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Docket Number:	16-IEPR-02
Project Title:	Natural Gas
TN #:	211800
Document Title:	Investigating Methane Emissions from California's Natural Gas Systems
Description:	Yu Hou, Guido Franco of CEC for June 6th and 7th Methane Symposium
Filer:	Raquel Kravitz
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	6/13/2016 3:23:49 PM
Docketed Date:	6/13/2016



Investigating Methane Emissions from California's Natural Gas System

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California Energy Commission

Methane Emissions from California's Natural Gas System: Challenges and Solutions

June 6, 2016



Outline

- Historical context: Energy Commission's prior research on methane emissions from California's natural gas* system
- Overview of PIER (Public Interest Energy Research) Natural Gas research on methane emissions
- Upcoming project and next steps

*Natural gas is mostly methane (CH_4) with small quantities of ethane (C_2H_6) and other compounds



Historical Context

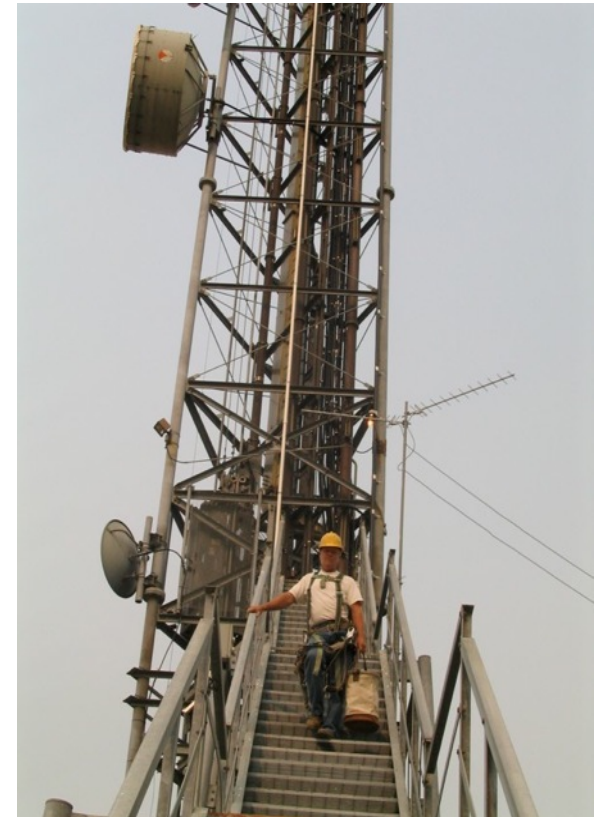




Ambient Methane Measurements

Courtesy of Dr. Marc Fischer, LBNL

- Institution: Lawrence Berkeley National Laboratory
- Instrumented two communication towers (Walnut Grove and Sutro) to measure methane concentration
- The Air Resource Board continued and expanded the measurements





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Published online 24 October 2007 | *Nature* **449**, 960 (2007) | doi:10.1038/449960b

News in Brief

Greenhouse-gas sensors tower over California

California has begun installing regional greenhouse-gas detection systems in metropolitan areas, becoming the first US state to gather such regional data.

Sensors have been placed on Sutro Tower in San Francisco and Richland Tower in the Sacramento suburbs as part of the California Greenhouse Gas Emissions Project, a collaboration between state and federal agencies and universities. They measure greenhouse-gas concentrations twice a day.



Sutro Tower in San Francisco hosts the first of California's regional greenhouse-gas detectors.

S. Ragan/AP

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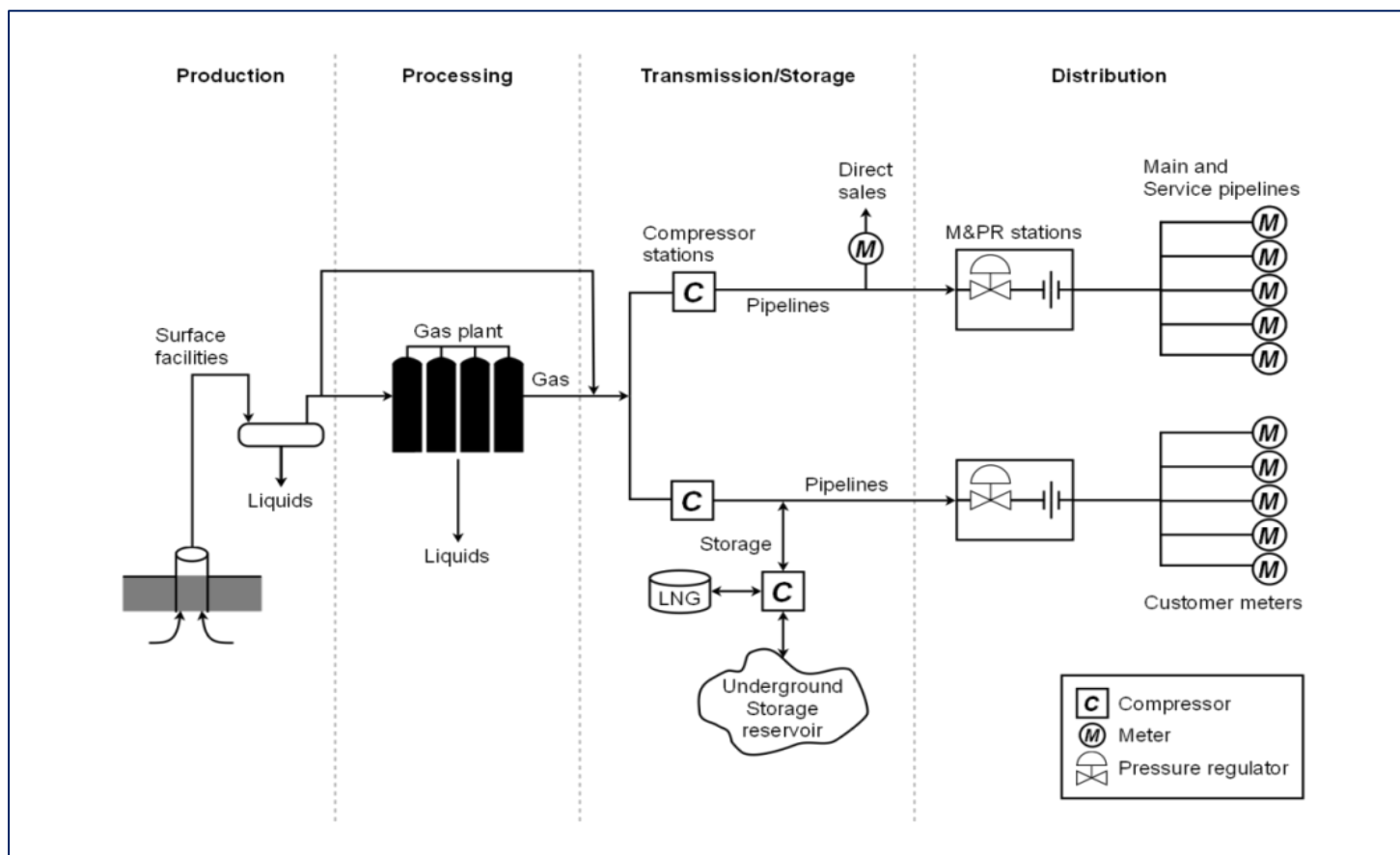
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“California....becoming the **first** US state to gather such regional data”
Nature. **October 2007**

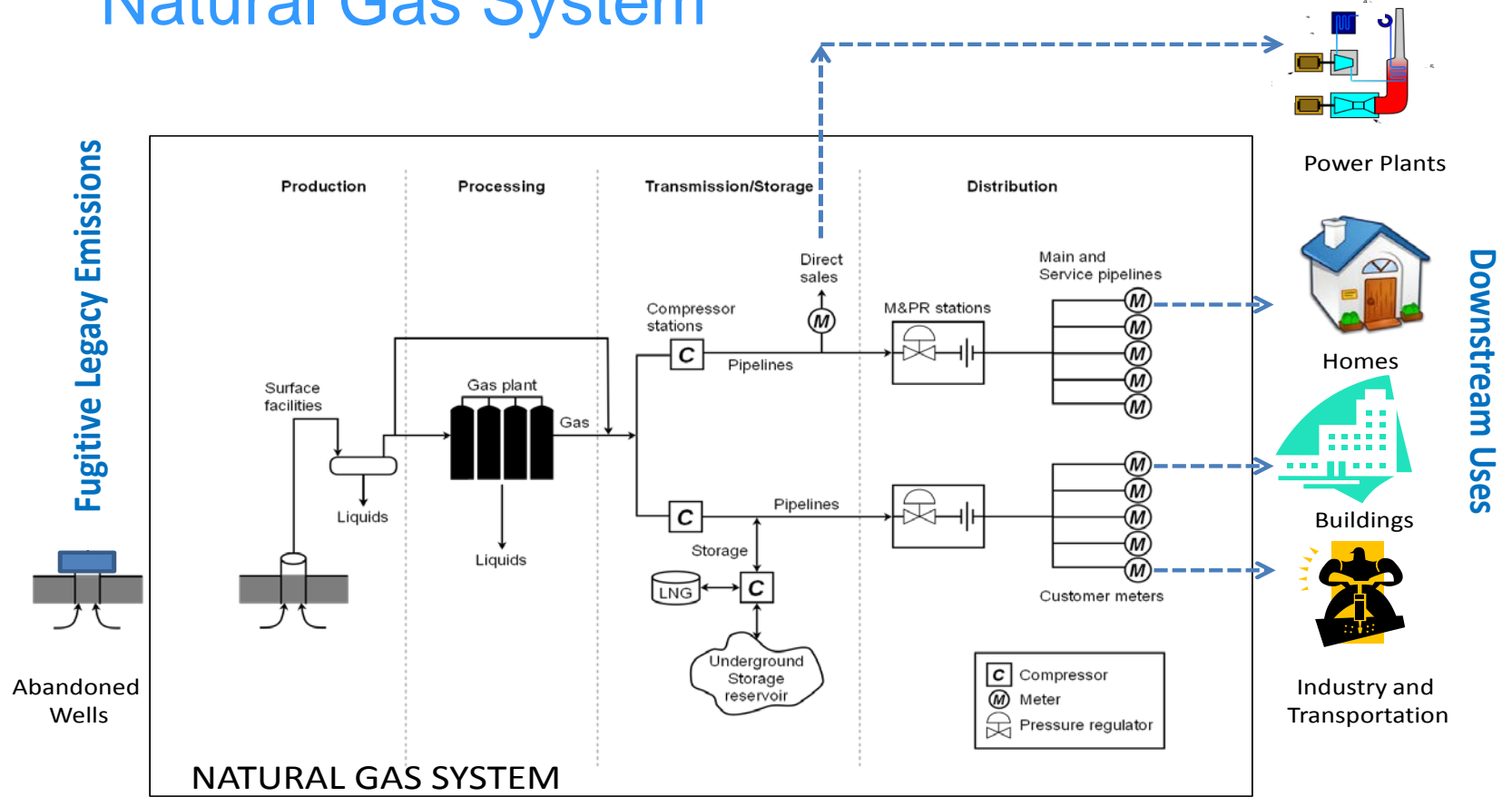


Classical Schematic Representation of the Natural Gas System





Revised Schematic Representation of the Natural Gas System



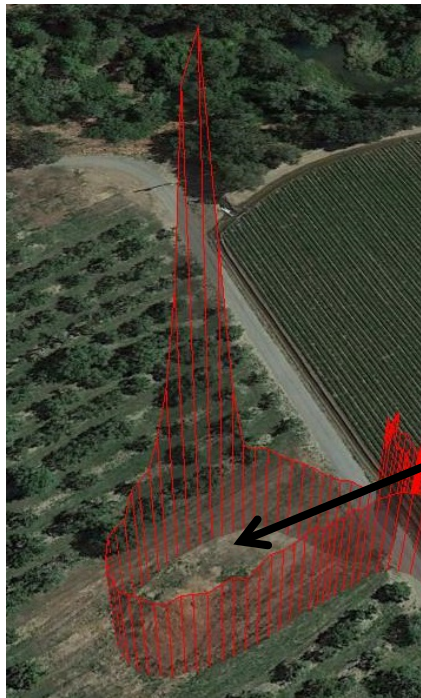


Overview of PIER Natural Gas Projects





Methane Emission Measurements in the Natural Gas System



Capped well



LBNL Mobile System



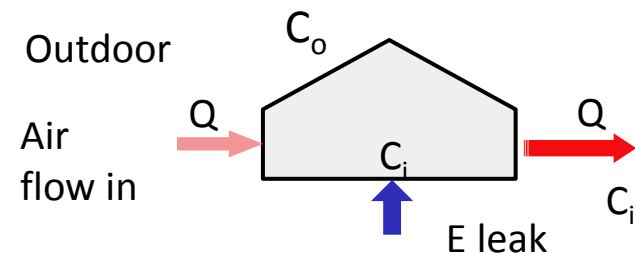
Courtesy of Dr. Marc Fischer, LBNL

Other sources tested: underground storage units, NG vehicle fueling stations, ~10 homes, Refineries (aircraft), NG fields (aircraft)

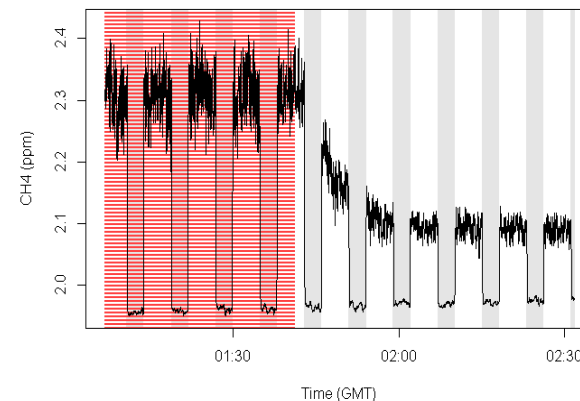


Emission from Homes (LBNL)

- Preliminary test indicate notable emissions from homes
- Measurements in ~75 additional homes
- Data also indicates methane from incomplete combustion of home appliances



Measured indoor (white) and outdoor (grey) methane during calibrated indoor leak (red)



Source: LBNL



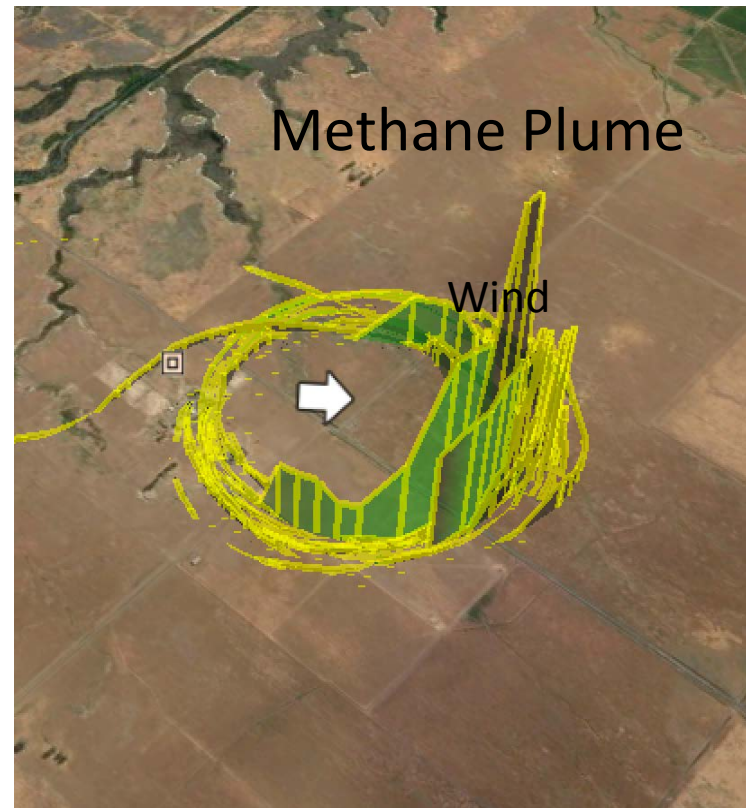
Emission from Buildings (GTI, ICF)

- Field measurements of buildings from multiple regions in California
- Gas Technology Institute plans to test approximately 40 restaurants and healthcare facilities
- ICF International plans to conduct tests in other building types (e.g., schools)
- Appliances will be also tested
- Expected completion: 2019



Emission from Natural Gas Pipeline and Storage Facilities

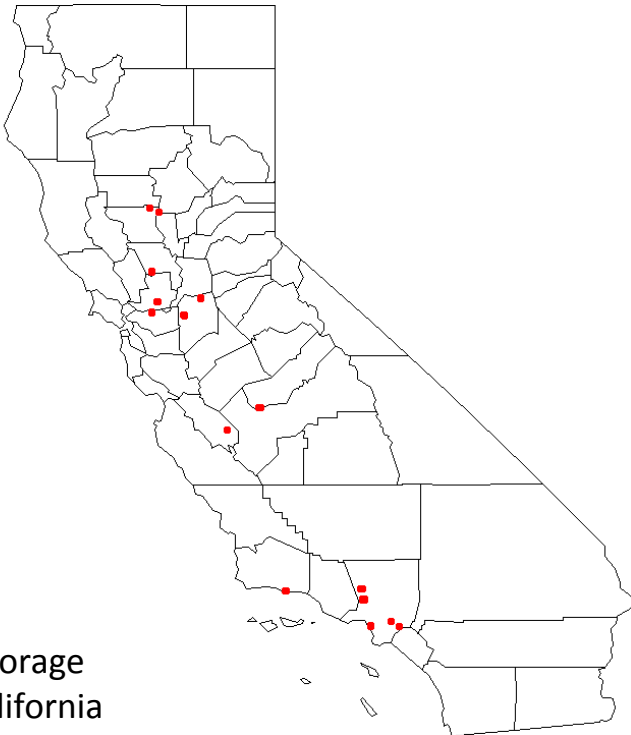
- Validated by controlled release
 - Methane release rate: $\sim 15 \text{ kg hr}^{-1}$
- Use of an ethane sensor to distinguish leaks of natural gas from other sources



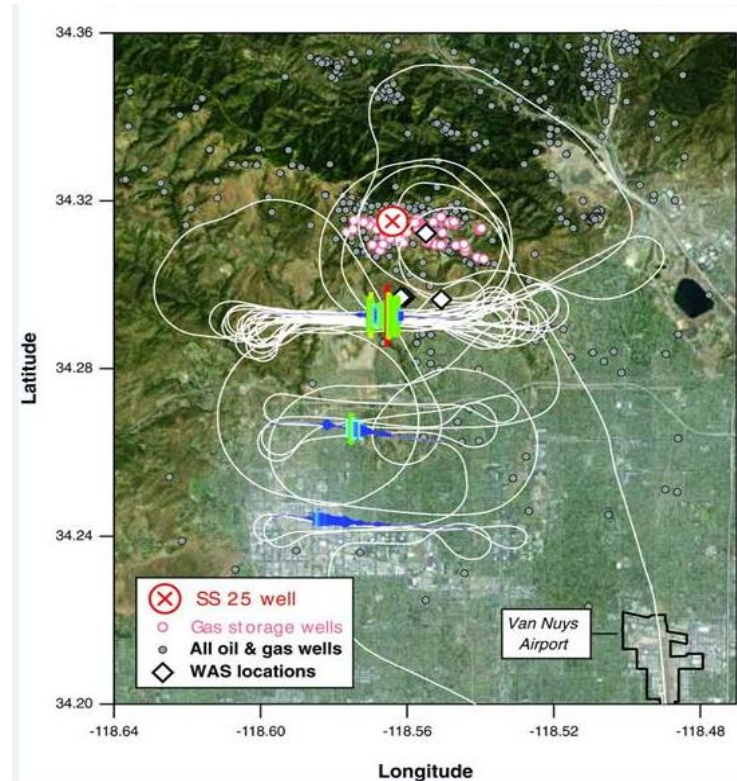
Courtesy of Dr. Steven Conley, UCD



Natural Gas Storage Facilities



Natural Gas Storage
Facilities in California





Publication in *Science*

GAS INFRASTRUCTURE

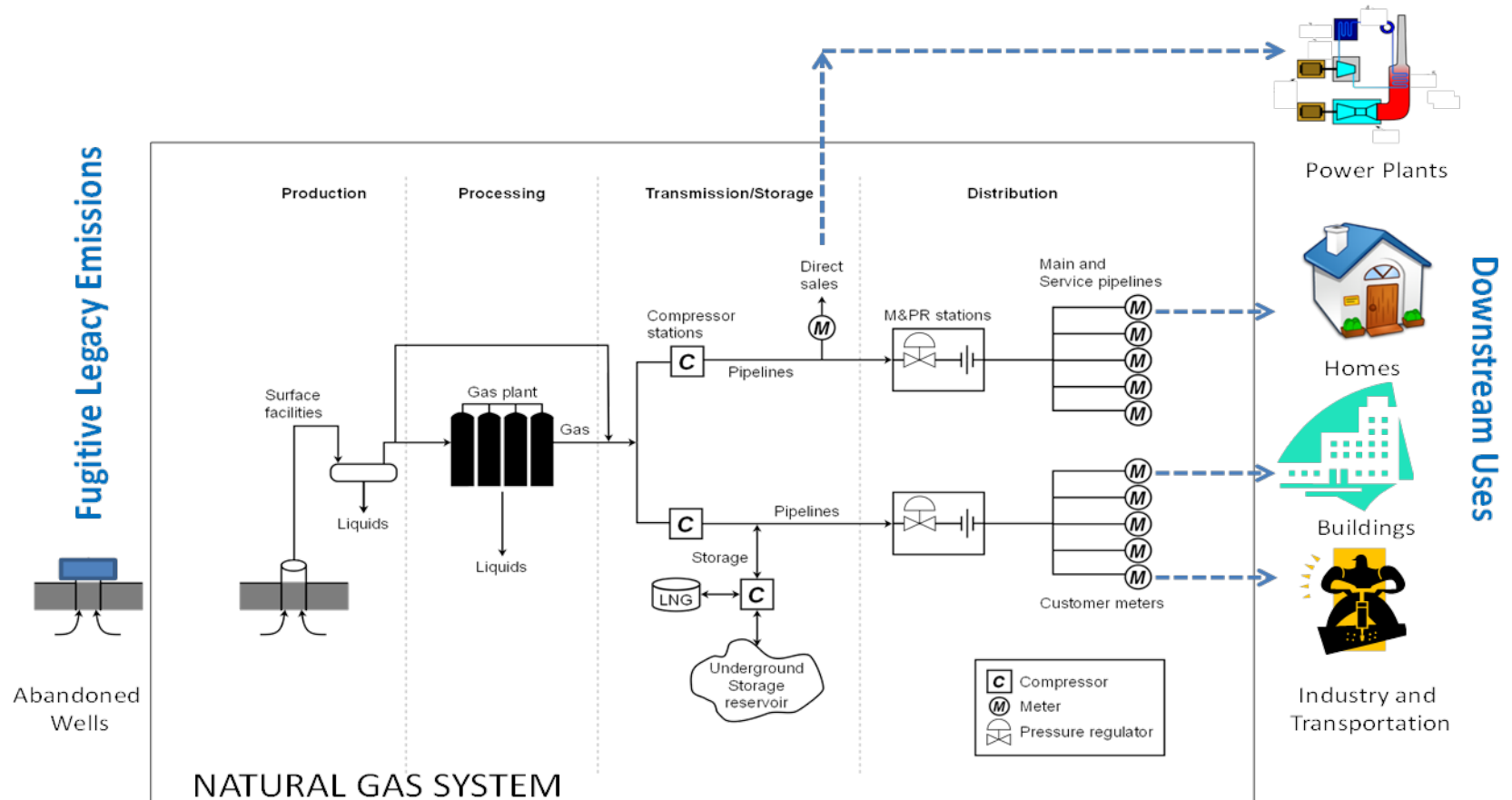
Methane emissions from the 2015 Aliso Canyon blowout in Los Angeles, CA

S. Conley,^{1,2*}† G. Franco,³ I. Faloona,² D. R. Blake,⁴ J. Peischl,^{5,6} T. B. Ryerson⁶†

Single-point failures of natural gas infrastructure can hamper methane emission control strategies designed to mitigate climate change. The 23 October 2015 blowout of a well connected to the Aliso Canyon underground storage facility in California resulted in a massive release of natural gas. Analysis of methane and ethane data from dozens of plume transects, collected during 13 research-aircraft flights between 7 November 2015 and 13 February 2016, shows atmospheric leak rates of up to 60 metric tons of methane and 4.5 metric tons of ethane per hour. At its peak, this blowout effectively doubled the methane emission rate of the entire Los Angeles basin and, in total, released 97,100 metric tons of methane to the atmosphere.

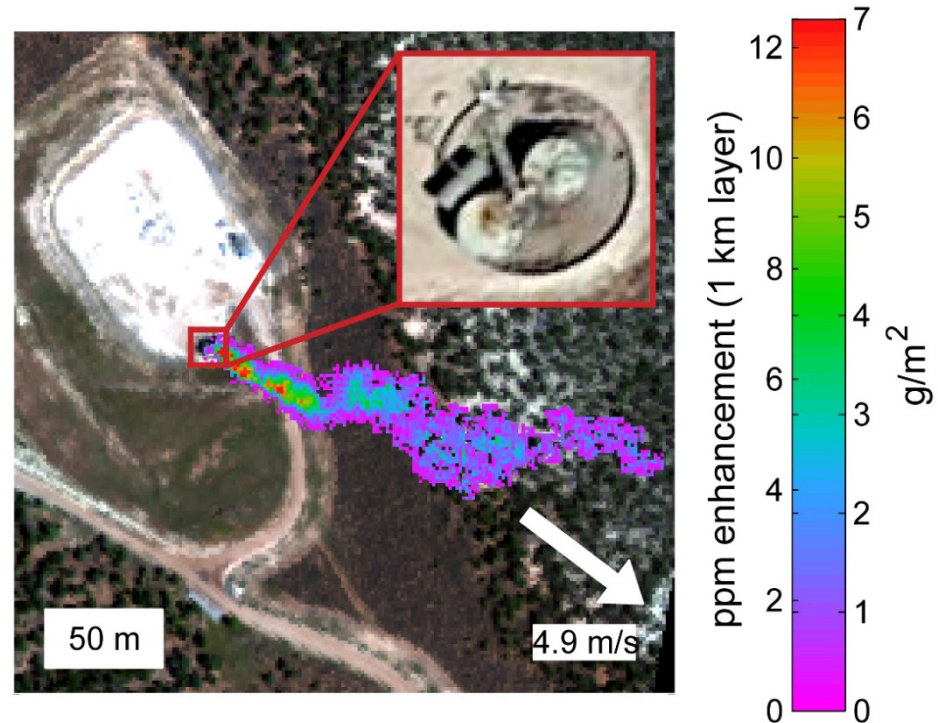


Upcoming Project and Next Steps



ARB-NASA-CEC Joint Effort

- NASA/JPL Methane Survey Project
- Collaborative effort between the ARB and the Energy Commission
- The Energy Commission project will focus on the natural gas system
- Coordinating with Division of Oil, Gas and Geothermal Resources (DOGGR)
- Project will identify large emitters



Source: Aubrey et al., NASA, 2015

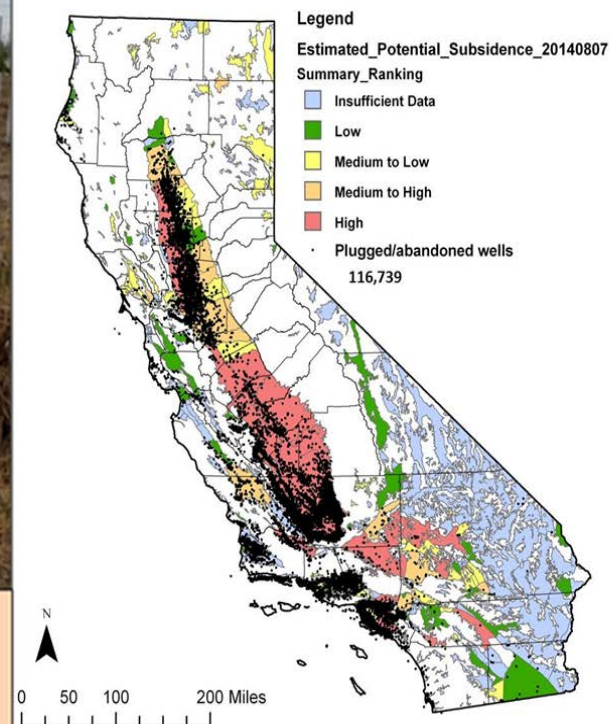


Natural Gas Research Plan

- After-the-meter emissions in Industrial and power sectors
- Groundwater related subsidence impacts on the natural gas system:
 - underground storage Facilities
 - pipelines
 - abandoned natural gas wells



2 year old well (drilled 2010). Land surface shows 2 feet of subsidence (well location shown on map). Photo courtesy Sarge Green, California Water Institute.



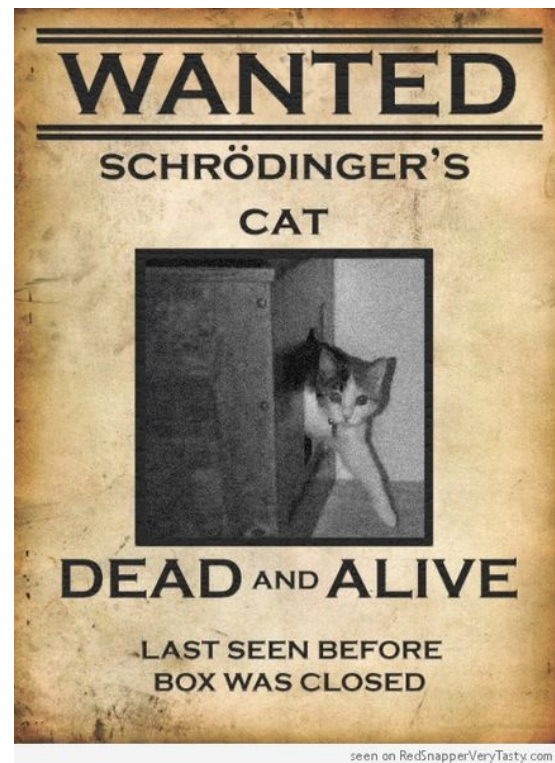


Summary

- The Energy Commission has been working on this topic for a long time
- Progress made in identification and characterization of the emission sources, measurement techniques. However, much work is still needed
- Working closely with ARB, DOGGR and other entities, the Energy Commission continue to support research in this topic area through the PIER Natural Gas program



Thank you!



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