



# Managing Methane Emissions

**From Airplanes to  
UAVs to Ground  
Systems**

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## Manned Aircraft



- Capable of measuring emissions from entire basins
- Perform “quick” surveys to identify super-emitters
- Measurements in areas where ground access is difficult.

## Unmanned Aircraft



- Most accurate individual site quantification.
- Survey sites in much less time than OGI camera.
- Measure emissions of individual equipment on site

## Continuous Monitoring



- Most cost-effective tool for rapid identification of super-emitters.
- Provide “rough” localization of emission source.
- Watching for leaks 24 hours x 7 days per week

# Project & Airplane Locations





# Aliso Canyon, December 17, 2015 Los Angeles, California

\*Photo courtesy of  
Environmental Defense Fund

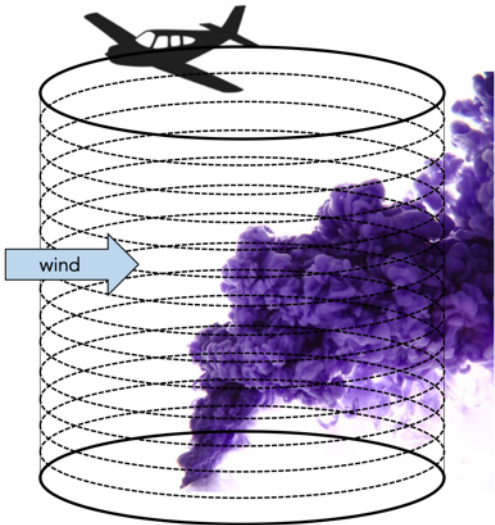


How much methane is that?

Our approach to airborne LDAR is focused on **detection** and **quantification** using *in situ* chemical gas analysis

## Quantifying emissions sources from the air:

Theoretical flight pattern:



Calculating the emissions rate requires:

- 1) Chemical measurement
- 2) Accurate on-board wind speed and direction

How to measure winds from airborne platforms:

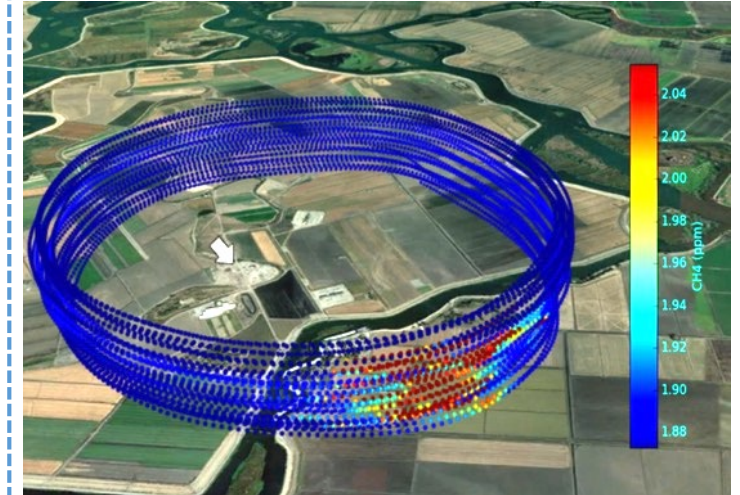
*(Conley et al., 2014)*

How to calculate emission from surface sources:

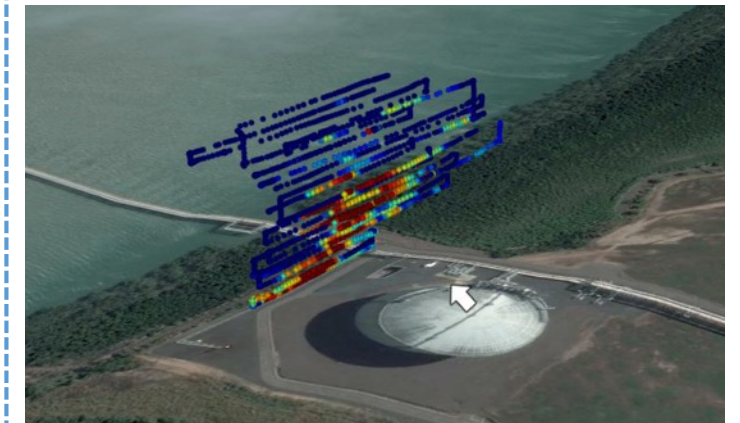
*(Conley et al., 2017)*

**We wrote the book on emission measurements!**

Actual flight example:



Drone flight example:





# Understanding the detection problem

## Every visit to the site costs \$\$\$

- Last week, while flying for EDF, our aircraft discovered a 12 Ton per hour leak!
- Did it start 5 minutes before we arrived or five months?
- Whether using aircraft, OGI or UAVs, each measurement is costly. EPA estimates \$600 per OGI inspection.
- Costs are primarily driven by the time it takes to get to the site.



**How do we increase inspection frequency without cost?**



# Continuous Monitoring Eliminates Surprises

## Meet SOOFIE – the \$1500 continuous monitor that actually works!

### SOOFIE Features

- Always watching, ever vigilant, SOOFIE makes sure you know about your leaks before anyone else does.
- Alarms based on calculated leak rate, rather than methane concentration.
- Sophisticated algorithms automatically identify anomalies and send alerts to designated recipients.
- Triangulation allows for identification of source location
- \$30 per month monitoring fee.

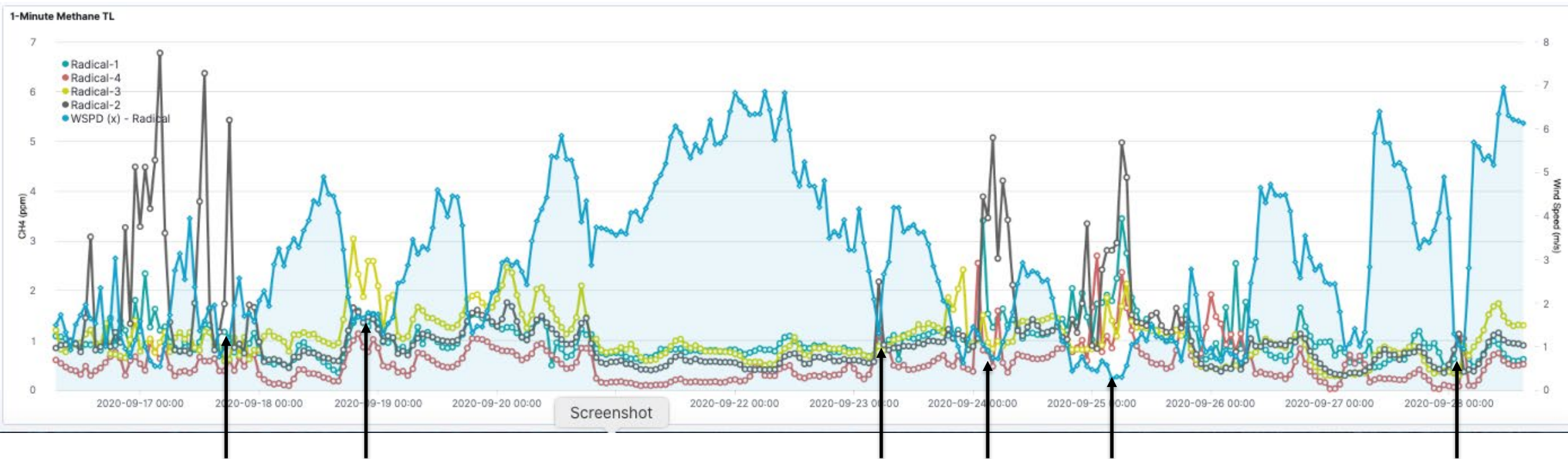




# Leak Rate vs. Methane Concentration

Notice what happens to methane when the wind dies?

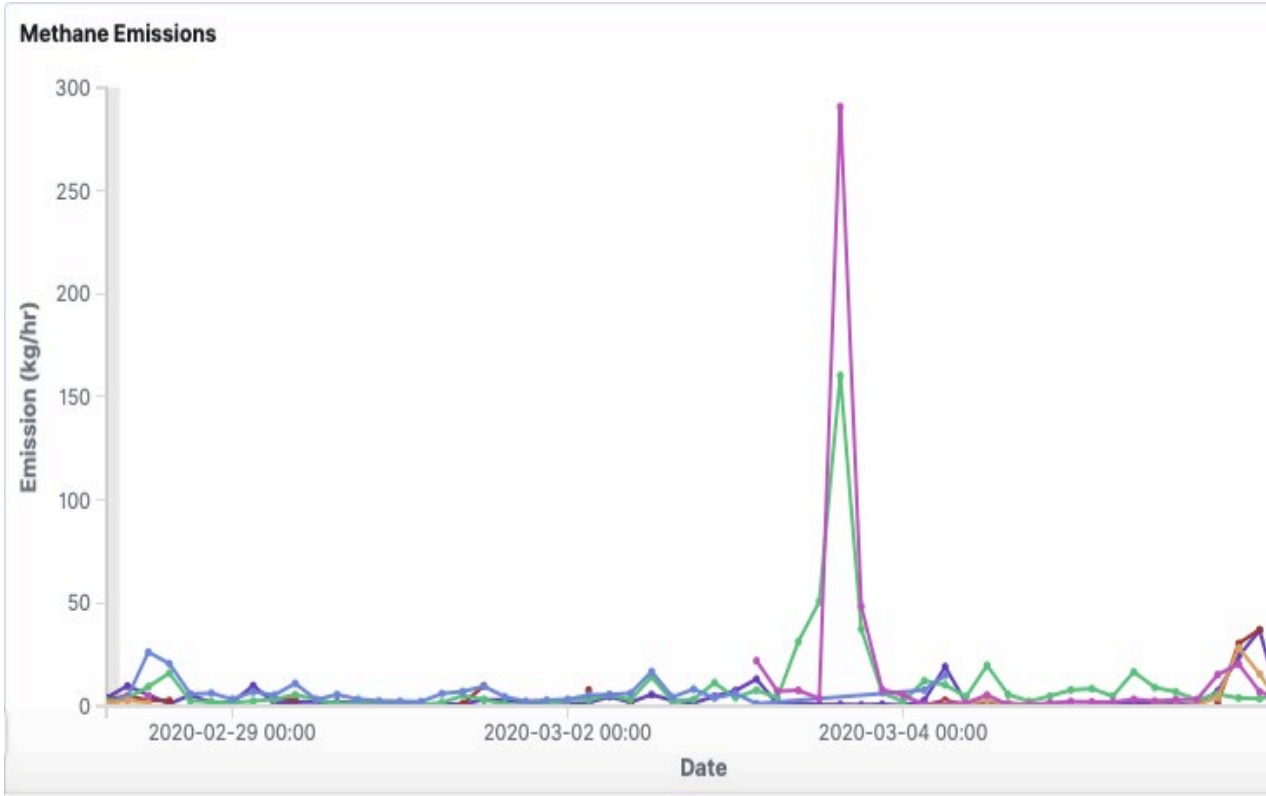
Basing alerts on methane concentration can result in false alerts every time the wind stops!





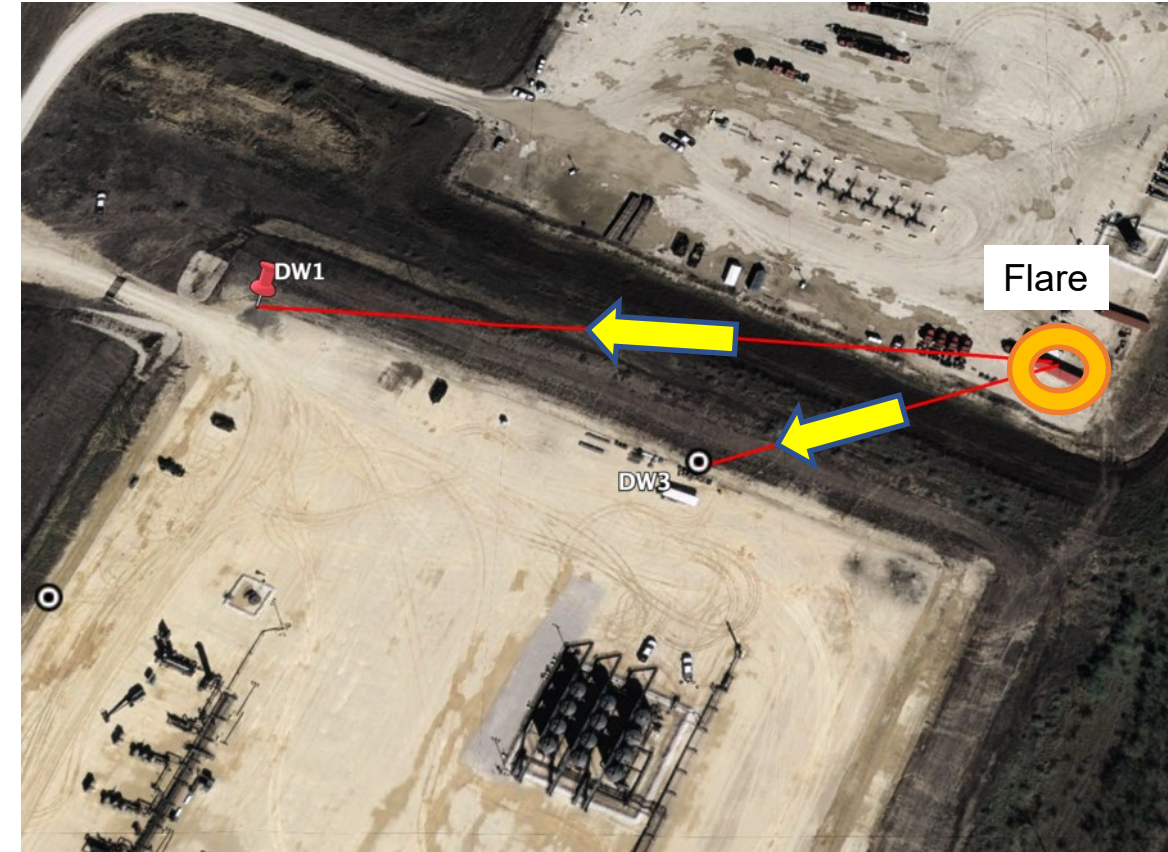


# SOOFIE's First Confirmed Save...



March 5, 2020 – Somewhere in Texas

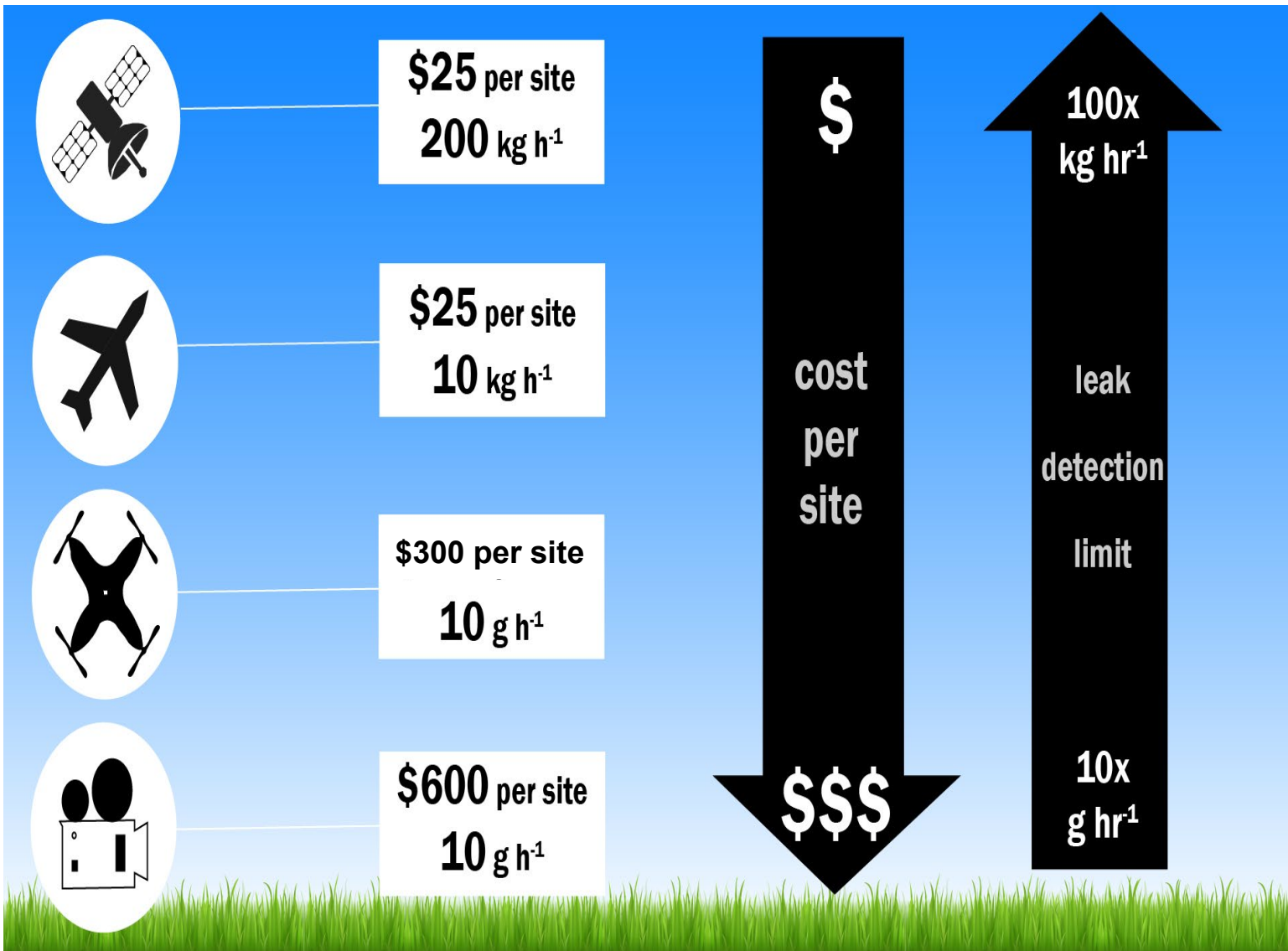
6:15PM - SOOFIE-1 detects large emission rate (E winds)  
9:00PM - SOOFIE-3 detects large emission rate (NE winds)



Probable Source: Flare on **adjacent** well pad  
Result: Assist gas set too high. Repaired

# Finding the silver bullet

(spoiler alert – there isn't one!)



- 1-Minute Data
- 15-Minute Leak Rates
- Customizable Alerts

**\$30/Month**  
**1 kg/hr**