Study of Neighborhood Air near Petroleum Sources

Lost Hills Draft Report:
Air Quality Results and Health Risk Assessment Overview

March 6, 2024

Thank you, Lost Hills Community

Engagement with the Lost Hills community has been essential in informing many aspects of the SNAPS program, including:

- Locations and times for mobile monitoring
- Which pollutants to display live on the SNAPS website
- How to best communicate data during meetings and in report

Thank you for your patience!

Agenda

1. **SNAPS Overview**
2. **Air Quality Results**
   - Meteorology
   - What is the air quality in Lost Hills?
   - Is Lost Hills disproportionally affected compared to other locations in the Central Valley?
   - What are the potential sources?
3. **Health Risk Assessment Results**
4. **Actions, Ongoing Efforts, and Next Steps**

Overview

Study of Neighborhood Air near Petroleum Sources

- Characterize air quality in neighborhoods
- Select neighborhoods close to oil and gas extraction facilities
- Assess potential cumulative impacts from all surrounding sources

Scope

Program Goals

Characterize air quality in communities near oil and gas operations

Identify emission sources as feasible

Analyze data for **possible health risks**

Major Pollutants

Toxic Air Contaminants (TACs)

Criteria Pollutants
Particulate Matter ($PM_{2.5}$)
Carbon Monoxide (CO), Ozone (O_3)

Volatile Organic Compounds (VOCs)

Methane (CH_4)

Hydrogen Sulfide (H_2S)

Metals

Glycols

Stationary Monitoring:
On-site and Discrete Measurements

On-site Measurements

- Fast response instrumentation (reported hourly)
- Continuous (measurements every second or minute)
- Compounds include those that were posted to our website in near real-time (CH_4, H_2S, O_3, CO, $PM_{2.5}$, BC); some VOCs and metals
- Meteorological data (wind speed, wind direction, temperature)

Discrete Measurements

- Requires lab analysis
- 24-hr samples taken every 6 to 12 days
- Compounds include aldehydes, polycyclic aromatic compounds (PAHs), and sulfur-containing compounds

Mobile Monitoring

- Instruments housed within a vehicle
  - Measures methane, ethane, black carbon, ozone, and hydrogen sulfide continuously
  - BTX measurements every 15-30 minutes
- Monitoring along public roadways in communities
- Measurements are ‘snapshots’ in time
  - Multiple passes on streets
  - Includes upwind and downwind measurement periods

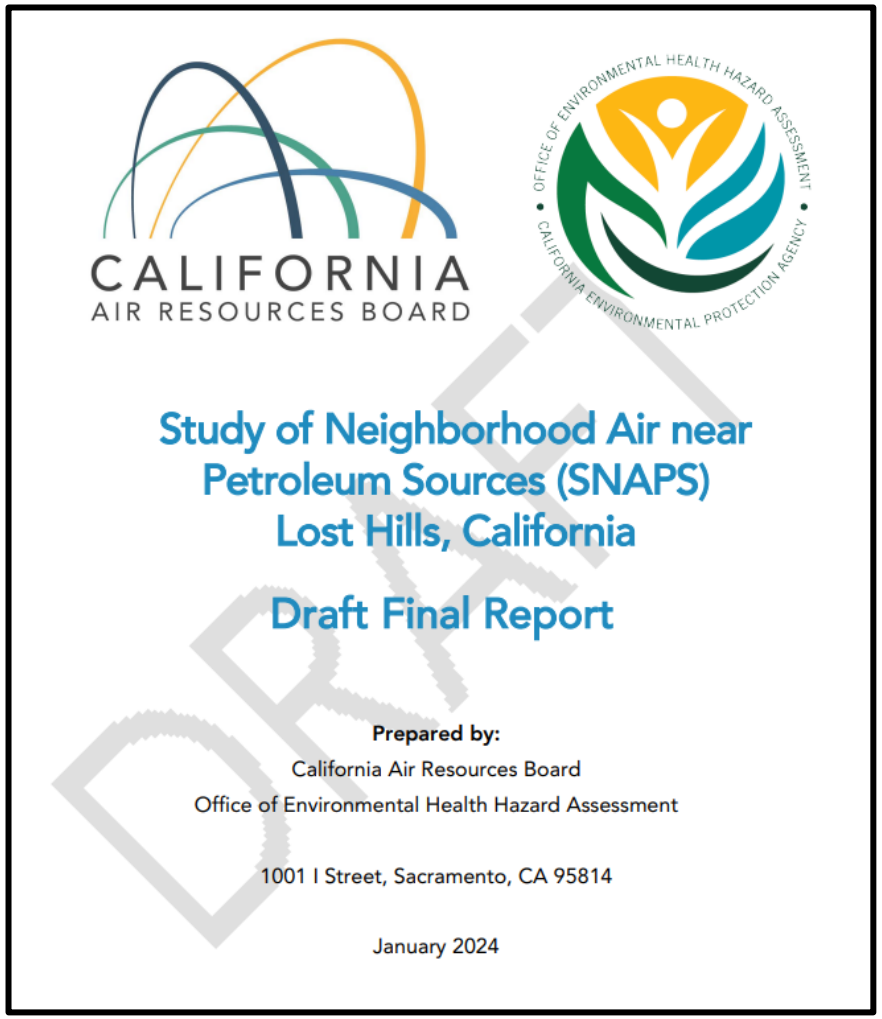
CARB SNAPS mobile monitoring platform near Inglewood Oil Field – September 2022

Lost Hills Timeline

Oct 2018	• Informational meeting
May 2019	• Monitoring starts • Kickoff meeting
Oct 2019	• Mid-monitoring update meeting
Mar 2020	• Operations adjusted due to stay-at-home orders • Continued online data streaming
Apr 2020	• End of stationary monitoring in Lost Hills
2020-2023	• Data analysis • Draft report writing
Early 2024	• Community meeting to discuss draft report • Public comment period on draft report

Measured over 200 compounds from June 2019 – March 2020

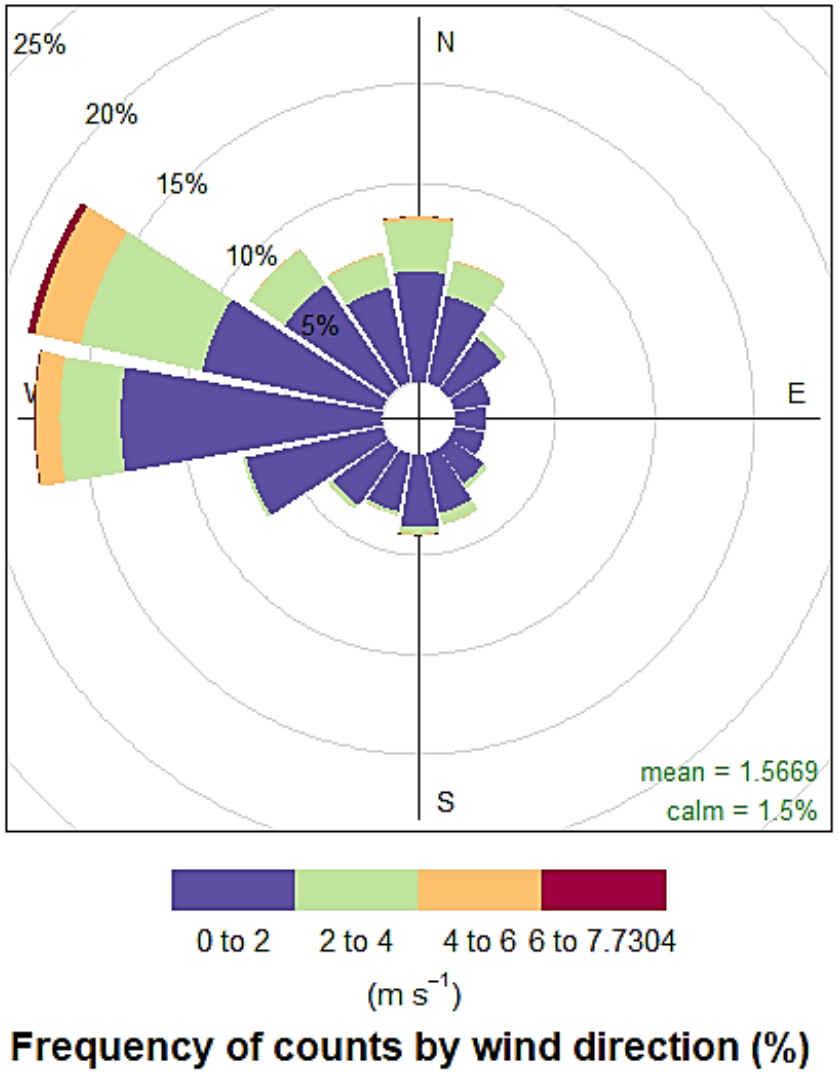
Lost Hills Draft Report



- Lost Hills report released as draft for public comment. Report (and presentation today) includes:
  - Introduction and Background on SNAPS
  - Scope of SNAPS Monitoring and Methodology
  - Lost Hills Air Monitoring Results
  - Actions, Ongoing Work, and Next Steps
  - Resources
- Report released in three formats:
  - Full Report (100+ pages) plus appendices
  - Summary Report (25 pages)
  - Results Overview Document (5 pages)
  - All drafts in both English and Spanish

Results: Meteorology

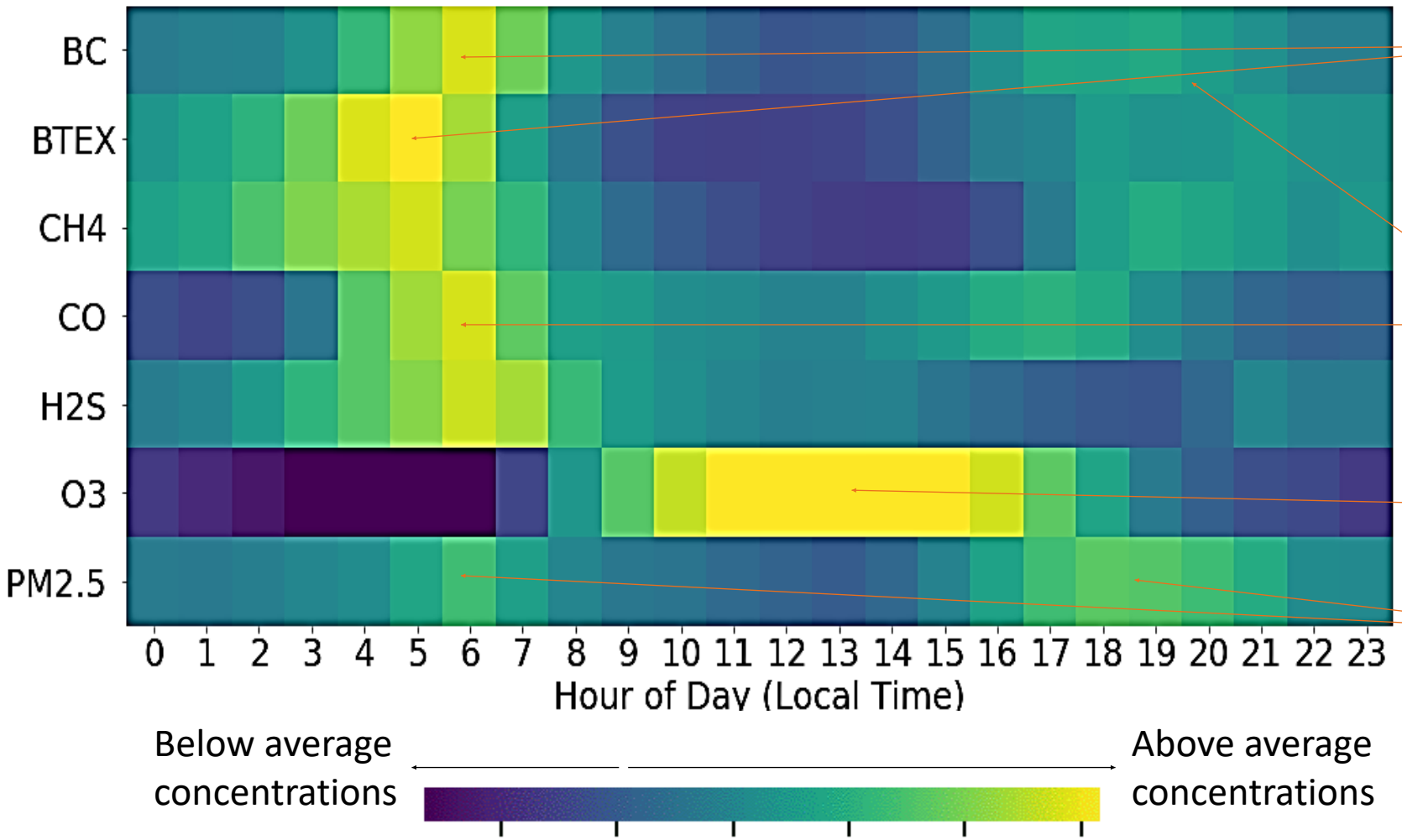
Meteorology



- Wind frequently came from the west to northwest
- The Lost Hills community was often downwind of the Lost Hills Oil Field
- Other times, wind was light and variable, meaning pollutants could originate from other local sources

Results:
What is the Air Quality in Lost Hills?

Atmospheric Conditions Strongly Influenced Pollutant Concentrations



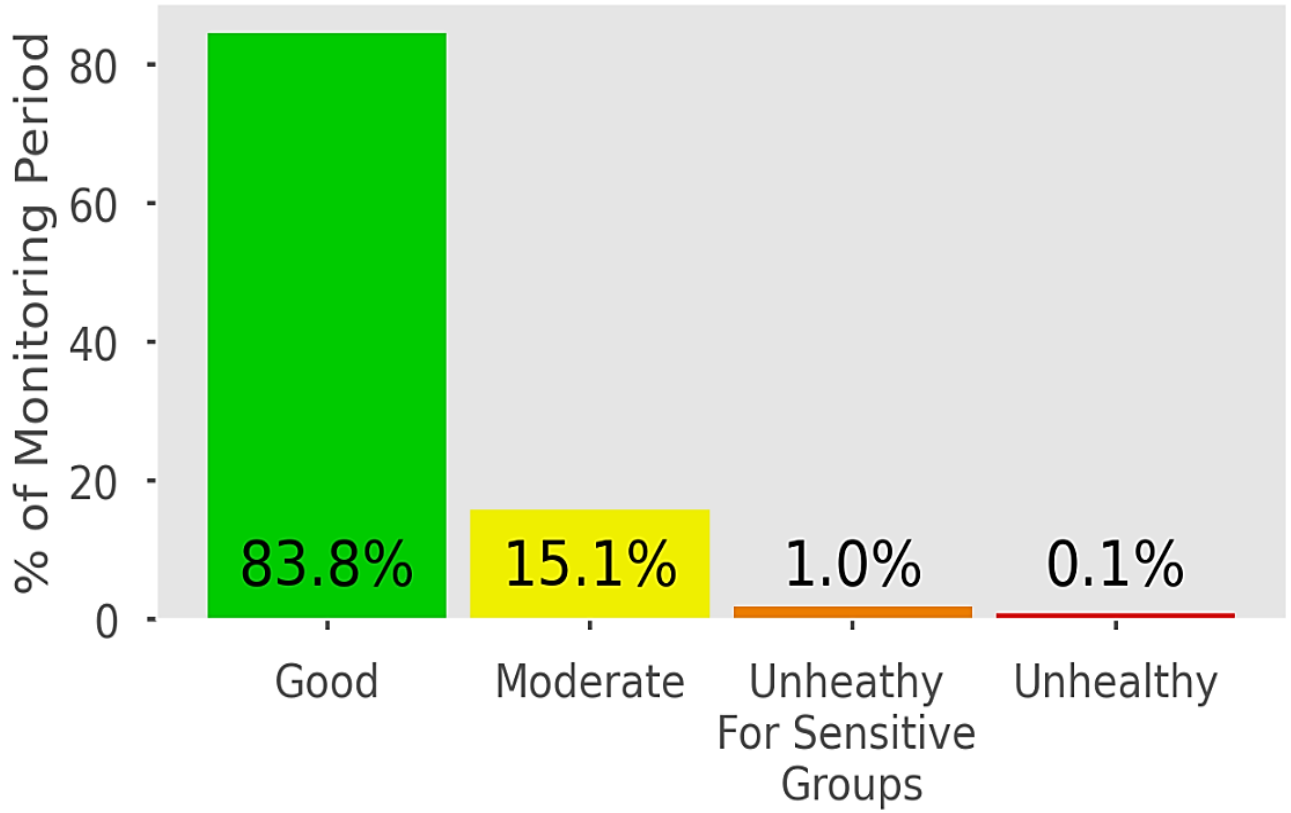
Highest BTEX and CH_4 in the early morning – likely due to meteorology

Higher BC and CO in the morning and evening

O_3 typically highest during the afternoon

$PM_{2.5}$ typically highest during the morning and evening

Air Quality Index (AQI) was Generally Acceptable



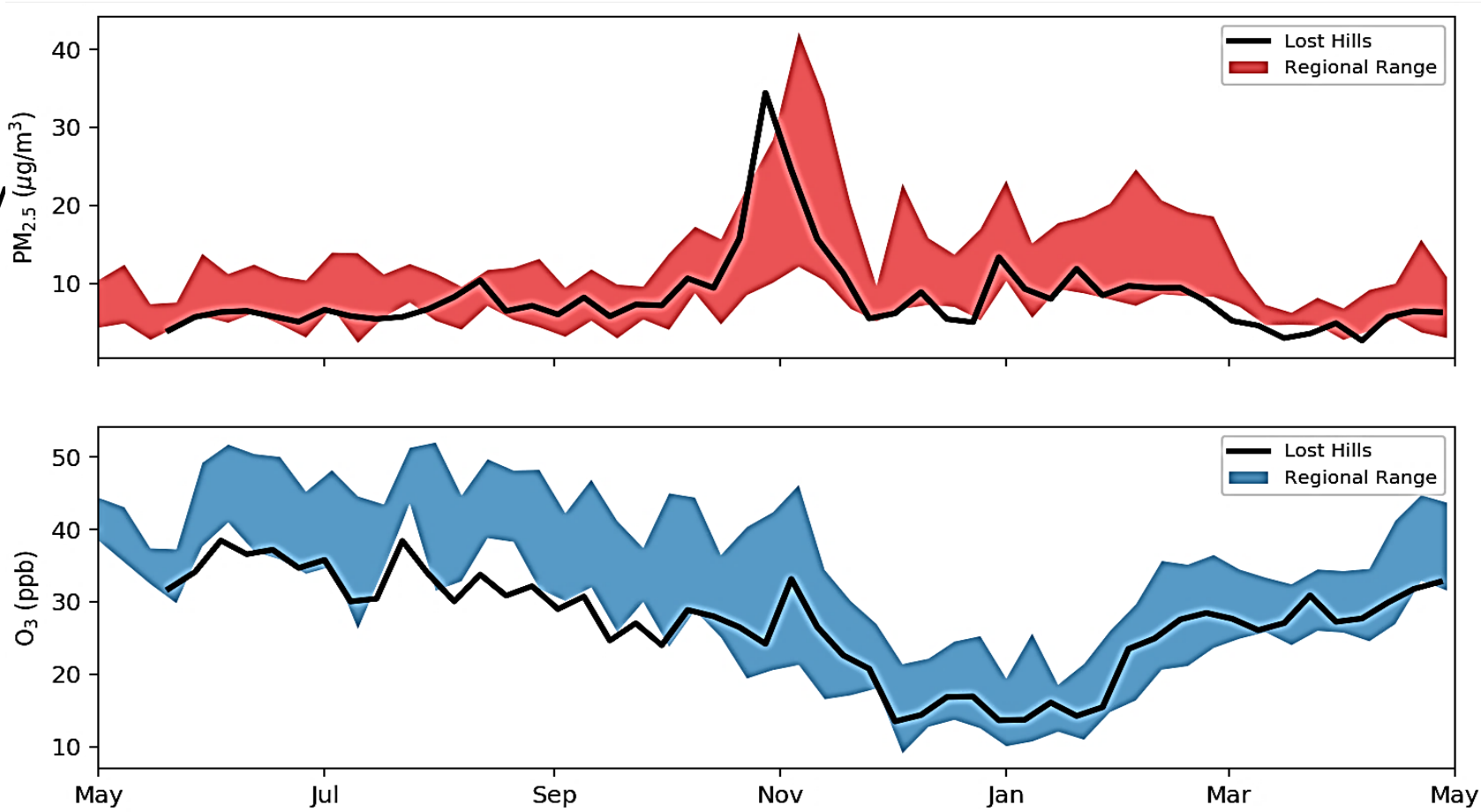
Air Quality Index Levels of Health Concern	Numerical Value
Good	0 to 50
Moderate	51 to 100
Unhealthy for Sensitive Groups	101 to 150
Unhealthy	151 to 200
Very Unhealthy	201 to 300
Hazardous	301 to 500

- AQI considered “good” or “moderate” 98.9% of the time
- “Unhealthy” and “Unhealthy for Sensitive groups” values driven by $PM_{2.5}$ during Fall 2019 when winds were elevated

Results:
Is Lost Hills Disproportionally Affected Compared to Other Areas in California and the Central Valley?

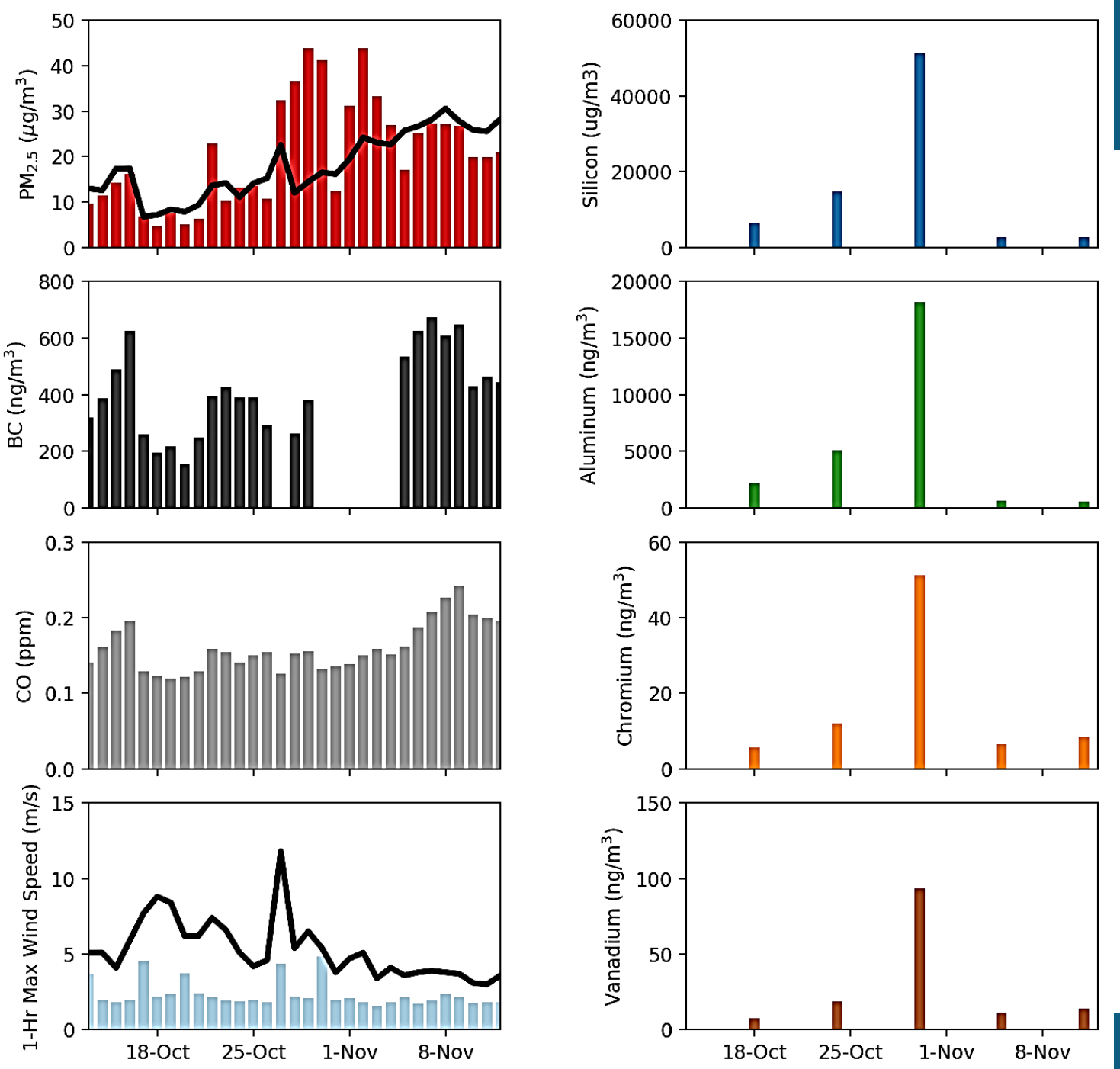
$PM_{2.5}$ and O_3 Concentrations: LH vs Central Valley

- $PM_{2.5}$ and O_3 concentrations in Lost Hills were similar to concentrations observed elsewhere in the Central Valley
- $PM_{2.5}$ peaked during Fall 2019 in association with elevated winds transporting dust and other particulates toward Lost Hills
- O_3 peaked during Summer 2019 due to photochemical (sun-driven) processes

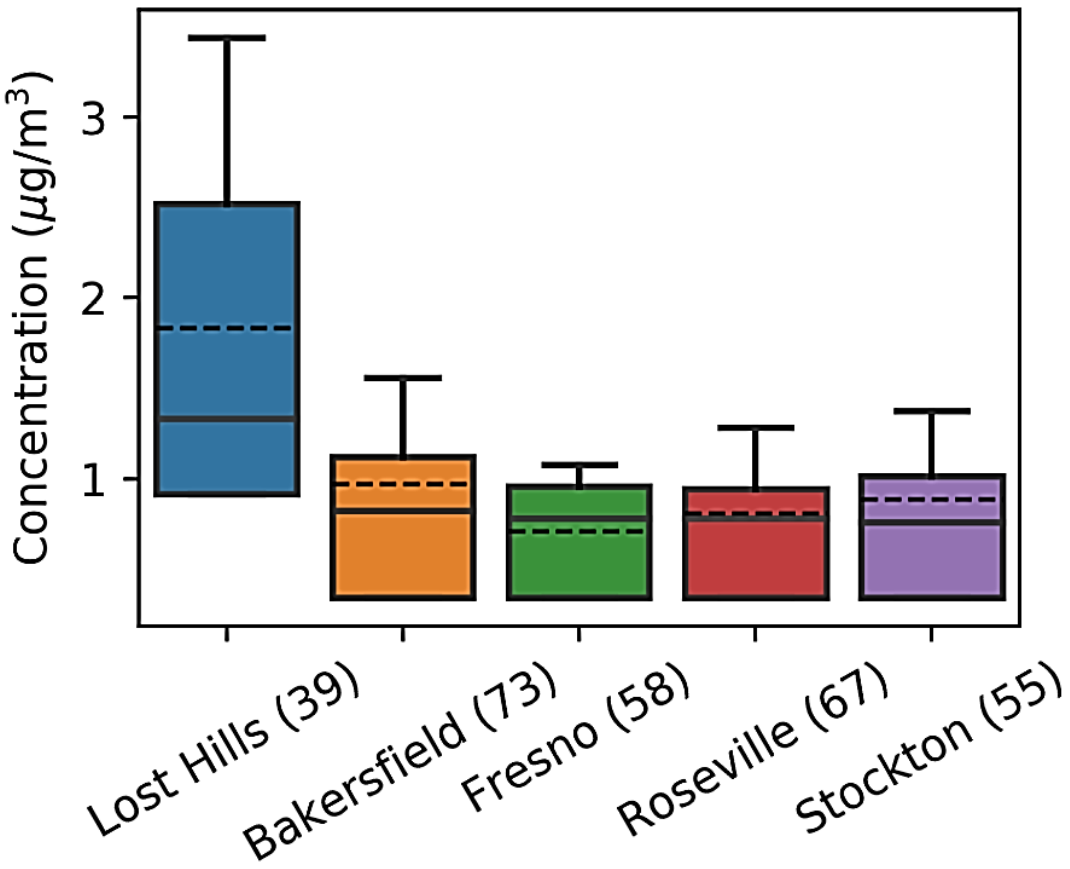


Oct-Nov 2019 Wind Event

- Concentrations of PM and most metals peaked from late October through early November 2019
- Fall 2019 peak associated with elevated wind speeds transporting dust, aerosols, and smoke across the Central Valley



Acrolein Concentrations Were Elevated in LH



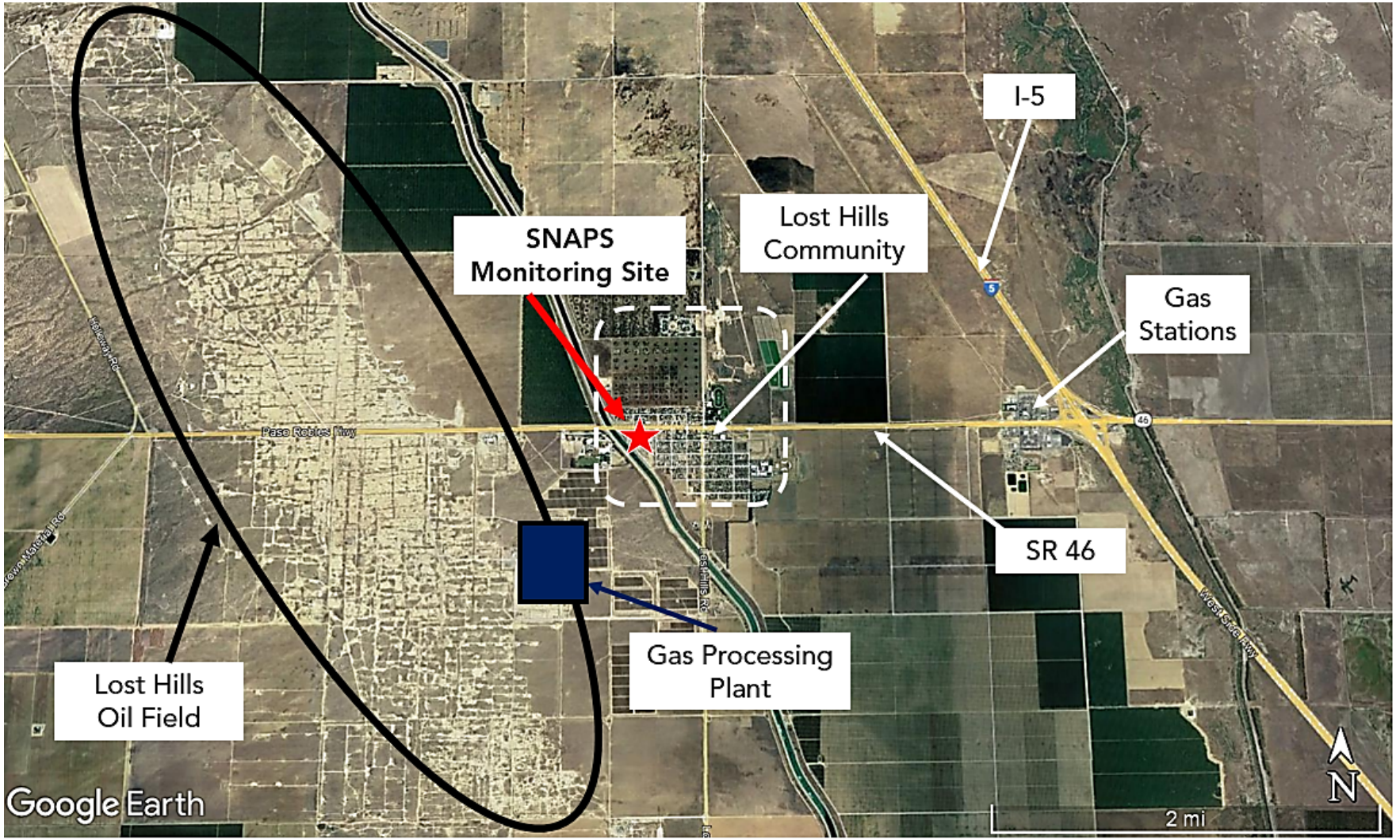
- Concentrations of many pollutants (inc. VOCs and TACs) in Lost Hills were similar to concentrations observed across the Central Valley – main exception: ***acrolein***
- Average concentrations roughly twice as high in Lost Hills
- Potential sources: combustion processes (e.g., automobile, equipment, diesel exhaust on and off oil field), agriculture, reactions in the atmosphere, landfills, residential burning, cigarette smoke
- Acrolein was the primary driver of noncancer health risk in Lost Hills

Results:
What are the Potential Sources?

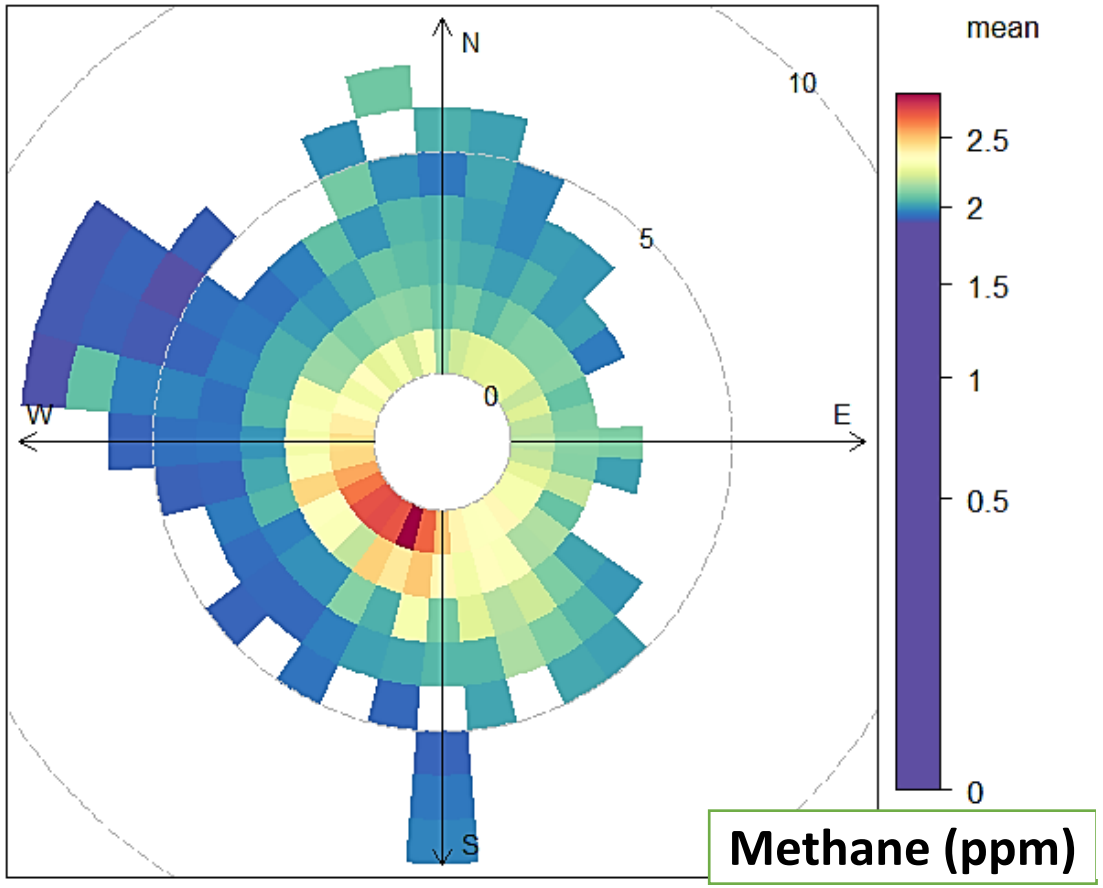
Potential Sources

Potential Sources

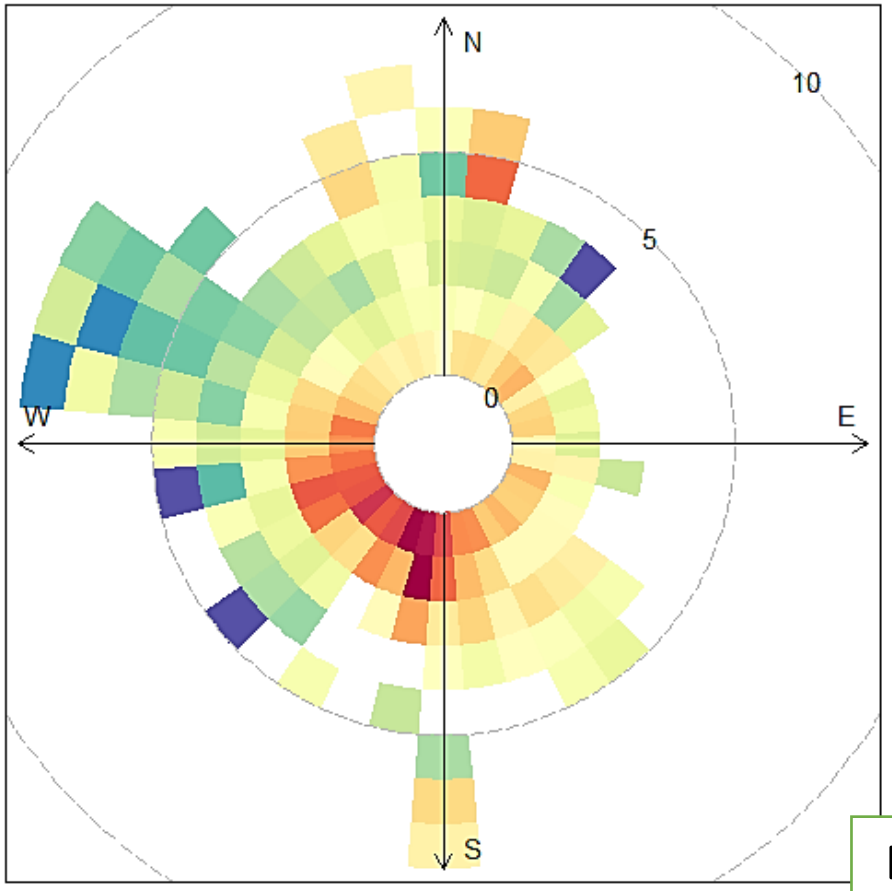
1. Mobile sources (I-5 and SR-46)
2. Lost Hills Oil Field
3. Local natural gas distribution lines
4. Agriculture, landfills, composting facilities
5. Other Regional Sources



Gas Processing Plant a Potential Source



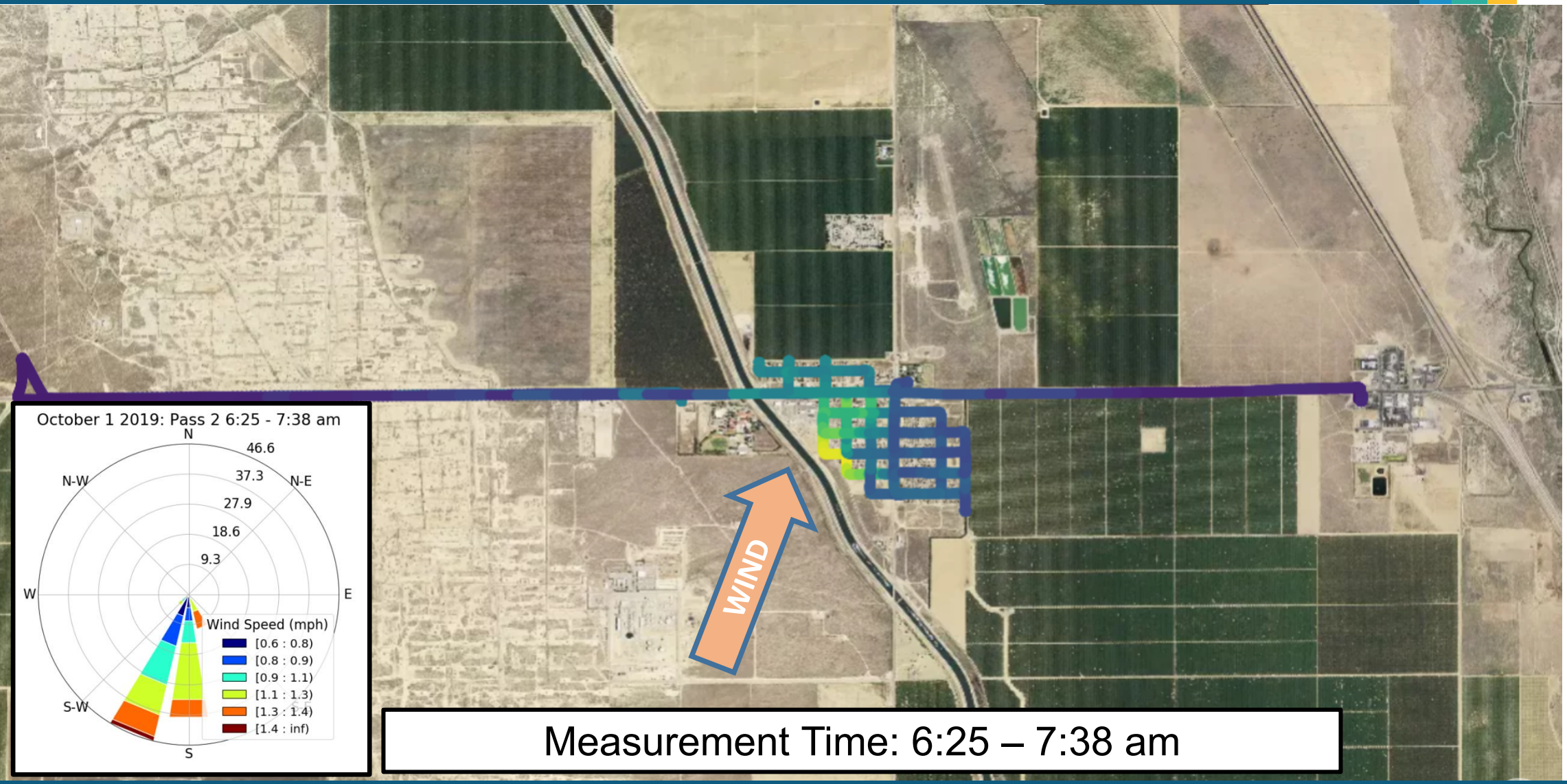
Methane (ppm)



Benzene (µg/m³)

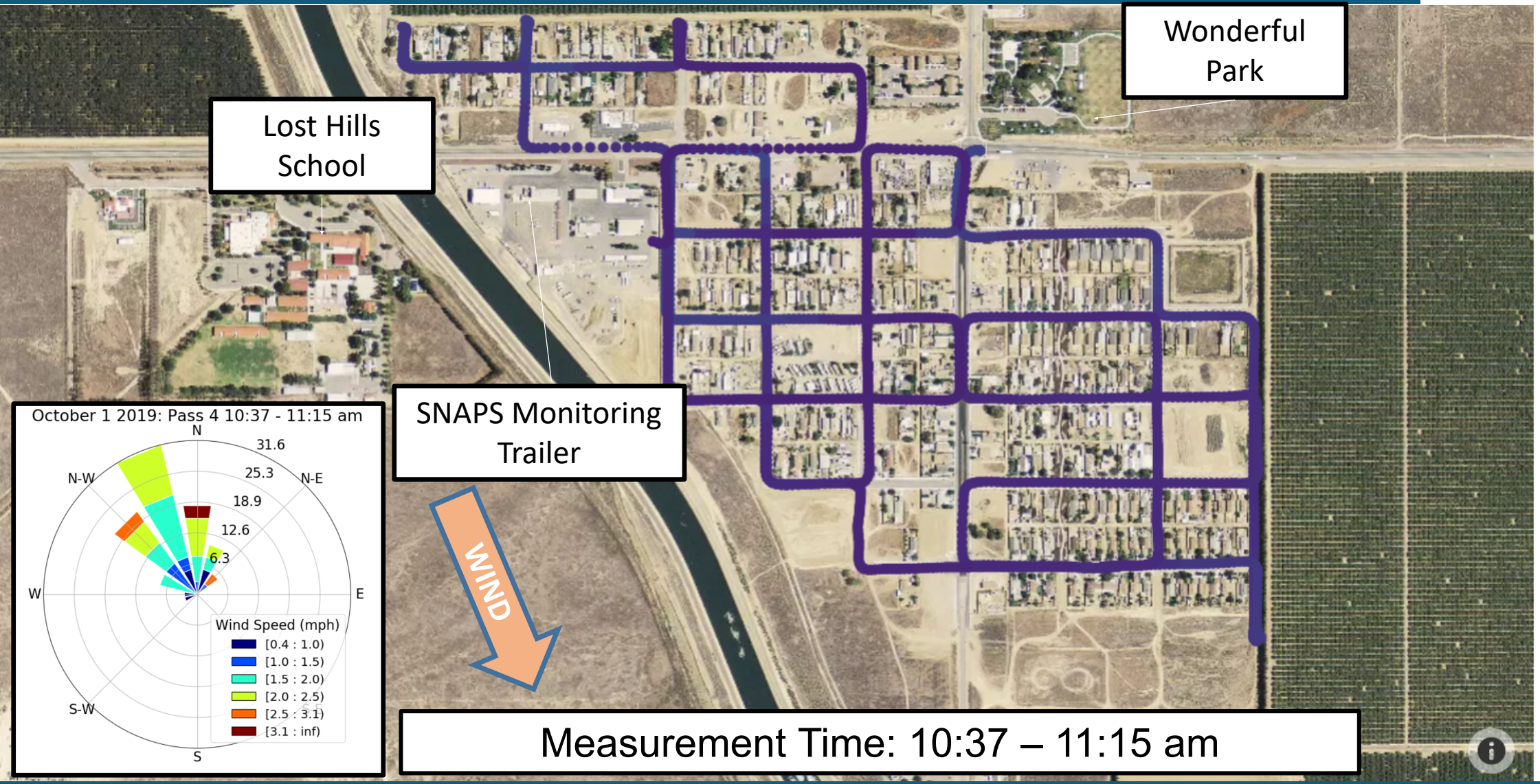
- When wind was light and from the southwest (i.e., originating near the gas processing plant), concentrations of methane, benzene, and other VOCs were elevated
- Other monitoring projects (SNAPS mobile monitoring, FluxSense, JPL flyovers) have noted similar findings

Methane Mobile Monitoring (Oct 1, 2019)



Methane concentrations vary around Lost Hills across space and time

Methane Mobile Monitoring (Oct 1, 2019)

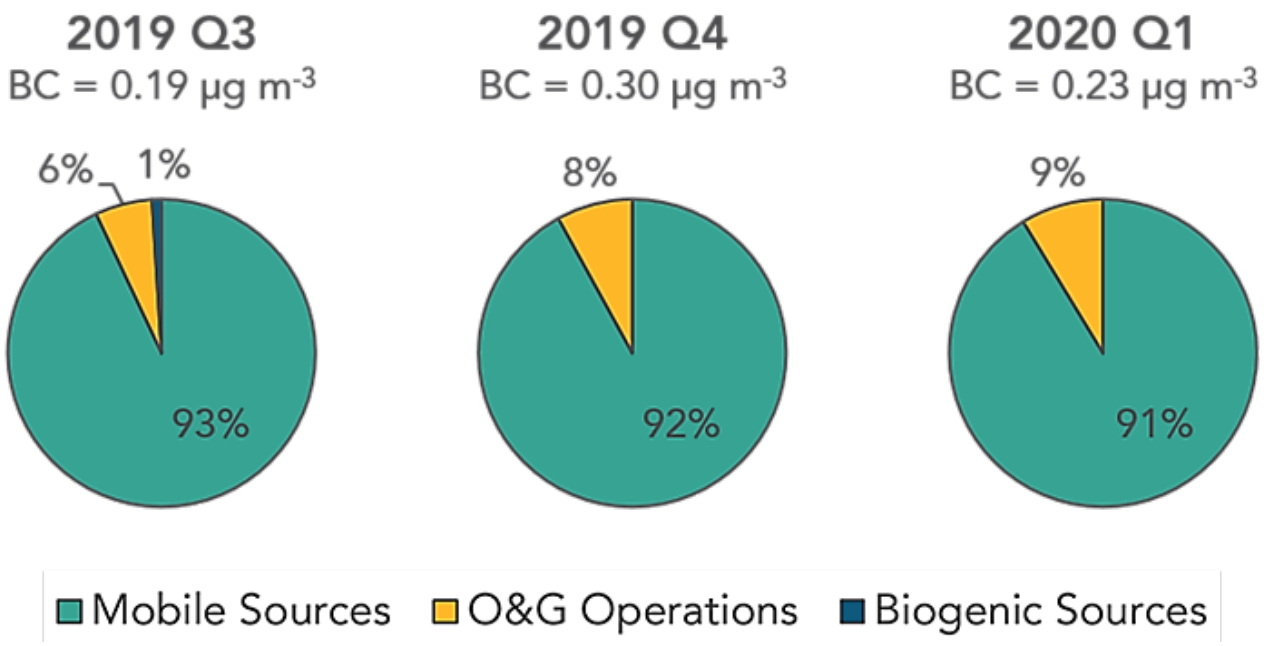


Very different map three hours later

Data are preliminary. Final results will be published in the final report.

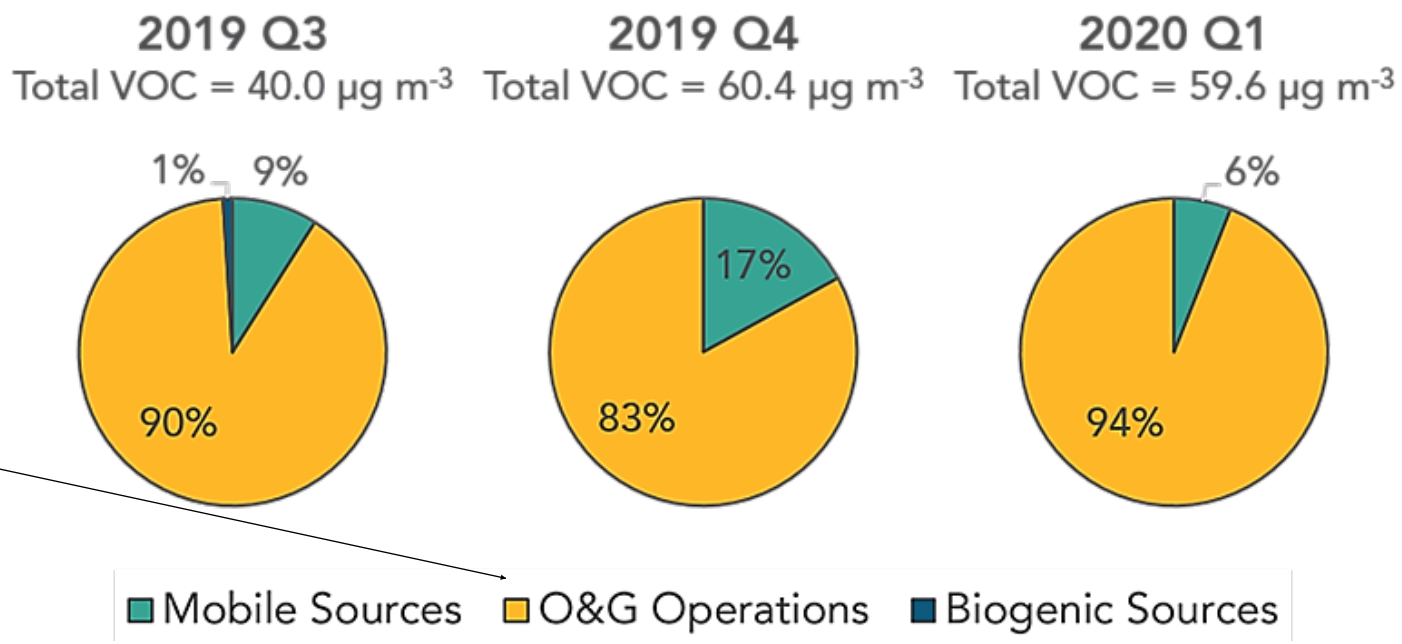
Positive Matrix Factorization (PMF) Analysis

- Additional source attribution analysis was conducted to identify potential sources of pollution in Lost Hills
- Positive Matrix Factorization (PMF) focused on BC and a group of VOCs, including BTEX, which are important from a health perspective
- Mobile sources contributed toward majority of BC emissions



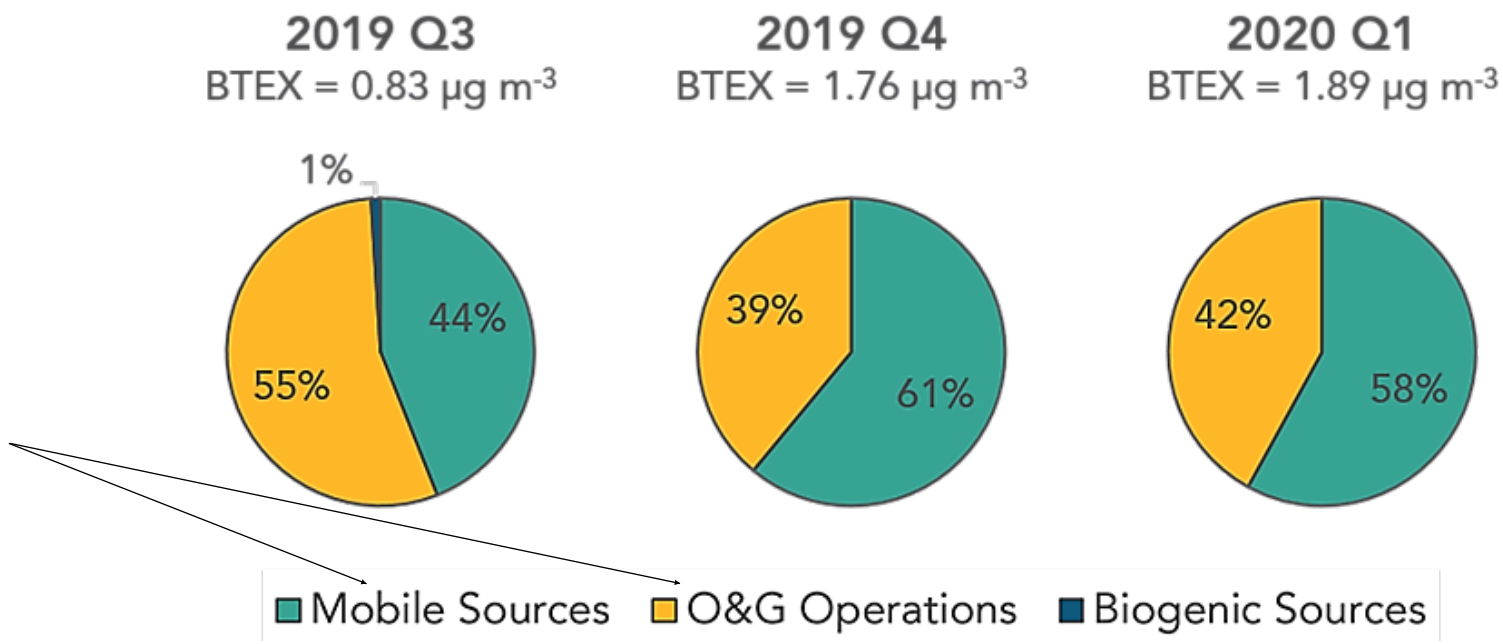
Positive Matrix Factorization (PMF) Analysis

Oil and gas-related sources contributed toward majority of VOC emissions



Positive Matrix Factorization (PMF) Analysis

Both mobile and oil and gas-related sources contributed similarly toward BTEX emissions



10-Minute Break

Results:
Are There Health Risks Associated with the Air Quality in the Lost Hills Community?

Background on Risk Assessment

Risk = Toxicity x Exposure

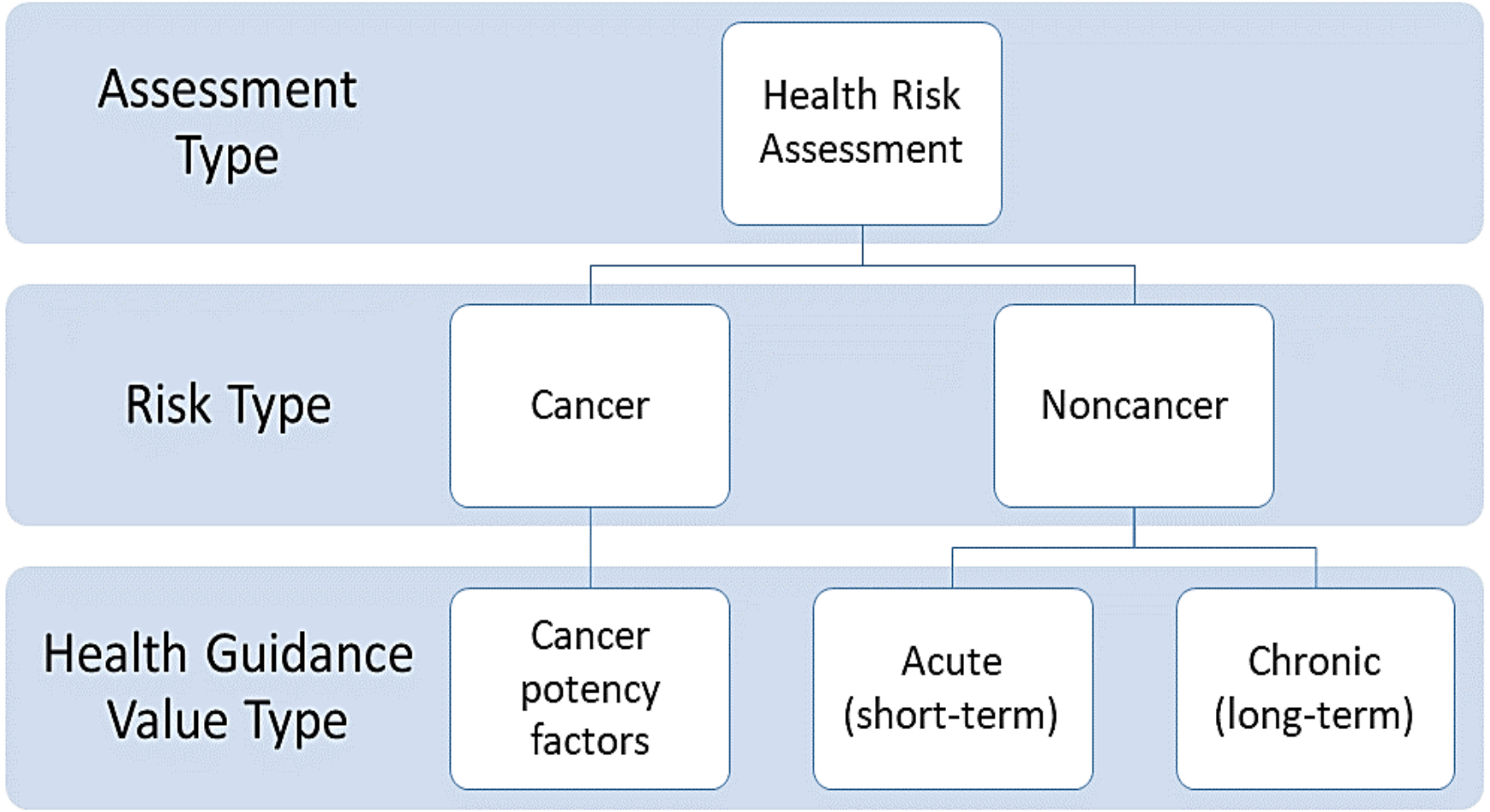
What kinds of health effects? At what levels?

Does compound contact or enter our body?

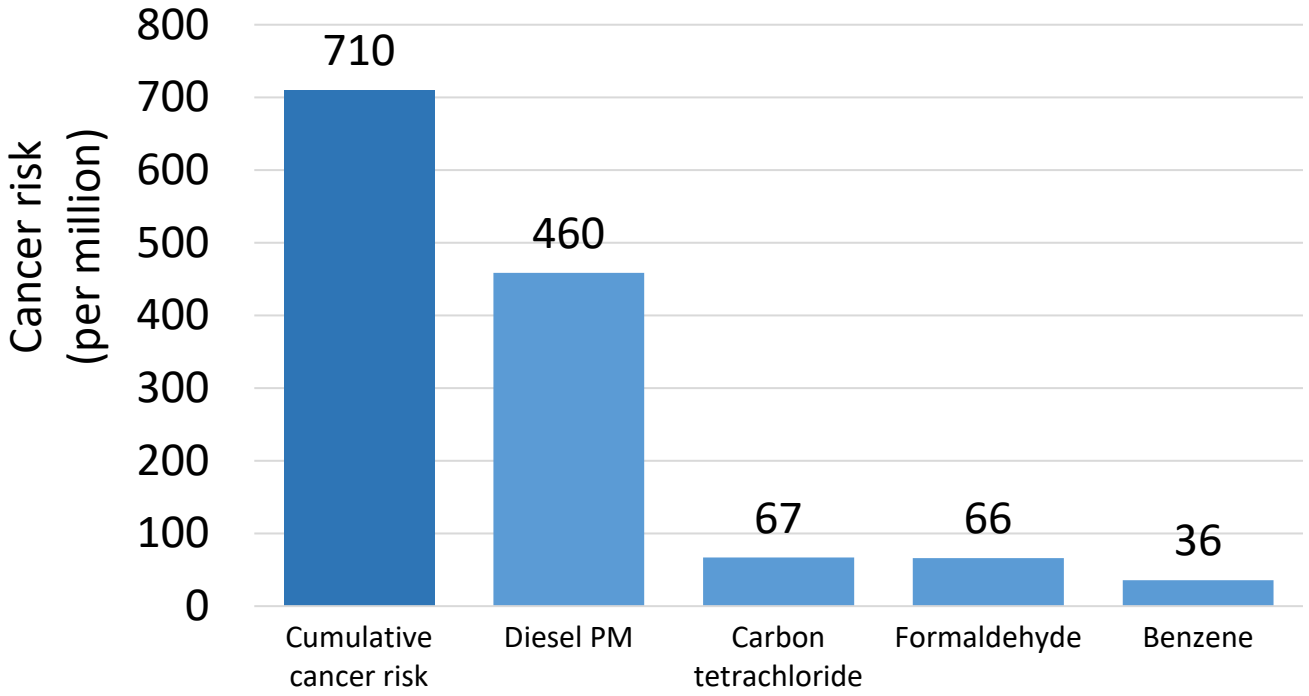
Health Guidance Values

Air monitoring data

Overview of Health Risk Assessment



Cancer Risks in Lost Hills

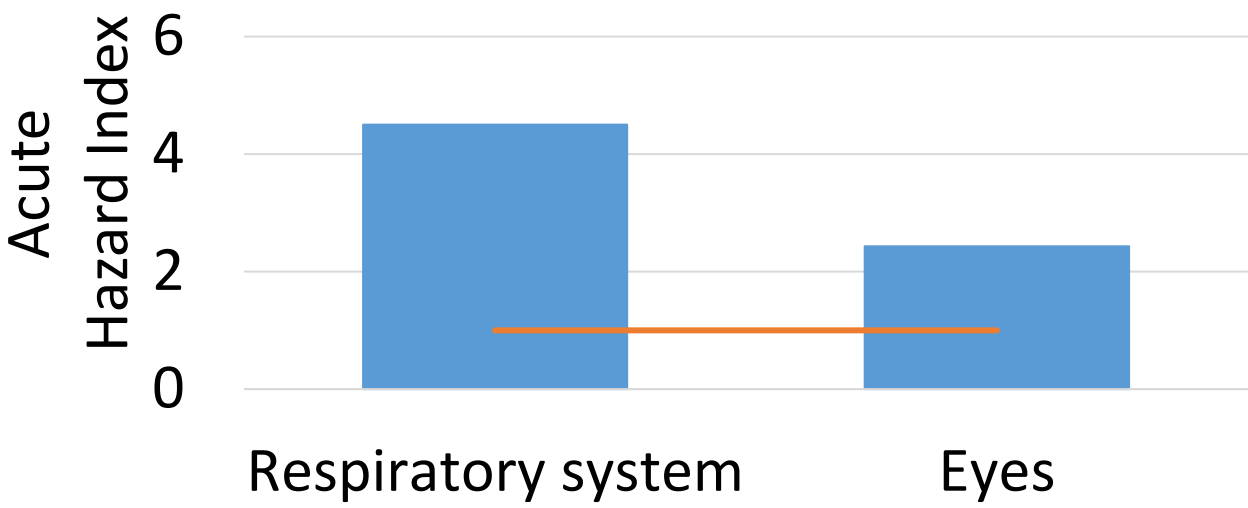


- Cumulative Cancer Risk: 710 excess cases per million people
- Primary cancer risk drivers:
  - Diesel PM (65%)
  - carbon tetrachloride (9%)
  - formaldehyde (9%)
  - benzene (5%)
- Concentrations similar to other areas of California

Acute Noncancer Risks of Concern

Acute effects

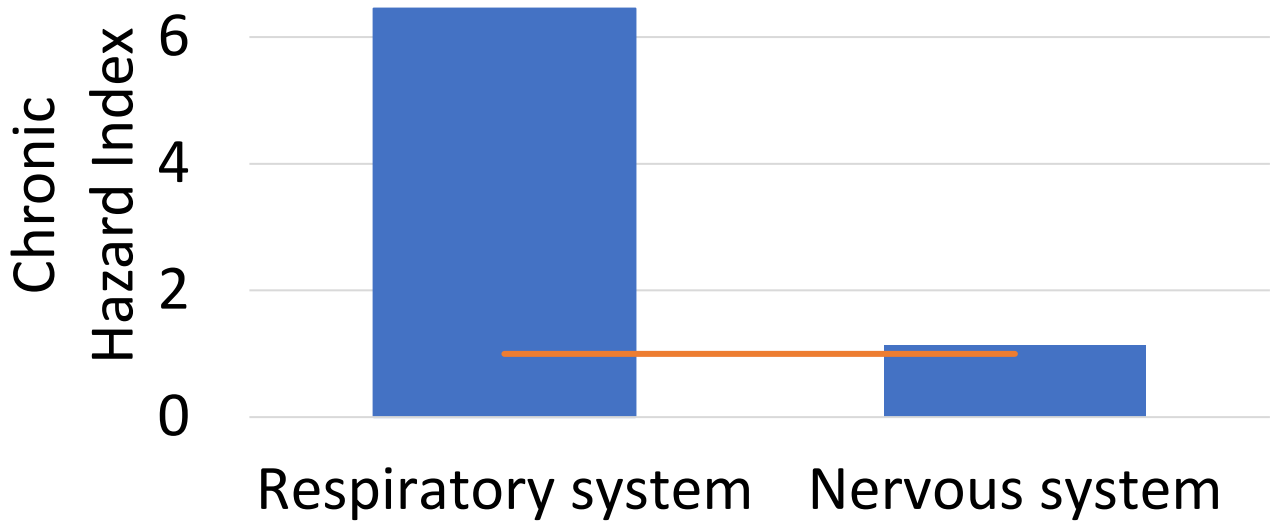
- Respiratory system and eyes
- Risk driven by acrolein and dimethyl disulfide



Chronic Noncancer Risks of Concern

Chronic effects

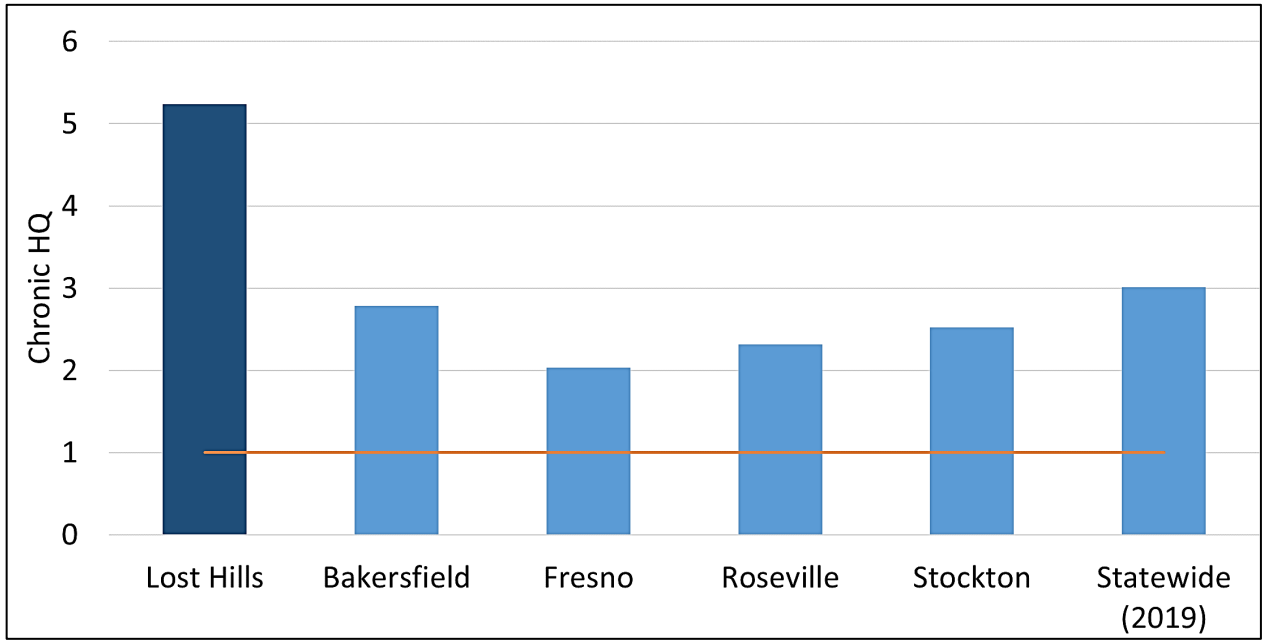
- Respiratory system and nervous system
- Risk driven by acrolein



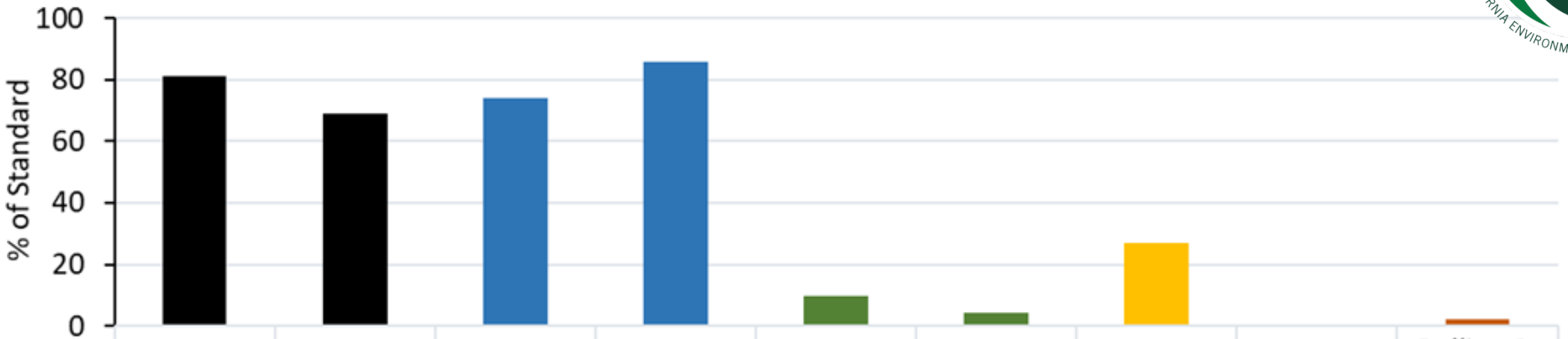
Acrolein elevated in Lost Hills

Acrolein

- Noncancer risks higher than other Central Valley California communities



Criteria Air Pollutant and Hydrogen Sulfide Concentrations Met Ambient Air Quality Standards



	24-hr	Annual	1-hr	8-hr	1-hr	8-hr	1-hr	30-day average	Rolling 3-month average
	National	California	California		California		California	California	National
	PM2.5		Ozone		Carbon monoxide		Hydrogen sulfide	Lead	
% of Standard	81	69	74	86	10	4.1	27	0.27	2.4

- Concentrations of $PM_{2.5}$ and ozone measured in Lost Hills are below State and National standards

Screening Level Odor Assessment

- There were several odor complaints from community members
- Several compounds found at concentrations that may be detected by smell
- Hydrogen sulfide and ozone exceeded odor threshold most frequently
- Identifying sources of odors can be difficult

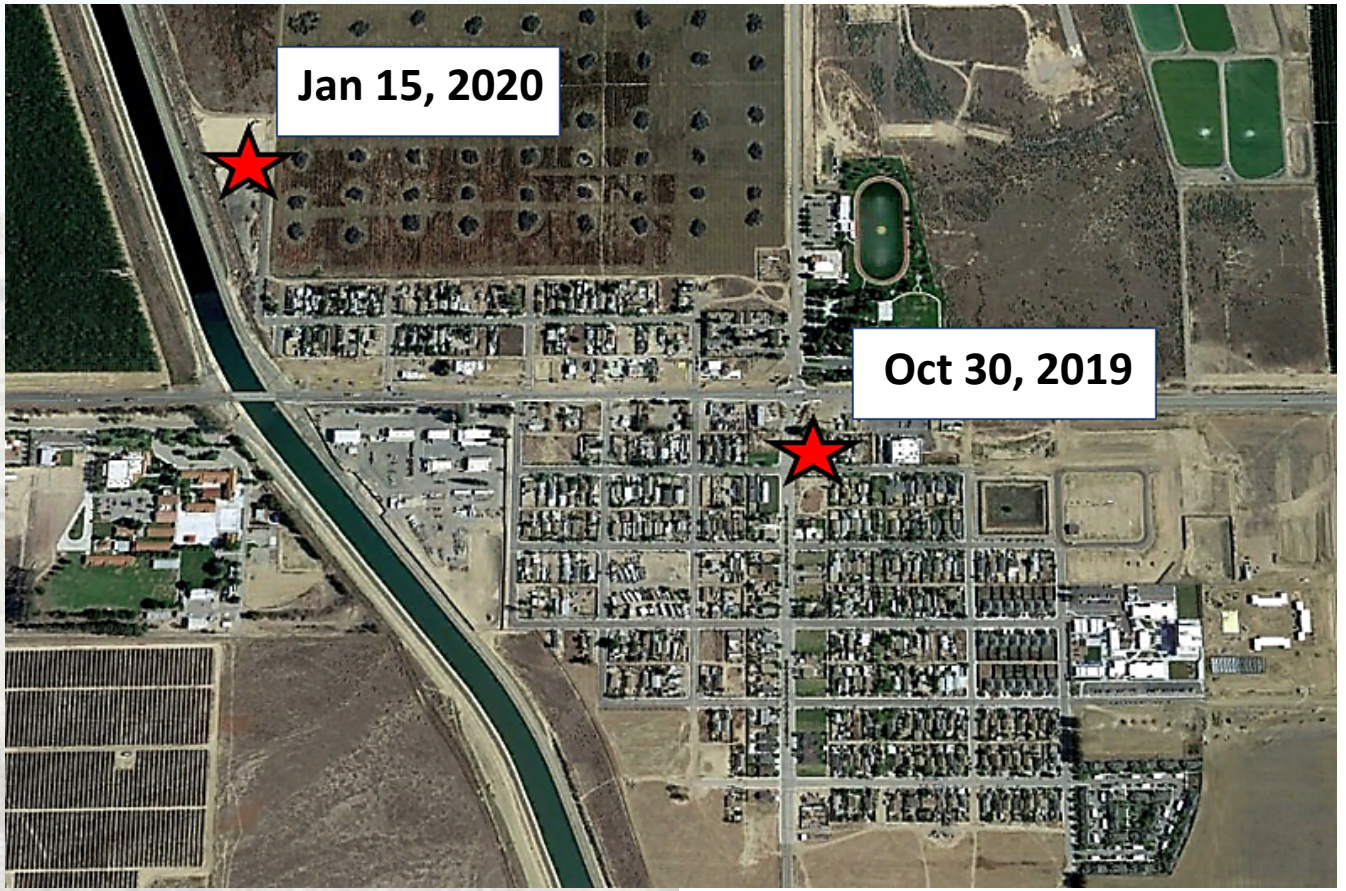
Health Risk Assessment Summary

- Carcinogens detected in Lost Hills air are concerning and similar to levels in other areas of California
- Noncancer health risks of concern were identified for the respiratory system, eyes, and nervous system – mostly from acrolein
- Concentrations of acrolein in Lost Hills are generally higher than in other areas of California
- Concentrations of PM2.5, ozone, carbon monoxide, lead, and hydrogen sulfide measured in Lost Hills met ambient air quality standards.
- Several compounds found at concentrations that may be detected by smell

Actions and Next Steps

Actions and Ongoing Efforts

- Natural gas leak detections (10/30/19; 1/15/20) reported to SoCalGas for repair
- Inspections of gas processing plant:
  - Local air district (annual) - two significant leaks detected and repaired in January 2021; four significant leaks detected and repaired in Nov/Dec 2022
  - Joint inspection with other agencies in December 2021 – one significant leak detected and repaired
- Multiple CARB efforts are underway to reduce emissions from mobile sources, agriculture, and other pollution sources



Public Comment on Draft Report

- Accepting public comment through April 2, 2024
- Summary report and results overview document to supplement longer draft report
- Looking for feedback on the report:
  - Are there aspects of data analysis you would like to see that aren't in the draft report?
  - Do sections of the report need further clarification?
  - Others?

Next Steps

- **Lost Hills Report**
  - Once public comments are received and incorporated into report, final report with revisions will be released
  - Data from Lost Hills monitoring will be released with release of final report
- **Acrolein**
  - CARB to perform additional acrolein monitoring for source apportionment
  - OEHHA exploring development of cancer potency value for acrolein
- **Current SNAPS Monitoring**
  - In communities near the Inglewood Oil Field – began in June 2023

Questions?

Accepting Public Comment on Draft Report through April 2, 2024

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