New and Future Developments in Methane Policy and Technology

Presented to:
CMS Applications Policy Speaker Series
9/22/2015

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Methane Science

What have we done and learned?
EDF STUDIES BY SUPPLY CHAIN SEGMENT
(roughly 30 total papers)

1. NOAA Denver-Julesburg
2. NOAA Barnett
3. Coordinated Campaign
   - Barnett synthesis
4. UT Phase 1
5. UT Phase 2
   - Pneumatics
   - Liquid Unloadings
6. HARC/EPA
7. CSU Study
   - Methods
   - Measurements
   - National Scale-up
8. CSU Study
   - Measurements
   - National Scale-up
9. Methane Mapping
10. Boston Study
11. WSU Multi-City
12. Indianapolis Study
13. WVU Study
14. Pilot Projects
15. Gap Filling
16. Project Synthesis

Results public
Submitted, not yet public
Almost ready for submission
Not yet submitted
24 published studies so far


Barnett Coordinated Campaign Papers (July 2015)

13. Overview: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b02305
14. NOAA led Top-down study: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00217
17. Michigan airborne study: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00219
18. WVU compressor study: http://pubs.acs.org/doi/abs/10.1021/es506163m
19. Princeton near-field study: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00705
20. Purdue aircraft study: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00410
23. Picarro mobile flux study: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00099
24. Cincinnati tracer apportionment: http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00057
Barnett Shale
October 16 – 30, 2013

EDF COORDINATED CAMPAIGN

PRODUCTION
- NOAA/CU/Michigan
- Scientific Aviation/Penn State
- Purdue University

GATHERING/PROCESSING
- Picarro/Duke University

TRANSMISSION/STORAGE
- West Virginia University

LOCAL DISTRIBUTION
- Sander Geophysics
- Princeton/University of Texas - Dallas

TRUCKS AND STATIONS
- UC Irvine/University of Cincinnati
  (Air Samples)
- Aerodyne
- University of Houston
- Washington State University
A small fraction of sites and components contributes the majority of emissions
Where are we headed?

Methane Detection Technologies & Strategies
Today’s approach to leak detection
Cut cost, shift paradigm

Methane Leakage Detector
Methane Detectors Challenge – Innovation

Demand
Buy and Use

Market Maker
Convene and Catalyze

Supply
Innovate
- Colorado start-up
- Colorado academic
- Chinese coal mine safety co.
- Swedish sensor co.

Advise
SwRI
...and more...
### Desired specifications for detection tech

**Table 1: Specifications desired in each phase of the challenge**

<table>
<thead>
<tr>
<th>Specification</th>
<th>First Round Lab Test</th>
<th>Second Round Lab/Field Test</th>
<th>Industry Pilot Purchase/Deployment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detection limits</td>
<td>5 ppm*</td>
<td>5 ppm*</td>
<td>2 ppm*</td>
</tr>
<tr>
<td>Detection range</td>
<td>5 ppm - 250 ppm*</td>
<td>5 ppm - 250 ppm*</td>
<td>2 ppm - 2000 ppm*</td>
</tr>
<tr>
<td>Leak detection capability</td>
<td>Not specified</td>
<td>5 scf/m</td>
<td>2.5 scf/m</td>
</tr>
<tr>
<td>Calibration frequency</td>
<td>1-2 times or less per test phase</td>
<td>1-2 times or less per test phase</td>
<td>Once per year or less</td>
</tr>
<tr>
<td>Remote calibration</td>
<td>Optional</td>
<td>Optional</td>
<td>Preferred</td>
</tr>
<tr>
<td>Ability to measure methane</td>
<td>Required</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Ability to measure other hydrocarbons</td>
<td>Optional</td>
<td>Optional</td>
<td>Optional</td>
</tr>
<tr>
<td>Methane specific detection</td>
<td>Optional</td>
<td>Optional</td>
<td>Preferred</td>
</tr>
<tr>
<td>Ability to isolate on-site methane gas from off-site sources</td>
<td>Optional</td>
<td>Required</td>
<td>Required</td>
</tr>
<tr>
<td>Power requirements</td>
<td>110v, 20 amp or single size solar panel and rechargeable battery</td>
<td>Single, standard size solar panel and rechargeable battery</td>
<td>Single, standard size solar panel and rechargeable battery</td>
</tr>
<tr>
<td>Power consumption</td>
<td>As low as possible</td>
<td>As low as possible</td>
<td>As low as possible</td>
</tr>
<tr>
<td>Cost of hardware</td>
<td>Not specified</td>
<td>Not specified</td>
<td>$5000/$1000 per unit**</td>
</tr>
</tbody>
</table>

SOURCE: Methane Detectors Challenge, Request for Proposal, 2014 (table excerpted in part)
Preliminary results

Figure 4.1. Sensor Measurements for Tests 1 and 2 of the Ambient Test.
Bringing innovation to life
U.S. methane policy

What is coming?
National Action to Reduce Methane is Underway

**White House**
Set goal to reduce methane by 40-45%

**BLM**
Will reduce methane waste on public lands

**EPA**
Will set rules for new/modified sources
International

How do we take on the challenge?
## Top global methane emitters

**Table 2: Top 30 emitting countries in 2012**

Excluding major oil and gas producers for which no data is available

<table>
<thead>
<tr>
<th>Country</th>
<th>MT CO2e</th>
<th>100-year GWP</th>
<th>20-year GWP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% global</td>
<td>% country</td>
</tr>
<tr>
<td></td>
<td></td>
<td>o&amp;g CH4</td>
<td>total GHG</td>
</tr>
<tr>
<td>Russia</td>
<td>387</td>
<td>23%</td>
<td>21%</td>
</tr>
<tr>
<td>US</td>
<td>192</td>
<td>11%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Uzbekistan</td>
<td>97</td>
<td>5.8%</td>
<td>42%</td>
</tr>
<tr>
<td>Canada</td>
<td>54</td>
<td>3.2%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Mexico</td>
<td>43</td>
<td>2.6%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>43</td>
<td>2.6%</td>
<td>53%</td>
</tr>
<tr>
<td>EU</td>
<td>43</td>
<td>2.5%</td>
<td>1.0%</td>
</tr>
<tr>
<td>Iran</td>
<td>43</td>
<td>2.5%</td>
<td>7.2%</td>
</tr>
<tr>
<td>Venezuela</td>
<td>38</td>
<td>2.3%</td>
<td>16%</td>
</tr>
<tr>
<td>Turkmenistan</td>
<td>37</td>
<td>2.2%</td>
<td>33%</td>
</tr>
<tr>
<td>Algeria</td>
<td>30</td>
<td>1.8%</td>
<td>19%</td>
</tr>
<tr>
<td>UAE</td>
<td>29</td>
<td>1.7%</td>
<td>10%</td>
</tr>
<tr>
<td>Ukraine</td>
<td>29</td>
<td>1.7%</td>
<td>7.4%</td>
</tr>
<tr>
<td>Nigeria</td>
<td>27</td>
<td>1.6%</td>
<td>8.1%</td>
</tr>
<tr>
<td>India</td>
<td>25</td>
<td>1.5%</td>
<td>1.1%</td>
</tr>
</tbody>
</table>

SOURCE: “Untapped Potential: Reducing Global Methane Emissions from Oil and Natural Gas Systems” (table excerpted in part)
Questions