

# Biomonitoring California Scientific Guidance Panel Meeting

## August 2026



## Community Health and Air Quality Implications of Refinery Retirements in Los Angeles (CHAIRS-LA) Study

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# Disclosure

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I declare no conflict of interest to disclose.

Photos credits to Marinelle Villanueva.

# REFINERY POLLUTION BURDENS

- Third largest stationary source of PM<sub>2.5</sub> in the nation<sup>1</sup>
  - Emit more than 180 chemicals including metals<sup>2,3,4</sup>
- About 1.5 million Californians live within 5 km of an oil refinery<sup>5</sup>
- Disproportionately impact low-income, Hispanic, and Black households<sup>6</sup>

[1] US EPA NEI, 2021 [2] Riveles & Nagai (OEHHA), 2019

[3] Adebiyi et al, 2022 [4] Tavella et al, 2025

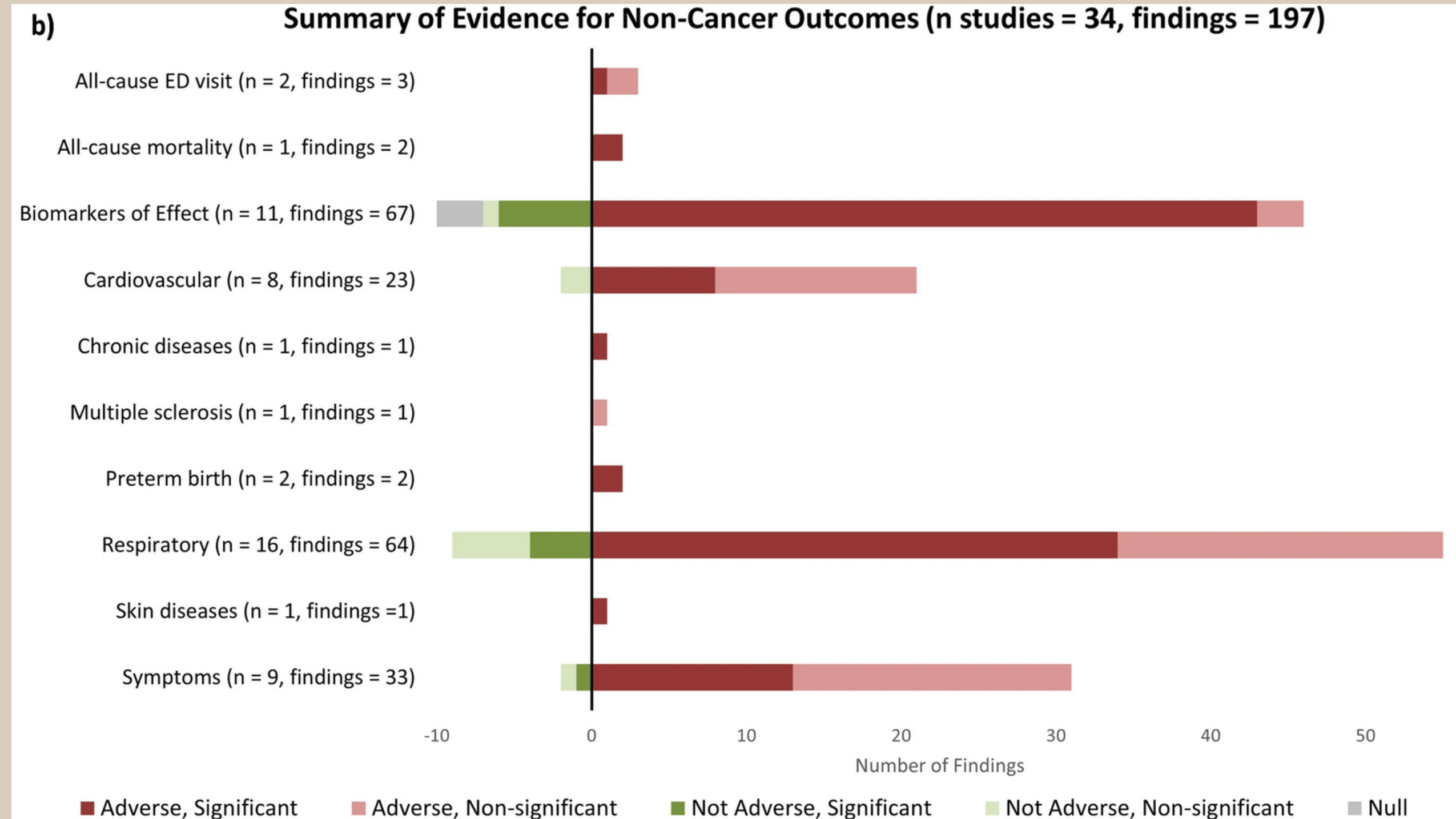
[5] American Community Survey, 2019-2023 [6] Donaghy et al, 2024



Phillips 66 oil refinery fence line in Wilmington, California

# HEALTH EFFECTS OF LIVING NEAR REFINERIES

- Scoping review of 54 epidemiological studies from 15 countries
- Strong evidence of cancer and adverse respiratory outcomes associated with living near oil refineries
- Most studies were cross-sectional



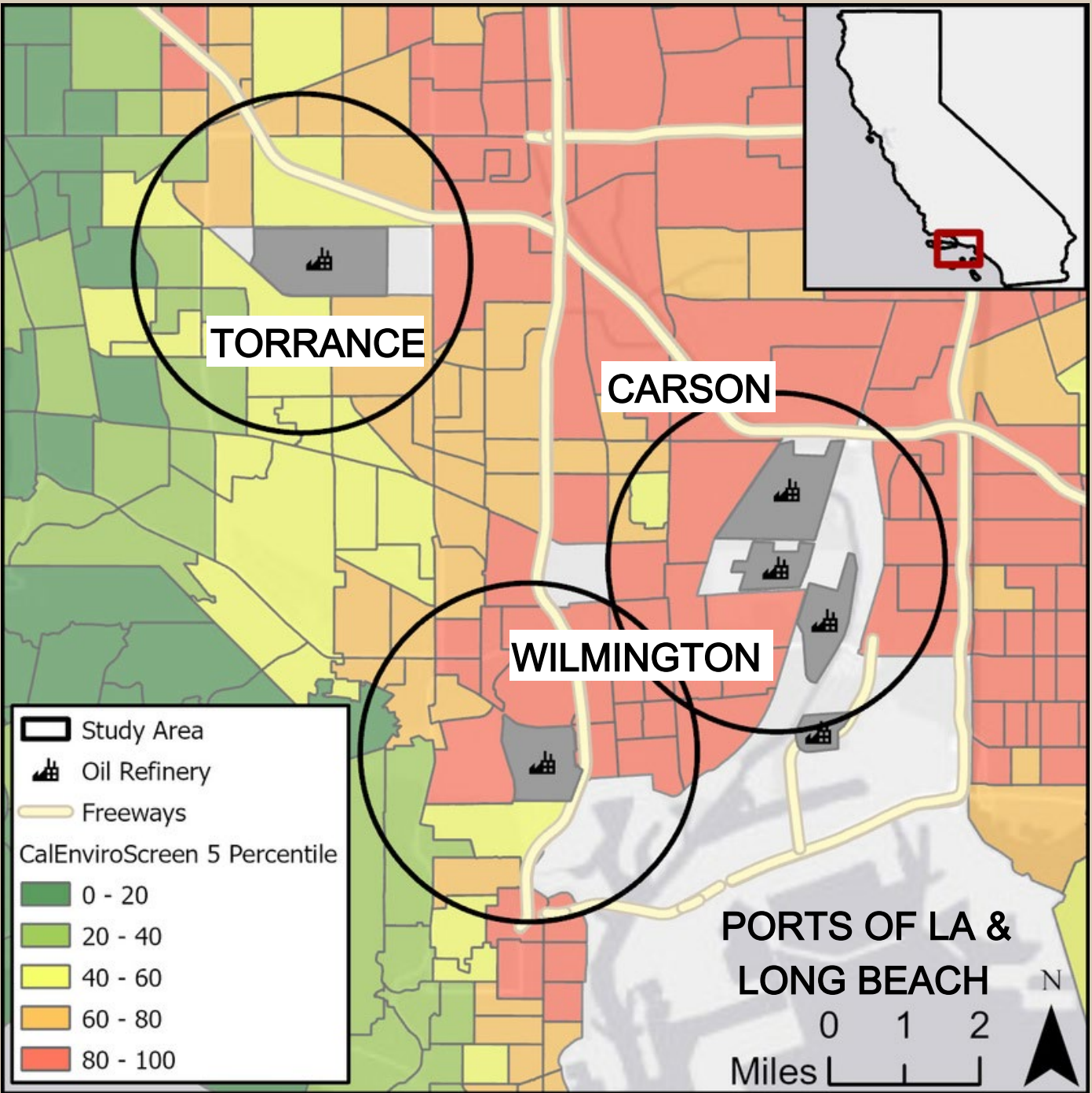
(Villanueva et al., 2026. *Current Environmental Health Reports*)

# LOS ANGELES SOUTH BAY & HARBOR REGIONS

- High Pollution Burden <sup>7</sup>
- Six oil refineries<sup>8</sup>
- Third largest oil field in the US (Wilmington Oil Field) <sup>9</sup>
- Two busiest ports in the US
- Railways and three major freeways

| Demographics <sup>10</sup>          | Wilmington | Carson | Torrance |
|-------------------------------------|------------|--------|----------|
| Latinx (%)                          | 87         | 35     | 13       |
| Asian (%)                           | 2.7        | 24     | 29       |
| Black (%)                           | 2.6        | 25     | 1.9      |
| Less than high school education (%) | 61         | 29     | 9.4      |
| Foreign born (%)                    | 44         | 33     | 28       |

[7] CalEnviroScreen5.0 [8] South Coast AQMD Rule 1180  
[9] EJ Atlas, 2023 [10] Los Angeles Times Mapping L.A. Neighborhoods



Multiple census tracts rank in the top 5% most pollution burdened according to CalEnviroScreen

# OIL REFINERY CLOSURES

- Phillips 66 Los Angeles Refinery retired in December 2025
- Local air pollution likely to decrease after emissions from refining operations cease
- Facility decommissioning and remediation processes may release contaminants
- Unclear whether refinery retirements will improve public health

THE PHILLIPS 66 LA REFINERY CLOSURE NOTICE WAS A BIG SURPRISE.

**COMMUNITIES** for a  
**BETTER**  
**ENVIRONMENT**  
est. 1978

## Is fossil fuel phaseout finally picking up speed?

November 2024 | Julia May, Senior Scientist, CBE

NEWS • News

### DAILY BREEZE

## As oil industry in California wanes, what will become of shuttered refineries?

The Phillips 66 Los Angeles Refinery could be a test case for how the state and local governments should handle refinery closures, experts say



By **MADELINE ARMSTRONG** | marmstrong@scng.com  
PUBLISHED: March 2, 2026 at 6:30 AM PST



### Refinery to Halt Production

The Phillips 66 Los Angeles Refinery, with locations in Carson and the Los Angeles neighborhood of Wilmington, is slated to idle before 2026.

PAUL HORN / Inside Climate News

**CHAIRS-LA** is a longitudinal, community-based study to measure exposures to air pollution and cardiopulmonary health near oil refineries in Los Angeles County and examine the potential public health benefits of a transition from petroleum fuels.



## OBJECTIVES

- 1** Examine the differences in exposures to air pollutants and cardiopulmonary health in communities near active and retired refineries.
- 2** Assess potential changes in exposures and cardiopulmonary health after the retirement of the Phillips 66 Los Angeles Refinery.
- 3** Advance community education and research capacity by collaborating with community partners in study design, recruitment, and results return.

# COLLABORATORS

## ACADEMIC INSTITUTIONS



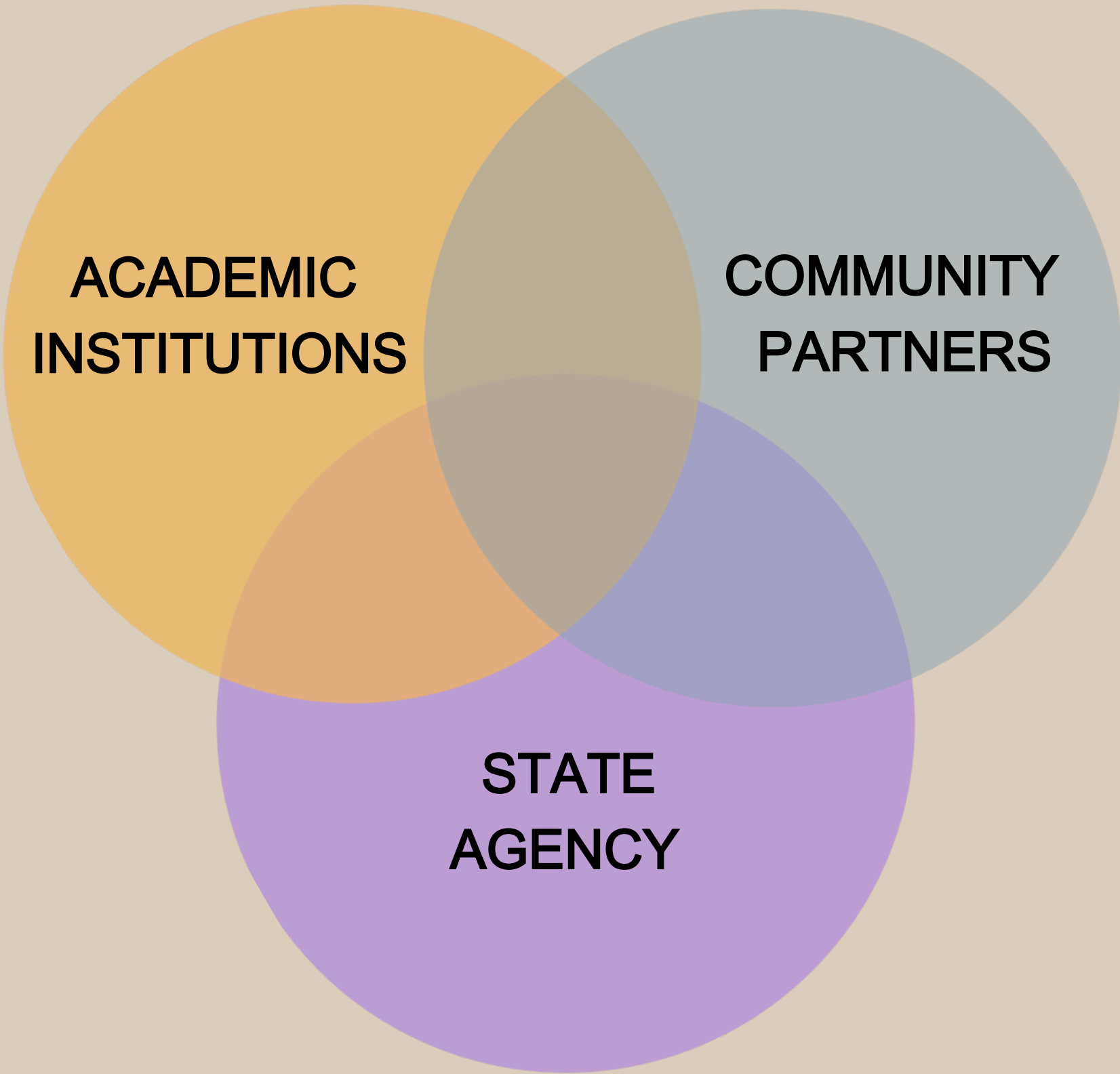
## STATE AGENCY



## COMMUNITY PARTNERS



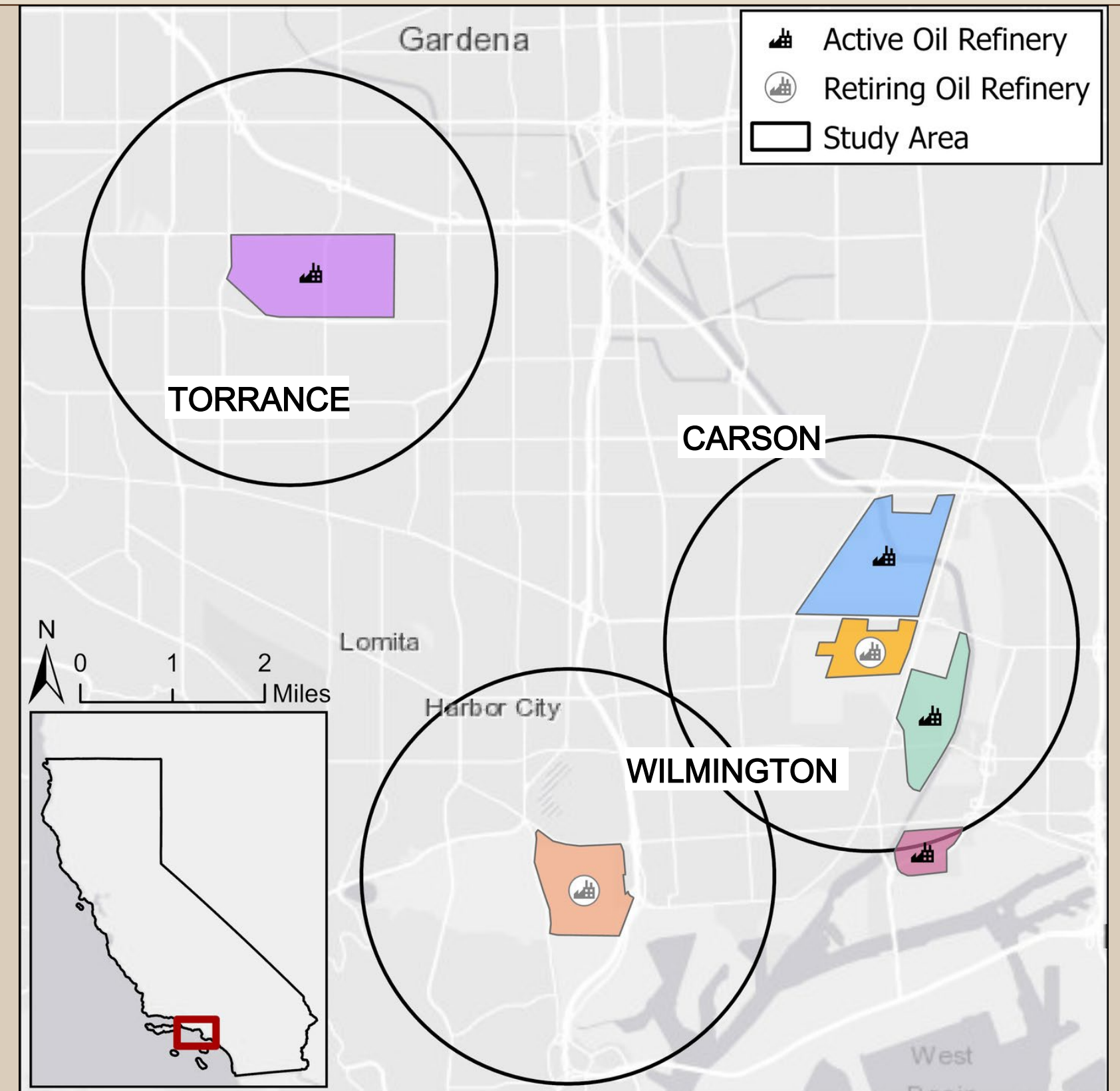
# COMMUNITY ENGAGED RESEARCH



# STUDY AREA & ELIGIBILITY CRITERIA

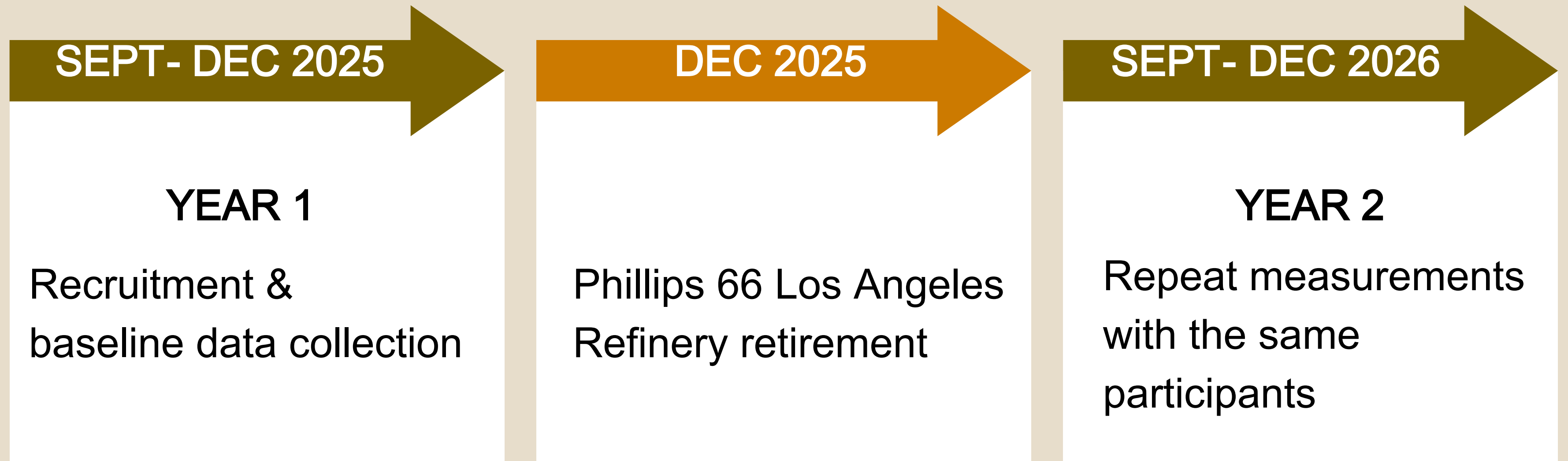


- Adults at least 18 years old
- Do not smoke tobacco products
- Reside within 2 km of:
  - Retiring oil refinery
  - Torrance (active) oil refinery
- Residence duration of at least 1 year
- Speak English, Spanish, or Tagalog
- One person per household



# TIMELINE

Collect air and urinary samples and cardiopulmonary health measures, repeated annually before and after the refinery's retirement



# RECRUITMENT



## SAMPLING METHOD

Convenience sample

Potential participants were screened for eligibility



## COMMUNITY OUTREACH

Door-to-door flyer distribution

Community meeting presentations

Physical flyers at public institutions

Targeted social media advertising

**CHAIRS**  
Community Health & Air Quality  
Implications of Refineries and Vehicles

## SE BUSCAN VOLUNTARIOS

### Estudio sobre Refinerías, Calidad del Aire, y Salud

¿Vive cerca de una refinería de petróleo en Carson, Wilmington, o Torrance?

Investigadores de la Universidad de California, Los Ángeles están realizando un estudio para evaluar si el cierre de las refinerías de petróleo afecta la exposición a la contaminación del aire y la salud respiratoria de residentes cercanos

| Criterio de elegibilidad                                                                                                                                                                    | Requisitos del estudio                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>18 años de edad o más</li> <li>Haber vivido dentro de 2 km de una refinería durante al menos un año</li> <li>No fumar productos de tabaco</li> </ul> | <ul style="list-style-type: none"> <li>Tener puesto/a una muñequera por 7 días</li> <li>Encuesta de salud</li> <li>Medición de presión arterial y función pulmonar</li> </ul> |

**CHAIRS**  
Community Health & Air Quality  
Implications of Refineries and Vehicles

## VOLUNTEERS NEEDED

### A Study on Refineries, Air Quality, and Health

Do you live near an oil refinery in Carson, Wilmington, or Torrance?

Researchers from the University of California, Los Angeles are conducting a study on whether the retirement of oil refineries affects air pollution exposure and respiratory health for nearby residents

| Eligibility Criteria                                                                                                                                                            | Study Requirements                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>18 years old or older</li> <li>Living within 2km of a refinery for at least 1 year</li> <li>Do not smoke any tobacco products</li> </ul> | <ul style="list-style-type: none"> <li>Wear a wristband for 7 days</li> <li>Health survey</li> <li>Blood pressure &amp; lung function measures</li> </ul> |

Compensación adicional por cada visita anual, hasta un total de \$500

Para obtener más información, por favor contacte a: [contact information]

**Participants will receive \$50**

## YEAR 1 INITIAL VISIT



**INFORMED CONSENT  
BASELINE QUESTIONNAIRE**



**CARDIOPULMONARY MEASUREMENTS**

**DISTRIBUTED SAMPLE COLLECTION MATERIALS**

- Fresh Air wristband
- Fresh Air outdoor clip (subsample)
- Biomonitoring materials (urine, subsample)
- Daily journal
- Biomonitoring questionnaire (subsample)



Fresh Air Clip



Fresh Air Wristband



Lung function test using spirometry

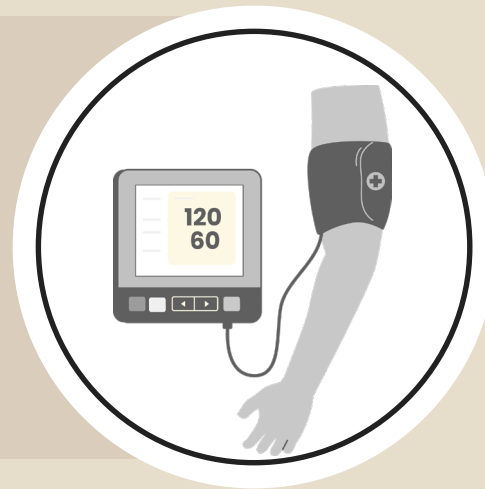
# CARDIOPULMONARY HEALTH MEASURES

## Blood Pressure

Systolic & Diastolic Pressure

Pulse Rate

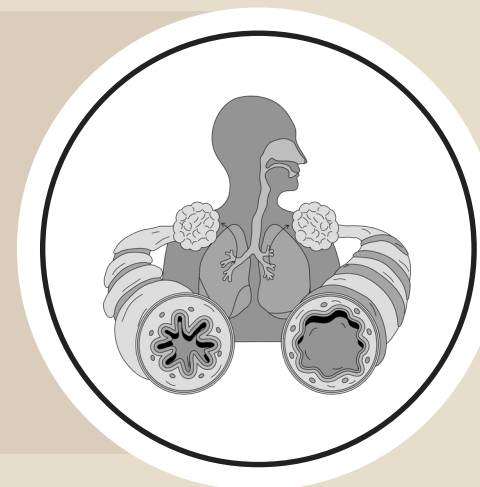
- Measured x3 per participant



## Airway Inflammation

Fractional Exhaled Nitric Oxide (FeNO)

- Biomarker of immune response



## Lung Function

Forced Vital Capacity (FVC)

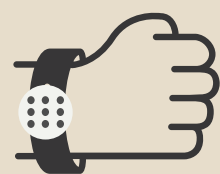
Forced Expiratory Volume in 1 Second (FEV1)

- Maximal-effort spirometry test



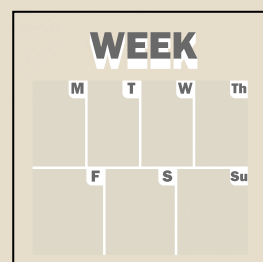
# PERSONAL & OUTDOOR AIR CONCENTRATIONS

## FRESH AIR PASSIVE SAMPLER



Compared to silicone wristbands:

- Higher retention of semi-volatiles<sup>11</sup>
- Exclusively collects gas-phase contaminants<sup>11</sup>

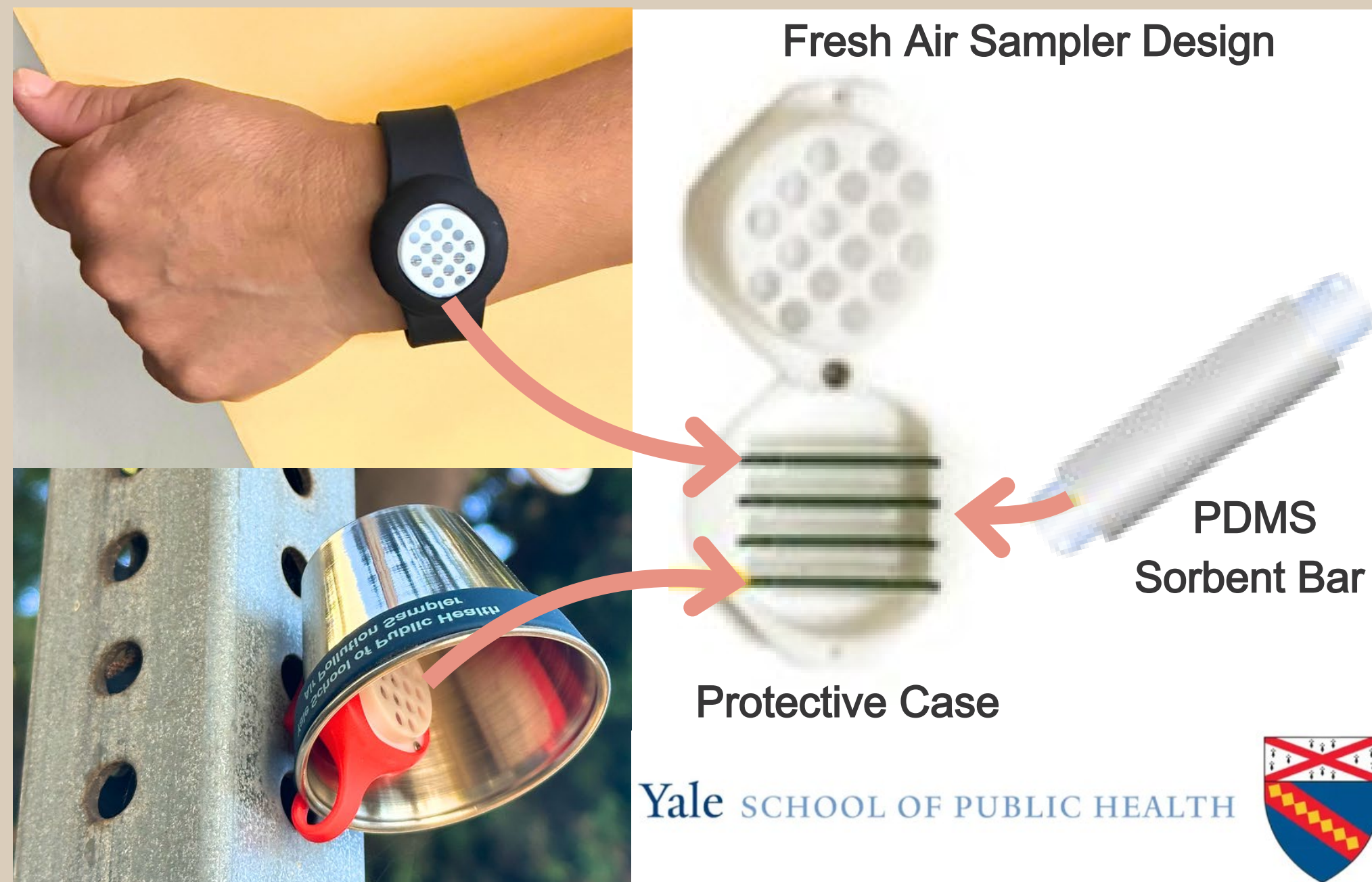


Continuous ~7 day sampling period



Analyzed by gas chromatography-mass spectrometry<sup>12</sup>

[11] Okeme et al, 2023 [12] Lin et al, 2020



# POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

- Semi-volatile chemicals with carcinogenic, mutagenic, and teratogenic properties
- **Health impacts:** cancer, respiratory diseases, reproductive and neurological dysfunction
- **Sources:** combustion processes and unburned petroleum
- **Exposure routes:** inhalation and ingestion

[13] Feng et al, 2025 [14] Kim et al, 2013

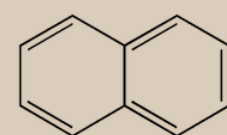
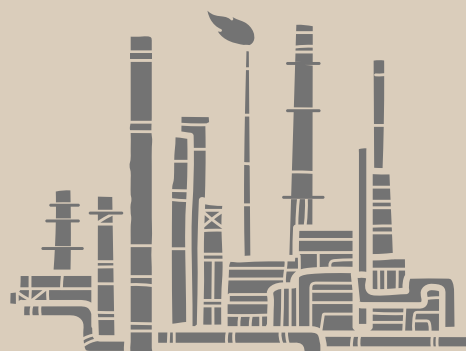
Gasoline and Diesel Vehicle Emissions



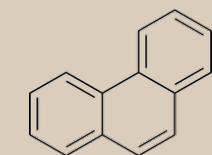
Wildfires



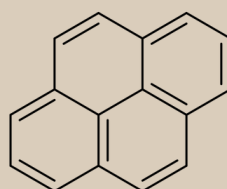
Industrial Emissions



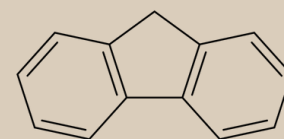
NAP



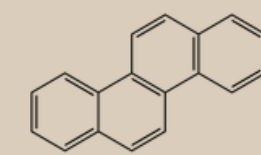
PHE



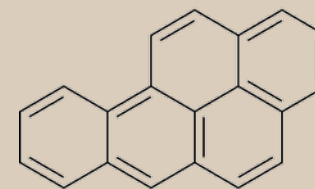
PYR



FLU



CHR



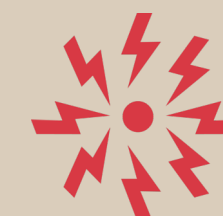
BaP



DNA Damage



Inflammation



Oxidative Stress

# AIR SAMPLE DEPLOYMENTS

178 wristband and 57 outdoor clip samples during Year 1 (fall 2025 - summer 2026)

Repeated outdoor clips at 6 households near refinery fencelines and 2 background sites

- Track seasonal changes in outdoor concentrations
- Measure potential air pollution reductions overtime after the refinery retirements



**Fall 2025**

178 wristbands  
33 outdoor clips

**Winter 2026**

8 outdoor clips

**Spring 2026**

8 outdoor clips

**Summer 2026**

8 outdoor clips

# URINE SAMPLE COLLECTION & ANALYTES

## FIRST MORNING VOIDS



86 participants collected two samples  
on two consecutive mornings

- 178 samples total

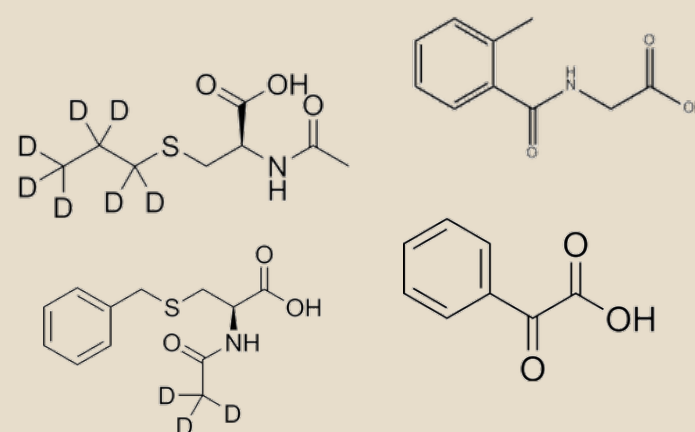
Environmental Health Lab (Richmond, CA)



Metals

|                                        |                                      |                                         |
|----------------------------------------|--------------------------------------|-----------------------------------------|
| 25<br><b>Mn</b><br>Manganese<br>54.938 | 27<br><b>Co</b><br>Cobalt<br>58.9332 | 28<br><b>Ni</b><br>Nickel<br>58.6934    |
| 33<br><b>As</b><br>Arsenic<br>74.92159 | 34<br><b>Se</b><br>Selenium<br>78.96 | 48<br><b>Cd</b><br>Cadmium<br>112.411   |
| 51<br><b>Sb</b><br>Antimony<br>121.760 | 80<br><b>Hg</b><br>Mercury<br>200.59 | 81<br><b>Tl</b><br>Thallium<br>204.3833 |

VOC metabolites



(e.g. BTEX metabolites)



# QUESTIONNAIRES DURING SAMPLE COLLECTION

## DAILY JOURNAL



Activities logged each day while participant wore wristband

- E.g. environmental tobacco smoke, cooking with a gas stove, candle or incense burning



## BIOMONITORING QUESTIONNAIRE

- Product use, cooking habits, and dietary intake on the day before urine sample was collected
- Drinking water source
- Recent metal work

| CHAIRS-LA DAILY JOURNAL                                                                                                                                                                                                                                                                                       |                          |                          |                          |                          |                          |                          |                          |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| This tracker helps you document your daily activities and experiences while wearing the wristband. Each day, you'll see a list of statements asking if you engaged in certain activities or were exposed to specific situations. Simply check the box next to each statement that applies for each given day. |                          |                          |                          |                          |                          |                          |                          |
|                                                                                                                                                                                                                                                                                                               | Date:                    | Date:                    | Date:                    | Date:                    | Date:                    | Date:                    | Date:                    |
| Wore wristband today                                                                                                                                                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Left windows or door open                                                                                                                                                                                                                                                                                     | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Used an air conditioner                                                                                                                                                                                                                                                                                       | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Used an air purifier                                                                                                                                                                                                                                                                                          | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Used a humidifier                                                                                                                                                                                                                                                                                             | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Used a candle, incense, air freshener, or burned copal or sage                                                                                                                                                                                                                                                | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

| Food Consumption                                                                  |                                                                                                                                                                                            |                                                                                                                                                                                            |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Activity                                                                          | The <u>day before</u> collecting your first urine sample                                                                                                                                   | The <u>day before</u> collecting your second urine sample                                                                                                                                  |
| 8. How many times did you eat fried, grilled, barbecued, smoked, or roasted food? | <input type="checkbox"/> Never<br><input type="checkbox"/> Once<br><input type="checkbox"/> 2-3 times<br><input type="checkbox"/> More than 3 times<br><input type="checkbox"/> Don't Know | <input type="checkbox"/> Never<br><input type="checkbox"/> Once<br><input type="checkbox"/> 2-3 times<br><input type="checkbox"/> More than 3 times<br><input type="checkbox"/> Don't Know |
| 9. How many times did you eat any type of fish or shellfish?                      | <input type="checkbox"/> Never<br><input type="checkbox"/> Once<br><input type="checkbox"/> 2-3 times<br><input type="checkbox"/> More than 3 times<br><input type="checkbox"/> Don't Know | <input type="checkbox"/> Never<br><input type="checkbox"/> Once<br><input type="checkbox"/> 2-3 times<br><input type="checkbox"/> More than 3 times<br><input type="checkbox"/> Don't Know |

# SUMMARY OF STUDY PARTICIPANTS: YEAR 1



## 180 RESIDENTS

N=150 near refinery retirements  
N=30 near Torrance (active) refinery



## SOCIOECONOMIC STATUS

|                                 |     |
|---------------------------------|-----|
| Primarily Spanish-speaking      | 52% |
| Foreign born                    | 40% |
| Less than high school education | 33% |
| Household income < \$24,000     | 32% |



## DEMOGRAPHICS

Mean age 47 years (range 18-85)

|          |     |
|----------|-----|
| Female   | 83% |
| Hispanic | 76% |
| White    | 11% |
| Asian    | 9%  |
| Black    | 2%  |



## HEALTH

|                            |     |
|----------------------------|-----|
| Prior smoking history      | 22% |
| Non-tobacco product smoker | 3%  |
| Prior asthma diagnosis     | 17% |

# NEXT STEPS FOR CHAIRS-LA

- Lab analyses for Fresh Air and urine samples
- Exploring adding PAHs and biomarkers of effect in urine
- Community engagement and results return for Year 1
  - Share individual results with study participants
  - Present results in the community
  - Launch study website (chairs-study.org)
- Repeat measurements with study participants in Fall 2026
  - Updates to questionnaire
    - Changes to behavior or home, subjective cognitive function, perceived neighborhood air pollution
- Secure funding for additional years of data collection



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**Torrance Refinery Action Alliance:** Steve Goldsmith

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**UC Irvine** : Jill Johnston (Co-I) and Alexander Silverman

**Yale University** : Krystal Pollitt (Co-I)

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# THANK YOU!

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