

Methane Detection Projects

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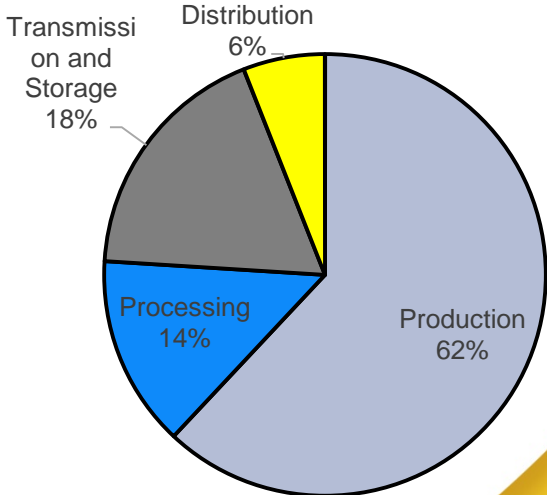
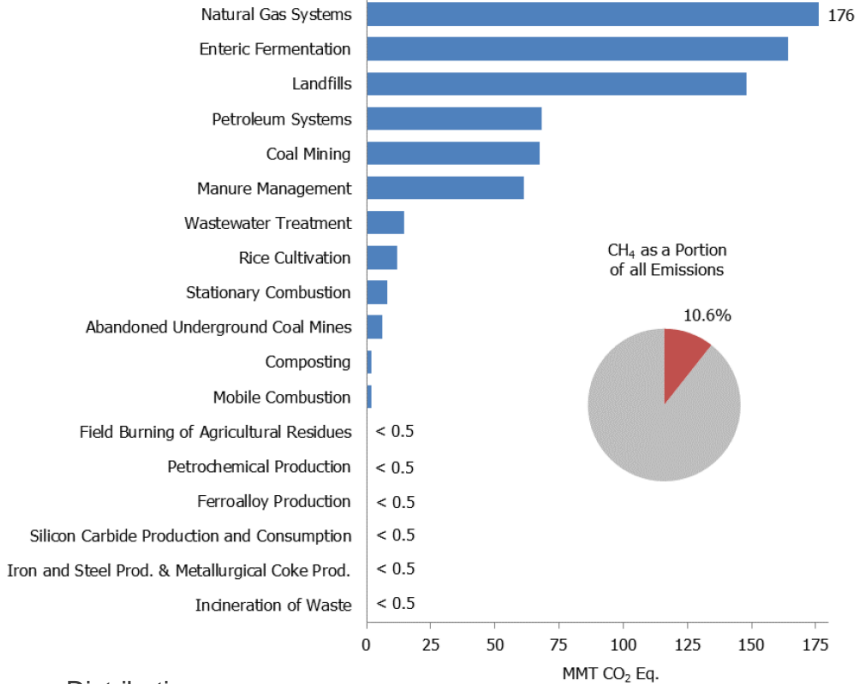
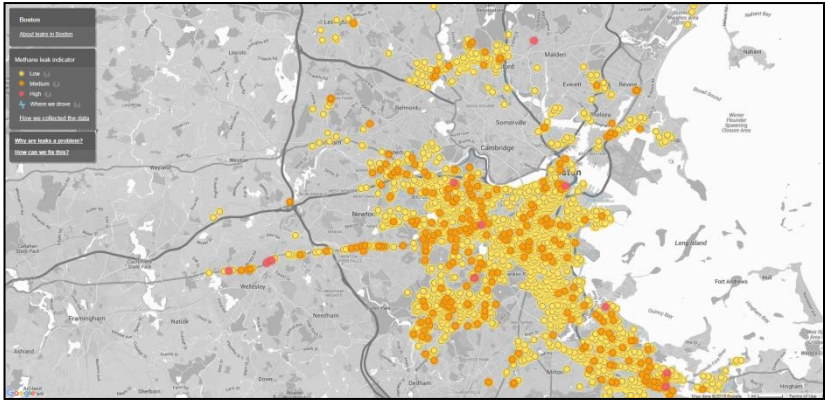
PHMSA R&D Forum

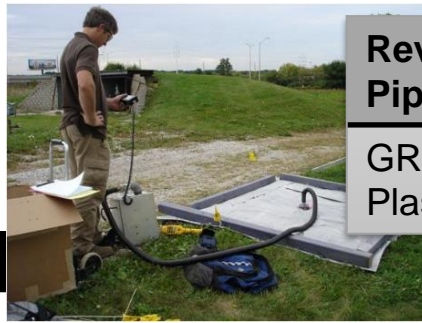
Cleveland, OH

OTD

Operations
Technology
Development

Need for Methane Detection and Monitoring





Revised Plastic Pipe EF	3.72 scf/leak-hr
GRI/EPA 1996 Plastic Pipe EF	12.45 scf/leak-hr



Emissions Quantification

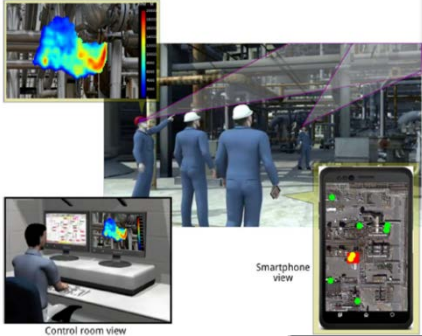
Remote Gas Sensing and Monitoring

Residential Methane Detectors

Leak Detection

Methane Detection and Measurement

Mitigating and Reducing Emissions



Methane Sensing for 1st Responders

- To create a device to remotely monitor the level of gases during emergency situations.
- The device will provide critical information to first responders and gas company personnel, allowing them to determine the concentration of methane, CO, and possibly other key indicators inside buildings, sewers, and other structures from a safe distance.



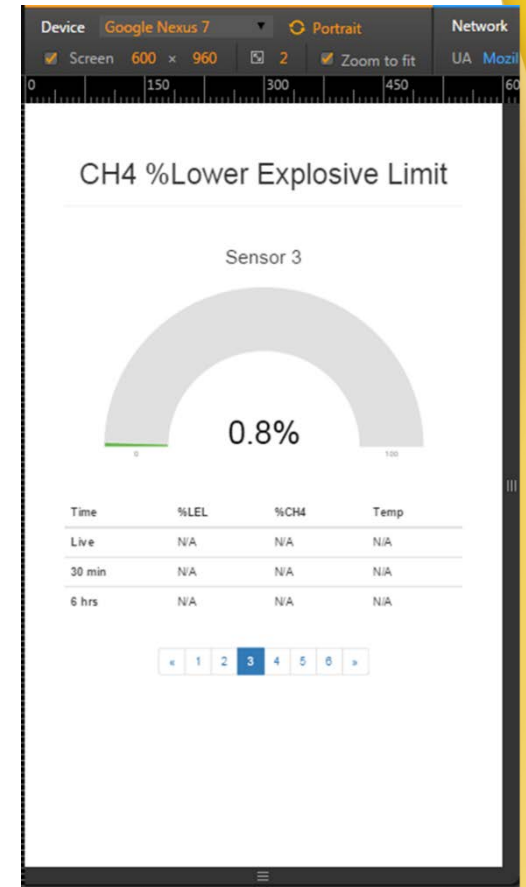
Methane Sensing for 1st Responders

- Six wireless sensor nodes that can detect CH₄ in LEL range.
- Mesh networking of sensor nodes with 30 m node-node spacing indoors with obstructions; range 100 m outdoors.
- Each sensor node serves a webpage via Wi-Fi that contains the data from all of the sensor nodes.
- Any device with WiFi and a browser near one sensor node can see the data from all the nodes in the mesh.



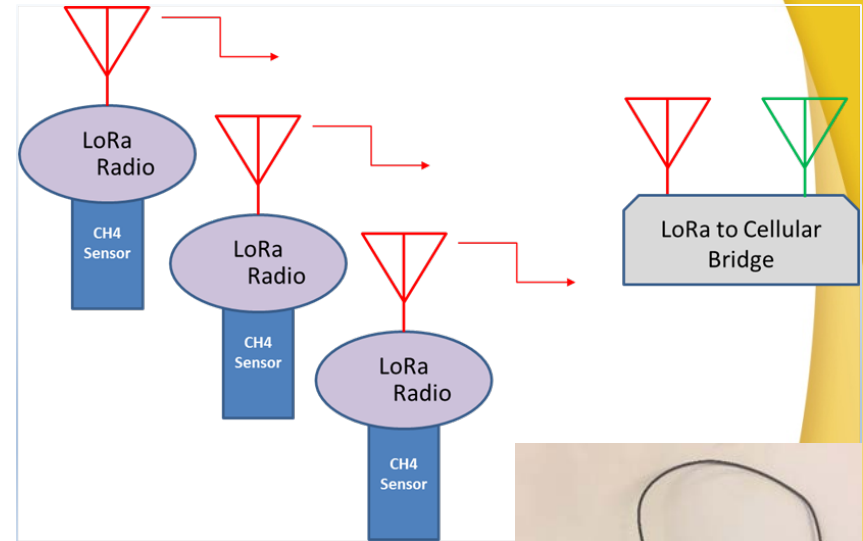
Methane Sensing for 1st Responders

- The display for the meshed methane sensors is a web app.
- It uses the TCP/IP standards ecosystem, not proprietary code.
- Wi-Fi and a modern browser are the only requirements on the viewing device.
- A native app for each device type is not needed.



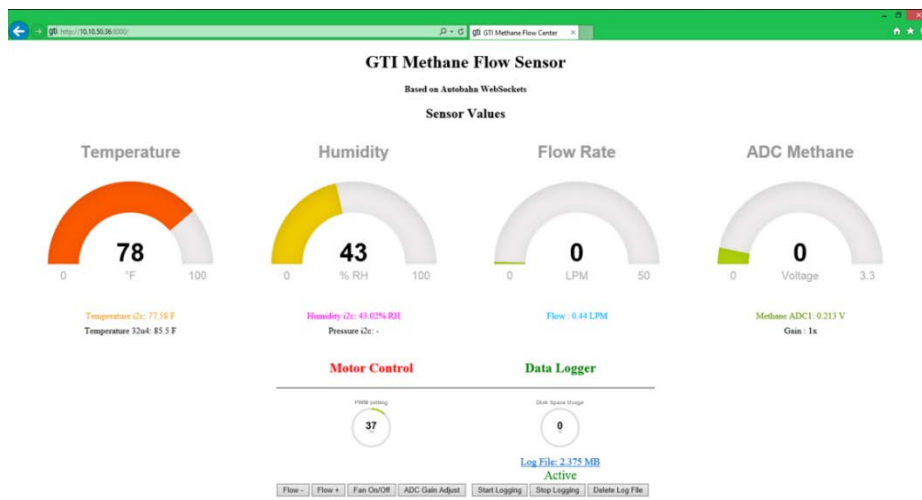
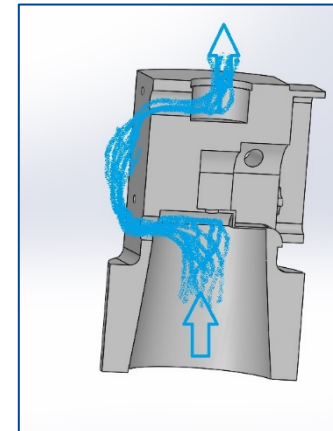
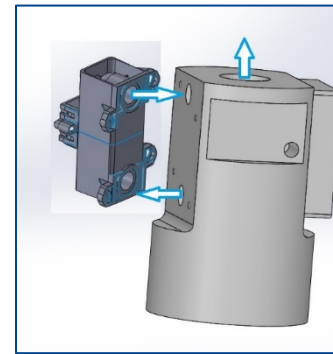
Unattended Methane Sensing

- An unattended methane monitor can free utility personnel from continuous monitor duty to do other tasks.
- The unattended monitor must run for several days and have a sensor that can fit in a barhole. A separate “bridge” sends the readings back to the utility.
- Prototype is currently in preparation.



Field Tool for Measuring Leaks

- Methane concentration does not tell the whole story.
- Utilities need a repeatable method to compare the leak rate and prioritize Class 2 & 3 leaks.
- Simultaneously measures CH₄ concentration, air flow, temperature, and humidity.

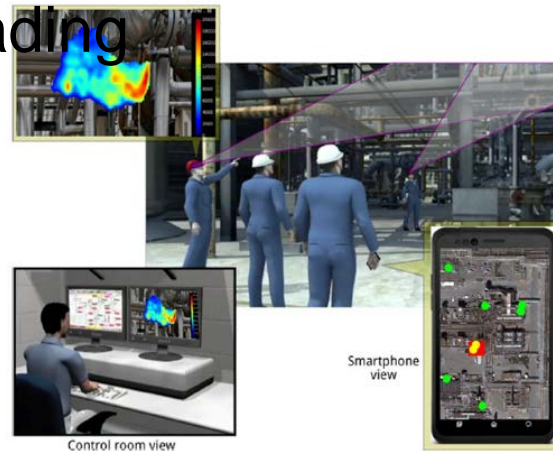


Cast Iron Winter Patrols - Early Detection of Leaks

- Demonstrate that the use of new technologies enhances the effectiveness of winter leak patrols in identifying cast iron main breaks due to freeze conditions.
- Studies have shown that new mobile leak detection technologies are potentially more effective in identifying certain categories of leaks than traditional survey methods.
- The reduction in cycle time to complete winter leak surveys and the expected increase in the effectiveness of surveys will directly enhance public safety and reduce leaks.

Evaluation of Quantitative Gas Imaging Cameras

- Few tools are on the market to quantify emissions
- Gas imaging cameras could reduce the time required to obtain a flow rate enabling utility companies to collect emission rate data from every leak if so desired.
- Leak flow rate information could then be utilized as a secondary factor (primary factor being safety) to develop leak repair prioritization plans.
- Other applications include use as a tool for first responders during leak investigation and grading



Residential Methane Detectors Program – Enhancing Safety for Customers

2014

- Phase 1 testing of commercially available residential methane detectors*
- Phase 2 testing of commercially available residential methane detectors (includes international products)

*testing was done in 2010

2015

- Consumer behavior study
- Address existing product's detection levels
- Begin effort to create a fit-for-purpose UL standard
- Establish plan for pilot program

2016 - 2017

- Execute pilot program
- Education/public awareness campaign
- Work with manufacturers to get products into market with lower detection levels



Biosensors for Gas Detection



An Innovative Way for Chemical Sensing



Multi-Gases with High Selectivity and Sensitivity

One sensor array for four main components: methane, ethane and two mercaptans



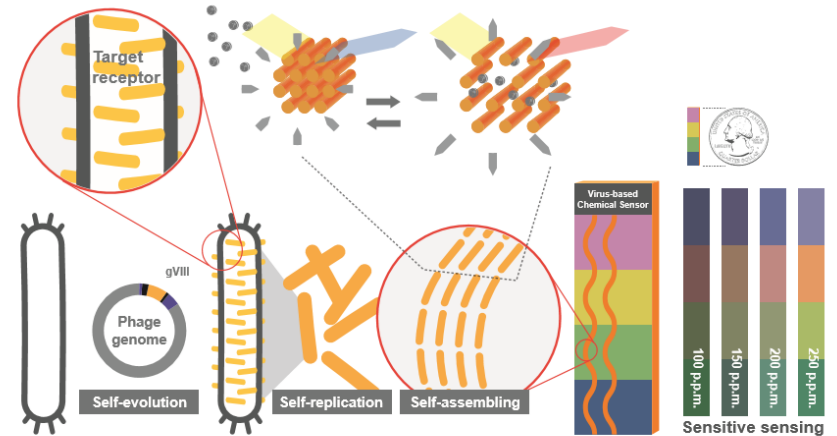
Go down to sub PPM levels



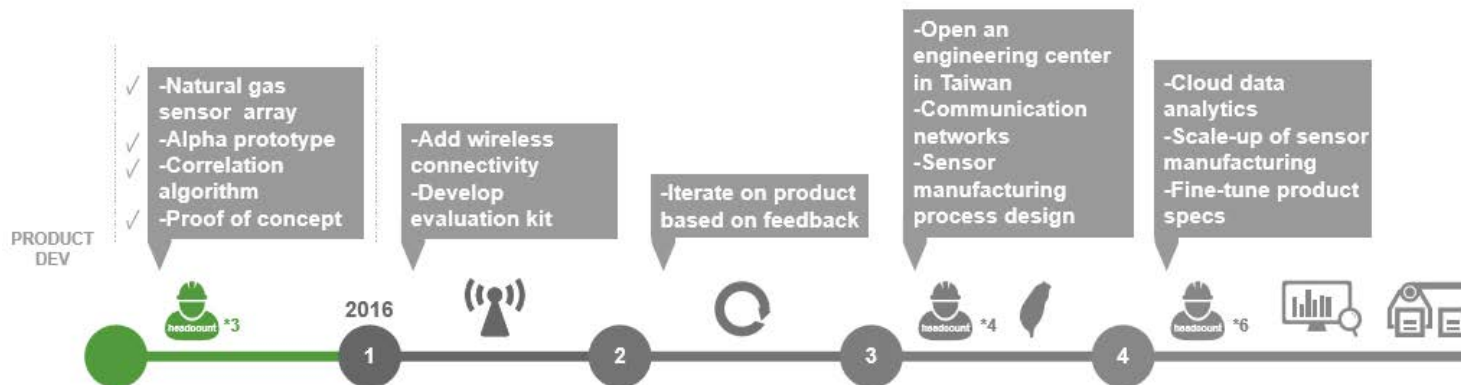
Low Cost and Easy Fabrication Process

Having huge advantages over current sensors that require complex synthetic methods

Virus-based Colorimetric Chemical Sensor



Genetic Engineering for Chemical & Pathogen Detection



Combined Systems for Leak Detection and Gas Shut-off

Detect. Connect. Protect

Triple+
Detect. Connect. Protect.

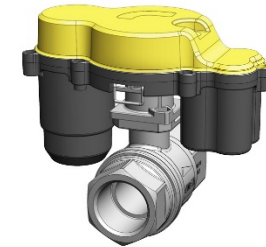
Detect

(Detector)
Upon detection and analysis of an event, it will beep and will connect to the shut off system



Protect

(real time action)
At the moment-of-occurrence the system will automatically shut off



Connect

(online information)
When an event occurs, a notification is sent to the owner and service company

- Owner can monitor and remotely control devices
- Owner can get system status any time

Prevent Blowdown of Gas to Atmosphere

- Investigate traditional planned blowdown procedures of venting natural gas
- Investigate alternative methods of blowdown processes
- Compare and contrast alternative methods with the traditional practice
- Examine the current best practices and equipment used for recapture processes
- Provide a cost analysis of implementation of alternative methods that includes environmental impacts of these methods

Research Gaps and Needs

- Cheap sensors for online monitoring of equipment leaks
- Monitoring and assessing leaks at storage facilities
- Rapid identification of hot spots/large leaks
- Demonstration and evaluation of evolving methane measurement technologies
- Better technologies to distinguish species of combustible gases such as saturated vs unsaturated hydrocarbon gases (ethylene vs ethane) to enable mobile leak survey devices to identify pipeline gas from other combustible gases in urban environments
- Incorporation of emissions risk in pipe segment replacement prioritization
- Low-power multi-gas sensor for smoke, CO and Combustible Gas

Questions

