Leak quantification using mobile-mounted sensors

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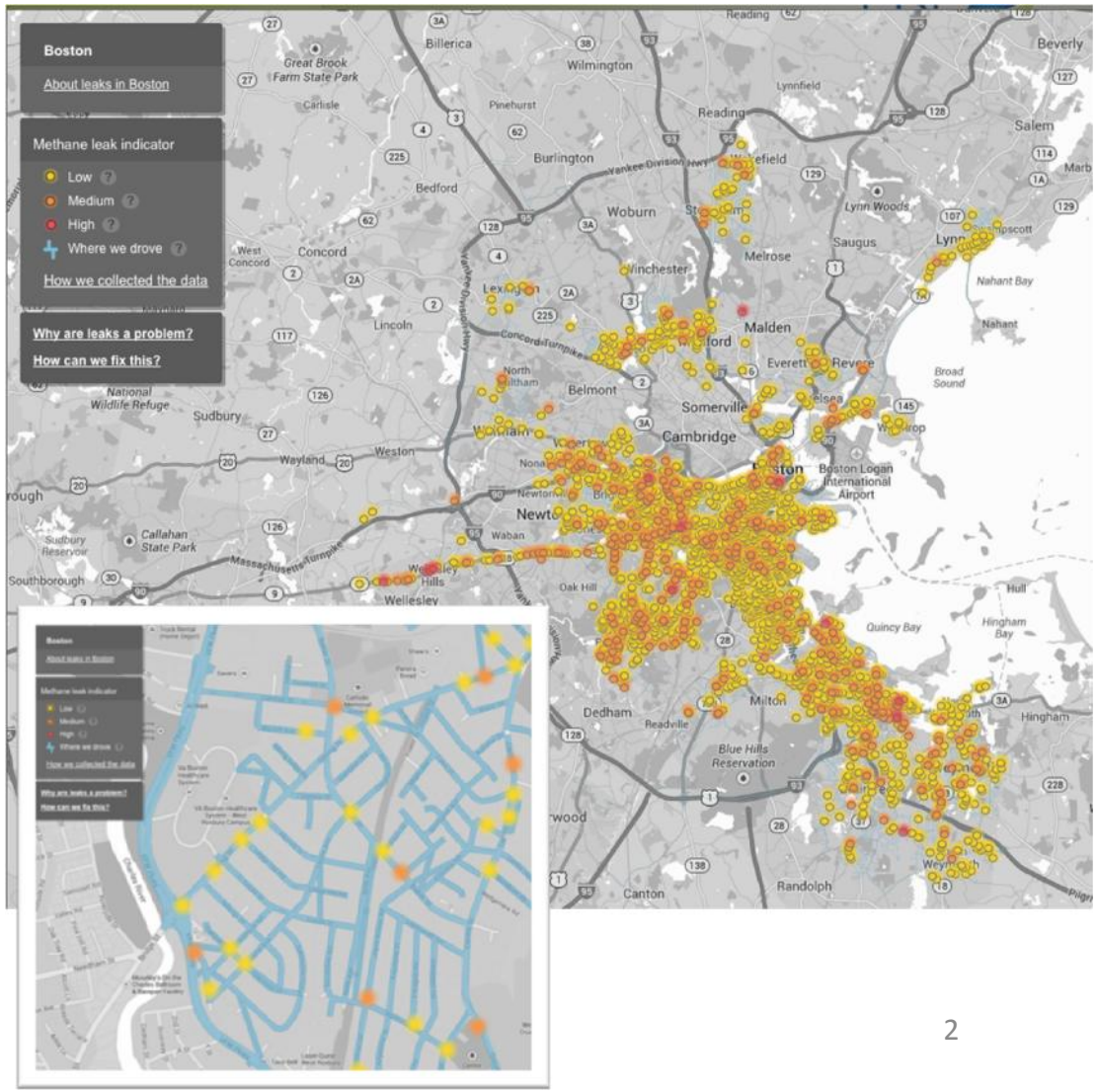
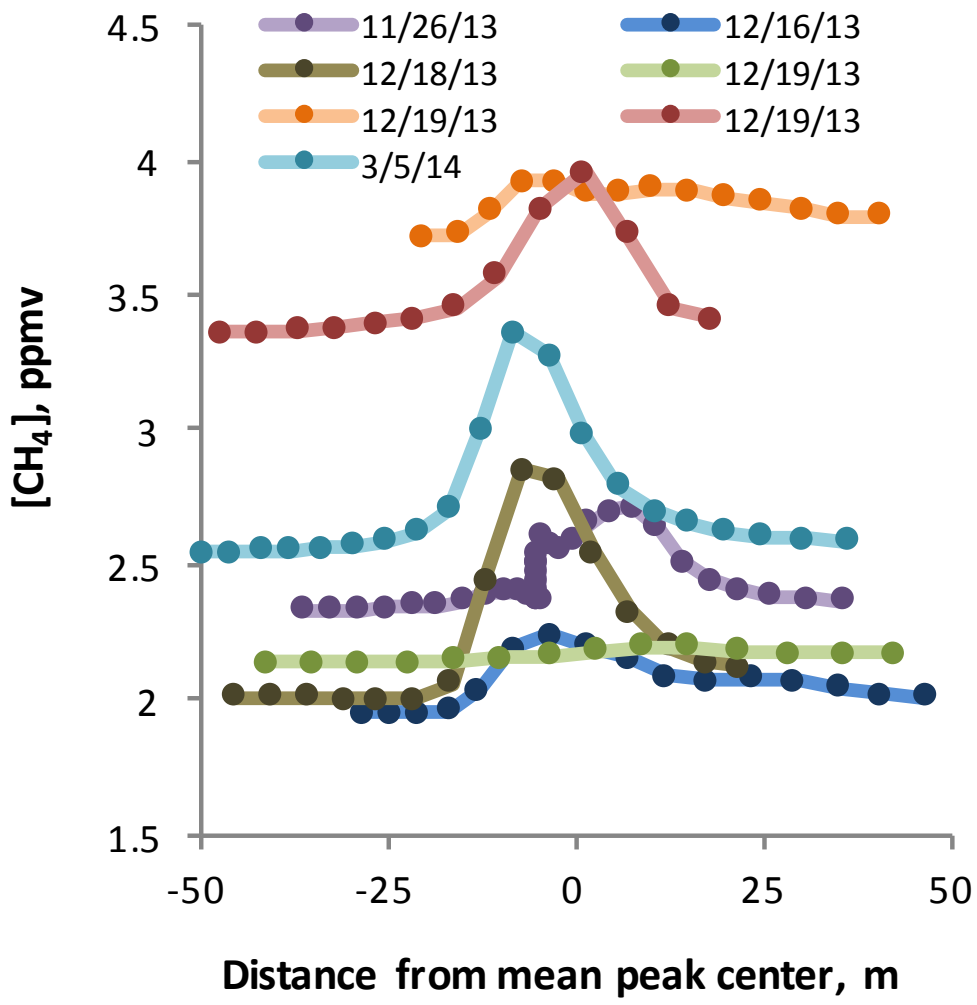
CSU leads science in Google-EDF Methane Mapping project



National scale project in diverse cities

- Google-EDF leak quantification project has released maps from 7 U.S. cities
  - Boston, Staten Island, Syracuse, Burlington VT, Indianapolis, Chicago, Los Angeles.
- Work in 5 other cities/regions ongoing

What we see on the street



Laser-based analyzers more sensitive than hand-held

Part per million sensitivity

Part per <u>billion</u> sensitivity

Controlled release experiments

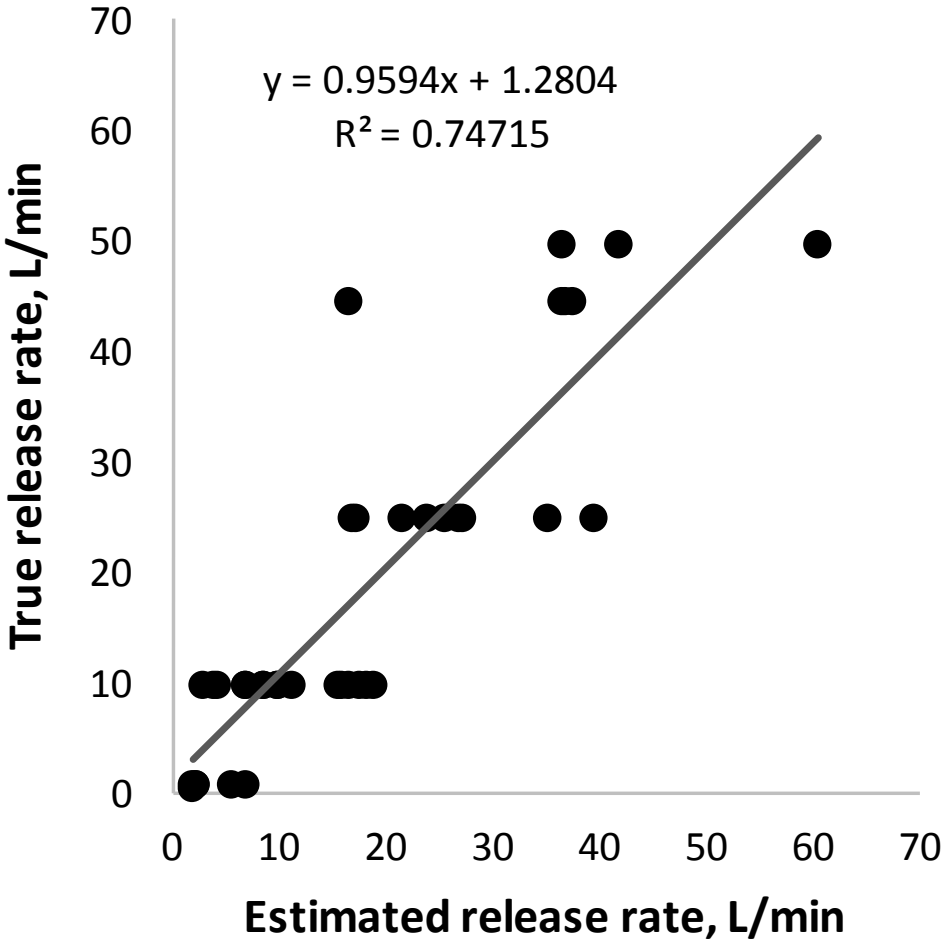
Driving strategy & automated data analysis system

- Human action
  - Drive each street 2+ times
- Computer-automated tasks
  - Transfer data from car to cloud
  - Filter out low-quality data
  - Find locations of repeatedly-elevated readings
  - Exclude leaks of likely non-NG origin
  - Estimate leak rate for each observation
  - Generate map of leak location and average size
- Human action
  - Review results
  - Communicate with stakeholders

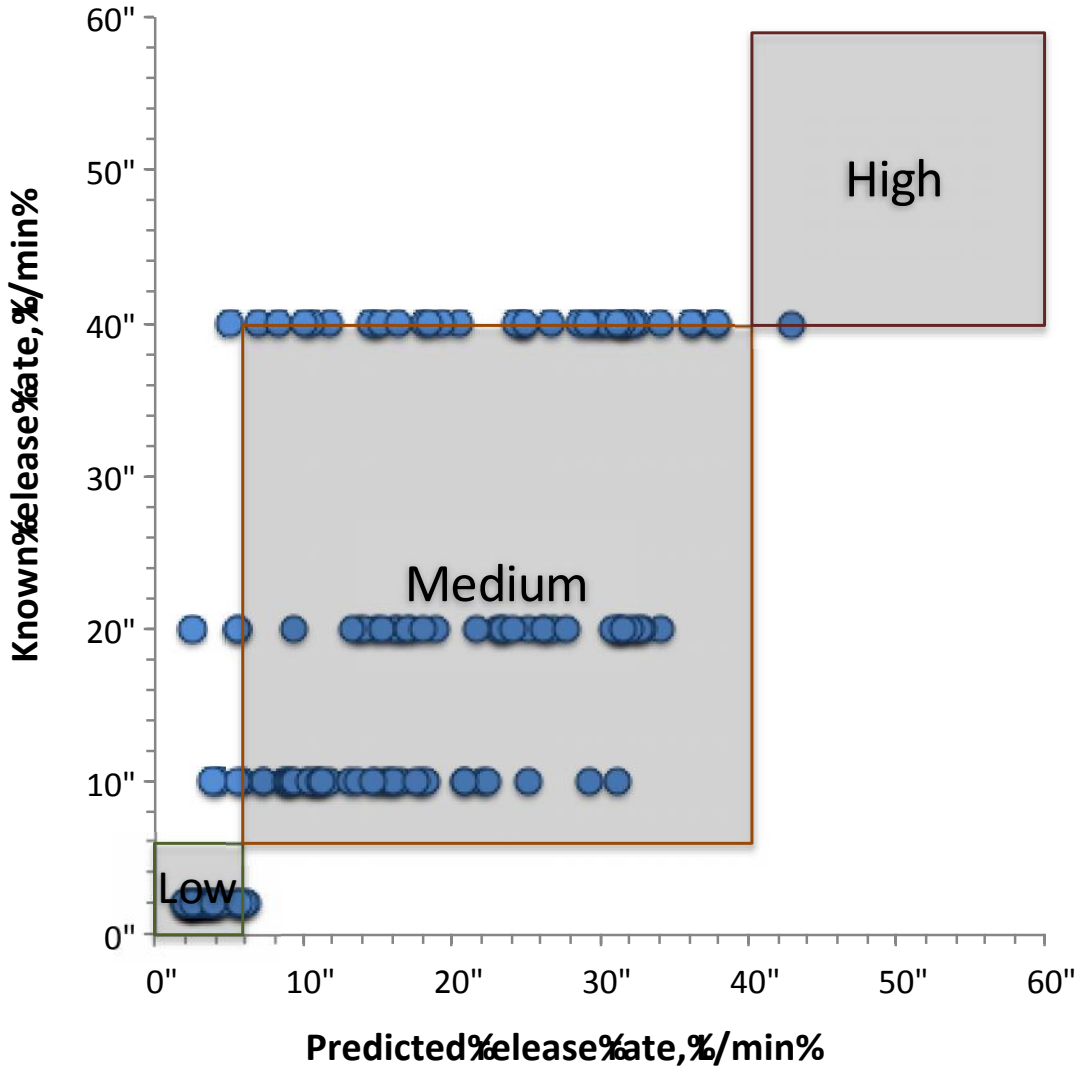
Quality of leak quantification technology

- Leak rate estimation is accurate and unbiased
- Binning approach maximizes precision of quantifying individual leaks
- Relevance of size estimate for leak repair prioritization
- Cumulative emission curve
- Accuracy in estimating overall system leak rates

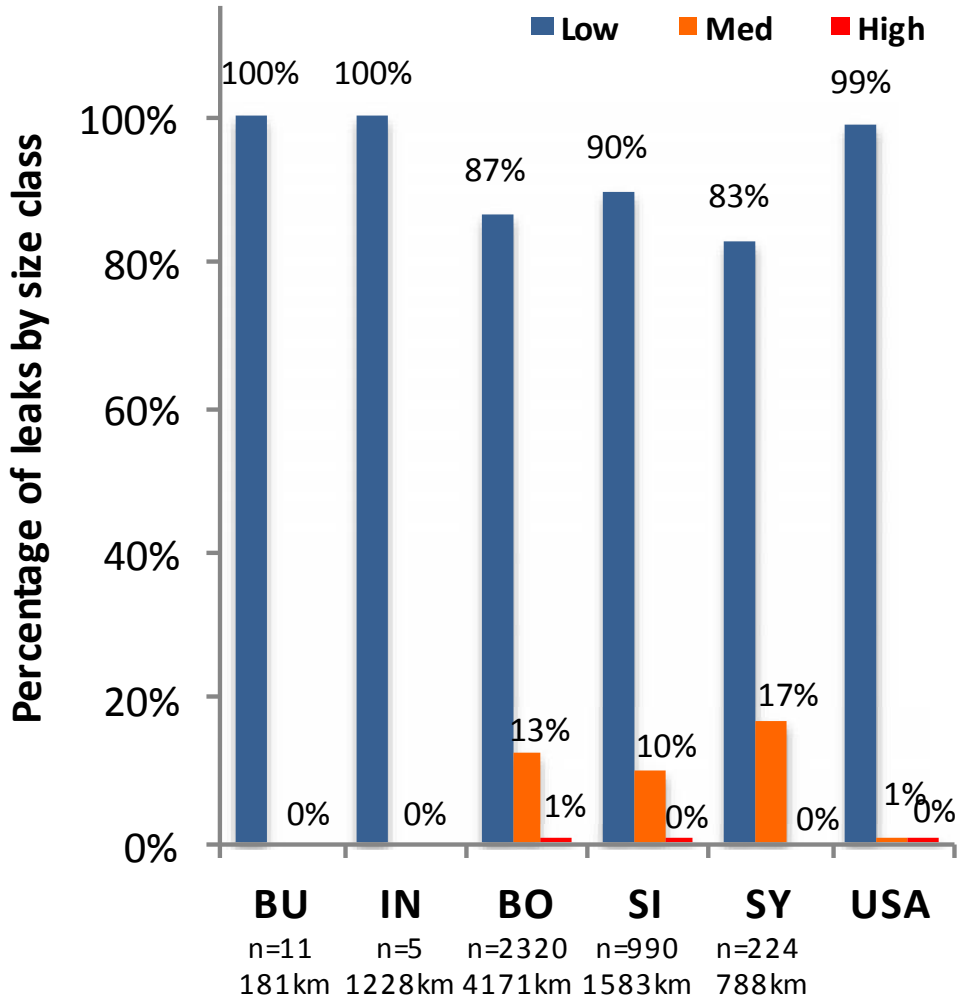
Leak rate estimates are accurate and unbiased



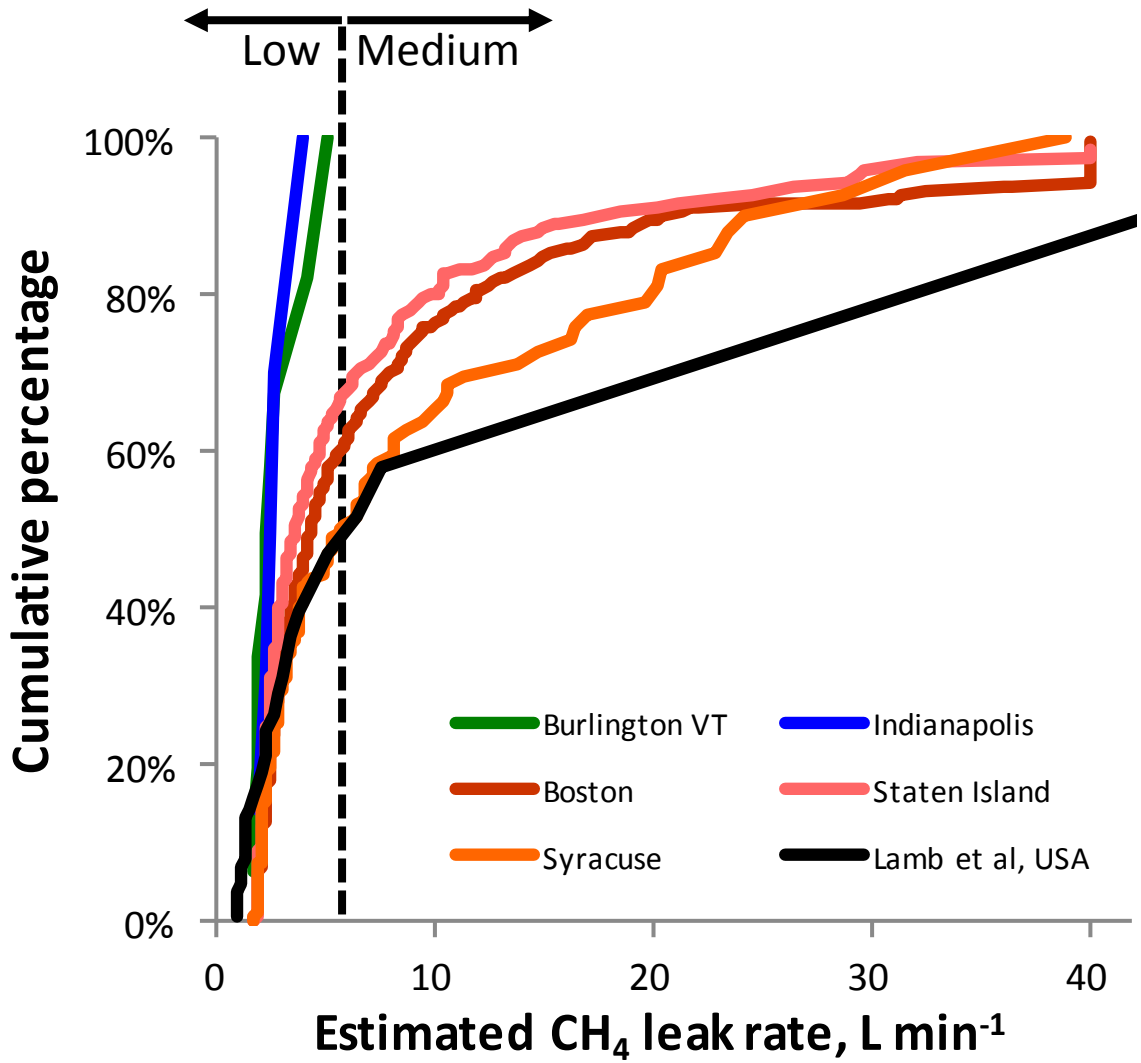
Binning approach leads to 85% precision



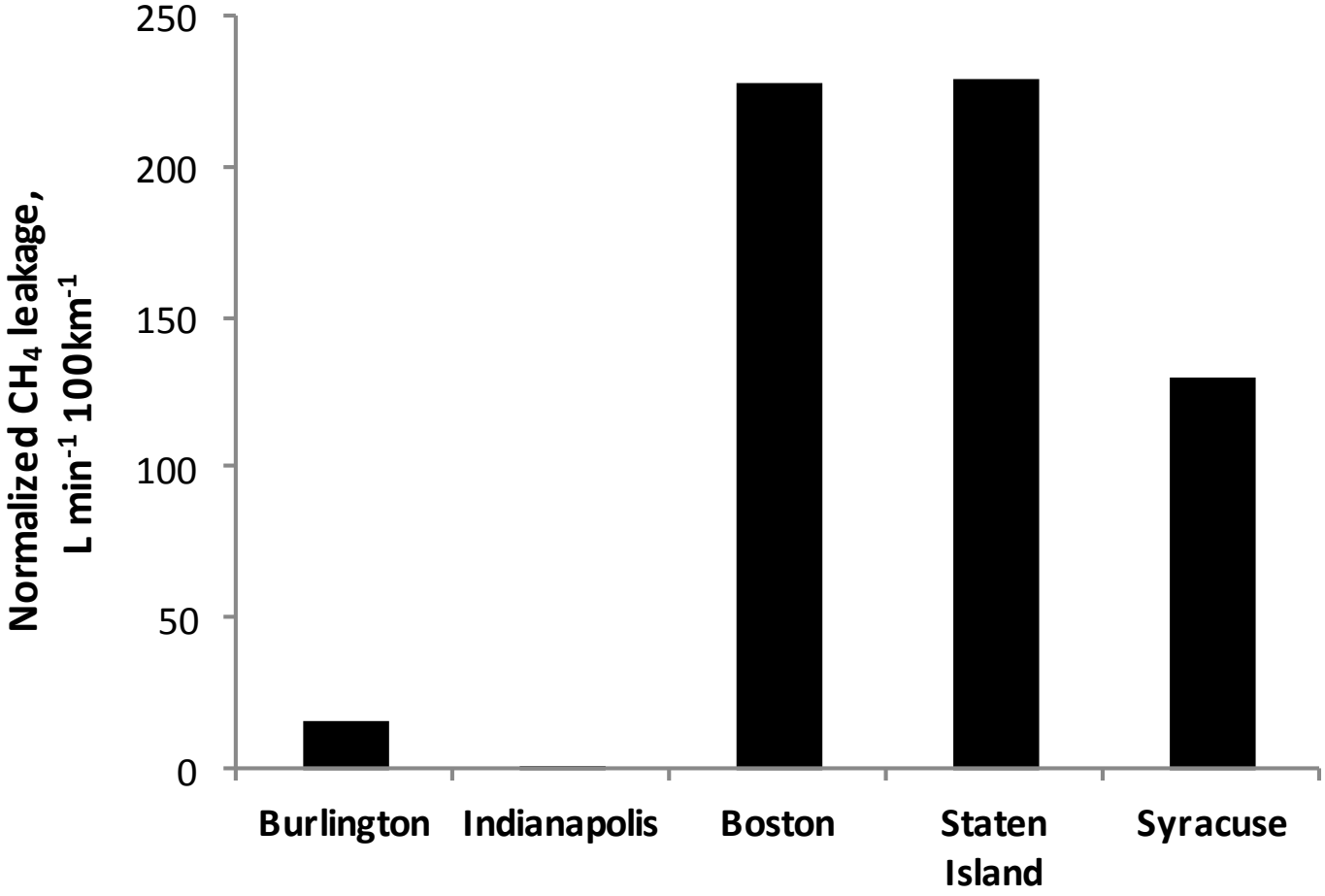
Most leaks are small, but 10% to 15% can be much larger



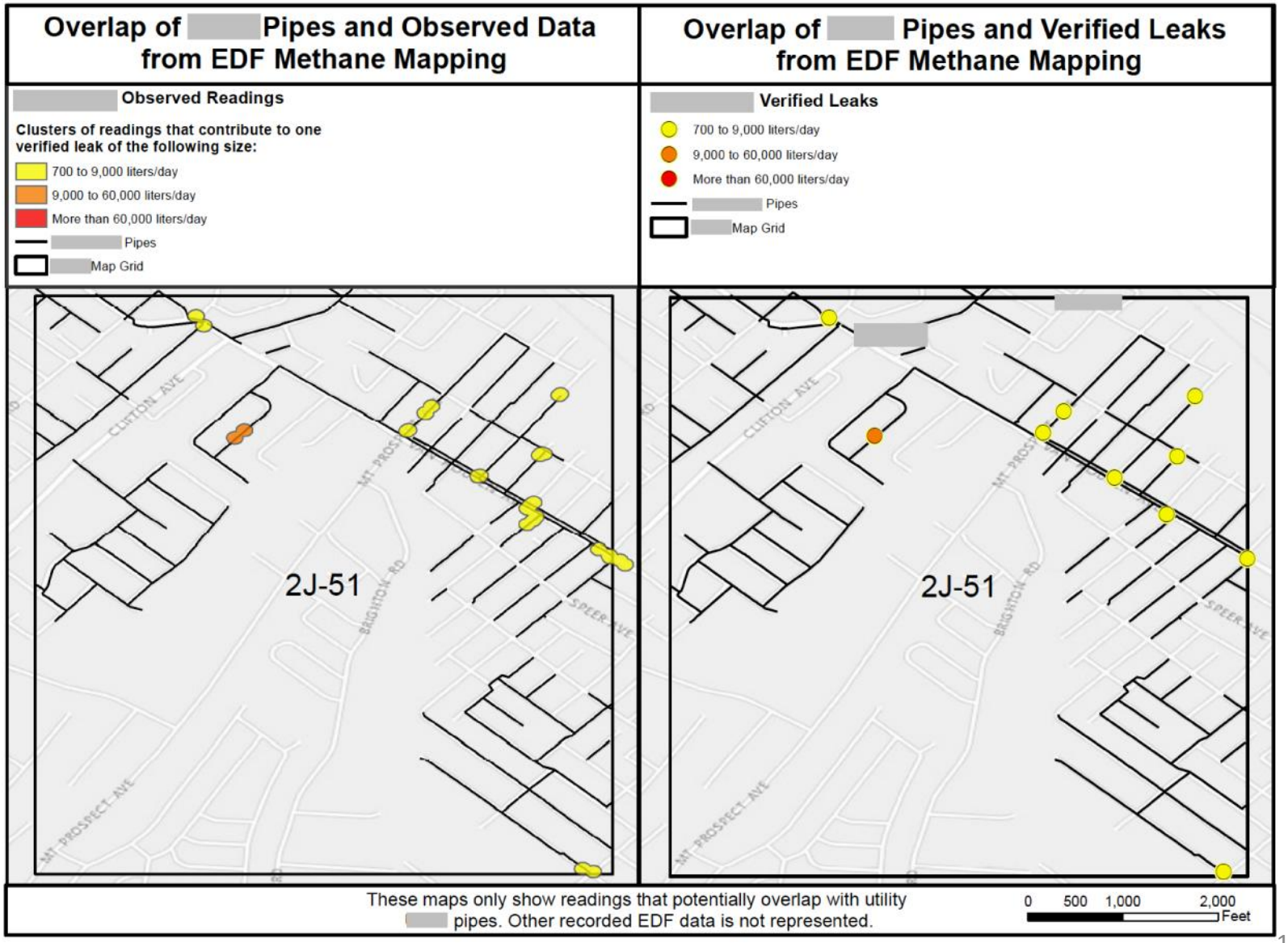
50% of emissions come from 10-15% of leaks



Overall city leakage rates per unit roadway



Technology proven and improving

- New manufacturers coming to market (e.g., Los Gatos Research)
- Improvement areas
  - Ethane for source attribution
  - Sensor mount location
  - Driving strategies
  - Multiple sensors per car
  - Gathering & analysis of wind data

Synthesis of asset and leak data