



ARPA-E WORKSHOP: UBIQUITOUS METHANE LEAK DETECTION THROUGH NOVEL SENSORS AND SENSING PLATFORMS

March 29, 2012, 8:00AM – 3:30PM
 Offices of ARPA-E
 955 L’Enfant Plaza SW, North Building, Suite 8000
 Washington, DC 20024

The amount of methane leaking from the natural gas infrastructure such as wells and pipelines and other sources such as landfills is a controversial topic, both as a source of wasted revenue and significant greenhouse gas emissions. Less controversial is that these leaks should be found and stopped. This workshop will bring together thought leaders from distinct science, engineering, and commercial communities to collectively develop new ideas and identify key needs and potentially transformational technological approaches for rapidly finding leaks in the thousands of wells and tens of thousands of miles of pipelines that are ever increasing in the United States. The day’s events will include the opportunity for a wide ranging discussion among experts within the natural gas and emissions monitoring communities about what research activities could be transformative but are not currently being adequately pursued and funded. There will also be specific areas of interest:

- Is this a non-problem, as industry could simply instrument the existing infrastructure adequately at minimal cost, given the proper regulations and/or incentives? Or are new methods required?
- Quantum cascade lasers (QCLs) have achieved success in detecting methane in a variety of applications but typically where a small distance separates the laser, source and detector. Can the detection range of QCLs be significantly extended? What are the difficult technical challenges to making this happen? Do better alternatives exist?
- What are the tradeoffs between active remote measurement techniques such as LIDAR and passive methods such as thermal spectrometers? Will remote sensing be the key solution or is there a role for local sensing applications as well?
- If a reliable long distance methane detection technique existed, what type of deployment method would maximize its impact? Can such systems be mounted on unmanned aerial vehicles (UAVs) to intelligently probe for leaks? Should such a system be arranged in a backscatter method, where both emitter and detector are on the same unit, or would a separate detector mounted either on the ground or another UAV be preferable?
- Might it make more sense to equip a larger number of UAVs with local sensing techniques? How small can these UAVs be made, what should their communications and control backbone be, and how can they be powered so they can remain in the field for a long time, if not indefinitely? What is the optimal search algorithm when operating these UAVs?

Participants are invited to submit 1 powerpoint slide on any or all of the following topics prior to the workshop by emailing philippe.larochelle@hq.doe.gov. Slides can also be brought on a USB storage device on the workshop day. There is a limit of 1 slide per topic. Time permitting these can be shown during the breakout sessions, or if not will be considered by ARPA-E after the workshop.

Topic 1 (Morning Breakout)	Topic 2 (Afternoon Breakout)	Topic 3 (Afternoon Breakout)
What is known about methane leaks from natural gas and other sources? Can existing technologies solve this? If not, what targets must a new technology achieve to be impactful? Which are ARPA-E hard problems? Is a CH4 sensing prize warranted?	What are possible sensor technology advances for local or remote CH4 detection with the speed, accuracy and range needed? Which are ARPA-E hard problems?	What are the best strategies to use sensors and sensor platforms such as aircraft, ground vehicles and UAVs to achieve ubiquitous leak detection? Which are ARPA-E hard problems?



<u>Time</u>	<u>Title</u>	<u>Speaker/Breakout Lead</u>	<u>Location</u>
7:30-8:00AM	Breakfast and Registration	--	CNF-AR-1-8206A (VCS) – Outside
8:00-8:10AM	Welcome and Introduction to ARPA-E	Dane Boysen Program Director, ARPA-E	CNF-AR-1-8206A (VCS)
8:10-8:20AM	Meeting Goals and Agenda	Phil Larochelle ORISE Researcher, ARPA-E	CNF-AR-1-8206A (VCS)
8:20-8:50AM	EPA Natural Gas Star Program Emissions, Sensors and Tech Needs	Roger Fernandez Program Manager, EPA	CNF-AR-1-8206A (VCS)
8:50-9:00AM	Natural Gas Infrastructure Survey, CH4 Sensing Development Projects	Kiran Kothari Program Manager, GTI	CNF-AR-1-8206A (VCS)
9:00-9:20AM	The ITT Angel Project: Technology Development & Industry Experience	Dan Brake Team Lead, ITT Exelis	CNF-AR-1-8206A (VCS)
9:20-9:30AM	UAV Methane Measurements Using VCSEs, Fast Sampling QCLs	Mark Zondlo Professor, Princeton University	CNF-AR-1-8206A (VCS)
9:30-9:45AM	Break		
9:45-11:45AM	<u>Morning Breakout Sessions</u> Topics covered in both breakouts: What is known about methane leaks from natural gas and other sources? Do technologies exist to solve this? If not, what targets must a new technology achieve to be impactful? Which are ARPA-E hard problems? Is a CH4 sensing prize warranted?	Karma Sawyer Assistant Program Director, ARPA-E Robert Conrado Fellow, ARPA-E	CNF-AR-1-8206A (VCS) CNF-AR-1-8024 (Rock Star)
11:45-12:15PM	Lunch		Hallway
12:15-12:30PM	Pranalytica QCL Techniques Prospects for Laser Sensing CH4	C. Kumar Patel Chairman, Pranalytica; Prof. UCLA	Booz Allen Room
12:30-12:40PM	Distributed Spectroscopic Laser Trace-Gas Sensor Networks	Gerard Wysocki Professor, Princeton University	
12:40-12:50PM	Thermal Spectrometer Based Atmospheric Measurements	John Henderson Associate Program Leader, LLNL	CNF-AR-1-8206A (VCS)
12:50-1:00PM	Airborne Laser-based Sensors for Pipeline Leak Detection	Mickey Frisch Manager, Physical Sciences	CNF-AR-1-8206A (VCS)
1:00 – 1:15PM	Autonomous Flying Vehicles and Sensor Measurements	Vijay Kumar Professor, University of Pennsylvania	CNF-AR-1-8206A (VCS)
1:15-3:15PM	<u>Afternoon Breakout Sessions</u>		
	What are possible sensor technology advances for local or remote CH4 detection of with the speed, accuracy and range needed? Which are ARPA-E hard problems?	Karma Sawyer Assistant Program Director, ARPA-E	CNF-AR-1-8206A (VCS)
	What are the best strategies to use sensors and sensor platforms such as aircraft, ground vehicles and UAVs to achieve ubiquitous leak detection? Which are ARPA-E hard problems?	Robert Conrado Fellow, ARPA-E	CNF-AR-1-8024 (Rock Star)
3:20-3:30PM	Wrap up and closing remarks	Phil Larochelle ORISE Researcher, ARPA-E	CNF-AR-1-8206A (VCS)
3:30-5:00PM	No Host Bar		L'Enfant Plaza Hotel Bar