Downwind Effects:
Public Health Response & Recovery to the Nation's Largest Gas Leak

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Outline

I. Overview of Aliso Canyon Natural Gas Release

II. Post-Leak Environmental Health Investigation

III. Lessons Learned and Capacity Building to Reduce the Impact of Environmental Threats

Background

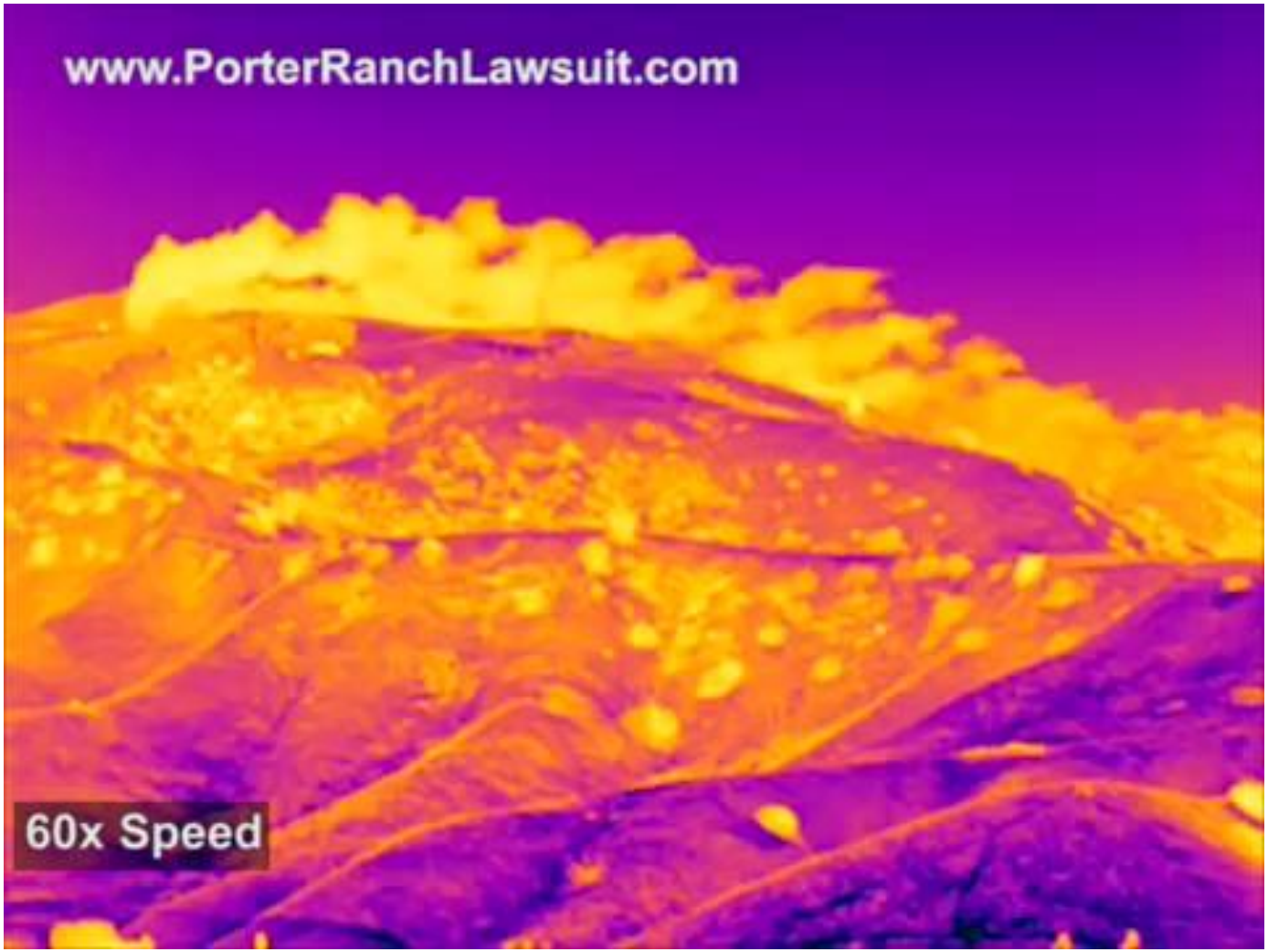
Aliso Canyon Natural Gas Storage Facility

- One of the largest in the U.S.
  - 115 wells drill into a reservoir in the Los Angeles Basin
  - Gas injected underground for storage, then withdrawn during summer/winter peak demand

- Operated by Southern California Gas Company (SoCalGas)
  - Supplies 11 million Californians

L.A. County Public Health – Initial Response

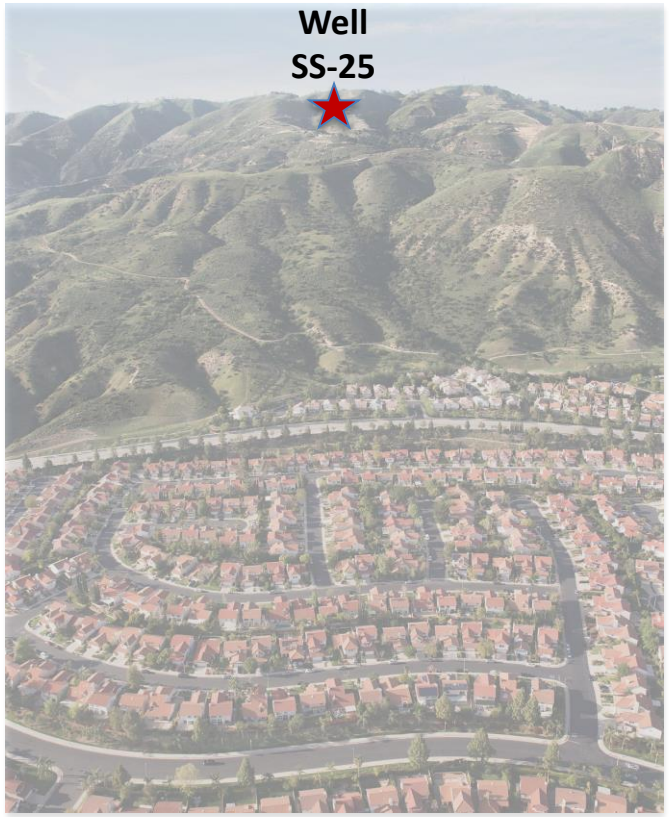
- Public Health was notified of the gas leak on Oct. 28
- Review and interpret results of air monitoring data from the first few days of the gas leak:
  - Methane,
  - Sulfur odorants,
  - Hydrogen sulfide
  - Benzene and other volatile gases
- Presented information on health impacts of sulfur odors at a community meeting on November 4.
- Closely monitored situation reports to gauge how long it would take to stop the flow of gas.


www.PorterRanchLawsuit.com
60x Speed

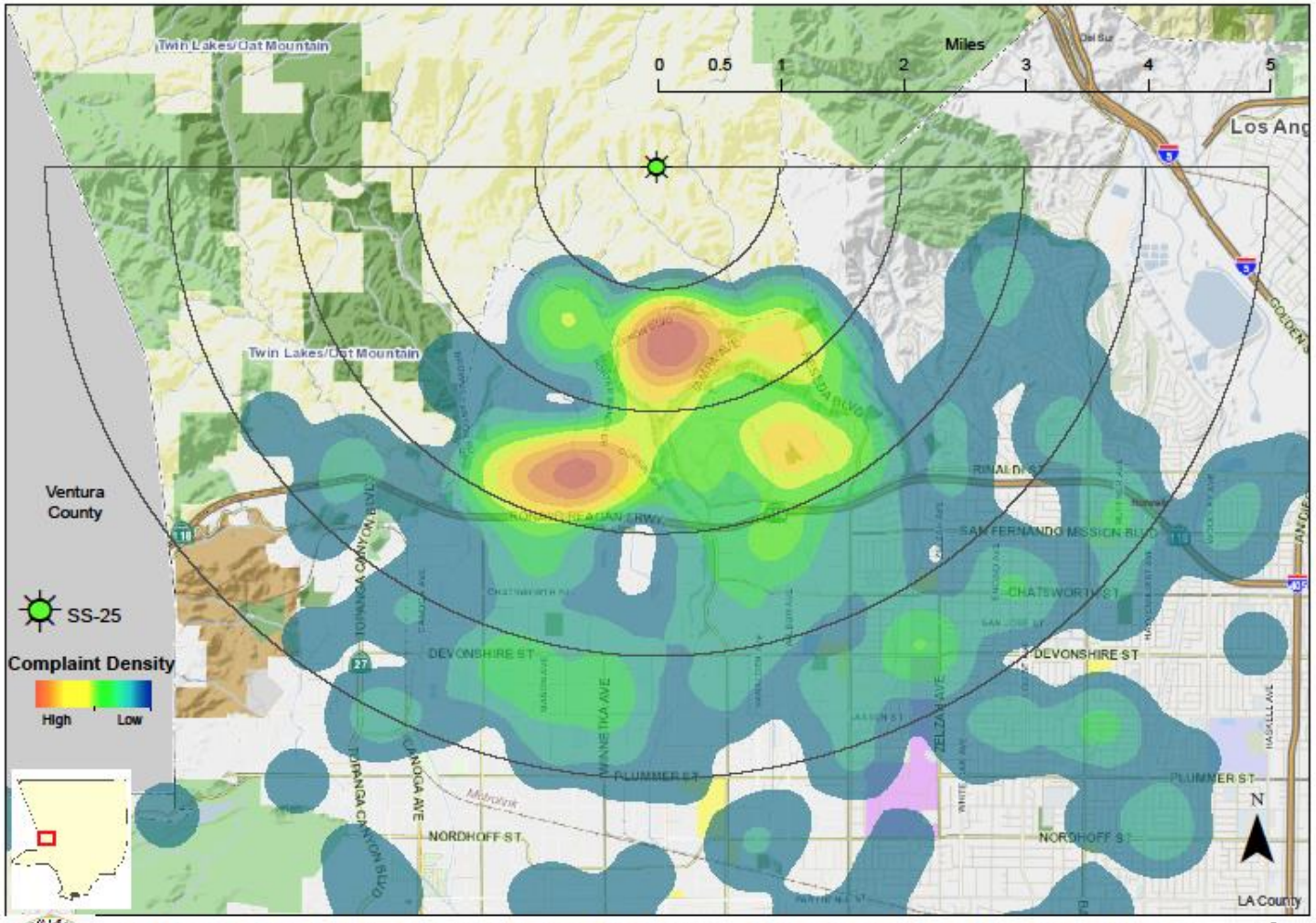
Views of SS-25 Well After Kill Attempts

Common Symptoms Reported Among Residents

- Headache or migraines
- Nausea / vomiting / stomach ache
- Nosebleeds
- Shortness of breath /
- difficulty breathing
- Chest tightness / chest heaviness
- Dizziness / lightheadedness
- Eye irritation
- Nose or throat irritation
- Cough



Symptoms Reported to Public Health by Distance to Well SS-25



Aliso Canyon Symptom Survey Respondent's Address

Created by: Office of Health Assessment and Epidemiology, Epidemiology Unit. 02/3/16. Map shows the density of Symptom Survey respondent's addresses. 511 of 687 addreses were located (the rest were excluded due to incorrect or missing addresses).

Public Health Directive for Relocation

- Nov 19: Public Health issued a directive to SoCalGas to offer free, temporary relocation to any area residents affected by odors from the Aliso Canyon site

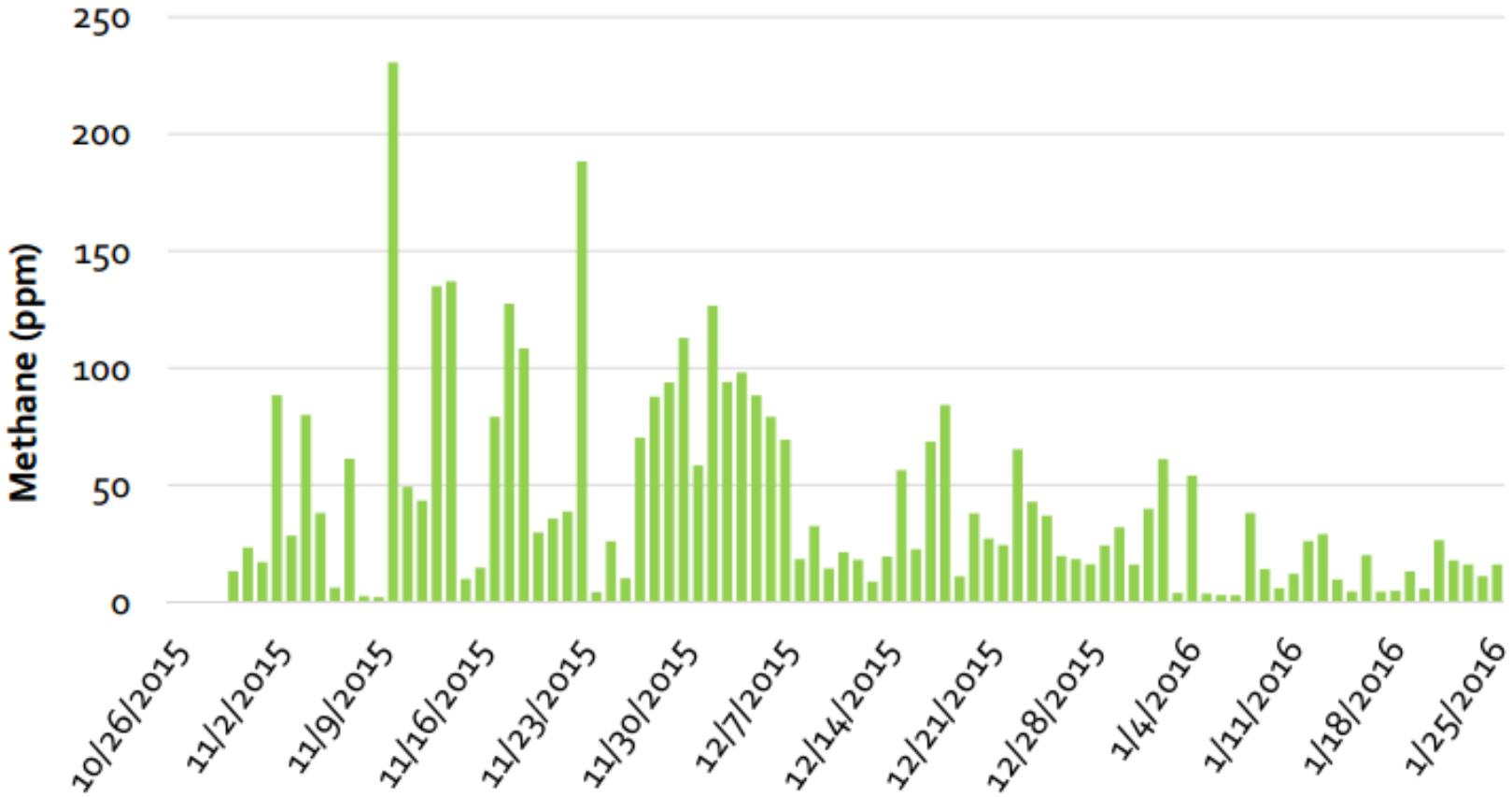
  - Preliminary Environmental Health Assessment:
    - Odors are causing significant symptoms to some residents
    - Symptoms expected to continue as long as odors remain

  - Followed by a supplemental directive in December to relocate schools in Porter Ranch

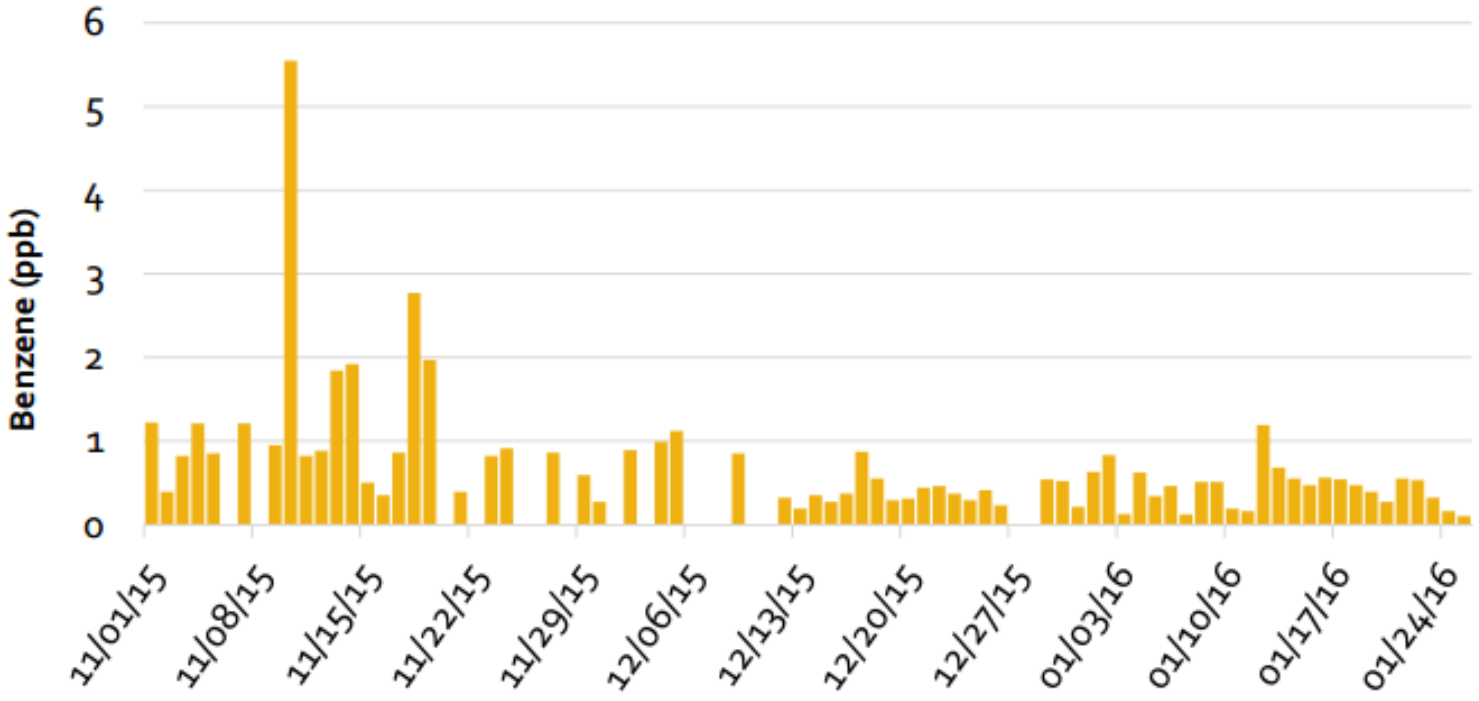
Expanded Air Monitoring Plan

- When LA County Department of Public Health (DPH) was informed the gas leak could take several months to fix, DPH began coordinating with other agencies and the Gas Company to implement more testing.
- DPH identified ways to improve monitoring efforts, including:
  - more strategic community locations,
  - stricter laboratory reporting limits,
  - expanded analytical list of chemicals, and
  - longer sample collection times.

Outdoor Methane Levels (Nov. 2015 – Jan. 2016)



Outdoor Benzene Levels (Nov. 2015 – Jan. 2016)



*Non detectable levels are shown as zero (0). There are a total of 16 days that are shown as zero. The detection limits of the laboratory tests used for samples collected by SoCalGas in November and December 2015 were not as low (sensitive) as the laboratory tests performed after that time.

Expanded Analytical List of Chemicals Tested in Outdoor Air at the Facility

- Chemicals in outdoor air were detected at higher concentrations downwind of the leak, as compared to upwind (January 27, 2016).
- Results indicated complex oil and gas mixture emitted:
  - Barium and other metals
  - Polycyclic aromatic hydrocarbons
  - Benzene
  - Cyclohexane
  - Toluene
  - Other volatiles: hexane, n-nonane, n-octane

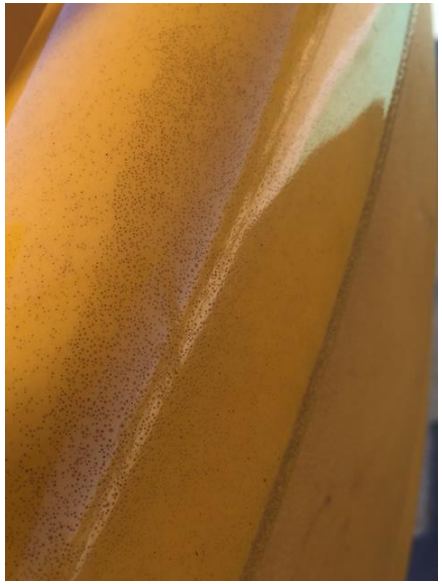
Summary of Health Assessment During Gas Leak

- Sulfur odorant appeared to be responsible for the symptoms, based on available data and information from mercaptan study in Alabama.
- However, symptoms do not completely match those experienced by odorants alone and suggest some uncertainty about the cause.
- Data gaps in information for expanded list of chemicals during the early period of the gas leak.

Post-Leak Environmental Investigation

Post-Leak Impacts

- **Symptom Reporting Continued**
- **Widespread Reporting of Oily Residue**
  - **f**requent reports of “oily residue” on outdoor surfaces
  - e.g. cars, patio furniture, playgrounds, etc.



Post-Leak Public Health Activities

1. Health Effects Evaluation
   - Community Assessment for Public Health Emergency Response (CASPER)

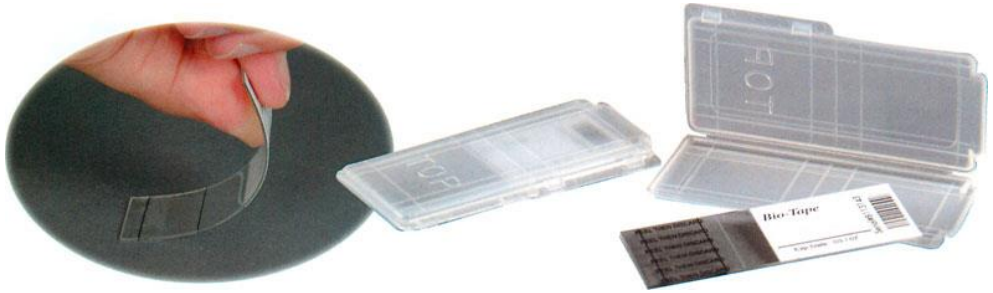
2. Indoor Exposure Evaluation
   - Indoor Air Sampling
   - Household Dust Sampling

CASPER Results

- Symptoms reported:
  - Before leak was sealed: 81%
  - After leak was sealed: 63%
- Majority of households (61%) sought medical care for symptoms experienced after well was sealed
- Residents commonly report alleviation of symptoms upon leaving their homes, both before and after leak was sealed
- 41% of households reported smelling “gas-like” odors after leak was sealed
- 35% of households reported oily residue and another 12% didn’t know if they noticed oily residue

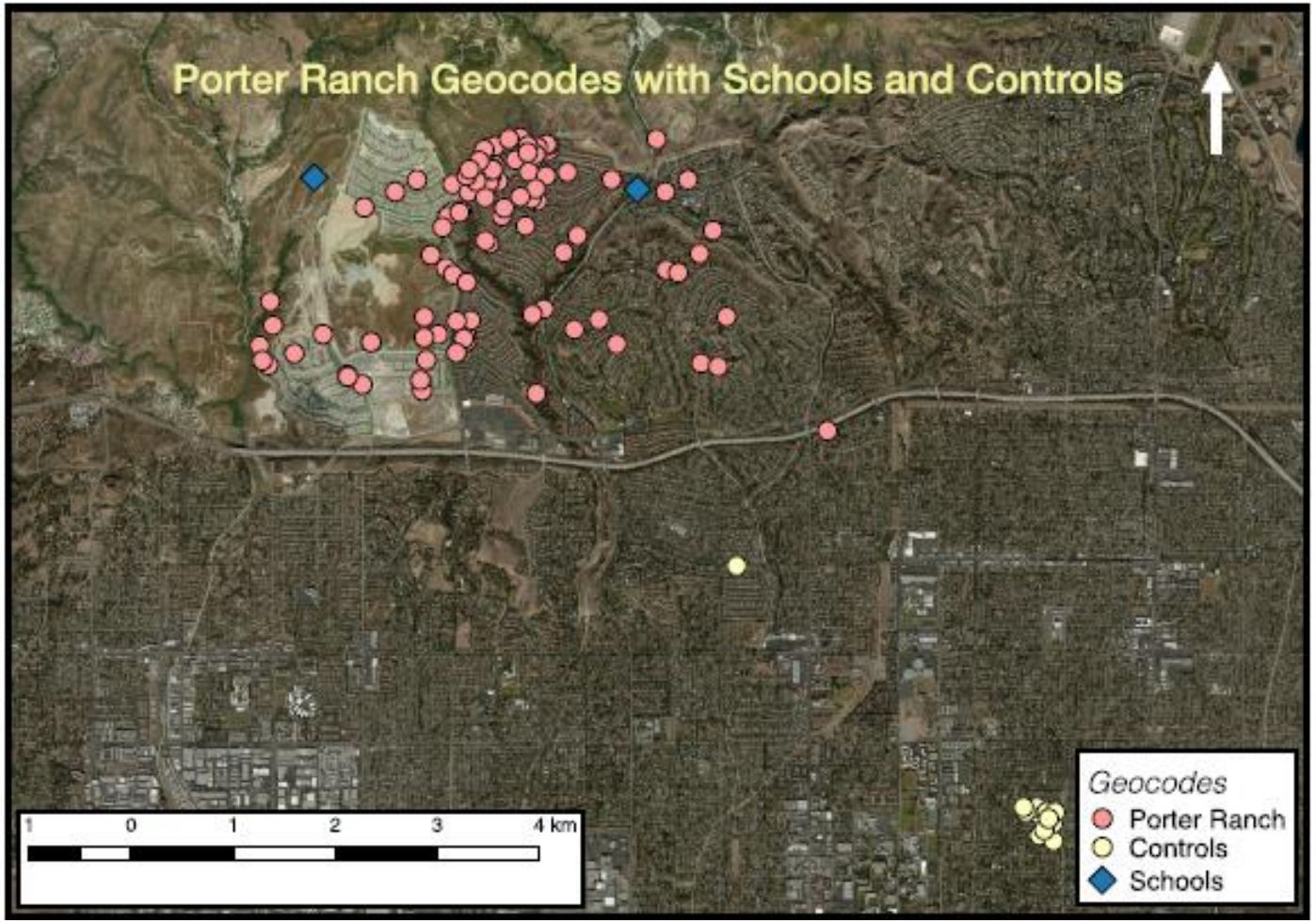
Indoor Exposure Evaluation - Methods

1. Household dust samples



2. Indoor air sampling used 4 instruments to collect air over 24-hour period

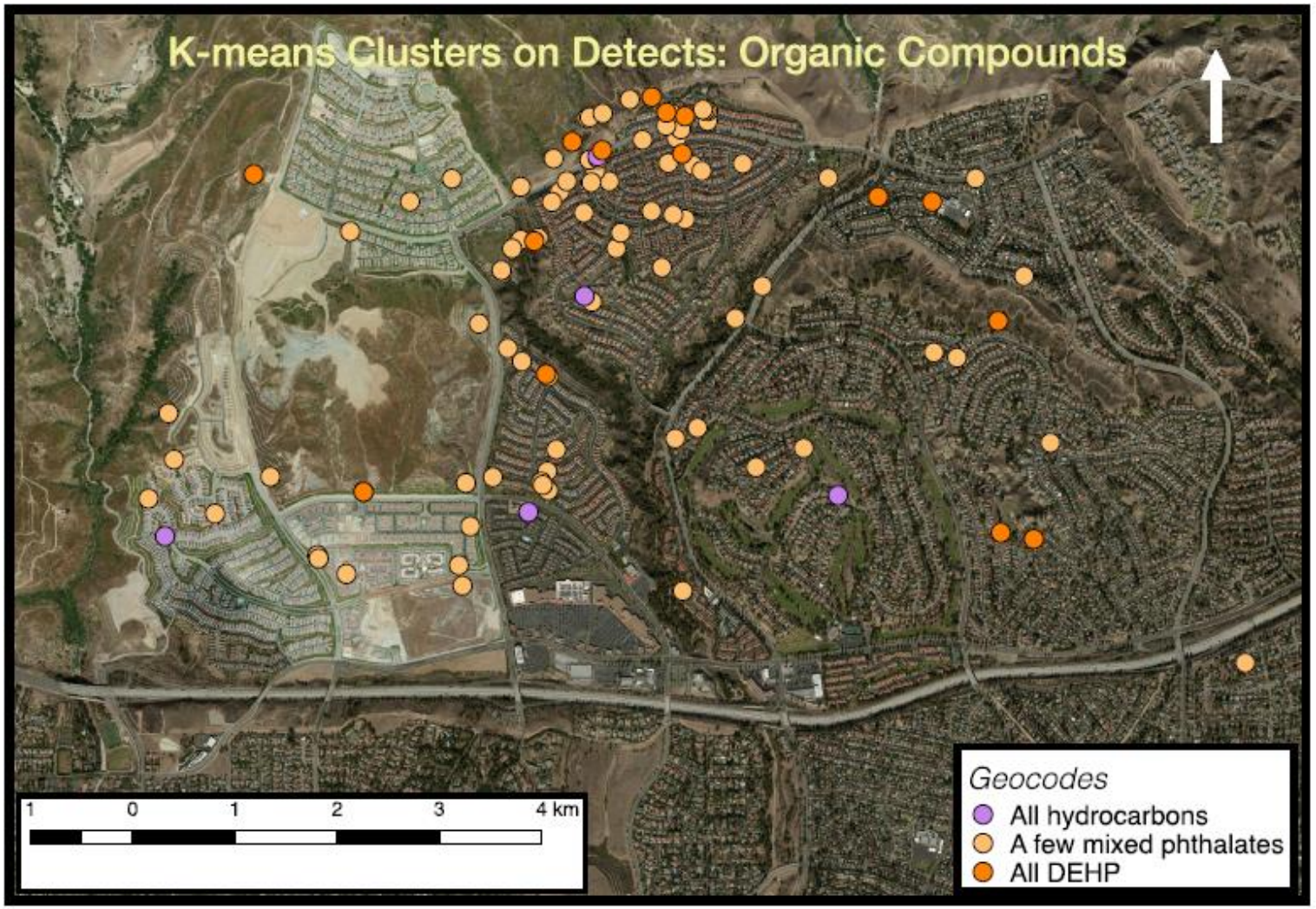
Indoor Exposure Evaluation – Sampling Locations



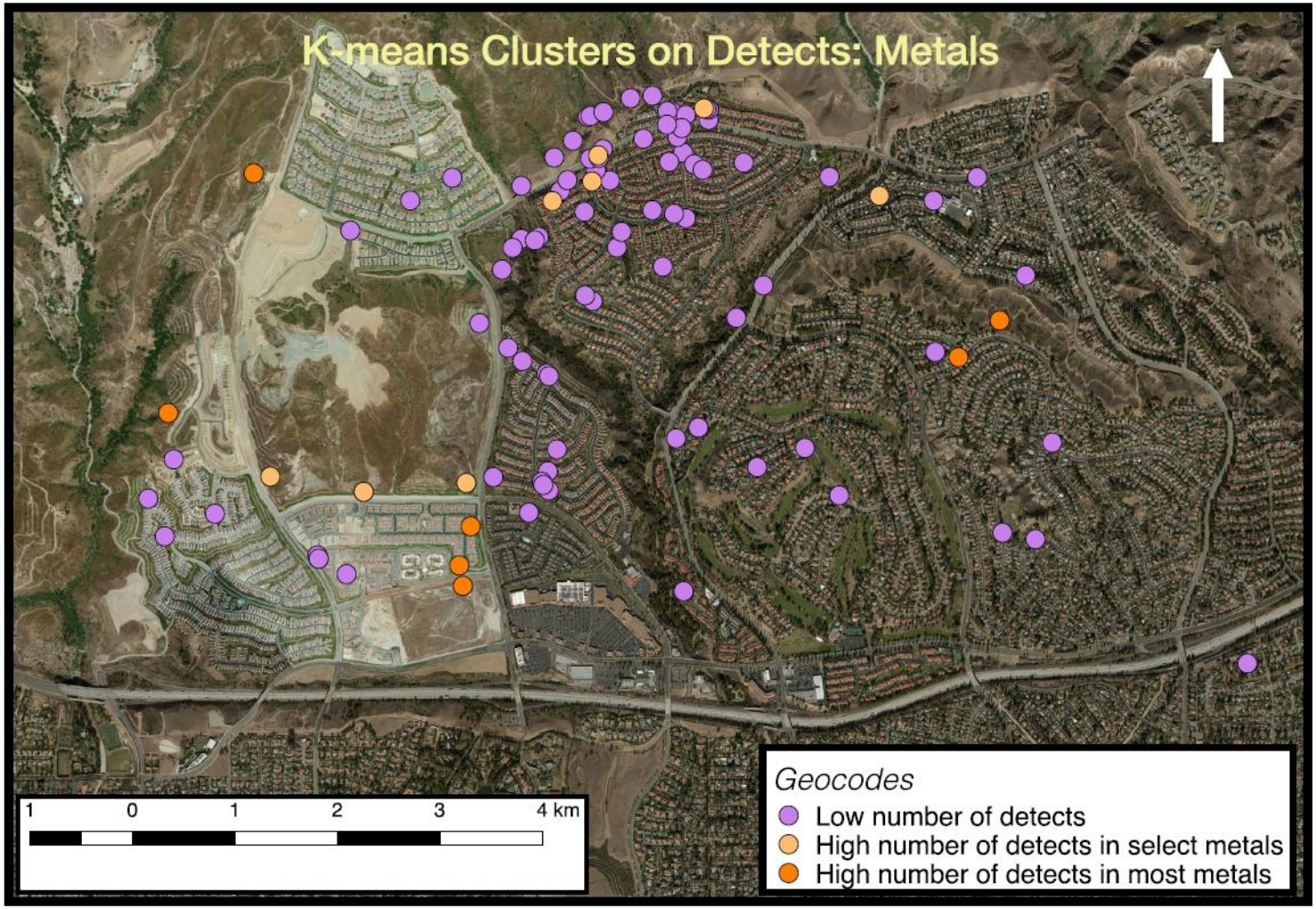
Indoor Data Assessment Methods

- Compared Porter Ranch area samples with controls and regional background data
- Mapped results to visually evaluate patterns
- Principal component analysis
  - Do houses share similar exposure profiles?
  - Is there a consistent chemical mixture?
- Sensitivity analysis by removing iron and aluminum, as some samples were taken from window sills and may expect to see these metals due to normal wear.

Map of Organic Compound Detections



Map of Metal Detections



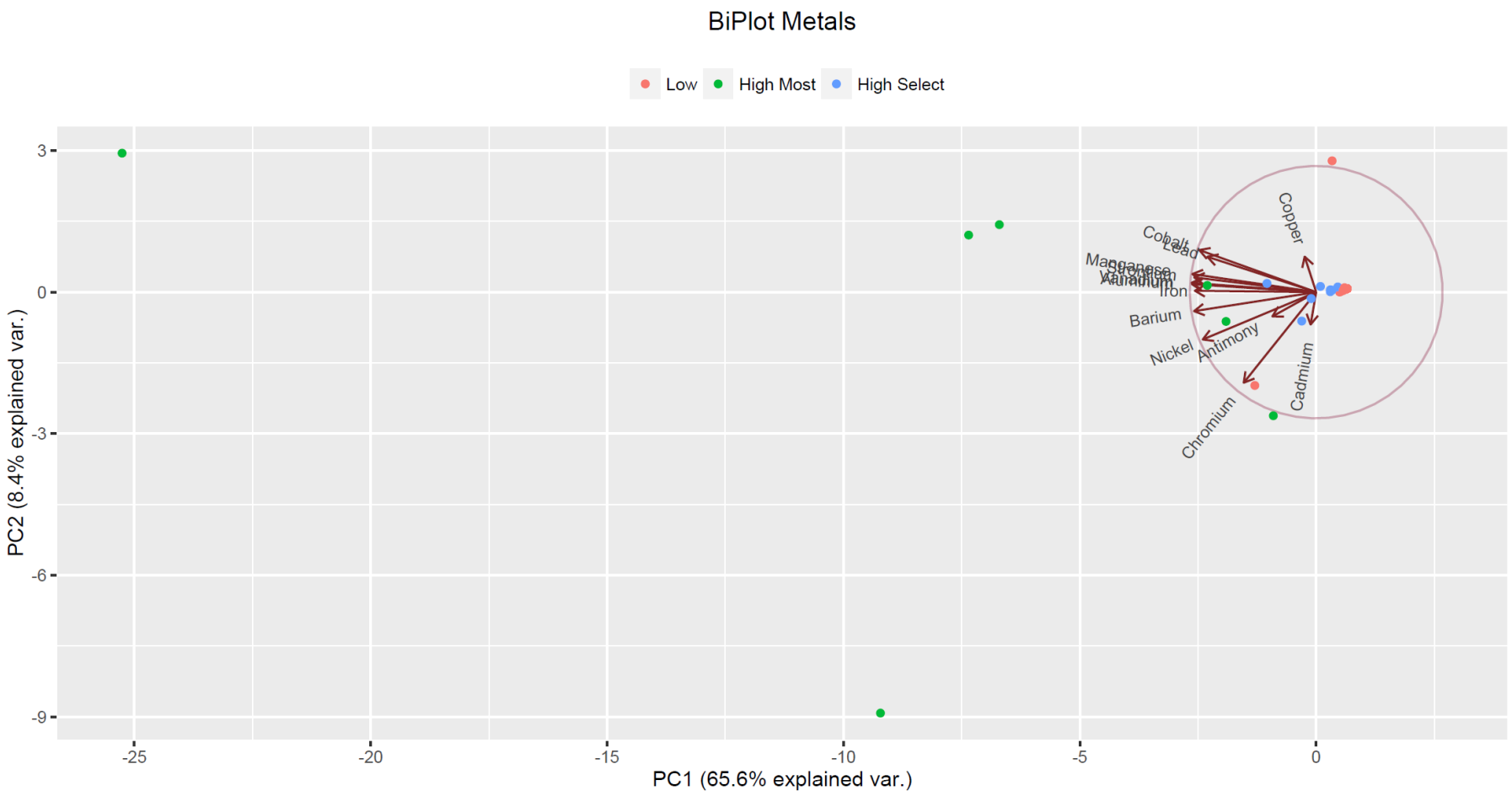
Lack of Spatial Clustering

- No apparent visual pattern of organics or metals
- No statistical evidence of clustering (Ripley-K method)

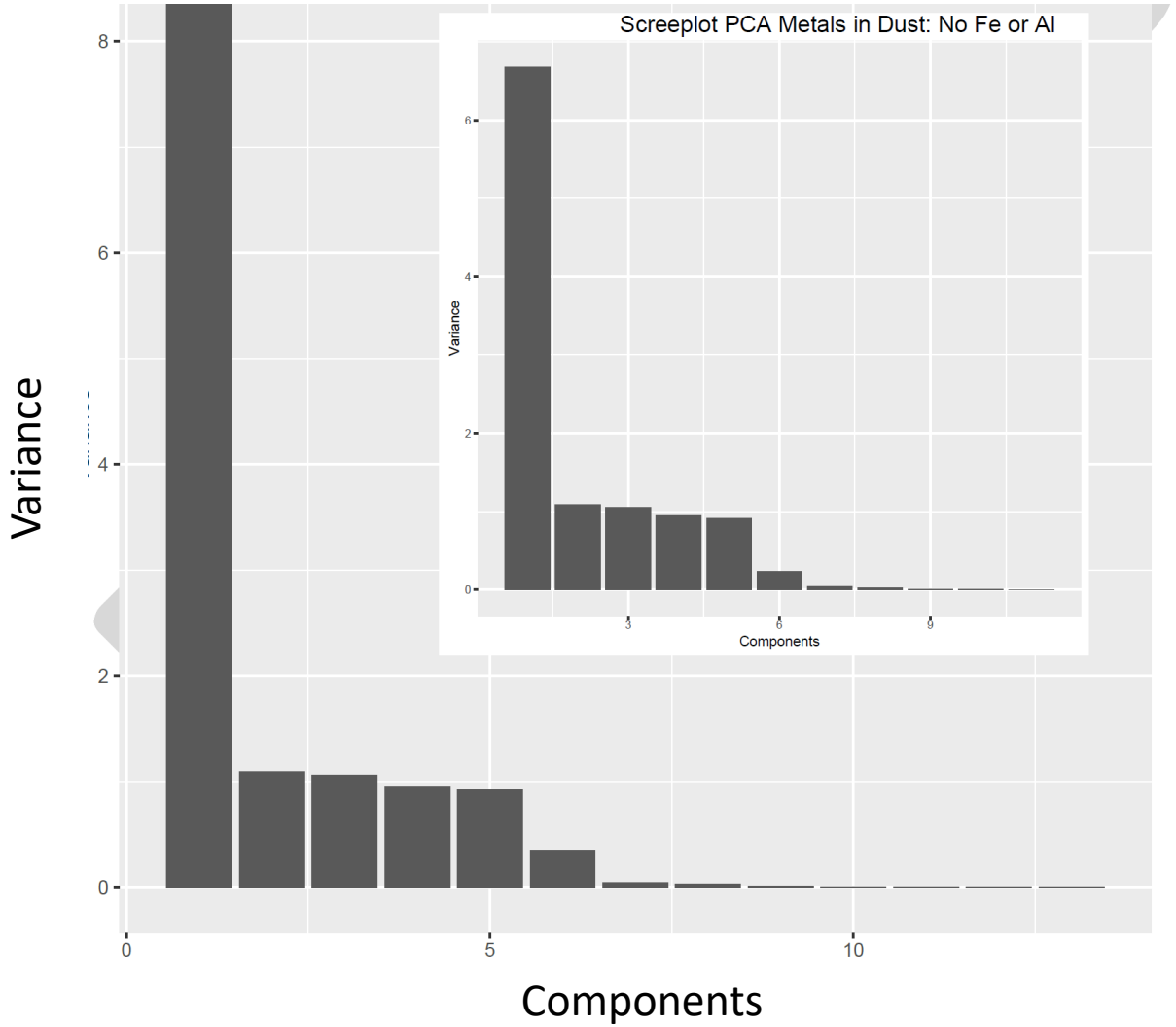
In order to identify clustering, each of the sampled homes would need uniform characteristics related to:

- Particle infiltration
- Particle settling
- Interior environmental conditions (e.g. temp, humidity)
- Window and door seals
- Insulation properties

Principal Component Analysis



Sensitivity Analysis



“Fingerprint” of Metals Linked to Drilling Mud

Barium and other metals detected in:

- Drilling mud sludge during misting events
- Soil sampling at SS-25 Well Head
- Downwind air samples during gas release
- Indoor dust samples
- Pool samples

- Provided evidence that particulates from the gas release entered homes.
- Low levels of metals may explain some of the irritation symptoms that residents continued to report.

Summary of Indoor Exposure Evaluation

Household dust:

Metals in dust detected more often/higher concentrations in Porter Ranch homes than comparison homes

- Could contribute to short-term symptoms reported
- Barium and other metals were used in drilling muds

Air sampling:

- Levels of chemicals in indoor air samples were similar between Porter Ranch homes and comparison homes

Public Health Directive for Interior Home Cleaning

- May 13: Public Health issued a directive to SoCalGas to implement the comprehensive cleaning of all homes:
  - (1) Located in Porter Ranch
  - (2) Relocated as a result of the gas leak disaster
  - (3) Located within 5 miles of Well SS-25 where residents experience symptoms

Follow-up and Survey of "Cleaned" Homes

- Of ~1,700 homes on SoCalGas' appointment list for cleaning, a total of 502 households responded to Public Health survey
- 66% of households reported symptoms after the SoCalGas cleaning
  - 43% eye, nose and throat irritation
  - 33% headache/migraine
  - 34% respiratory symptoms
  - 29% skin irritation
  - 21% nausea/vomiting
  - 20% dizziness/ lightheaded
  - 16% nosebleeds

Ongoing Public Health and Safety Assessment Needs

- Home cleaning by professionals trained in post-disaster remediation
- Continued air monitoring for particulates, air toxics
- Improved data management and integration
- Long-term health study, as ordered by Air Quality Management District
- Consult community to identify recovery priorities

Capacity Building to Reduce Environmental Threats

Recent Environmental Threats

Aliso Canyon Gas Release, Porter Ranch

- Methane leak caused health symptoms and forced relocation of residents
- Required redirection of over 100 staff to respond

Recent Environmental Threats

Exide Battery Recycling Facility, East LA

- Facility released lead and arsenic into surrounding communities of East LA, Vernon, Huntington Park, Maywood, Bell and Commerce
- Required redirection of 95 staff to respond

Recent Environmental Threats

Fruitland Magnesium Fire, Maywood

- Fire & explosion in facility immediately adjacent to residential community
- Required redirection of 43 staff to respond

Recent Environmental Threats

Hexavalent Chromium, City of Paramount

- Active investigation into industrial sources of hexavalent chromium in air
- Number of public health staff redirected to respond: pending

Source: LA Times

Environment Threats to Public Health are Mounting

- Aliso Canyon Gas Leak
- Exide Battery Contamination
- Fruitland Magnesium Fire
- Chromium in Paramount
- Firmin St. Oil Wells
- Cabrillo and Malibu Schools
- Jordan Downs
- Sleepy Valley
- Quemetco Recycling
- Extreme Weather/Wildfires
- Lugo St. Industrial Fire
- Sunshine Canyon Landfill
- Allenco
- KAST Superfund Site
- Del Rey Cleaners

Recent Environmental Disasters in Los Angeles County Highlight Need for Stronger Prevention

- Poor land use decisions that put residents and industry in close proximity
- Gaps in current regulatory system
- Aging infrastructure (e.g. oil and gas, water, power, sewage)
- Climate Change is a *"threat multiplier"*

LA County Prioritizes Environmental Health

On June 27, 2016, the Board of Supervisors adopted a motion recognizing Environmental Health Oversight and Monitoring as a Board priority.

Current Public Health Approach:

- Increase scientific and technical capacity
- Expand emergency response ability in partnership with other local and state agencies
- Fully leverage regulatory agency authorities
- Promote health in policy decisions
- Engage community partners

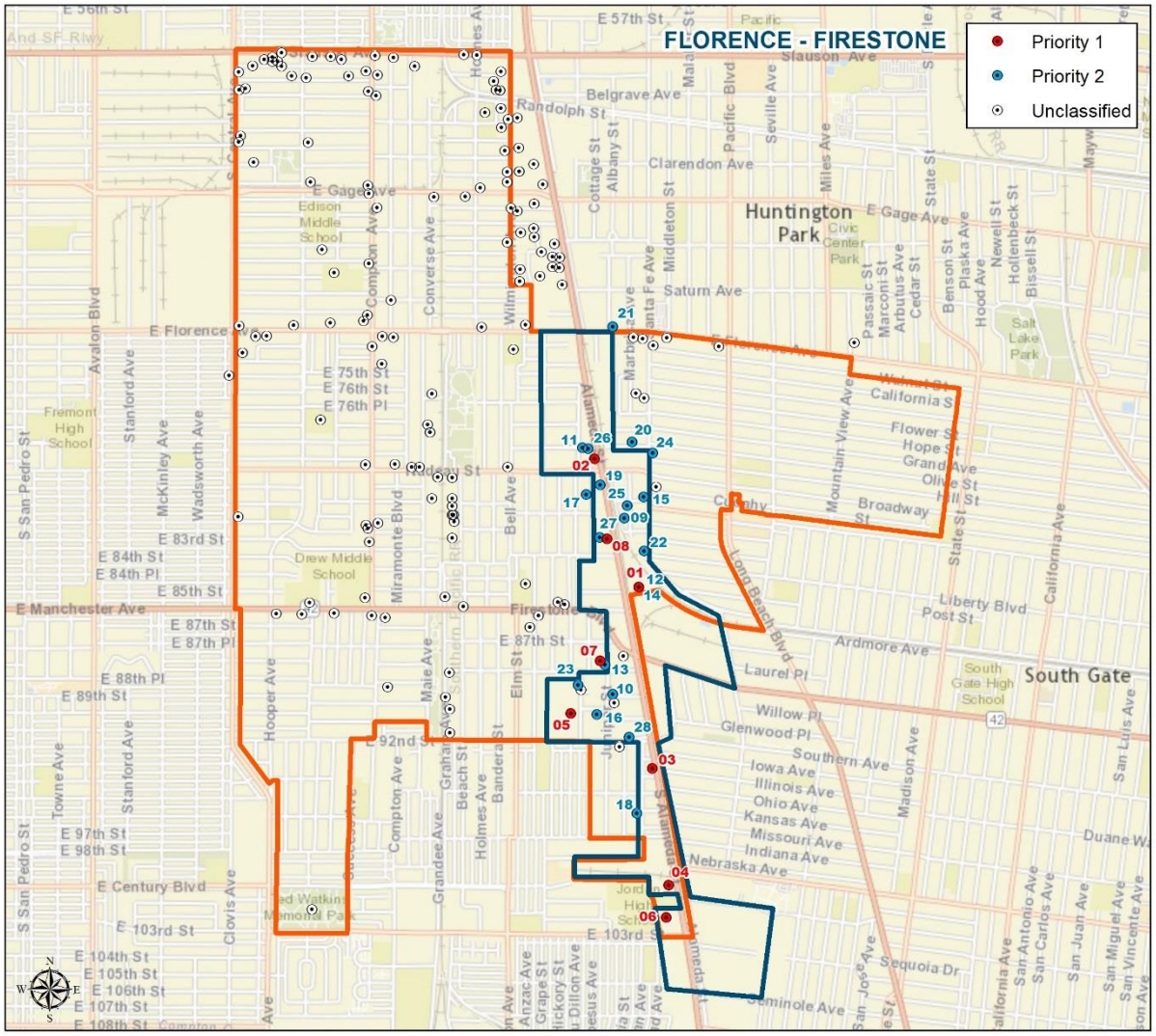
Vision for Improved Environmental Health

Los Angeles County team envisions a new landscape in which

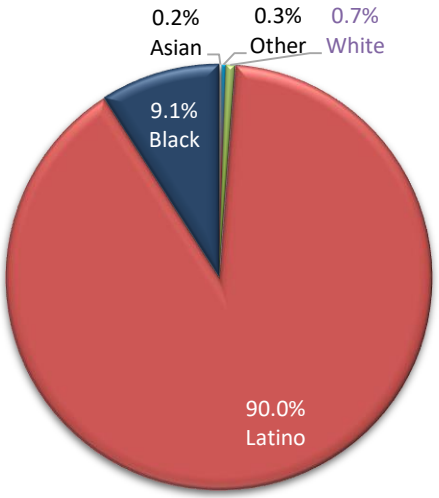
- regulations are strengthened,
- communities are empowered,
- industrial facilities achieve higher rates of compliance and
- toxic emissions are reduced.

As a result, environmental threats are minimized and health outcomes will improve.

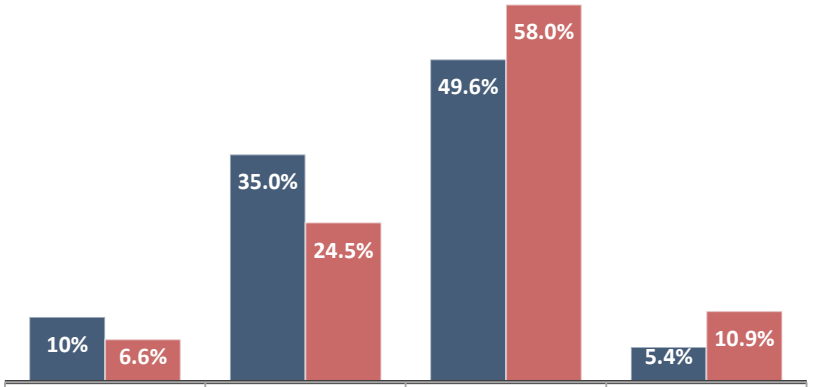
Focus Area in Community of Florence – Firestone



Florence - Firestone Ethnicity Profile

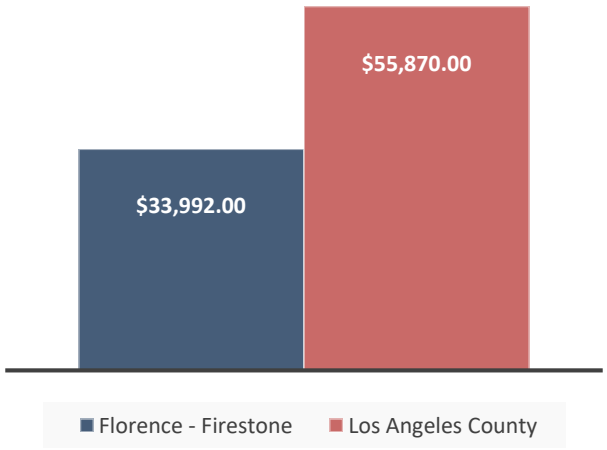


Population Distribution (Age)

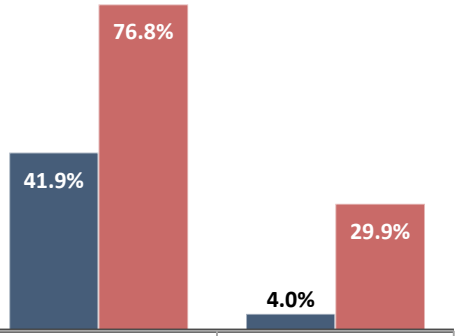


	> 5 yrs old	6 - 18 yrs old	19 - 64 yrs old	65+ yrs old
Florence - Firestone	10%	35.0%	49.6%	5.4%
Los Angeles County	6.6%	24.5%	58.0%	10.9%

Median Household Income

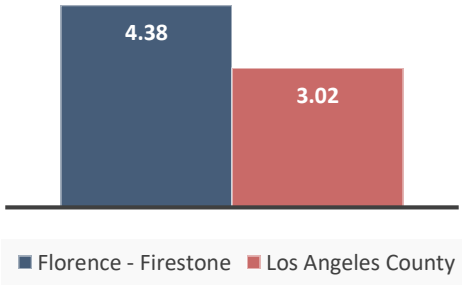


Education Attainment



	Residents 25+ with HS degree	Residents 25+ with 4 yr degree
Florence - Firestone	41.9%	4.0%
Los Angeles County	76.8%	29.9%

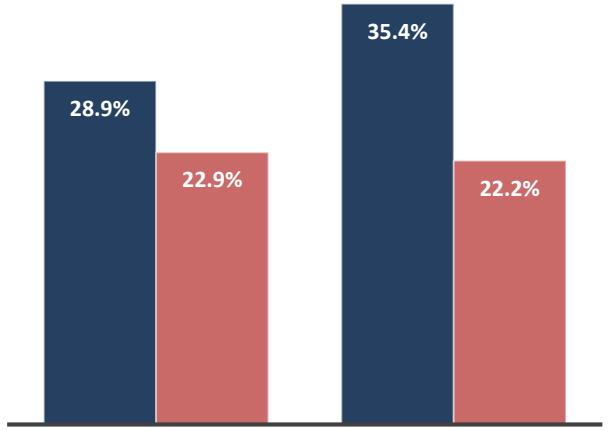
Average Household Size



Disease Death Rate

(Age Adjusted per 100,000 Population)

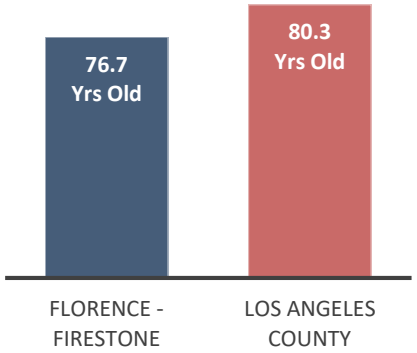
Obesity



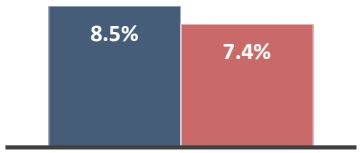
Asthma

ED visits and Hospitalizations

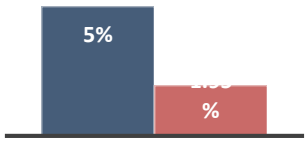
Life Expectancy



Low Birth Weight



Blood Lead Level



A Collaborative Effort

Health Services
LOS ANGELES COUNTY

County of Los Angeles
Public Health

PUBLIC WORKS
Public Service That Works

OFFICE OF EMERGENCY MANAGEMENT
CHIEF EXECUTIVE OFFICE

HOPE WELLNESS RECOVERY
LAC DMH
LOS ANGELES COUNTY DEPARTMENT OF MENTAL HEALTH

LOS ANGELES COUNTY DEPARTMENT of REGIONAL PLANNING

COUNTY OF LOS ANGELES FIRE DEPARTMENT
CALIFORNIA

Thank you

County of Los Angeles Public Health