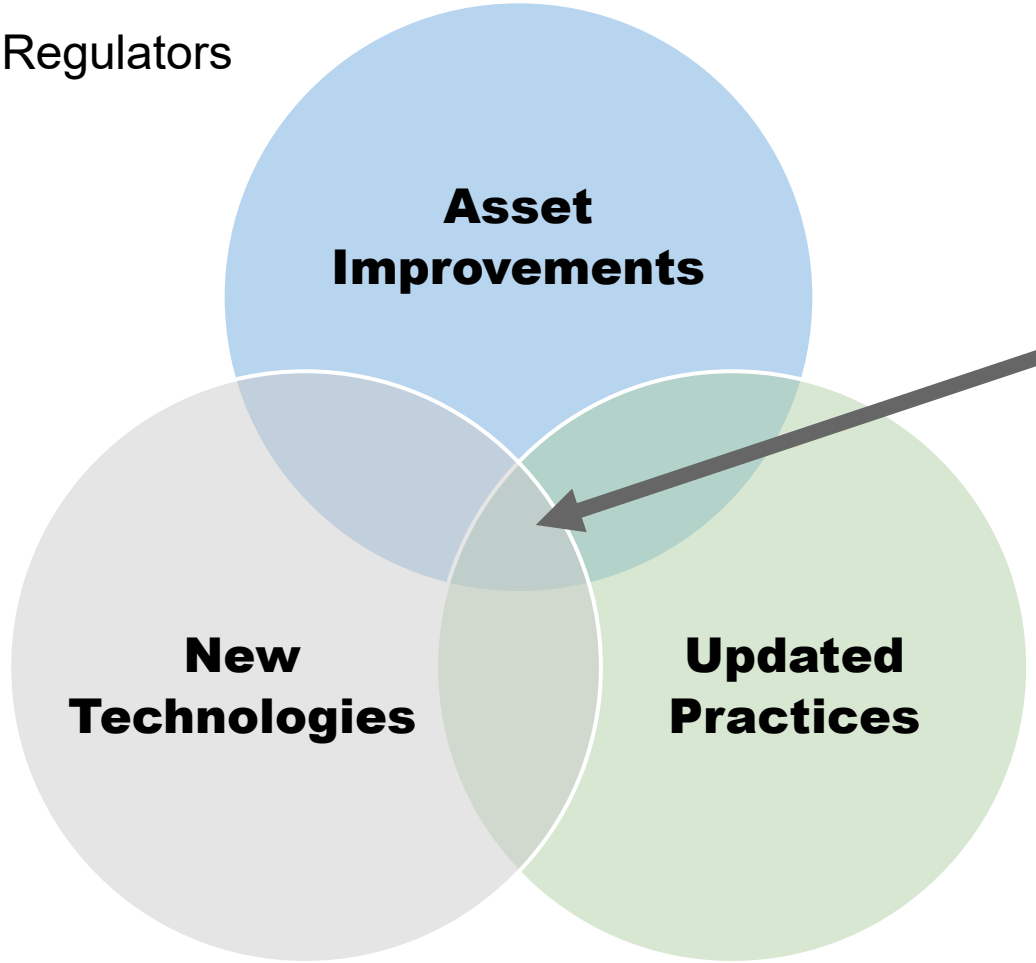
OTD Members

Serving 50 million gas consumers in the U.S., Canada and France



Methane Measurement, Mitigation, and Operations

Vent Limiting Regulators



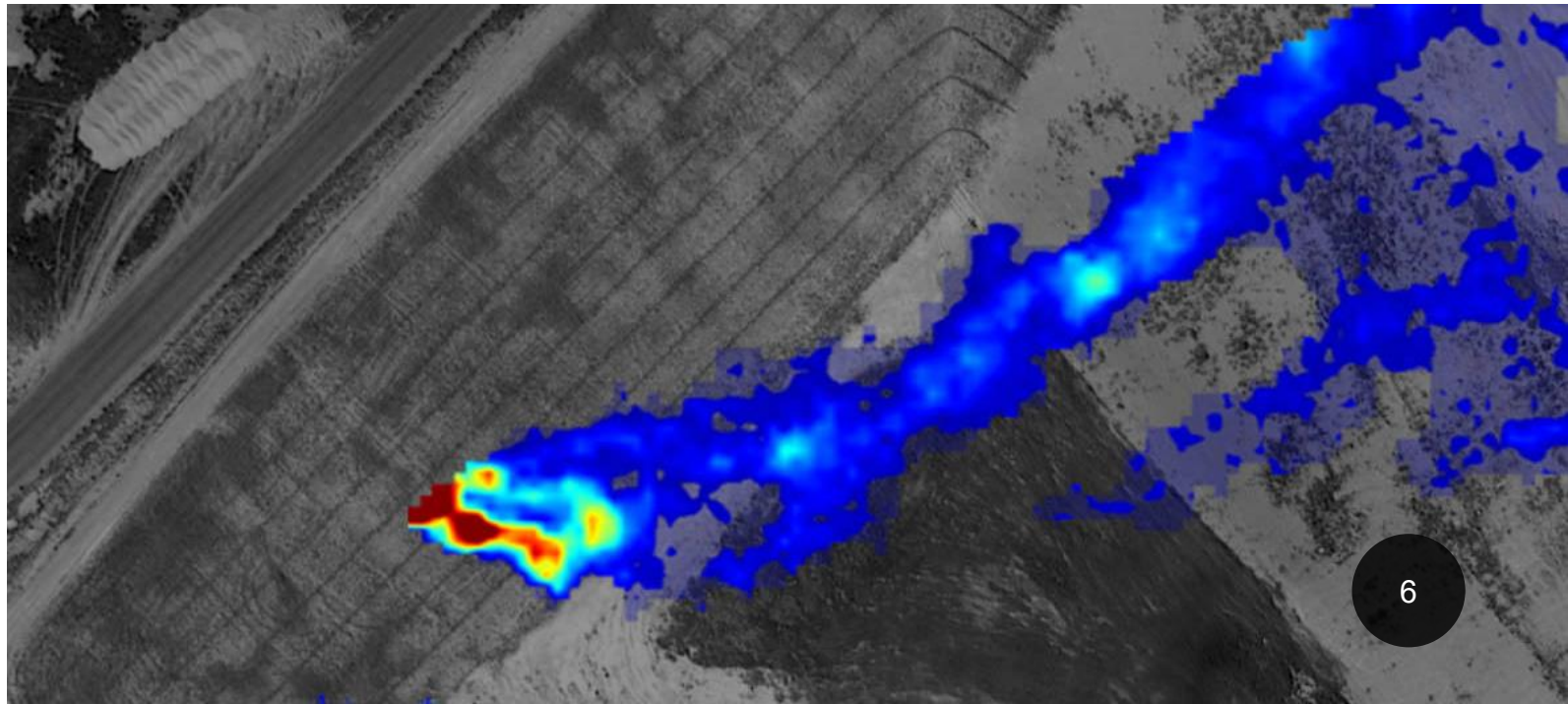
Emission Quantification

Smart Safety Shutoff, Vacuum Purging, Methane Mitigation ThermoElectric Generator

Limiting venting and purging, prioritizing leak repair based on safety then emissions

Methane Emission Quantification

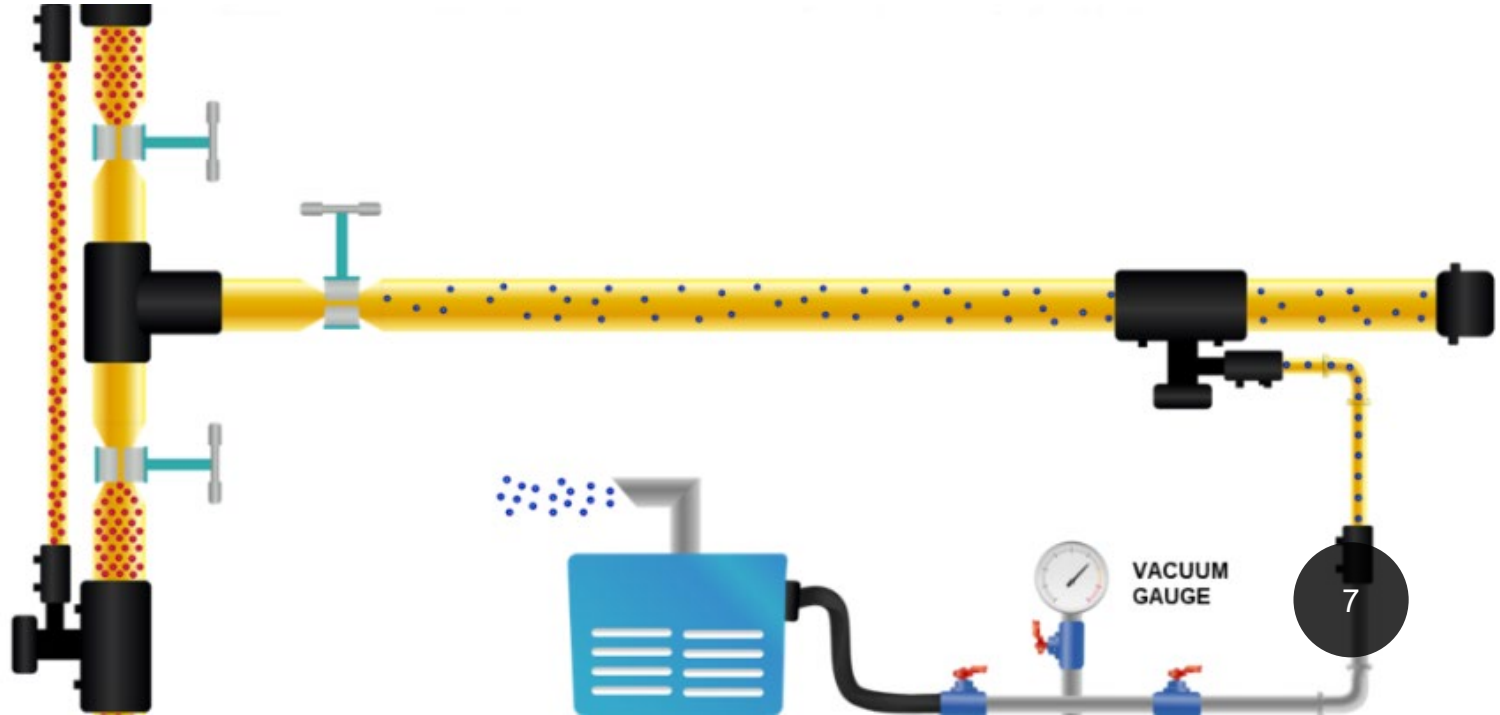
- Accepted methodologies for quantifying emissions are limited
  - Especially for buried assets



OTD Operations Technology Development

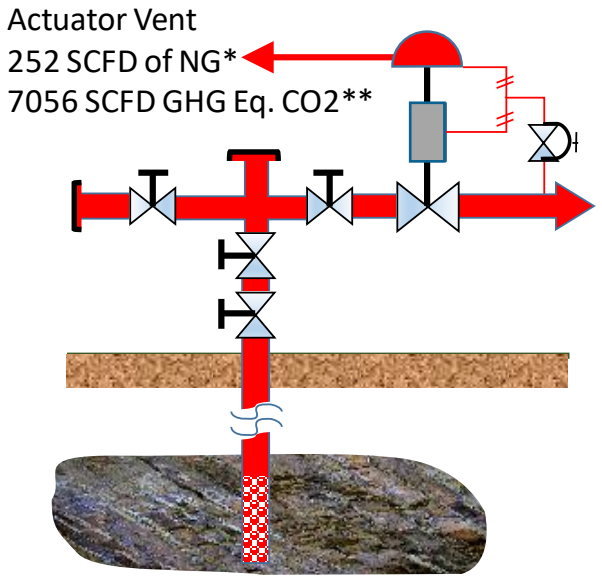
Purging Gas Pipes into Service without Venting

- Develop an alternative vacuum focused method to purge gas pipes into service with no or minimal gas vented
- Vacuum, “pump-downs,” to remove air that entered when out of service
- Pure system gas introduced eliminating emissions from purging
- In Phase 2 now - moving to commercial ready system



Straightforward Retrofit Concept to Existing Wellhead Arrangement

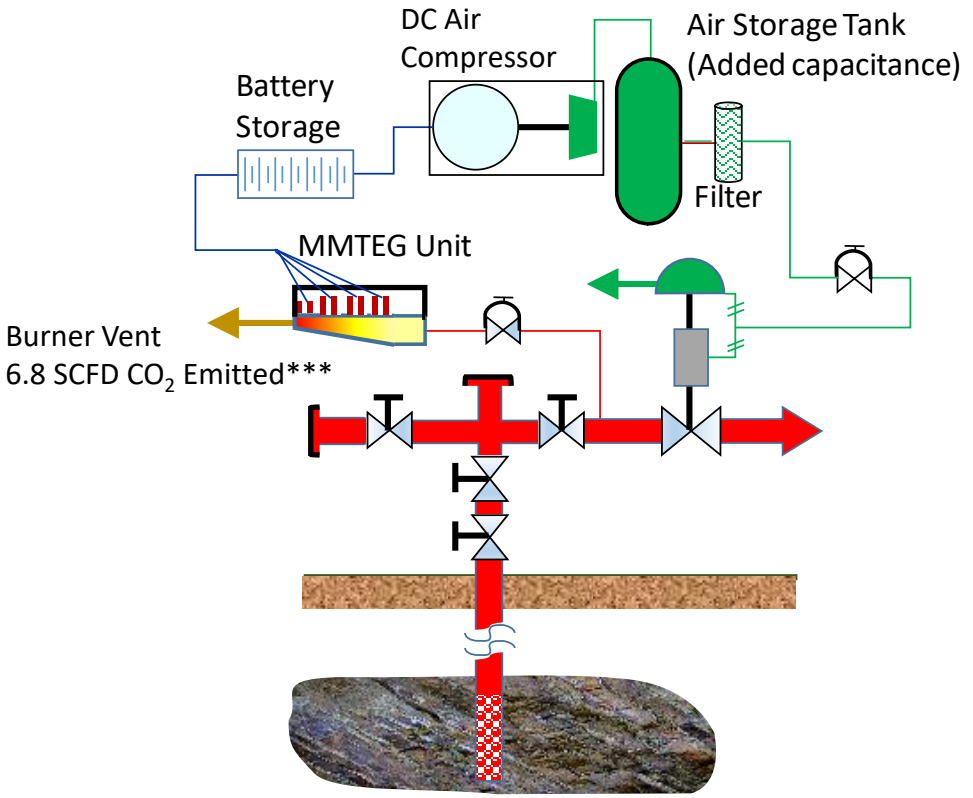
Current Systems:



Implementation of this system reduces:

- **NG losses by more than 97%**
- **GHG emissions by greater than 99.9%**

Retrofit:



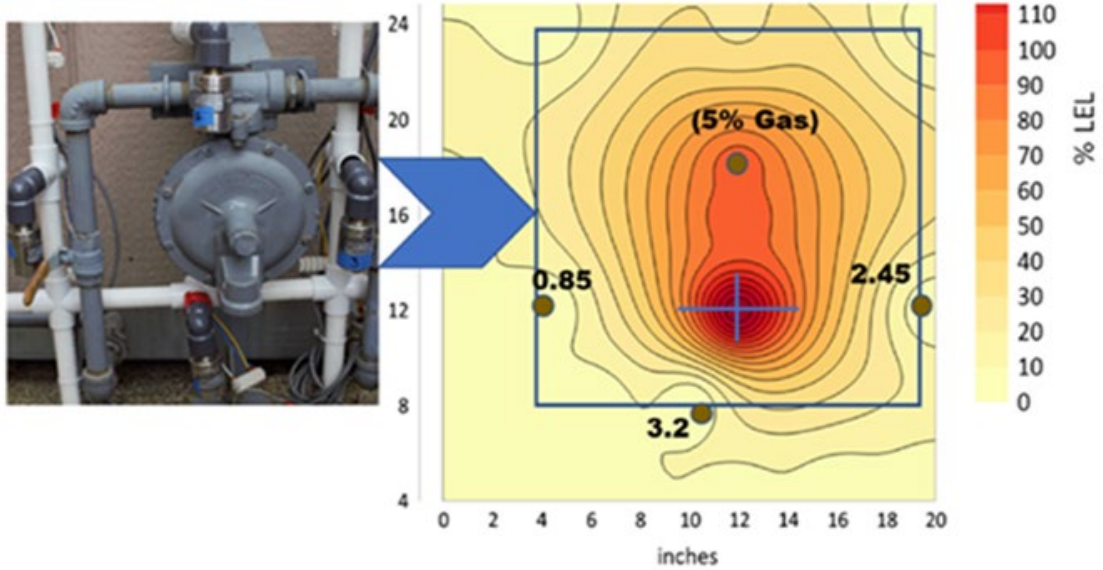
- Based on Allen, et. al., Measurement of methane emissions at natural gas production sites in the United States, PNAS, Vol. 110, No. 44, pp 17768-17773

** Using GHG intensification factor of 28

*** Assumes 2.27 cycles per day per controller, per conversation with D. Sevier SWN

Design and Placement of Compact Service Regulators

- Research on "vent limiting" gas service regulators that will provide gas utilities with more options for outside placement.
- Vent limiting regulators produce less natural gas emissions as compared to traditional internal relief valve regulators.
- Comparative testing includes:
  - Measurement of Emissions
  - Measurement of Concentration



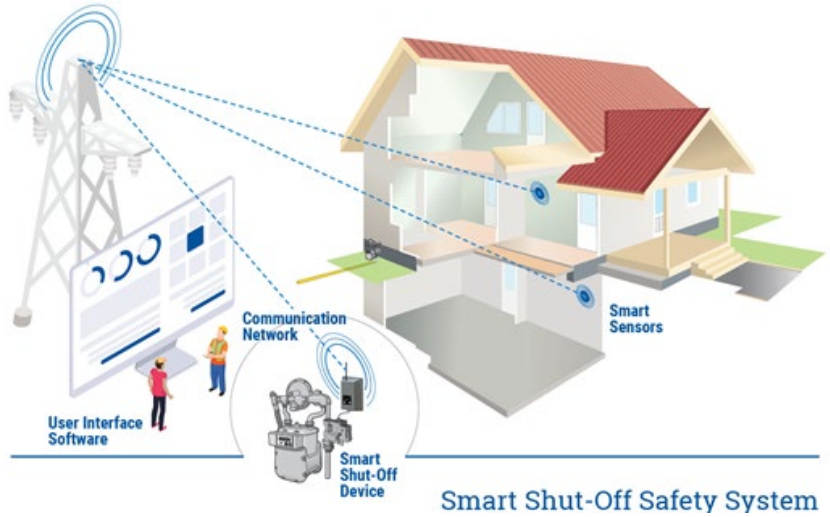
Design of a Comprehensive Natural Gas Smart Safety Shutoff System

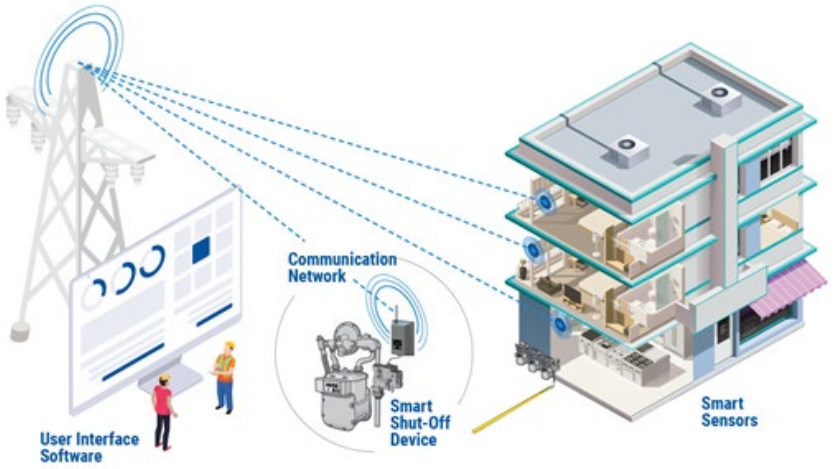
- Consists of 4 main components
  1. Smart Sensors: RMD, Fire, Flood, e.g.
  2. Smart Shutoff Valve
  3. Communication Network
  4. User Interface Software

- RMD detects low LEL methane levels starting at 10%

- Communicates LEL levels to the gas utility to dispatch an employee to investigate.

- Smart valve shuts off the gas flow to the building to prevent gas levels from reaching the explosive limit.





Needs and Challenges

- Verifiable and accepted quantification methodologies
- Discussion on wider use of flaring in transmission and distribution
- Other procedural updates
- Addressing PIPES Act emissions issues while being safety compliant
- Low-cost pressure monitoring sensors

Questions