Tri-Valley
Community Air Monitoring Plan

California Statewide Mobile Monitoring Initiative (SMMI)

September 2025

Prepared by Aclima, Inc.
in partnership with Tri-Valley Air Quality Climate Alliance and the SMMI Project Expert Group

California Climate Investments
Cap and Trade Dollars at Work

California Air Resources Board

The Statewide Mobile Monitoring Initiative is part of California Climate Investments, a statewide initiative that puts billions of Cap-and-Trade dollars to work reducing greenhouse gas emissions, strengthening the economy, and improving public health and the environment — particularly in disadvantaged communities.

Summary

This Community Air Monitoring Plan is prepared under the Statewide Mobile Monitoring Initiative (SMMI), a California Air Resources Board project. The SMMI is a statewide effort to use mobile monitoring methods to gather a comprehensive dataset of criteria pollutants, toxic air contaminants, and greenhouse gases. The SMMI is part of California Climate Investments and aims to reduce greenhouse gas emissions and improve public health, particularly in disadvantaged communities. Aclima, Inc., a California Public Benefit Corporation focused on air monitoring technology, was contracted by the California Air Resources Board to develop and implement Community Air Monitoring Plans using mobile monitoring in 62 Consistently Nominated Communities (CNCs), which have been nominated for the community air protection program, but have not been selected for participation. Resources are needed to address air pollution in these communities.

The primary purpose of the SMMI is to provide better understanding of air pollution in 62 CNCs through mobile monitoring following a rigorously developed community air monitoring plan based on effective and inclusive community engagement.

The purpose of this Community Air Monitoring Plan (CAMP) is to outline the mobile air monitoring that will be conducted in response to air quality issues identified by community outreach in Tri-Valley and inform future plans and community actions. This CAMP will outline monitoring objectives that reflect resident concerns about where and what pollution is most impactful. Community voices directed where mobile air monitoring will take place, the monitoring objectives, and where focused pollution studies are needed. This project also seeks to ensure that data is shared in an accessible way with all interested parties, including community members, to support the planning and implementation of emissions reduction actions. Data will be presented in digital format, in physical printout form, and verbally in public webinars.

Contents

List of Abbreviations Used in the Community Air Monitoring Plan

Abbreviations	Term
AMN	Aclima Mobile Node
AMPs	Aclima Mobile Platforms
AQIs	Air Quality Indexes
AQS	Air Quality System
BAAQMD	Bay Area Air District
BC	Black Carbon
C2H6	Ethane
CAMP	Community Air Monitoring Plan
CARB	California Air Resources Board
CBOs	Community-Based Organizations
CES	CalEnviroScreen
CH4	Methane
CNC	Consistently Nominated Community
CO	Carbon Monoxide
CO2	Carbon Dioxide
CLRD	Chronic Lower Respiratory Disease
EPA	Environmental Protection Agency
GHGs	Greenhouse Gases
L0	Level 0
L1	Level 1
L2a	Level 2a
L2b	Level 2b
L3	Level 3

L4	Level 4
NO	Nitric Oxide
NO2	Nitrogen Dioxide
NOx	Total Oxides of Nitrogen
O3	Ozone
PEG	Project Expert Group
PEL	Permissible Exposure Limit
PI	Principal Investigator
PM2.5	Fine Particulate Matter
PML	Partner Mobile Laboratory
QA	Quality Assurance
QC	Quality Control
REL	Reference Exposure Level
RFP	Request for Proposal
ROG	Reactive Organic Gas
SMMI	Statewide Mobile Monitoring Initiative
TVAQCA	Tri-Valley Air Quality Climate Alliance
TVOC	Total Volatile Organic Compounds

What is the reason for conducting air monitoring?

1. Community partnership approach

The Statewide Mobile Monitoring Initiative (SMMI) prioritizes forming strong community partnerships from the outset to guide the development of Community Air Monitoring Plans (CAMPs).

The SMMI Community Engagement Plan (Appendix A) is central to the success of the SMMI, emphasizing that communities must have a leading role in design, engagement, and implementation for the initiative to be successful. Aclima has implemented a co-leadership model with existing community experts and co-ownership with communities. This model is informed by CARB's Community Engagement Model, the People's Blueprint, CARB's Blueprint 2.0, and Facilitating Power's Spectrum of Community Engagement to Ownership. The goals of the community partnership approach include:

1. Develop and implement CAMPs that are responsive to the air quality concerns and needs of community members in pollution-overburdened areas.
2. Define monitoring objectives that reflect resident concerns about where and what pollution is most impactful. Community voices will direct where mobile air monitoring takes place, the monitoring objectives, and where focused pollution studies are needed.
3. Build community capacity to interpret mobile air quality data and help translate data into actions for emissions reduction and public health improvement.
4. Ensure that data is shared in an accessible way with all interested parties, including community members, to support the planning and implementation of emissions reduction actions.

Several groups play integral roles in the implementation and success of the SMMI. The SMMI Project Expert Group (PEG) includes community members, representatives from local air districts, community-based organizations (CBOs), and academia. Over 50 percent of the PEG comprises community members or representatives of CBOs. Engagement Leads, who are trusted community organizations, are subcontracted to lead and facilitate community engagement in the 62 Consistently Nominated Communities (CNCs). These Engagement Leads work closely with Aclima and the PEG to ensure CAMPs are responsive to community needs and that engagement is culturally and linguistically relevant. The California Air Resources Board (CARB) funds and oversees the SMMI. Aclima, as the contracted air monitoring technology company, is responsible for conducting community engagement and mobile monitoring. The project aims for a collaborative process where community members actively contribute to defining air monitoring objectives and the scope of actions.

1.1 Project Team Roles and Responsibilities for Community Partnerships

The core project team is made up of paid staff at a number of different organizations. These are described in Table 1.1. Additional project roles and responsibilities are outlined in Section 5.

Engagement Leads: Aclima has subcontracted with trusted community-based organizations or leaders to lead and co-manage community engagement efforts in the designated communities. These Engagement Leads are responsible for designing and implementing engagement strategies, conducting outreach, and working with Aclima to translate community knowledge (e.g., air pollution concerns) into responsive CAMPs. Some organizations may cover more than one community. Engagement Leads distribute an air pollution concerns survey and lead and conduct outreach for two community meetings, which serve as forums for community members and other interested parties to discuss local air pollution concerns and define where they would like air quality monitoring to occur. The Engagement Lead is also responsible for summarizing these meetings for Aclima, who then integrates community concerns into the CAMP. Engagement Leads serve as a conduit between community members and Aclima and CARB, helping to raise community questions and concerns and communicating project updates to the community.

Project Expert Group (PEG): A cross-sector group of representatives from local air districts, community-based organizations, academia, and residents from overburdened communities that guides community engagement and decision-making for this project. Over 50 percent of the Project Expert Group is composed of community members or representatives of community based organizations. The PEG serves as a trusted group of experts to help define and steer the initiative and ensure it meets community needs. PEG members are responsible for attending eight meetings during the project period, and completing six assignments that help inform and steer the project. Specifically, PEG members helped shape the content of the Community Engagement Plan, served on the selection committee for Engagement Leads, and shaped the methodology for allocating monitoring miles to each project community. Outside of meetings and assignments, Aclima requests that PEG members support decision-making in areas relevant to their professional and lived experiences.

Aclima's Project Team: Aclima monitors local engagement strategies and supports Engagement Leads by offering technical expertise, data interpretation, outreach materials, and meeting support. Aclima is responsible for organizing and facilitating all PEG meetings and managing PEG assignments.

Table 1.1: Project teams and contact details

Organization/team	Contact details	Type of Support Offered
CARB	smmi@arb.ca.gov	All project questions after the project has completed (May 2026)
Aclima	carb-team@aclima.earth	Monitoring updates and CAMP questions during the project period (through May 2026)
Project Expert Group	carb-team@aclima.earth	Questions about community engagement framework and statewide engagement opportunities during the project period (through May 2026)
Tri-Valley Air Quality Climate Alliance (Engagement Lead)	tomedmunds@tvagca.org	Community engagement questions during the project period (through May 2026)

1.2 SMMI resources

The CARB SMMI website (https://ww2.arb.ca.gov/statewide-mobile-monitoring-initiative) details the objectives of the SMMI; the size and recipient of the contract award and collaborations with research institutions. Additionally, the website outlines community engagement efforts, public participation opportunities, and the development of air monitoring plans. The website provides access to summary documents including the original CARB Request for Proposal (RFP), a project summary one-pager, FAQs, and Aclima's technical proposal.

The Aclima SMMI website (https://aclima.earth/ca-smmi) provides an overview of the SMMI. It explains the community engagement approach, project scope, monitoring technology and approach, and data availability. The website also provides access to the joint Aclima-CARB press release.

1.2.1 Engagement tools

The online and offline tools used to support community engagement as part of CAMP development include:

Online

- Aclima Project Website: For updates, resources, and contact information.
- Air Pollution Concern GeoSurvey: Online survey to gather community input on air quality concerns.
- Broad Area Monitoring Selection tool for community members to select the boundaries for broad area monitoring given allocated driving resources for each community
- Social Media Graphics: Customizable graphics and text for outreach efforts.
- Meeting Summary Report: Document template for documenting meeting content.

Offline

- Physical Flyers: Customizable flyers for distribution at community hubs.
- Community Air Monitoring Plan Development Handout: Infographic detailing the Community Air Monitoring Plan development process.
- Door-to-door outreach (in some communities)
- Phone call/text message outreach (in some communities)
- Radio announcements and/or project interviews (in some communities)

1.3 Statewide community meetings

The Community Engagement Plan includes the following statewide community meetings:

- **Pre-meeting / Introduction to project**: An online meeting introducing the project and answering questions, held at the air district level.
- **Meeting 1 / First Draft Community Air Monitoring Plan Boundary**: A hybrid (in person and online) meeting to identify community air quality concerns, monitoring objectives, monitoring areas, and community roles in the project.
- **Meeting 2 / Affirming Community Air Monitoring Plan**: A hybrid (in person and online) meeting to confirm monitoring areas and review draft Community Air Monitoring Plan(s).

- **Meeting 3 (series) / Project Results**: A series of online meetings, organized geographically by air district (or at a sub-district level if necessary), to explain project results, answer questions, and discuss next steps.

1.4 Engagement during and after monitoring

There will continue to be opportunities for the public to engage with the SMMI throughout monitoring and after completion of monitoring.

During the monitoring period:

- Project website: use the project website to access updates, resources, and contact information
- Webinars and training: participate in online sessions about data literacy, interpretation, emissions reduction success stories, and air management policies/regulations
- Community-specific project pages (via project website): Find updates, contact information, and leave comments/feedback for each Consistently Nominated Community on the project website
- Continued communication: receive email updates on progress towards monitoring completion (if contact information was provided during the engagement process). For example, monthly event notifications summaries (see Section 14.1), broad area monitoring progress, and locations where PMLs have completed monitoring.
- Office hours: Attend online office hours to ask project-related questions of the Aclima team

After the monitoring period:

- Publicly available data hosted by CARB
- StoryMaps: Explore interactive data visualizations for each Consistently Nominated Community
- Project Results meeting: Attend online meetings to learn about project results, ask questions, share experiences, and discuss next steps. These meetings will be held in English with Spanish interpretation and designated Spanish breakout rooms.
- Post-Meeting Survey: Provide anonymous feedback on the project and engagement process after the Project Results Meetings.

2. State the community-specific purpose for air monitoring

The primary purpose of the SMMI is to develop and implement Community Air Monitoring Plans that are responsive to the air quality concerns of community members and other stakeholders in the 62 CNCs. These communities have been consistently nominated by air districts, CBOs, and community members as needing extra attention to address high levels of air pollution.

Community air monitoring generally falls into two types of air pollution concerns:

1. Ambient air quality monitoring - measure the levels of relevant air pollutants to understand which areas of the community are experiencing **disproportionate or unequal impacts** from air pollution as well as evaluate measured concentrations against existing standards and historical information.

2. Stationary source monitoring - measuring air pollutants near **specific stationary emission sources** (e.g. industrial facilities) to better understand and characterize the air within the vicinity of these known or suspected sources.

This air monitoring plan will address these monitoring aims - to identify and characterize areas experiencing disproportionate air pollution impacts and specific air pollutant emission sources - by focusing on specific sources and air pollution concerns identified by the community. Residents and other interested parties' knowledge were solicited through community meetings and surveys to understand the community's pollution burdens. A specifically designed Air Pollution Concerns Survey was used to help identify priority air pollution concerns in each community and collect detailed information to guide monitoring objectives. The CAMPs will define where mobile air monitoring takes place, what the monitoring objectives are, and where focused pollution studies are needed, all directed by community voices.

2.1 Tri-Valley Community profile

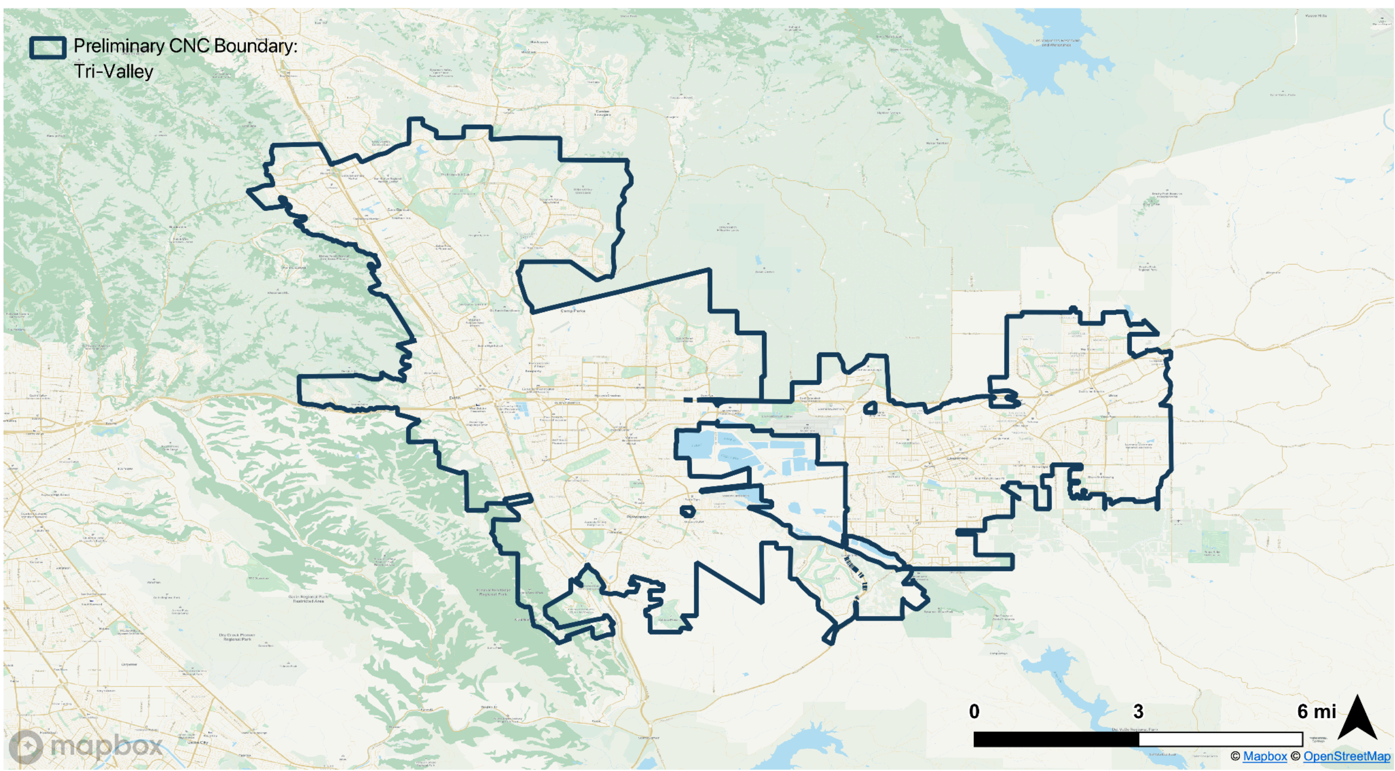


Figure 2.1: Preliminary CNC Boundary: Tri-Valley. The Tri-Valley boundary is based on the four municipal boundaries listed in the TVAQCA's Airshed definition: Pleasanton, Livermore, Dublin, and San Ramon.

The Tri-Valley Air Quality Climate Alliance (TVAQCA) chose to define the community as an airshed based on the 1,000-ft elevation contour that surrounds the cities of San Ramon, Dublin, Pleasanton, and Livermore. The airshed acts to define common air quality issues because of its topographic confinement of air pollutants. In the summertime, traffic emissions from the Bay Area are transported via the sea breeze into the Tri-Valley, creating the potential for high ozone. In the winter, local emissions are trapped within the valleys during high pressure systems resulting in Spare-the-Air Days alerts from the Air District to limit wood-burning.

The four cities in the area (San Ramon, Dublin, Pleasanton, and Livermore) have a combined 2023 US Census population of 311,618 comprising 111,939 households each averaging 2.8 persons. San Ramon and Dublin residents live at 4,600 persons per square mile while Pleasanton and Livermore are 3,300 persons per square mile. The four cities' limits encompass a total of 85 square miles. While each of the cities has experienced decades of continual growth, in 2023 Dublin, Pleasanton, and Livermore lost 5% of their population.

Figure 2.2 shows the average racial makeup for the 4 cities. Dominated by three races, the makeup varies significantly between the cities:

• Livermore's white population is highest at 60%; Dublin is lowest with 28%.

• Livermore is 16% Asian while the other three cities are 42-54% Asian.

• Livermore is 23% Hispanic/Latino while Dublin is 11%.

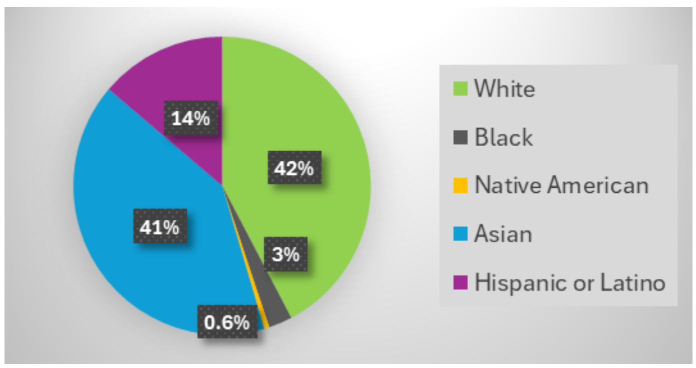


Figure 2.2: Average racial composition of the four Tri-Valley Cities from the 2023 US Census.

- About a third of the Tri-Valley residents were born in a foreign country and 41% speak a foreign language at home including Spanish, Mandarin, Hindi, Arabic, Japanese and others.
- About 6% of the population is 5 and under, 25% are 18 and younger, 13% are 65 years and older.
- About 70% are in the labor force and on average take about 34 minutes to get to work. About 70% are homeowners with a median home value of $1.2M. The median 2023 household income is about $185,000 with about 4.6% living at the poverty level. Pleasanton has the highest at 5.5% poverty (the 2020 poverty level was income less than $13K per individual or $20K for a family of 3). The highest neighborhood concentration of low-income households is in two census tracts on the north side of Livermore.
- About 96% of the population have high school diplomas and 65% have earned a B.S. or higher degree. Over 99% use computers at home, most with Internet access.

With sensitive populations that include a few percent pregnant women and infants, 12% elderly (65 years or older) and 18% asthmatic, over 100,000 residents in the Tri-Valley may experience health effects on days with moderate or higher Air Quality Indexes (AQIs at 50 or above). Historically, these occur about one in five days in the Tri-Valley.

Summary from CalEPA's CalEnviroScreen statewide percentiles for the Tri-Valley's 55 census tracts:

- Asthma and Cardiovascular Risk are 24th and 24th percentiles respectively.

- Dublin and Pleasanton are 22nd percentile for Asthma rate of emergency department visits while San Ramon and Livermore are slightly higher at 28th percentile. Cardiovascular disease expressed as age-adjusted rate of emergency department visits of heart attacks per 10,000 is highest in Livermore at the 62nd percentile with other cities in the 30th range.
- The health-related measure for pregnant women is Low Birth Weight—the Tri-Valley averages about 5% which ranks 50th percentile statewide.

Summary from Alameda County Health Department for Dublin, Pleasanton & Livermore:

1) Life expectancy

- Tri-Valley residents live 1-2 years longer than Alameda County's 82.3-year average.
- African American/Black people live six years less than those from other racial groups.

2) Mortality rates (see Figure 2.3)

- Livermore has the same cancer mortality rate as Alameda County average of 135 per 100,000 people; Pleasanton and Dublin are lower with 119 & 117, respectively.
- Similar to 116 per 100,000 people for Alameda County, Dublin has a heart disease mortality rate of 114, but Livermore with 109 and Pleasanton at 97 are lower.
- African American/Blacks have the highest cancer rates and much higher rates of heart disease.
- Hispanics have the lowest cancer rates while Asians are lowest for heart disease.
- Chronic Lower Respiratory Disease (CLRD) and adult asthma rates are similar to the rest of Alameda County, but hospital visits for asthma are much higher in the Tri-Valley.

3) Low birth weight (LBW or less than 2500 grams or 5.5 pounds)

- The Tri-Valley has a few percent less LBW than the rest of Alameda County for all racial groups except Asians who are similar to the county average.

Figure 2.3 summarizes the mortality rates by disease and race for Dublin, Pleasanton, & Livermore.

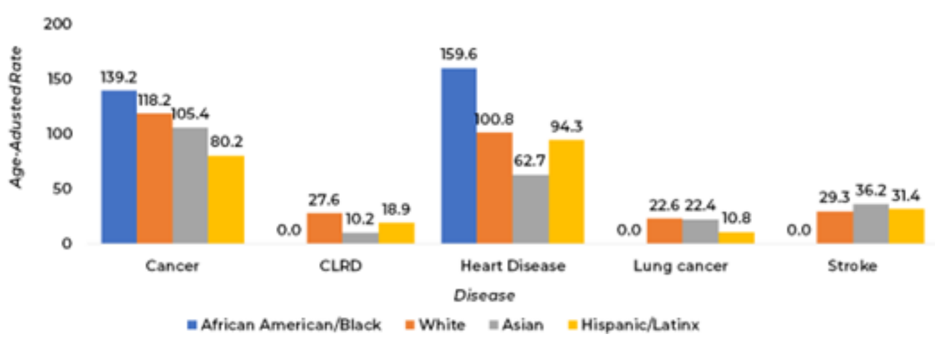


Figure 2.3: Tri-Valley mortality rates (per 100,000 people) by disease and race. (Source: Alameda Co. Health Dept.) Note: Due to low counts, CLRD, Lung cancer & Stroke mortality rates for African-American/Black people are not reported.

2.2 Tri-valley community-specific motivations for air monitoring

Community-identified air pollution concerns

To identify the community-specific motivations for air monitoring in Tri-Valley, Aclima worked with Tri-Valley Air Quality Climate Alliance to gather air quality and emission source concerns directly from the community. An SMMI Air Pollution Concerns survey was circulated by email, distributed in person community meetings, and made available during other events in the community. In addition, Tri-Valley Air Quality Climate Alliance collected air pollution concerns voiced during community meetings in support of the SMMI effort.

Most of the time the Tri-Valley falls within air quality standards. However, in the past, the ozone (O_3) and Fine Particulate Matter ($PM_{2.5}$) standards have been exceeded at the Air District's Livermore Air Quality Monitoring Station. Consequently, starting in 2014, the Bay Area Air Quality Management District (BAAQMD) CARE Program identified the Tri-Valley as an Impacted Community.

Figure 2.4 highlights the relative magnitude of largest stationary sources for the criteria pollutants. The 400 permitted stationary sources contribute 10% of the total Tri-Valley NO_X and 30% of the Reactive Organic Gas (ROG) and $PM_{2.5}$ emissions. The largest stationary source of NO_X is Dublin-San Ramon Services District at 49 tons/yr; Gillig Bus in Livermore totals 59 tons/yr of ROG.

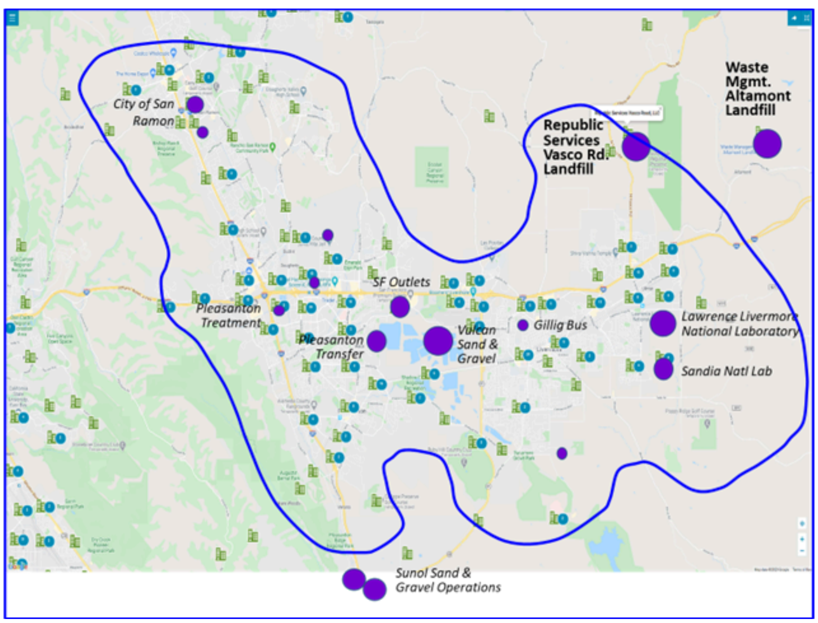


Figure 2.4: Map of permitted stationary sources in Tri-Valley. Green icons represent source locations; purple circles represent largest aggregated emissions. (Annotated from: BAAQMD Interactive Data Maps)

Two major freeways, I-580 and I-680, crisscross the Tri-Valley airshed. Automobile and Diesel Particulate Matter (DPM) emissions create the largest local pollution exposure. Exposure to diesel depends strongly on the proximity to freeway traffic, especially during rush hours. Figure 2.5 shows that the Bay Area Air District (BAAD) estimates DPM contributes to over 65% of cancer risk in the Tri-Valley.

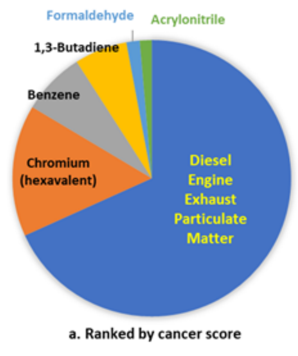


Figure 2.5: Ranking of health effects by toxic source type in the Tri-Valley. (Source: BAAQMD 2021)

In Oct 2020 and Jan 2021, BAAQMD provided ArcGIS map layers online for Tri-Valley. Figure 2.6 shows the estimated cancer risk from permitted stationary sources in the Tri-Valley. The larger the circle, the larger cancer risk, which is a qualitative illustration of relative risk. Superimposed are the locations of sensitive receptors from BAAQMD ArcGIS map.

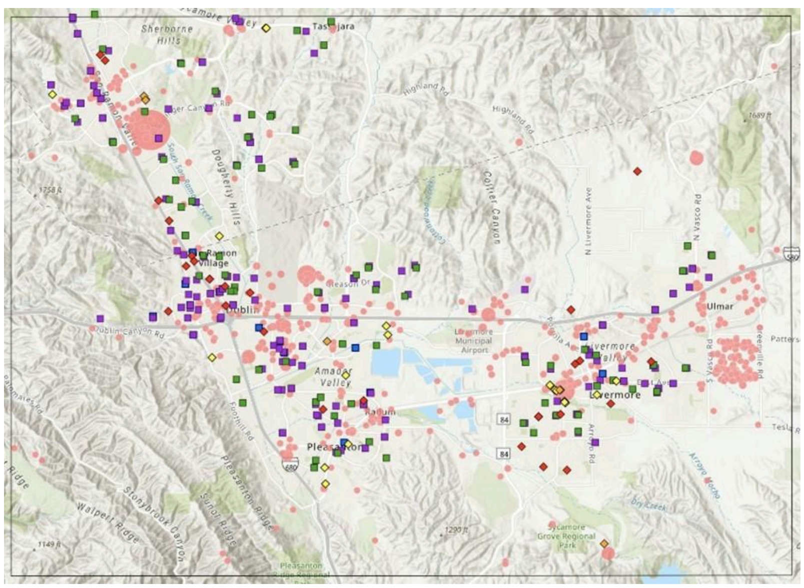


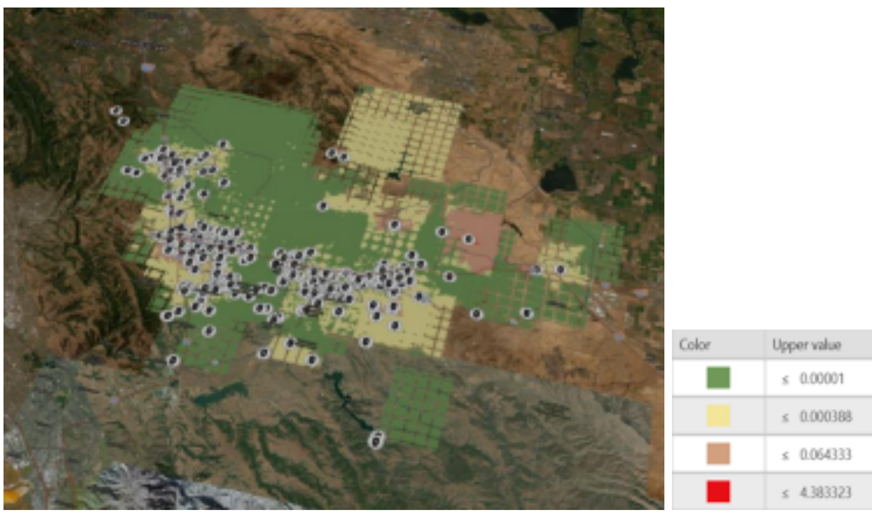
Figure 2.6: Relative cancer risk (orange circles) from 2018 permitted sources mapped with sensitive facilities in Tri-Valley (hospitals, nursing homes, schools, and childcare facilities) Source: BAAQMD ArcGIS.

During the last year, working with Virginia Lau, BAAQMD's Advanced Project Advisor, Planning and Climate Protection, Fabjola Kasaj, a TVAQCA graduate student intern, developed a quantitative modeling analysis of cancer risk for the BAAQMD emissions inventories from 2018-2022.

Following the BAAQMD protocol, this analysis applies industry-standard AERMOD and HARP2 health risk assessment models. While previous BAAQMD analyses have used a conservative approach, TVAQCA's study provides a more quantitative perspective including insight into how the community's risk levels have evolved from changes in emissions from 2018 to 2022. TVAQCA developed an interactive web application that shows each local source's contribution to cancer risk throughout the Tri-Valley. Figure 2.8 is an example output showing the ranges of cancer risk due to local sources in 2021 for the whole Tri Valley. Facilities (see Figure 2.4) that create higher risk are:

- Waste Management of Alameda County – Northeast of Livermore outside of the airshed • Republic Services Vasco Road, LLC – North of Livermore
- Lawrence Livermore National Laboratory – East of Livermore
- Dublin-San Ramon Services District – Wastewater Treatment Plant
- City of Pleasanton facilities near the intersection of I-580 and 680

According to BAAD, a cancer risk greater than 10 per million requires further review and possible additional regulation. Research did not identify any facilities exceeding this limit. However, given the opportunity to collaborate with Aclima, the cancer risk assessment could serve as a valuable tool when working with the community survey results.



Cancer Risk (per million)

Figure 2.8: Map of cancer risk from 2021 emissions in the Tri-Valley. Black symbols represent facility locations. Scale bar is Cancer Risk (per million)

In addition to those summarized above, other specific concerns identified through community engagement are included in the table 2.1 below. These concerns were compiled from community members during community meetings as well as through the SMMI Air Pollution Concerns Survey.

Table 2.1: Specific concerns identified through community engagement. Details about community concerns are direct quotes from the community member concern submissions.

Location and Concern	Details
Loading/unloading zones at elementary schools	Smell auto exhaust; 8:00 am and 3:00 pm weekdays.
Water treatment plant in Pleasanton	Sewage smell from Water treatment plant in Pleasanton at corner of Stoneridge Dr and 680.

Vasco Road Landfill, Livermore	Rotting material observed. Smells "at all times", worst during high pressure systems.
Cement plant and rock crushing operations	On Stanley Blvd between Pleasanton and Livermore. Possible diesel emissions from heavy trucks, other unknown. During day with high pressure systems tending to make it worse.
Roadways (including Highway 680)	Concerns noted include Bumper-to-bumper traffic & exhaust fumes.
Wastewater treatment plant	No additional details were provided for these entries in the sources
Airport (including Livermore Airport)	No additional details provided
Landfill (including Vasco Road Landfill)	No additional details provided
Distribution or last mile warehouse (Amazon Distribution Center)	No additional details provided
Hazardous Waste Facility (Alameda County Household Hazardous Waste Collection Facility - Livermore)	No additional details provided
Gas station (Quik stop fuel station)	No additional details provided
Hospital (Valley Care Hospital)	No additional details provided

From 2020 through 2024, TVAQCA conducted four annual surveys and over 100 outreach activities. TVAQCA frequently and consistently communicates directly with city councils and mayors, primarily Pleasanton and Livermore. One of TVAQC's members is on the Pleasanton Energy and Environment Committee. Through years of outreach and media exposure, TVAQCA is a recognized organization for air quality and climate expertise.

Throughout these interactions the Tri-Valley community has expressed several concerns regarding air quality:

1. Freeway traffic and gas-powered lawn & garden equipment, the largest emitters of local air pollution, affect the community's health.
2. The community needs to protect indoor air when wildfire plumes enter the Tri-Valley.
3. The community needs to reduce cars idling near schools.
4. Livermore Airport emissions (particularly lead) are not acceptable.

The Tri-Valley community has undertaken several specific activities to address air quality concerns. These include distributing 142 Air District filter units and 293 room air cleaners at community events to low-income households vulnerable to wildfire smoke. The community has also advocated for the installation of unleaded gas at Livermore Airport due to potential lead emissions affecting nearby residents, providing a technical assessment and engaging with the Facility Base Operator, leading to the installation of a 94-octane unleaded tank. Their efforts regarding the airport expansion plan and support for a 100-octane unleaded tank are ongoing.

Additionally, the community has promoted the Idle-free Zone Campaign and Safe Routes to School, assisted with developing and implementing Climate Action Plans for Tri-Valley cities, and supported over two dozen interns. They enthusiastically supported Pleasanton's 2024 ban on gas-powered leaf blowers and are conducting a study on I-580 to measure PM2.5 reduction from sound walls and greenbelts. Furthermore, the community has made recommendations and written letters supporting various legislative and agency initiatives related to toxic air contaminants, transportation, school energy efficiency, and climate literacy.

Recognizing that gas-powered lawn and garden equipment emissions now exceed automobile traffic emissions, from 2020-2023 TVAQCA funded $56,284 to a dozen local landscaping companies, cities, and school districts to purchase electric equipment. For several years, TVAQCA attended city council and committee meetings supporting the City of Pleasanton's ban on gas-powered leaf blowers. As the ban went into effect conditionally on June 1, 2024, landscaper conversion will take a while. In the last year TVAQCA has promoted implementing the ban through outreach and social media. TVAQCA has also advocated for the other Tri-Valley cities to create bans. This effort is one of TVAQCA's primary goals from our beginning and greatest successes. TVAQCA continues supporting the task in our JCS Grant. Status is shown on our website and in our JCS Quarterly Reports to BAAQMD.

Top pollution sources identified via emission inventories

Aclima scientists gathered important sources from available emission inventories, focusing on major polluting facilities and AB2588 Air Toxics Hot Spots. Known pollution sources within Tri-Valley are listed in Tables 2.2. These facilities represent a range of operations, including waste management, water treatment, real estate, and healthcare services. The most complex and high-emission sites include the Dublin San Ramon Services District wastewater treatment plant and the Vasco Road Landfill, both of which report a wide array of toxic substances, including DPM, heavy metals (e.g., lead, cadmium, mercury, arsenic), VOCs (e.g., benzene, toluene, formaldehyde), and known carcinogens such as hexavalent chromium and trichloroethylene.

Facilities such as the Pleasanton Garbage Service and the City of Livermore Water Reclamation Plant also emit numerous pollutants associated with industrial diesel use and hazardous waste byproducts. Several sites, including real estate operations like Rosewood Commons and PROLOGIS 6 Livermore, primarily emit DPM, reflecting emissions linked to vehicle and equipment use rather than manufacturing processes. Notably, medical facilities such as Stanford Health Care Tri-Valley and Kaiser Permanente campuses also appear in the top ten, signaling that healthcare operations may contribute meaningfully to local toxic emissions through fuel combustion and the use of sterilizing agents. This diverse range of sources underscores the need for targeted strategies that account for emissions from both industrial and non-industrial land uses in the monitoring area.

Table 2.2: Top 10 AB2588 Air Toxics Hot Spots located within the monitoring area boundary for Tri-Valley (up to 200 m outside the boundary), as defined by the total toxicity-weighted emissions (TWE) for chronic, cancer causing, and acute categories combined.

Facility Name	Longitude	Latitude	Description	Reported Pollutants
PLEASANTON GARBAGE SERVICE	-121.8535	37.6755	LOCAL TRUCKING,WITHOUT STORAGE/TRUCKING AND WAREHOUSING/TRUCKING,COURIER SVCS, EX. AIR/LOCAL TRUCKING WITHOUT STORAGE	Chromium, hexavalent (& compounds), Lead, Beryllium, Manganese, Mercury, Cadmium, Arsenic, Diesel engine exhaust, particulate matter (Diesel PM), Nickel
DUBLIN SAN RAMON SERVICES DISTRICT - WASTEWATER TP	-121.9138	37.6884	SEWERAGE SYSTEMS/ELECTRIC,GAS,SANITARY SERVICES/SANITARY SERVICES/SEWERAGE SYSTEMS	Manganese, Cadmium, Nickel, Chromium, hexavalent (& compounds), Benzene, Diesel engine exhaust, particulate matter (Diesel PM), Mercury, Toluene, Lead, Perchloroethylene {Tetrachloroethene}, Methylene chloride {Dichloromethane}, Formaldehyde, Arsenic, Beryllium, Chloroform, Trichloroethylene {TCE}, Xylenes (mixed), Ammonia
VASCO ROAD LANDFILL	-121.7233	37.7105	REFUSE SYSTEMS/ELECTRIC,GAS,SANITARY SERVICES/SANITARY SERVICES/REFUSE SYSTEMS	Hexane {n-Hexane}, Vinylidene chloride, Formaldehyde, Toluene, Benzene, Xylenes (mixed), Perchloroethylene {Tetrachloroethene}, Manganese, Lead, Vinyl chloride, Methyl chloroform {1,1,1-Trichloroethane}, Carbon tetrachloride, Cadmium, Chloroform, Methylene chloride {Dichloromethane}, Ethylene dichloride {EDC}, Trichloroethylene {TCE}, Ethyl benzene, Methyl ethyl ketone {2-Butanone}, Beryllium, Arsenic, Hydrogen sulfide, Chromium, hexavalent (& compounds), Mercury, Diesel engine exhaust, particulate matter (Diesel PM), Nickel, Naphthalene
CITY OF LIVERMORE WATER RECLAMATION PLANT	-121.8091	37.6885	SEWERAGE SYSTEMS/ELECTRIC,GAS,SANITARY SERVICES/SANITARY SERVICES/SEWERAGE SYSTEMS	Lead, Chloroform, Toluene, Formaldehyde, Benzene, Methylene chloride {Dichloromethane}, Hydrogen sulfide, Beryllium, Cadmium, Nickel, Diesel engine exhaust, particulate matter (Diesel PM), Arsenic, Chromium, hexavalent (& compounds), Xylenes (mixed), Methyl chloroform {1,1,1-Trichloroethane}, Ammonia, Trichloroethylene {TCE}, Manganese, Perchloroethylene {Tetrachloroethene}, p-Dichlorobenzene, Mercury

ROSEWOOD COMMONS PROPERTY OWNER LLC	-121.8825	37.7009	REAL ESTATE AGENTS/MANAGERS/REAL ESTATE/REAL ESTATE AGENTS, MANAGERS/REAL ESTATE AGENTS AND MANAGERS	Diesel engine exhaust, particulate matter (Diesel PM)
2600 CR LLC SUNSET DEVELOPMENT	-121.9639	37.7653	NONRESIDENTIAL BLDG OPERATORS/REAL ESTATE/REAL ESTATE OPERATRS,LESSORS/OPERATRS OF NONRESDNTL BLDGS	Benzene, Toluene, Formaldehyde, Diesel engine exhaust, particulate matter (Diesel PM)
PROLOGIS 6 LIVERMORE	-121.8097	37.6877	REAL ESTATE AGENTS/MANAGERS/REAL ESTATE/REAL ESTATE AGENTS, MANAGERS/REAL ESTATE AGENTS AND MANAGERS	Diesel engine exhaust, particulate matter (Diesel PM)
STANFORD HEALTH CARE TRI-VALLEY	-121.8781	37.6908	GENERAL MED/SURGICAL HOSPITALS/HEALTH SERVICES/HOSPITALS/GEN MEDICAL,SURGICAL HOSPITALS	Cadmium, Beryllium, Benzene, Lead, Toluene, Nickel, Formaldehyde, Chromium, hexavalent (& compounds), Mercury, Manganese, Diesel engine exhaust, particulate matter (Diesel PM), Arsenic
KAISER PERMANENTE	-121.7162	37.7070	PSYCHIATRIC HOSPITALS/HEALTH SERVICES/HOSPITALS/PSYCHIATRIC HOSPITALS	Diesel engine exhaust, particulate matter (Diesel PM)
KAISER PERMANENTE MEDICAL CENTER	-121.9269	37.6907	GENERAL MED/SURGICAL HOSPITALS/HEALTH SERVICES/HOSPITALS/GEN MEDICAL,SURGICAL HOSPITALS	Toluene, Diesel engine exhaust, particulate matter (Diesel PM), Benzene, Formaldehyde

Past and ongoing air quality measurements and studies

The Bay Area Air District (BAAQMD) operates several regulatory air monitoring stations within the Tri-Valley region. The San Ramon air quality monitoring station is located at 9885 Alcosta Blvd, San Ramon, and was established in 2012. This station monitors nitric oxide (NO), nitrogen dioxide (NO_2), oxides of nitrogen (NO_x), and ozone (O_3). The Pleasanton-Owens Ct. station is located near the Dublin-Pleasanton border, at Owens Ct. in Pleasanton. This site was established in 2018 and monitors carbon monoxide (CO), NO, NO_2, NO_x, and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). Two stations are in Livermore. The Livermore site, located at 793 Rincon Ave., monitors black carbon (BC), NO, NO_2, NO_x, O_3, and $PM_{2.5}$. This site was established in 1999. The other Livermore site, Livermore-Portola, was established in 2023, and monitors BC, NO, NO_2, NO_x, O_3, methyl ethyl ketone, acetone, and several aldehydes, including acetaldehyde, formaldehyde, and benzaldehyde. This station is located at 2451 Portola Ave. These stations are operated by BAAQMD and are part of the national regulatory network overseen by the U.S. EPA in support of the Federal Clean Air Act. The measurements from the stations are intended to represent regional air quality and demonstrate compliance with federal and state clean air standards.

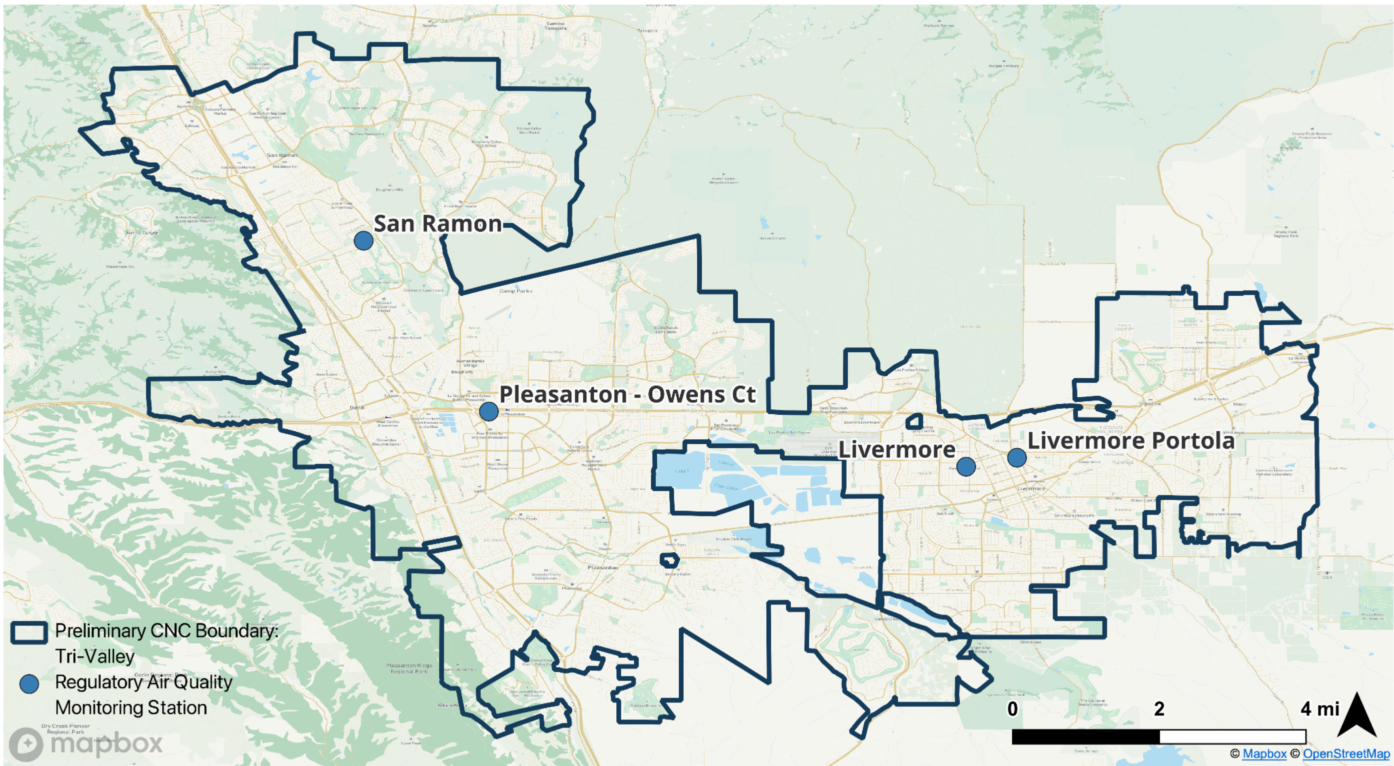


Figure 2.9: Map of the preliminary Tri-Valley CNC boundary and local regulatory air quality monitoring sites.

The Tri-Valley region did not pursue an AB617 Community Air Monitoring Program due to the absence of a major industrial source. Existing air quality monitoring efforts beyond the Air District's four stations are limited. However, the following studies have been conducted:

- In 2012, CARB and BAAQMD contracted UC Davis to measure Ultrafine Particles (UFPs) in ten California cities, including Livermore. In Livermore, dominant sources of UFPs were found to include traffic, urban background aerosol, secondary formation, wood burning, and natural gas combustion.
- In December 2017, Aclima, in collaboration with the University of Texas, Google Earth Outreach and the Environmental Defense Fund, measured air pollutants in Livermore using Google Street View cars. This study emphasized black carbon concentrations and spatial variability. Aclima also monitored in the Tri-Valley area from December 1, 2019 - November 30, 2020 in cooperation with BAAQMD; the results can be viewed at air.health. The results showed notable spatial variability for pollutants like NO_2, $PM_{2.5}$, and CO, particularly on and and near I-580 and on heavily trafficked roads. However, the suite of pollutants measured by Aclima during that effort did not include key pollutants that support the characterization of specific pollution sources, specifically black carbon, helpful for identifying sources of diesel particulate matter, and TVOCs

helpful for identifying stationary sources of VOCs. The monitoring also took place during the COVID pandemic, which impacted business activity and traffic patterns.

- The community has shown a significant interest in air quality, indicated by the increase in Purple Air $PM_{2.5}$ samplers from approximately 25 in 2018 to over 100 currently, likely due to concerns about wildfire smoke. This data has been used to analyze air quality variations, identify affected populations during pollution episodes, and encourage indoor air filtration for low-income families.

An intern conducted a prototype project involving sample $PM_{2.5}$ and CO_2 measurements using a drone above Las Positas College. This project was primarily for educational purposes, introducing the student to instrumentation, drone capabilities, data reduction, and analysis, and was not intended to produce significant data.

2.3 Gaps in air quality information that SMMI will address

While existing regulatory and research-based air monitoring in the Tri-Valley region provides important insight into regional air quality, these data sources have notable limitations in addressing the community's specific environmental health concerns. The Bay Area Air Quality Management District operates several fixed monitoring stations, including in Livermore and Dublin, which are designed to assess compliance with regional air quality standards under the Clean Air Act. However, these stations are intended to represent regional, not hyperlocal air quality and are not intended to measure pollutant concentrations at sensitive receptor locations like homes, schools, or parks.

Previous studies, while valuable, also have limitations. The suite of pollutants measured by the Aclima platform during previous monitoring campaigns in the area did not include key pollutants that support the characterization of important pollution sources. Earlier research, such as the UC Davis ultrafine particle study and student-led drone monitoring, offered unique insights but were not designed for comprehensive or long-term pollution characterization.

The Tri-Valley is a suburban and semi-urban area characterized by major roadways, growing residential development, and regional service infrastructure such as landfills and wastewater treatment plants. A summary of the air pollution concerns and sources identified by the community, supported by available data on toxics hot spots and facilities, includes:

- Freeway traffic emissions
- Diesel exhaust from local trucking operations and distribution centers.
- Landfills and wastewater facilities, such as Vasco Road Landfill and multiple water reclamation plants
- Cement plant and rock crushing operations and associated diesel emissions from truck traffic
- Livermore airport emissions
- Vehicle emissions from cars idling near schools

To provide the type of data necessary to characterize the areas of concern identified by the community and prioritize locations for further plans and community action, the following data gaps were identified:

- Lack of localized air monitoring that reflects conditions in residential neighborhoods and at sensitive receptor sites (e.g., schools, child care centers, parks)
- Limited or no speciated air toxics data near community-relevant sources

- Limited source-specific monitoring
- Limited pollutant scope
- Lack of long-term data that captures short-term spikes from events like wildfires, inversions, or industrial upsets

This plan proposes to use mobile air pollution monitoring to provide highly spatially resolved pollutant concentration data for the community. The detailed spatial information from mobile monitoring can help identify specific, localized sources of pollution and show how pollutant levels change across and between different neighborhoods. The Aclima Mobile Platform includes an expanded suite of pollutants that support improved characterization of sources including the use of black carbon to diesel particulate matter and TVOCs to indicate areas where toxic air contaminants may be located. The information gathered through mobile monitoring supports the development of pollution reduction plans that can be different for various parts of a community, allowing for solutions that are specifically suited to local needs.

3. Scope of actions

Data gathered by mobile air monitoring can support a wide range of actions by communities and governments to reduce emissions and/or exposure. Examples of possible actions include, but are not limited to:

- Regulatory investigation: where these data identify locations of persistently elevated concentrations, local and state agencies may decide to do further investigative work that can lead to compliance and enforcement actions (e.g. fines, new emissions control requirements)
- Traffic management strategies: by identifying locations of persistently elevated concentrations caused by vehicular emissions, these data can inform local and state vehicular emissions control strategies, including initiatives like anti-idling enforcements or vehicle emissions inspection programs
- Urban planning: governments can use an understanding of how air quality varies over time and space to direct investment in green spaces or update zoning regulations to restrict certain land uses
- Corporate action: individual companies may be able to use these data to adjust their transportation routes and schedules, or facility operations, to reduce emissions and health impacts
- Modeling and forecasting: mobile air monitoring data can support improved modeling of historical air quality that allows better prediction of future patterns and impacts across a community
- Health risk assessments: where these data identify disproportionate impacts of pollution across the geography of a community, these insights can be used in conjunction with other datasets to assess potential health impacts for communities or identify locations where formal health risk assessments should be performed
- Community action: data provided by mobile air monitoring may be useful to community-based organizations in advocacy work to reduce emissions and/or exposure, including the development of Local Community Emissions Reduction Plans (LCERPs)

When monitoring has concluded, CARB, Air Districts, community groups, regulatory agencies, researchers, and other parties are encouraged to leverage the data to address specific air pollution concerns.

4. Air monitoring objectives

4.1 Define objectives

The air monitoring aims described in Section 2 can be expanded into two primary **air monitoring objectives**:

1. **Identification and characterization air pollutant emission sources**
   This objective seeks to better understand and characterize the air within the vicinity of known, suspected, or unknown sources, which can include the following goals:
   - Understand what locations in communities are impacted by pollution near sources
   - Understand how concentrations can vary directly downwind of a given source
   - Understand how concentrations near a given source may vary by time of day

2. **Identification disproportionate air pollution impacts**
   Mobile air monitoring can also be used to investigate various objectives focused on understanding the unequal distribution of air pollution within a community:
   - Identify the key pollutants that impact ambient air in a community
   - Understand the typical concentrations of pollutants in ambient air in the community
   - Understand how pollution is distributed across a community
   - Understand how pollution varies in time across a community

These two objectives support investigation of the majority of concerns identified by the community by either characterizing both individual sources, such as PM and heavy duty trucking associated with the cement plant, and broader source types, such as mobile source emissions, as well as the impact of these sources across the community.

4.2 Define mobile monitoring methods to support objectives

Given the gaps identified in Section 2.3 and the community specific air quality concerns, the types of data needed include high spatial resolution data in a wide variety of locations across the community of Tri-Valley, in particular for black carbon (as a proxy for diesel particulate matter) and VOCs (as a proxy for organic air toxics). The mobile monitoring approach enables the collection of data at high spatial resolution throughout the community over the entire mapping period. This approach results in measurements of a snapshot of the concentration of air pollutants near to many if not most of the areas of concern identified by the community during the project. The data resulting from mobile monitoring support targeting a wide range of source types within the monitoring area, allowing for flexibility of source analysis without predetermined source selection.

The CAMP will use two mobile monitoring approaches to support project air monitoring objectives - broad area monitoring and targeted area monitoring. Broad area monitoring supports the air monitoring objectives throughout the entire CAMP monitoring areas over the entire monitoring time period while targeted area monitoring will focus on a subset of specific air pollution concerns with focused driving around those concerns for shorter periods of time.

Broad area monitoring: monitoring vehicles collect data within the entire CAMP monitoring area over an extended time period using the Aclima Mobile Platform. Vehicles monitor on publicly accessible roads, gathering repeat measurements at different times of day, days of the week, and seasons. Broad area monitoring tells us about the typical concentrations of pollutants and locations of persistently high pollutant concentrations throughout the CAMP area over the whole period of monitoring. As an example, Figure 2.2 shows results of a broad area monitoring approach in San Francisco, displaying typical NO2 concentrations observed over a one-year time period. Broad area monitoring will occur over a nine-month time period between June 2025 and March 2026.

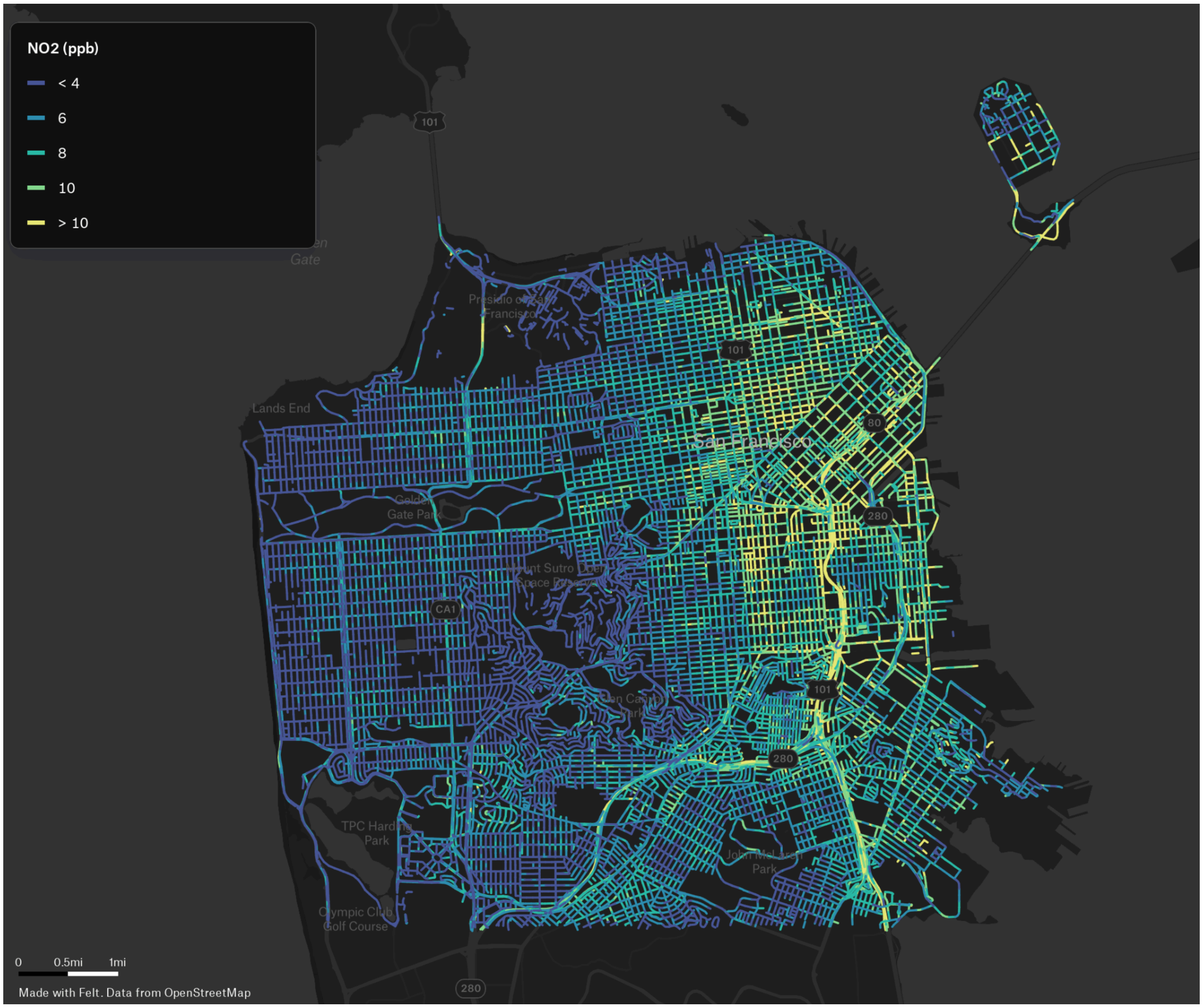


Figure 4.1: Example of plotted ambient concentration estimates for NO_2 in the San Francisco Bay Area, CA, showing typical concentrations observed over a one-year monitoring period. This example shows how high NO2 concentrations (as illustrated by the brighter green colors) are disproportionately impacting the eastern parts of the city. This plot uses data generated by the broad area monitoring method.

The suite of pollutants measured by the AMP supports the exploration of many source types identified by the community. Black carbon measured in combination with NO_2 and other combustion related pollutants help identify areas impacted by diesel particulate matter pollution. TVOC data help identify areas where organic toxic air contaminants may be located near waste management and industrial facilities. Methane and ethane data combined with other pollutants help identify locations of elevated biogenic methane, which can indicate emissions from landfills and wastewater treatment plants.

Targeted area monitoring: a subset of monitoring vehicles focuses on specific air pollution concerns (sources or impacted areas) at smaller spatial scales and shorter time periods. This measurement strategy involves monitoring over a relatively small area over a shorter time period with more intensive driving (i.e. more samples in a specific area on any single day). There is an inherent limitation in the targeted area studies in that they will typically occur over a short time period and the results are likely to not be representative over longer time periods (different facility operating patterns and/or meteorological conditions). While broad area monitoring may provide more temporally representative results, targeted area monitoring is a complimentary approach that can tell us more detail about a specific concern, such as the exact makeup of chemicals being emitted from a particular facility, what areas of a community are most impacted in the immediate vicinity of pollution sources, or what times of day these areas are most impacted. Targeted area monitoring vehicles will either be drawn from the broad area monitoring fleet (Aclima Mobile Platforms) or from a special mobile laboratory fleet (a small number of vehicles with higher accuracy/precision sensors detecting a wider range of pollutants including toxic air contaminants), depending on the specific source of concern. In contrast to the broad area monitoring approach, the number of concerns that can be addressed is much more limited, but the depth at which the data about the concerns can be collected and analyzed is potentially greater.

Targeted area monitoring vehicles can be deployed in different ways to meet different objectives.

- *Fenceline* driving (Figure 4.2) gathers data systematically on predetermined routes around the perimeter of a known or suspected source facility/site. Fenceline driving can help determine the chemical makeup of emissions from a known source.
- *Transect* driving (Figure 4.2) follows a path designed to go upwind, through, and downwind of a potential plume of pollution from a known or potential source. Transect driving can help us better understand the chemical makeup of emissions in a plume, and where the plume is impacting in the local community.
- *Pseudo-stationary* driving approximates a more traditional stationary monitoring approach by temporarily stopping a monitoring vehicle within a potential plume of pollution from a known or potential source. Pseudo-stationary driving can help us better understand how pollution from a source varies in time. It can also allow for measurements of certain pollutants where measurement methods require longer sampling times (minutes up to an hour).
- *General Survey driving* is repeated monitoring along a predetermined route or on all roads within a predetermined area, attempting to collect air pollutant data evenly across time.

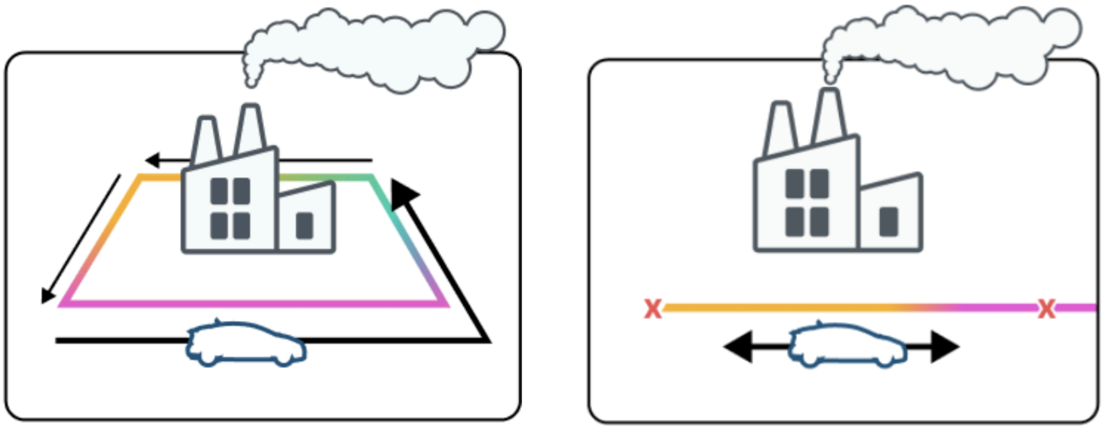


Figure 4.2: Example measurement technique for targeted area monitoring using (left) fenceline driving systematically surveys around the perimeter of a known or suspected source facility/site and (right) transect driving following a path designed to sample upwind, in, and downwind of a potential plume of pollution from a known or potential source.

Targeted area monitoring for Tri-Valley will be conducted by Aclima, and additional information about the targeted area monitoring can be found in Section 8.3. The suite of pollutants for monitoring by Aclima includes NO_2, $PM_{2.5}$, CO, O_3, and TVOCs that are relevant to the mixture of air pollutants expected from the concerns and sources identified in Section 2. Aclima's mobile platform is optimal for measuring pollutants associated with traffic emissions, with the ability to identify both passenger vehicle and heavy duty truck impacts, which will be well suited for characterizing truck traffic around local industries and distribution centers.

4.3 Community-defined concerns, objectives, and analysis plans

The community engagement process has defined a range of air pollution concerns. These concerns were translated into specific high-level monitoring objectives and sub-objectives, which in turn allowed the selection of appropriate mobile monitoring methods and data analysis plans to collect the type of data needed to address gaps in prior monitoring efforts and to address specific community concerns. Not all concerns and identified pollution sources are assigned specific monitoring objectives. In some cases it is because the measurement methods for monitoring the sources are not available to address the specific pollution sources (for example, Aclima does not have measurement capabilities for speciated VOCs or heavy metals in particulate matter to characterize emissions from sources like hazardous waste generators or waste management facilities). More generally, however, it is because resources for targeted area monitoring are limited across the entire SMMI project (62 different communities) and not all concerns can be directly addressed through the targeted area monitoring approach. While the concerns listed below will be the primary focus of the monitoring in Tri-Valley, the final collected data set can be further analyzed beyond the scope of SMMI to address a much wider set of concerns and sources.

Note that the selection of specific concerns to be included as monitoring objectives for targeted area studies does not imply that these are the most impactful sources or the most impacted areas in the community. The results of these studies will not be able to provide a comprehensive view into all possible sources in the community and the monitoring objectives listed here should not be interpreted that way.

Table 4.1 below provides an outline of the community specific concerns, objectives/sub-objectives, mobile monitoring methods, and data analysis approaches that may support actions to reduce emissions or exposure in a community. More details on the monitoring methods and presentation approaches can be found in Section 8 and Section 13, respectively.

Table 4.1: Community-defined concerns, objectives, and analysis plans

Community Concern	Primary Monitoring Objective	Monitoring Sub-objective	Mobile Monitoring Methods	Analysis Approach
Roadways (including Highway 680)	Identify disproportionate impacts	Locations impacted Pollutant levels Time of Day	Targeted area: General Survey Conducted by Aclima	Ambient concentration map of key pollutants Clusters of enhancement detections on a map Diurnal plot of detection events
On Stanley Blvd between Pleasanton and Livermore. Possible diesel emissions from heavy trucks, other unknown. During the day with high pressure systems tending to make it worse.	Identify disproportionate impacts	Locations impacted Pollutant levels	Broad Area Monitoring	Clusters of enhancement detections on a map Statistics on detections
Emissions from Livermore Airport	Characterizing Sources	Locations impacted Pollutant levels	Broad Area Monitoring	Clusters of enhancement detections on a map Statistics on detections

5. Project roles and responsibilities

The SMMI defines the roles and responsibilities of various stakeholders in the community monitoring. The Community Engagement Plan details these roles and responsibilities and outlines how different groups will work together for community engagement. This section outlines the organizational structure for the SMMI partners

(Figure 5.1), a list of community organizations that are Engagement Leads, and a list of the PEG members (Figure 5.2). Information on the SMMI project, including links to Engagement Leads, PEG members, and PEG meetings is also available at https://aclima.earth/ca-smmi. Responsibilities for Engagement Leads and PEG members are laid out in Section 1.1 in detail.

CARB's Monitoring and Laboratory Division is responsible for funding, managing and overseeing the project and ensuring it meets all contractual requirements. Aclima is the primary contractor for the project and is responsible for designing and implementing a plan for statewide community engagement, developing CAMPs for all project area communities, deploying mobile platforms to collect data, managing and analyzing data, and developing public reports. CARB and Aclima meet weekly to discuss project updates and ensure the project is progressing.

Based on the project's Community Engagement Plan, Tri-Valley Air Quality Climate Alliance (TVAQCA), the Engagement Lead for Tri-Valley, plans and implements community outreach and engagement for the project, with the goal of understanding specific community concerns around air pollution. In addition to the distribution of an air pollution survey, Tri-Valley Air Quality Climate Alliance (TVAQCA) holds and conducts outreach for two community meetings focused on local air pollution concerns that are tailored to the specific linguistic, cultural, and accessibility needs of the community. Tri-Valley Air Quality Climate Alliance (TVAQCA) then summarizes community air pollution concerns for Aclima to translate into the CAMP. Community members play a crucial role in providing their knowledge and experiences with air pollution both through participating in the community meetings and through completing the air pollution concerns survey. The Project Expert Group guides community engagement and decision-making throughout the project, meeting eight times over the project period in meetings facilitated by Aclima.

SMMI Partners

Figure 5.1: SMMI Project Organizational Chart

Community Organizations

Engagement Leads lead and co-manage community engagement efforts in the designated communities

- Acterra
- Breathe SoCal
- Californians for Pesticide Reform
- Canal Alliance
- CCEJN
- Center for Community Action and Environmental Justice (CCAEJ)
- Center on Race, Poverty, and the Environment
- Citizen Air Monitoring Network
- Clean Water Fund
- Climate Action Campaign
- Community Agency for Resources, Advocacy and Services (CARAS)
- Cool OC
- Day One
- El Concilio
- Girl Plus Environment
- Greenbelt Alliance
- HARC, Inc.
- Healthy Fresno Air
- HOPE Collaborative
- Just Cities
- Leadership Counsel
- Los Amigos de la Comunidad
- Madera Coalition for Community Justice
- One Treasure Island
- Our Children's Earth Foundation (for Rodeo Citizens Association)
- Pacoima Beautiful
- Rise South City
- Sacramento EJC
- San Leandro 2050
- SOMCAN
- Sustainable Contra Costa
- Sustainable Solano
- The Niles Foundation
- Tri-Valley Air Quality Climate Alliance
- UNIDOS Network
- United for Justice
- Valley Improvement Projects
- Valley Onward
- Valley Vision

Project Expert Group

A cross-sector group of representatives from local air districts, community-based organizations, academia, and residents from overburdened communities that guides community engagement and decision-making for this project.

- Nader Afzalan
- Stephanie L. Mora Garcia
- Brent Bucknum
- Mikela Topey
- Agustin Angel Bernabe
- Amelia Stonkus
- Anna Lisa Vargas
- Gustavo Aguirre Jr
- Jamallah Green
- Jonathan Mercado
- Ken Szutu
- Lillian Garcia
- Moses Huerta
- Ms. Margaret Gordon
- Brad Dawson
- Kate Hoag
- Lily Wu-Moore
- Payam Pakbin

Figure 5.2: List of Engagement Lead organizations and PEG members for SMMI

How will monitoring be conducted?

6. Data quality objectives

Data quality objectives are a series of goals set to make sure that the data collected, the analyses performed, and the visualizations produced are of good enough quality to address the stated monitoring objectives. These goals can be related directly to the quality of the measurement method, for example the accuracy or the precision of a sensor. They can also be more qualitative goals that determine how the measurement data is analyzed and visualized to accurately address community air quality concerns without being misleading. Data quality indicators are sometimes included as part of a data quality objective and are specific metrics that can be used to tell how good a measurement is. Some commonly used data quality indicators are data completeness, precision, bias, or limit of detection. Additional information on these and other data quality indicators can be found in Appendices C, D, E, F, and G.

Mobile air quality monitoring enables a variety of high-resolution spatial analyses that support different air monitoring objectives. One output uses time-resolved data from multiple individual drives of the same location to identify areas where pollution concentrations vary substantially and persistently from local background levels, indicating a probable local emissions source. This supports the air monitoring objective of attempting to identify and characterize pollution sources. Another output is the creation of maps of typical air pollution concentrations at block-by-block resolution that show areas of persistently high or low levels of individual pollutants, supporting the air monitoring objective of identifying areas of disproportionate impact.

Different monitoring objectives have different data quality objectives. The two primary monitoring objectives for SMMI and their associated data quality objectives are:

1. **Identify and characterize air pollutant emission sources**

   Typical pollutants of interest: CH_4, C_2H_6, BC, $PM_{2.5}$, NO, CO, and TVOC

   Data quality objectives:

   a. Find and map spots where pollution is likely coming from by detecting noticeable spikes in measurement readings that are clearly above normal background levels. More specifically, this means that the spike measurement must have a signal to noise ratio of at least 3.
   b. Ensure high confidence in the locations where pollution emissions sources are detected and minimize the presence of "false positives" in the resulting data. This is done by ensuring that multiple detections of emissions sources occur in the same location before identifying it as a likely source of pollution. This can be quantified as the number of detections per visit to a particular location.
   c. Aclima will monitor and track the performance of each underlying measurement using the following key data quality indicators: gain drift and limit of detection. Additional information is in Appendix C.

2. **Identify disproportionate air pollution impacts**

   Typical pollutants of interest: O_3, NO_2, $PM_{2.5}$, and BC

Data quality objectives:

a. Produce an ambient concentration estimate of pollution for the monitoring area by collecting measurements at different times of day, day of week, and across seasons to account for natural variability of pollution levels.
b. Ensure data are spatially distributed throughout the entire user-defined area.
c. Produce concentration estimates at desired and practical spatial aggregation scales (e.g. hexbins, road segments).
d. Include a measure of confidence (i.e. a confidence interval) with each ambient pollution concentration estimate, so users can understand the reliability of the values and whether pollution levels are truly different between locations.
e. Monitor and track the performance of each pollutant measurement using the key data quality indicators of bias, drift, precision

These data quality objectives are largely qualitative goals that provide the foundation for the types of insights that mobile monitoring is designed to support. A critical aspect of quality assurance underlying these objectives is characterizing and maximizing the measurement quality of the air pollution measurements, particularly for the sensors. However, confidence in these data products will depend on a number of additional factors such as mobile monitoring strategy, the number of samples collected for features of interest (i.e. road segment or other spatial length scale), magnitude and variability in pollution concentrations, and meteorology over the contract period. Different sensors in Aclima's Mobile Platform have varying levels of data quality and limitations to consider, which are outlined in Appendix C.

Data completion is an important quantitative data quality indicator in air quality monitoring as incomplete data can lead to biased conclusions from the data collected. Traditionally, data completeness is quantified across the time dimension, for example, number of data points collected per total time elapsed. With mobile monitoring, in some cases it is more important to quantify data completion in the spatial dimension, for example, total number of data points collected in a specific location compared to an expected number of data points in that location. Aclima's completeness metric for monitoring is discussed in Section 12. For the customized targeted area monitoring, metrics for completion are discussed in Section 8.3. Achieving completion for the monitoring plan relies on individual sensors having high temporal data completeness rates and uptime. Completeness rates of 80% or higher generally allow for efficiently achieving the spatial completeness objectives. If completeness is below 80%, additional driving will be done to compensate in order to meet the monitoring completeness metrics. If this is not possible for specific monitoring objectives, the impact will be detailed in the final report.

The comprehensive quality assurance approach incorporates processes and metrics to minimize uncertainty. Achieving data quality objectives relies on more than just individual indicators, as real-world challenges (e.g., driver absences) and external events (e.g., wildfires) can affect data quality despite a robust QA plan. The primary aim of these objectives is to generate high-quality data with well-defined performance parameters, enabling effective aggregation and analysis of mobile data for informed decision-making and pollution reduction initiatives across various applications. Section 12 details the evaluation of the effectiveness in meeting these data quality objectives. Section 12.2 details the QA/QC information that will be included in the final report.

7. Monitoring methods and equipment

Aclima will deploy two distinct but complementary monitoring methods enabled by the use of a mixed fleet of AMPs and PMLs:

- **Broad area monitoring** collected by AMPs, with mobile monitoring guided by dynamic algorithm in monitoring areas defined by the community as areas of high pollution concern during community meetings and through survey submissions
- **Targeted area monitoring** for investigations of specific sources and areas of concern, collected by Aclima, with mobile monitoring guided by community-defined air quality concerns and monitoring objectives

7.1 Monitoring equipment

Broad area monitoring as part of this CAMP will be conducted using a fleet of Aclima Mobile Platforms (AMPs, Figure 7.1).

Figure 7.1: An Aclima Mobile Platform.

All AMPs have a standardized measurement suite that covers a core range of priority pollutants and greenhouse gases (GHGs) shown in Table 7.1, operating at a collection frequency of every second (with the exception of ozone which is measured every 2 seconds). The Aclima fleet will conduct broad area monitoring measurements during different times of day and different days of the week.

Table 7.1: Air pollution and greenhouse gas species measured by the AMP.

Pollutant	Measurement Frequency
Carbon Monoxide (CO)	1 sec
Carbon Dioxide (CO2)	1 sec
Nitric Oxide (NO)	1 sec
Nitrogen Dioxide (NO2)	1 sec
Ozone (O3)	2 sec
Methane (CH4)	1 sec
Ethane (C2H6)	1 sec
Total Volatile Organic Compounds (TVOC)	1 sec
Fine Particulate Matter	1 sec
Black Carbon	1 sec

7.2 Monitoring methods - broad area monitoring

In broad area monitoring, Aclima's fleet of Mobile Platforms will collect data within the community defined monitoring area boundary. AMPs will measure on publicly accessible roads within this boundary, gathering repeat measurements at different times of day, days of the week, and seasons.

Aclima will conduct monitoring within the defined boundary such that the fleet will complete an average of 20 repeat measurements distributed across all residential and major roads in all census block groups to provide adequate coverage throughout the monitoring area. However, rather than specify the number of samples on any specific length of road within each census block group, Aclima uses a dynamic mobile sampling algorithm that is updated daily with the specific goal of collecting data that will maximize improvement in the characterization of a location's air quality. This approach ensures that sufficient measurements are collected in areas where greater pollutant variability requires additional sampling to achieve representativeness, or measurements that are representative of the conditions across the specific monitoring period. The system uses observed data in combination with predictive models to prioritize data collection in locations based on these factors:

- Number of visits to-date relative to expected visits, given the time elapsed over the nine-month monitoring period
- Time elapsed since the last visit
- Variability in observed pollutant concentrations over repeat visits, i.e. a mismatch between observed concentration and the predicted concentration based on prior observations

At the beginning of the monitoring period, the number of visits is more heavily weighted than the other factors and once a suitable number of observations have been made to make reliable predictions, the variability of observed pollutant concentrations becomes more heavily weighted. In the end, locations where pollutant variability is higher, will be prioritized for more repeat visits in order to more adequately characterize the average pollutant concentrations in these locations.

Aclima ensures continuous mobile monitoring throughout the day by staffing driving shifts throughout the day and staggering start times to avoid operational gaps when drivers are ending and starting shifts. The drive planning algorithm operates across large areas, not individual communities of varying sizes, and aims for spatially diverse data collection daily across all CNCs, regardless of the amount of road miles contained in those communities. To mitigate time-of-day bias, specific road locations are randomly assigned to 6-hour windows on a daily basis to mitigate against overly biased collection in certain locations to certain times of day. The sampling algorithm also prioritizes maintaining an equal revisit rate across the monitoring area, aiming for the 20-visit average over a nine-month period rather than quickly completing specific locations. Locations that receive 20 visits early on in the nine-month period will continue to be visited over time.

The mobile sampling algorithm ensures sufficient data collection to support the calculation of spatially resolved ambient concentration estimates. In addition, the method supports source identification and assessment of disproportionate impacts by directing more sampling in regions where there is larger variation in pollution concentrations. For a detailed discussion of the broad area mobile monitoring and the dynamic mobile monitoring algorithm, see Aclima's QA documentation in the Appendices C, D, and E.

The broad area monitoring boundary for Tri-Valley is shown in Section 8: Monitoring Areas.

7.3 Monitoring methods - targeted area monitoring

Aclima will conduct targeted area monitoring that focuses on specific air pollution concerns at smaller spatial scales. This involves monitoring over a relatively small area over a shorter duration in time (approximately 1 to 2 weeks) and is designed to complement the broad area monitoring coverage by providing more in-depth information about a specific area of concern. This can provide both enhanced characterization of pollution sources as well as an assessment of the locations of concern and sensitive receptors in the community that are impacted by source emissions. Targeted area monitoring is designed to perform detailed chemical, temporal, and/or spatial characterization at a select number of locations of concern identified by communities. The characterization can include aspects such as denser temporal information about pollutants by time of day, detailed chemical speciation around sources of concern in a particular area, or spatial information about the location of an emission source and extent of the areas and people impacted by the source.

The mobile monitoring method for targeted area monitoring is different from that used for broad area monitoring. By the nature of targeted area monitoring, a more customized driving method is necessary to support air monitoring objectives and concerns specific to individual communities. As with the broad area monitoring, representativeness is achieved by conducting repeat measurements to sufficiently characterize pollutant concentrations; however, the repeat measurements will typically (though not exclusively) occur over a more condensed time period in these targeted investigations.

Section 8 (Monitoring Areas) details the targeted area monitoring study that will be conducted in Tri-Valley.

7.4 Strengths and limitations of mobile monitoring

Because of the nature of mobile monitoring and how it differs from stationary monitoring, there are inherent strengths and limitations to the approach.

- Mobile monitoring can cover more area at a higher spatial resolution than stationary networks (i.e. fewer spatial gaps in coverage). However, because mobile monitoring vehicles can only spend a limited period of time at a given location, there may be gaps in time for that location where monitoring data is not available.
- Mobile monitoring sensors and instruments can gather valid data on a wide variety of important pollutants for informing community action, but to achieve high spatial resolution, gather data on fewer pollutants and at lower precision and accuracy than is possible in stationary networks. As a result, mobile monitoring sensors are not certified by the U.S. EPA for gathering data that can be compared against national ambient air quality standards (NAAQS) and used in regulatory actions under the Clean Air Act. For certain regulatory actions, a follow-up study using U.S. EPA-approved monitoring methods may be necessary.
- While mobile monitoring can provide a significant amount of information across a given geographic area, monitoring vehicles may be present in that area for a limited period of time. This may mean rare events or seasonal patterns are not captured in the dataset.

8. Monitoring Areas

8.1 Community Mileage Allocation

A requirement for SMMI is that at least 50% of the population in the areas monitored are living in areas designated as Disadvantaged Communities (DAC), as defined by the top 25% of CalEnviroScreen scores under SB535. Across all CNCs designated for monitoring as part of SMMI, the total population is approximately 7.9M people, of which 2.9M people live in DACs (approximately one quarter of the California-wide DAC population). Aclima's monitoring resourcing scales with the length of roads contained within the selected monitoring area; in other words, more vehicles and drivers are required to monitor areas with a higher total length of roads. For all CNCs combined the total contained road length is approximately 18,000 miles[1]. The DAC census tracts combine to about 6700 miles. Aclima determined that allocating resources for SMMI such that approximately 12,000 miles of roads could be covered would allow for covering the DAC communities while also keeping the total % of DAC population at 50% or above, whereas adding additional resources would reduce the percentage of DAC population receiving monitoring resources. The implication of this is that because not all communities will receive monitoring resources to cover the entire community, an equitable process for allocating monitoring resources per community would need to be developed that would ensure that communities with higher proportions of DAC population will receive more monitoring resources . In consultation with the Project Expert Group (PEG), Aclima developed a method for allocating monitoring resources for broad area monitoring across the 62 CNCs that are part of the SMMI. The approach involved 3 steps:

1. The total number of available road miles was distributed across air districts according to the proportion of population contained within the CNCs in each of the 5 air districts containing the 62 CNCs (Imperial County, South Coast, San Joaquin Valley, Sacramento Metro, and Bay Area)[2]. This resulted in 100% of the road miles for CNCs in Sacramento, San Joaquin, and Imperial County Air Districts being allocated, because the proportion of these air districts' population is higher than their proportion of the CNC road miles compared to that over all CNCs. For the Bay Area and South Coast CNCs, there were more miles present within the CNCs

[1] Only major and residential road types are considered in estimates of monitoring area road miles for resourcing purposes; however, all accessible road types, which includes major, residential and highways/freeways, will be driven.
[2] The populations used for each Air District in this calculation are: Bay Area - 2838232; Imperial - 15330; Sacramento Metro - 138633; San Joaquin Valley Unified - 687473; South Coast - 4573865.

than there were miles available, and therefore a method was required for allocating the remaining miles among individual CNCs.

2. A customized prioritization metric for each census tract across all CNCs was defined to rank CNCs according to various socioeconomic and environmental indicators. This prioritization method was defined in consultation with the PEG. A description of how this prioritization metric was defined is given below.
3. Individual census tracts within CNCs were successively selected based on this customized ranking until the total road miles available for monitoring in each air district was exhausted. The road mile length of the census tracts selected is added up for each CNC, and that total is the number of miles available for monitoring for that CNC. The total number of miles assigned to each community by this method is presented in Appendix B.

The prioritization metric was created as an alternative to the CalEnviroScreen (CES4.0) score, addressing concerns raised by the PEG about the relevance of many of the metrics used in CalEnviroScreen as applied to the SMMI. Note that because the DAC communities are defined based on CES (under SB535), the PEG's prioritization metric will result in some non-DAC communities being prioritized over DAC communities. The methodology Aclima used, in coordination with the PEG, is outlined below.

- Aclima proposed a customized weighting of individual environmental and socioeconomic indicators relevant to the SMMI monitoring methodologies (including some in CalEnviroScreen plus others). The weighting was determined by a survey of PEG members, who collectively assigned weights to each available indicator.
- Survey Score Normalization: The Max/Min method was used to normalize the survey responses from PEG members to a scale of 0 to 1. This ensured that individual respondents' tendencies to give consistently higher or lower ratings did not skew the overall results.
- Indicator Weighting and Scoring: The normalized raw survey results were used to create weighting factors for each indicator. These weighting factors are shown in Appendix B. For each census tract, a mileage allocation score is derived by converting each indicator value into a percentile rank across all census tracts contained in the CNCs. This rank is multiplied by its corresponding weight, summing across all indicators, and normalizing to a value between 1-100. The indicators were taken from CES 4.0 and two additional non-CES indicators were added: the density of AB2588 Air Toxics Hot Spots and the density of large permitted sources, both measured as the number of sources per unit road length in census tracts. Some of the sources in the inventory had no emissions reported; these sources were first removed before calculating the density of sources.
- Final Score Calculation: The weighted scores for each indicator were summed for each census tract. This summed result was then normalized to a scale of 1-100 to create a PEG mileage allocation score for every census tract contained within the 62 CNCs. The final indicators and scores are available in Appendix B.

While this approach resulted in census tracts with the highest prioritization scores being prioritized within CNCs for the purposes of mileage allocation, the Community Engagement Plan (Appendix A) outlined a process for the Engagement Leads to work with communities directly to use the road mileage budgeted to select monitoring boundaries according to the priorities indicated by the communities. While this process empowers the local communities to make the decisions about where to direct monitoring, it should be acknowledged that the final monitoring area boundaries may not necessarily include the most disadvantaged communities as defined by established metrics such as CalEnviroScreen or by the PEG-developed metric.

For Tri-Valley, the total road length (for residential and major roads only) within the community is 137 miles, and the allocated mileage is 113 miles, as determined through the process above.

8.2 Broad Area Monitoring Coverage

Aclima's vehicles will gather detailed location-based and time-based pollution measurements throughout the community. This will happen over a nine-month period as the vehicles drive on roads that are open to the public. The specific neighborhoods where this mobile monitoring will take place were decided by the community members themselves during meetings led by Tri-Valley Air Quality Climate Alliance (TVAQCA). Broad area monitoring will occur consistently across a nine-month period from June to March, with repeat frequency in all locations (at the census block group level) on average approximately once every 2 weeks.

The maps below identify the region selected by the community for broad area monitoring along with location characteristics about known air pollution sources and community-identified concerns. Meteorological data (wind speed and direction) will be collected on the mobile platform and will be an additional location-based characteristic for incorporating into analysis and interpretation of data.

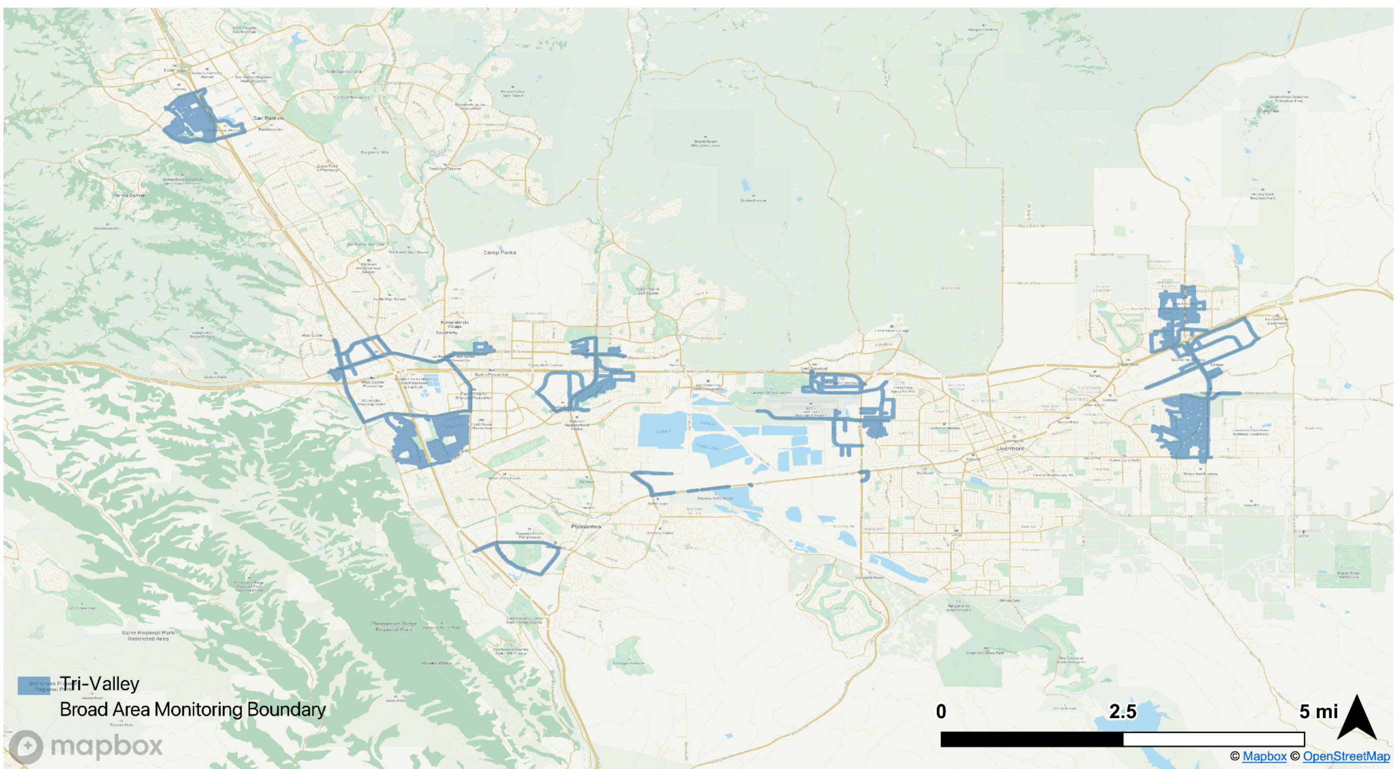


Figure 8.1: Map of the broad area monitoring boundary selected by Tri-Valley community members

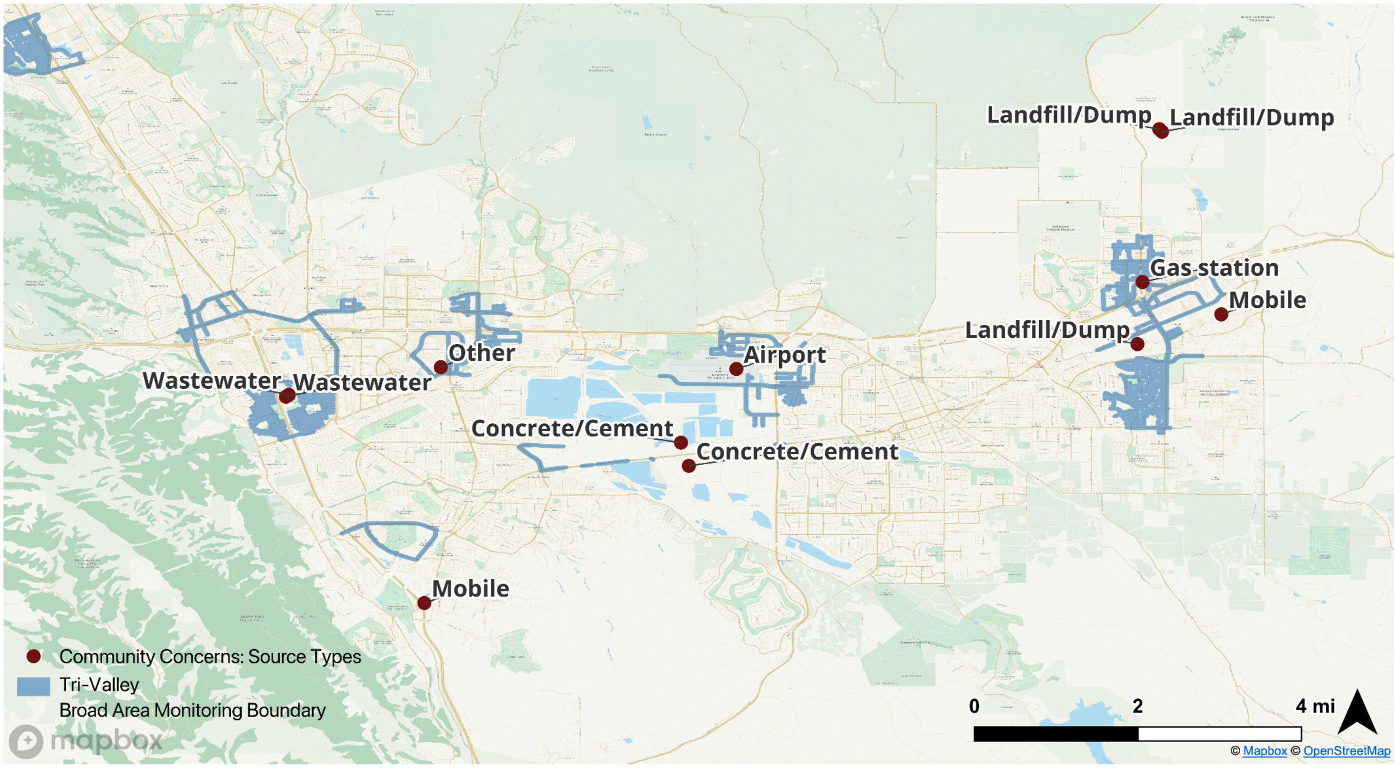


Figure 8.2: Map of the Tri-Valley broad area monitoring boundary and local air quality community concerns. Concerns noted by Tri-Valley community members include traffic-related emissions from major roads and highways, diesel particulate from heavy-duty vehicles, and emissions related to operations at Livermore Airport.

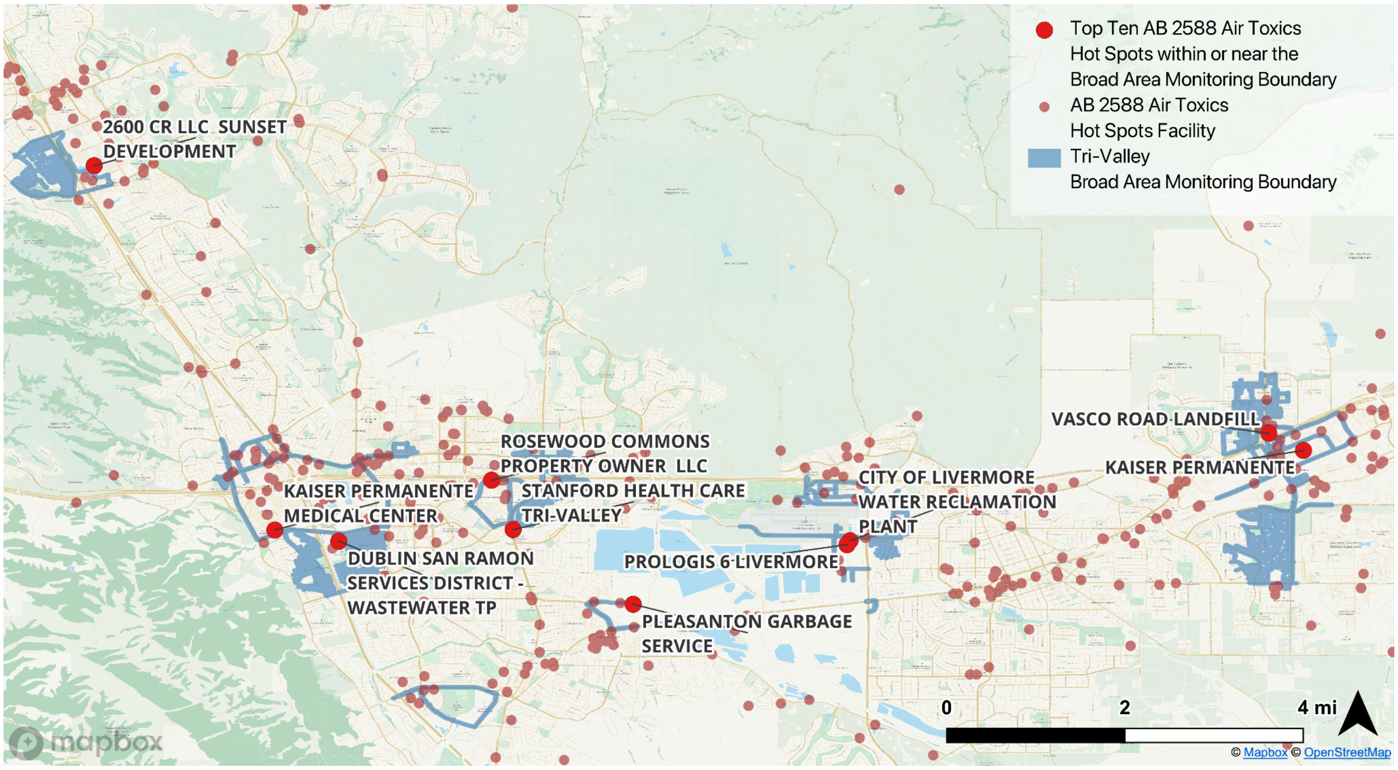


Figure 8.3: Map of AB 2588 Air Toxics Hot Spots within and near the Tri-Valley broad area monitoring boundary. The top 10 hot spots, based on total toxicity-weighted emissions (TWE), are emphasized. These sources include waste management, wastewater treatment, and medical and healthcare facilities, as well as sources described as real estate/residential.

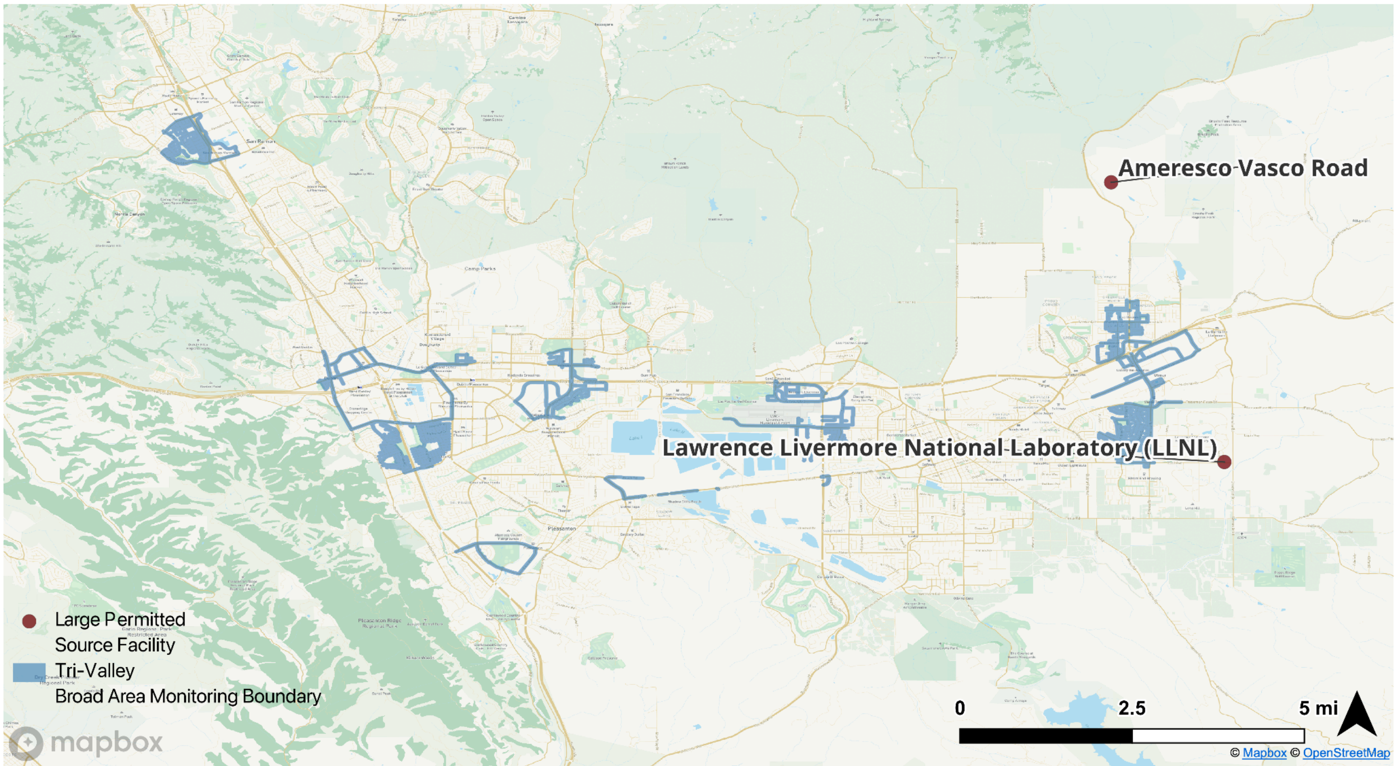


Figure 8.4: Map of large permitted facilities within and near the Tri-Valley broad area monitoring boundary.

8.3 Targeted Area Monitoring

Targeted area monitoring studies are designed to flexibly address specific air quality concerns raised by communities. The monitoring method, data analysis approach, and visualization approach will be customized to collect, visualize, and interpret the data in a way that is most effective for providing results that can ultimately be used to take action to address the air pollution concern. Aclima, with guidance from the PEG, have developed a method that draws from a modular set of predetermined monitoring, analysis, and visualization approaches that can be combined in unique ways to address a number of different concern types and monitoring objectives.

The air quality survey, community meetings conducted by ELs, and other outreach conducted with community members and air district representatives identified and prioritized the community air quality concerns (detailed in Section 2.3).

From the concern and monitoring objectives, a monitoring, analysis, and visualization approach is selected that is most appropriate for providing actionable results to help address the community air quality concerns.

The targeted area study for Tri-Valley will be conducted by Aclima and will address the community identified concern about locations near the 580 and 680 freeways being generally impacted areas with vehicle traffic. The primary monitoring objective for this targeted area study is identifying disproportionate impacts. Some of the key pollutants that will be of focus include black carbon, $PM_{2.5}$, CO, and NO_2. This targeted area study will be conducted using the following monitoring approach:

- **General Survey** Repeated monitoring along a predetermined route or on all roads within a predetermined area, attempting to collect air pollutant data evenly across time. The Aclima Mobile Platforms will collect data across different times of day, including overnight.

An Aclima Mobile Platform will conduct this targeted area study in the Tri-Valley by performing a general survey of areas immediately around the community concern identified. The vehicle will be temporarily reassigned from the usual broad area monitoring drive plan to do more intensive monitoring in a small location. Approximately 100 hours of monitoring (distributed across all times of day) will be conducted in this focused area to occur at some point during the nine-month broad area monitoring time period. The selected area will include about 10-15 miles of road length, allowing for approximately 2 repeat visits to each location in a single 8 hour shift, totaling approximately 20 repeat visits over the 100 hours of monitoring. The Aclima team will be in touch with the Tri-Valley Air Quality Climate Alliance in order to finalize the specific area selected for this targeted area monitoring and communicate timing. Community specific information about the local concerns and sources as well as the accessibility of certain roads can be discussed at this point in order to inform the mapping routes.

The map below shows the focus area for this targeted area study.

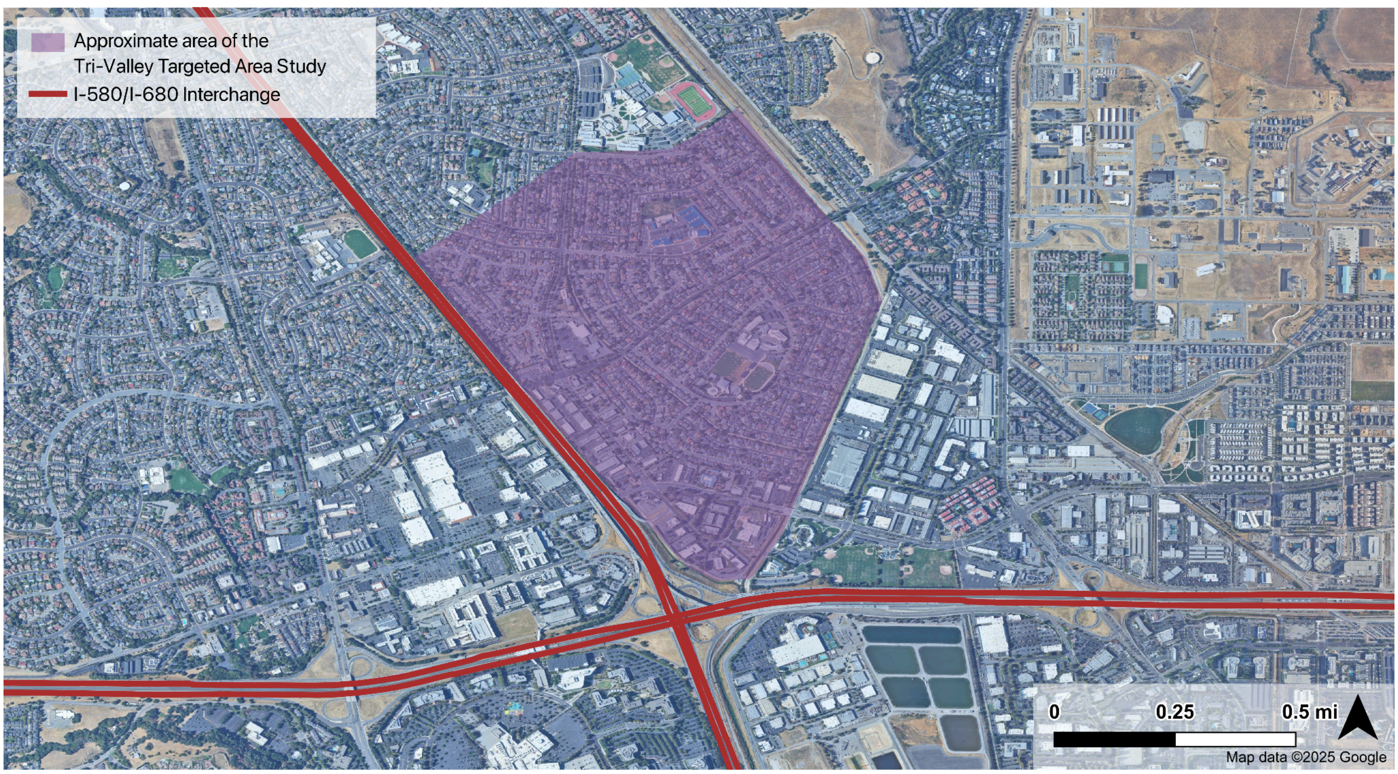


Figure 8.5: Map showing approximate area for the Tri-Valley targeted area study: neighborhoods to the northeast of the I-580 and I-680 Interchange. Actual drive plan and extent of monitoring is to be determined. See text for description of the monitoring approach.

9. Quality control procedures

Quality control procedures are an important part of all air monitoring plans because they outline the work that will be done before, during, and after the measurement period to make sure that the data collected meet Aclima's data quality objectives.

9.1 Aclima's Quality Assurance and Quality Control Procedures

Aclima has a comprehensive set of quality control (QC) procedures in place throughout the entire monitoring process, from the moment the sensors are installed into vehicles up until the final data is analyzed. These procedures help us track and minimize uncertainty, ensuring that the data collected is appropriate for the intended monitoring objectives. The following is a brief overview of these procedures. A full description of these procedures is included as accompanying documents in Appendices C, D, and E, including the frequency of QC checks conducted.

Ensuring Sensors Measure Accurately: Calibration

Calibration is a critical part of Aclima's quality control process. Aclima compares its sensors against trusted reference instruments and standards to make sure they are reporting the correct pollutant levels. Aclima does this at several stages:

- **Before Deployment (Pre-deployment Calibration):** Before mobile monitoring vehicles start collecting data in the community, each sensor undergoes a thorough calibration process.
- **During and After Deployment (Calibration Check):** During and after a mobile monitoring period, the sensors are brought back to Aclima's calibration facilities and recalibrated using the same methods as before deployment. This helps the team see if the sensors have drifted or changed their readings during the monitoring period. Calibration checks will occur approximately once every 6-8 weeks over the nine-month monitoring period.
- **Addressing Calibration Drift:** If Aclima finds that a sensor's calibration has shifted between any two calibration events, the team carefully reviews the data and may apply adjustments to ensure the accuracy of the measurements taken during the monitoring period. The way Aclima corrects for drift depends on the pollutant and the type of data product (e.g., long-term averages vs. short-term spikes).

Ongoing Checks During Monitoring:

There are several ongoing checks that occur while mobile monitoring vehicles are in the field:

- **Driver Checks:** Aclima's trained drivers perform daily visual inspections of the monitoring system, including checking sample lines and performing **PM zero checks** to ensure the system is operating correctly. They also monitor data connectivity and clean the black carbon sensor inlet.
- **Automated System Checks:** Aclima's mobile platform continuously monitors various **system status indicators**, such as temperature, pressure, humidity, and flow rates within the sensors. If these indicators fall outside of acceptable ranges, the data is automatically flagged for review. This helps us identify potential issues early on.

- **Manual Data Review:** Aclima's technical staff remotely monitor the incoming data and system diagnostics on a weekly basis to look for trends, unusual patterns, or potential sensor issues that automated checks might miss. Aclima may compare its data to that from nearby regulatory air monitoring stations to provide context for how pollutants are generally behaving over time in the region.

Addressing and Correcting Issues:

If any issues are detected during quality control checks, Aclima has the following procedures in place to address them:

- **Troubleshooting and Repairs:** For minor issues, drivers may be able to perform simple repairs in the field. For more complex problems, sensors or even the entire Aclima Mobile Node (AMN) may be returned to the calibration facilities for repair, recalibration, or replacement.
- **Data Flagging and Exclusion:** If Aclima identifies data that is likely inaccurate due to a sensor malfunction or other issue, Aclima flags this data in the system. Severely compromised data is excluded from further analysis to prevent it from affecting the final data products. Data that may have slightly higher uncertainty is noted and may be handled with more caution. Both the severity and the reason for flagging will be indicated
- **Data Adjustments:** If a calibration check reveals a consistent drift in a sensor's readings since the previous calibration, Aclima may apply adjustments to the data collected during the deployment to improve its accuracy over that time period. All data modifications are carefully tracked in Aclima's database. During calibration checks, the sensors also undergo recalibrations to derive the next set of calibration parameters for the next phase of data collection.

Table 9.1: Summary of Aclima QC Procedures and Frequency

Quality Control Activity	Frequency
Driver system checks (PM zeros, data connectivity, tubi ng and cable checks)	Daily
Manual data review	Weekly
Calibration checks (and subsequent recalibration)	Every 6-8 weeks
Routine Maintenance (internal filter or other consumables swaps, leak checks)	Every 6-8 weeks at calibration checks
Installation and Uninstall Checks (Flow checks, sample line cleaning, sample line filter swaps, etc)	Every 6-8 weeks at calibration checks
On-demand maintenance	As needed

Collocation of Aclima AMN at Regulatory Sites

Aclima AMNs will be installed at 2 regulatory monitoring sites operated by CARB or local air districts across California for long term intercomparisons in order to directly compare Aclima's measurements to regulatory measurements in different regions of the state. There are two motivations for this inter-comparison:

1. Provide transparency about how Aclima's measurements compare to FEM/FRM measurements of the key criteria pollutants (NO2, O3, CO, and PM2.5).
2. Identify any region-specific biases in the comparison of the AMN PM2.5 measurement with FEM methods. Aclima will consult with CARB to determine whether any systematic adjustment to Aclima's PM2.5 data should be performed based on the results of this intercomparison (see Appendices C and D for more details on the treatment of systematic bias).

These intercomparisons will be evaluated and quantified using various Data Quality Indicators (DQIs) (e.g. bias, precision, mean bias error, R2, etc). As of the publication of this CAMP, an AMN has been installed at a regulatory site in Sacramento (Downtown Sacramento – T Street, 1309 T Street, Sacramento, CA) and in Fresno (Fresno – Garland, 3727 N. 1st Street, Ste. 104, Fresno, CA). These sites were selected based on availability of space as well as the desire to collect AMN data in the Central Valley for characterizing regional differences in PM2.5. This data will be included in the data set released to the public at the conclusion of SMMI and the results of the intercomparison will be summarized in the final report.

10. Data management

The section briefly outlines how Aclima's system manages data from Aclima Mobile Nodes (AMNs) and Partner Mobile Laboratories (PMLs) throughout the SMMI campaign, fulfilling specific Scope of Work elements related to data management procedures and transfer mechanisms. A detailed description of Data Management can be found in Appendix F.

10.1 Data categories and levels

Data collected as part of this CAMP will range from 1-second measurements used for analysis, combinations or summaries of data collected throughout the observation period, and more rapid notifications of the detection of high concentrations. Aclima organizes these data further into levels reflecting the degree of processing, from the lowest level (Level 0, or L0) at sensor readout to high level (Level 4, or L4) modeled analyses which synthesize individual data points into actionable insights and data summaries for dissemination through visualization and reporting.

Table 10.1: Aclima's Data Processing Levels. Asterisks (*) indicate data levels provided to CARB or in support of non-scientific communication and community visualization.

Data Level	Name	Definition	Example
0	Raw Signal	Original signal produced by the sensor.	Voltage, digital number, raw mass spectra data
1	Intermediate geophysical quantities	Derived from Level 0 data using basic physical principles or calibration equations.	Concentration in ppb or ug/m3
2a*	Standard geophysical quantities	Estimate using sensor plus associated physical measurements directly related to measurement principle.	NO2 derived from O3 and Ox (O3+NO2) Temperature and humidity correction to sensor estimates. Methane and speciated air toxics peaks derived from time series data.
2b	Standard geophysical quantities, extended	Level 2a but using external data sources for artifact correction & directly related to measurement principle.	Not planned for use in the SMMI effort.
3*	Advanced geophysical quantities	Aggregated geospatial products using standard statistical methods.	Basic average concentration maps. Maps of enhancement events.
4*	Spatially continuous geophysical quantities, modeled spatio-temporal phenomenology	Aggregated geospatial products using advanced statistical models and potentially external data	Statistically reconstructed concentration maps with confidence intervals. Maps of locations of persistently elevated concentrations

10.2 Data management pipeline

The Data Management Pipeline includes five stages that manage data from collection to analysis. First, 1-Hz sensor data and accompanying metadata are **published** to remote (cloud) systems. Next, the sensor data and metadata are **ingested** into Aclima cloud storage. This Level 0 data is archived to ensure it is never altered. PML data is processed separately but in compatible formats. The raw, Level 0 data is **transformed** into calibrated physical quantities (Level 1) and further refined standard measurements (Level 2a), applying necessary corrections, time-shifting adjustments for sensor lag, and performing both automated and manual data quality flagging. Next, the **models** are used to aggregate L1/L2a information into higher-level geospatial data products (Level 3 using standard statistical methods and Level 4 employing advanced modeling techniques) to identify emission sources and disproportionately affected areas. Lastly, the data in all levels are labeled and **stored** using scalable cloud data storage. The original collected data is always preserved, and snapshots are taken at critical states. CARB will have access for a three-month period post-contract.

10.3 Data review and quality assurance

The data management system incorporates support for data review checks, defined as the manual or automated flagging of automated signals from sensor time series. Scientific details of data review can be found in the Appendices C, D, E, and F. Different data review and QA activities take place at different stages.

During the active deployment of a monitoring device and as data is streaming to the cloud, the monitoring team periodically checks (through a combination of manual and automated processes) the data being ingested to flag any sensor or data quality issues as they arise. Wherever possible, issues are resolved quickly in the field. Data that must be omitted from use for any reason (e.g. leaks, sensor failure, flow blockage, etc) is flagged.

After the deployment of a monitoring device is over (once the device returns to its home base), the monitoring team conducts a full review of all sensor data collected during that device's deployment, to ensure any issues that may have slipped through the cracks during the deployment period are detected before data is finally verified. Once again, any well-characterized data issues are flagged and any omissions from use are marked.

Once the deployment of all monitoring devices in the fleet is over (once all devices return to home base and the monitoring period is over), all collected data is re-processed to take account of flags and omissions and to prepare data for handing over to CARB and the community.

The original data coming from the sensors is always preserved, as well as all annotations from the various review and QA steps, so that the inclusion or omission of specific data can be properly traced.

10.4 Data transfer

Finalized L2a data from Aclima and the PMLs will be transferred to CARB via secure cloud storage, following a defined schema compatible with EPA's AQS where applicable. The delivery cadence of finalized data to CARB will be monthly beginning four months after data collection. File formatting and other details are specified in Appendix F.

10.5 Data visualization

Data will be used to create datasets and visualizations (e.g., Esri StoryMaps) focused on identifying pollution sources and areas of disproportionate impact, with templates and specific data layers described. Aclima will develop these, but CARB will own and host the final StoryMaps.

11. Work plan for conducting field measurements

The plan must describe field procedures that will be followed by those conducting measurements and provide the timeline for community air monitoring. Field procedures spell out individual tasks with enough detail so that air district staff or community members with the necessary training can complete the tasks. Examples of specific field procedures include documenting actions in logbooks, completing chain of custody forms, and conducting specific quality control procedures. The timeline needs to establish the duration of field measurements and denote milestones for completing key tasks. The plan will also describe communication and coordination steps to ensure field personnel know whom to contact for questions and how work products are delivered. Relevant safety considerations should also be documented.

The work plan for field measurements is distinguished by the monitoring approach.

11.1 Broad area monitoring

11.1.1 Field materials and procedures

Broad area monitoring principally involves the Aclima fleet (Aclima Mobile Platforms, or AMPs). Each vehicle is operated by an Aclima driver, who begins their shift at a local hub powering up instruments, a safety check, and troubleshooting. Their driving day is managed by a mobile application in their vehicle and includes mandated breaks. The day ends back at the local hub and with an instrument shutdown routine. During the day, each AMP is active on a route, constantly collecting data at 1 second intervals.

11.1.2 Communication and coordination

The operations team uses a range of software applications for communication, fleet management, safety, and navigation:

- Information for each operator starting their shift is communicated via a messaging application.
- Each operator can access online resources (written and video instructions) that describe specific standard operating procedures and provide resources for a range of encountered situations.
- Any photos or notes that the operator takes during the day are captured via a dedicated fleet management application.
- A sensor/instrument interface gives basic information to the operator on data reporting status.
- A dashboard mapping application loads the monitoring plan for the day and provides guidance on the route the operator must follow
- For general communication, a dispatch phone line is maintained.
- Operators can also file tickets for issues that cannot be immediately resolved.
- Safety training and issues are handled via a dedicated platform.

11.1.3 Timeline: duration, frequency, milestones, and deadlines

Broad area monitoring will be conducted by Aclima mobile platforms (AMPs) from June 2025 through the end of February 2026, for a total of approximately nine months of monitoring.

11.2 Targeted area monitoring

In addition to the Broad Area Monitoring, the following section details the work plan for Targeted area monitoring that will be conducted in Tri-Valley.

11.2.1 Field materials and procedures

Targeted area monitoring that is conducted by Aclima vehicles will follow the procedures outlined for broad area monitoring in 11.1.1.

11.2.2 Field communication and coordination

Targeted area monitoring will follow the communication and coordination processes in 11.1.1.

11.2.3 Timeline: duration, frequency, milestones, and deadlines

Targeted area monitoring will be conducted for a ~1 to 2 week period during the nine-month broad area monitoring period.

How will data be used to take action?

12. Evaluating effectiveness

The monitoring work plan and data will be evaluated across all stages of the monitoring phase of SMMI to ensure that air monitoring objectives are being met. These evaluations include on-going processes during monitoring,data review while collection is ongoing, and at data verification at the end of the monitoring period after all data has been collected. For additional details on these processes, see the detailed QA documentation in Appendices C, D, E, and G.

12.1 Evaluating effectiveness during the monitoring period:

The monitoring work plan and data will be evaluated across all stages of the monitoring phase of SMMI to ensure that air monitoring objectives are being met. These evaluations include on-going processes during monitoring, data review while collection is ongoing, and at data verification at the end of the monitoring period after all data has been collected. For additional details on these processes, see Aclima's detailed QA documentation in Appendices C, D, E, and G. Additional details about the public data release can be found in Section 14.2 and Section 10 of Appendix F.

- **Manual Data Review:** Aclima staff will conduct weekly assessments of vehicle and sensor performance, as well as overall data quality. These reviews consist of visual review of time series data from all sensors on each deployed vehicle, responding to automated alerts for specific known patterns of device issues (e.g. sample line leaks) and addressing through corrective actions as needed, and a review of other associated diagnostic data.
- **Automated Data Quality Checks:** The data processing pipeline includes automatic status indicator flags that signal when measurements fall outside predefined environmental or physical specifications for the sensors. These flags serve as immediate alerts for potential sensor malfunctions, data anomalies (e.g., negative values or concentrations outside the sensor's range), or issues with supporting systems like flow rates. These checks occur as data streams through the data processing pipeline, in near real-time.

- **Contextual Data Review:** Where available, data from regulatory monitoring sites within the mapping area will be used to provide context for large-scale air quality trends over time. This allows for a comparison of Aclima's sensor data with established networks, helping to identify whether observed patterns are consistent with broader trends or potentially indicative of issues with Aclima's measurements. Factors such as distance between mobile and stationary measurements, road type, site type, and temporal aggregation will be considered during these comparisons. These evaluations occur on a weekly basis as part of the manual review process.
- **Measurement Quality Objectives:** Acceptable quantitative criteria for data quality indicators at the individual sensors (e.g., precision and bias) will serve as benchmarks for evaluating effectiveness. These are referred to as calibration acceptance criteria in Aclima's detailed Quality Assurance document (Appendix C) In addition to calibration prior to the start of monitoring, all AMNs will receive calibration checks (and subsequent recalibrations) on a 6-8 week basis over the nine-month monitoring period, including at the end of monitoring.
- **Data Verification:**A thorough data verification process will be conducted on an ongoing basis throughout the monitoring period in order to produce finalized data in monthly increments, with the first delivery occurring four months after monitoring begins. The data verification process consists of 1) a manual data review process, 2) a review of calibration results, 3) the application (where necessary) of adjusted calibration parameters and data quality flags for data reprocessing, and 4) a final review of the reprocessed data with applied calibration adjustments and data quality flags. During this process, all of the above data quality checks described above are re-evaluated just prior to and immediately after any reprocessing of data occurs. The Aclima team conducts a similar data verification process as Aclima and on the same delivery cadence; specifics are outlined in Appendix G.
- **Evaluating Broad Area Monitoring Completeness:** Aclima mobile monitoring campaigns are designed to repeatedly drive roads in a monitoring area such that the roads are visited 20 times on average. An automated drive planning system evaluates the amount of driving coverage throughout a region on a daily basis and directs drivers to prioritize visiting roads in relatively underdriven regions. Additionally, Aclima analysts continuously monitor temporal and spatial driving coverage in the event that manual drive routing is needed to prevent regions with unexpectedly low numbers of visits. This is tracked by measuring the average number of measurements on each road by census block group.
- **Evaluating Targeted Area Monitoring Completeness:** This same completion criteria will be applied to Aclima's targeted area monitoring, with the 20 repeat visits (on average) conducted over the duration of the approximately 1 week targeted area monitoring period.

12.2 Evaluating effectiveness at the end of the Monitoring Period:

A comprehensive evaluation of the overall effectiveness of the community air monitoring initiative will be conducted at the conclusion of the data collection and verification phases. This final evaluation will be documented in the SMMI final report and will provide an overall assessment of the uncertainty associated with the collected data and derived data products. This will encompass various sources of error, including intra-network variability (uncertainty between different monitoring platforms), inter-network comparability (comparison with other monitoring networks, such as regulatory sites), sensor specific measurement errors, and modeling and sampling errors.

- **Comparison with External Data:** The report will include comparisons between Aclima's measurements and data from regulatory stationary monitoring sites. These comparisons will evaluate the accuracy and precision of Aclima's mobile measurements against established reference methods over various timescales. Metrics such as Mean Bias Error (MBE), Mean Absolute Error (MAE), and R^2 will be used to quantify the agreement between the datasets. Additionally, comparisons of the modeled ambient concentration estimates with annual averages from nearby regulatory monitors will be included to assess the overall performance of the data products.
- **Aclima Calibration Results:** Results from the calibration events conducted on Aclima's Mobile Nodes (AMNs), both before and after their deployment. These results will help characterize the typical measurement error at the device level by comparing sensor readings to reference instruments and amongst themselves.
- **Stationary Comparison with Regulatory data:** This evaluation will compare data from Aclima's stationary AMNs, collocated at regulatory monitoring sites, with the measurements from those regulatory monitors. This comparison will help determine the measurement error and how Aclima's data aligns with the established regulatory network's data.
- **Mobile Comparison with Regulatory data:** This analysis will involve comparing in situ measurements collected by Aclima's mobile monitoring fleet near regulatory sites with the concurrent data from those stationary sites. This will provide insight into the agreement between mobile and stationary measurements, considering both measurement errors and the natural spatial and temporal variability of pollutants.
- **Ambient Concentration Comparison with Regulatory data:** The hyperlocal ambient concentration estimates will be compared with long term average concentrations from regulatory stationary monitors. This will help assess the overall uncertainty in Aclima's estimates, including factors like modeling and the temporal sparseness of mobile measurements.
- **Analysis of completeness and representativeness:** Analysis will be performed to show how well distributed data collection is across times of day, days of week, and season. Additionally, the number of passes in each location will be reported.

12.3 End of monitoring

Monitoring ends when deployments for all vehicles (AMPs and PMLs) are complete. Given the fixed time constraints for the SMMI final report to be completed by May of 2026, the broad area monitoring period will end after nine months of data collection. In order to determine successful completion at the end of nine months the monitoring team will evaluate whether:

- Monitoring coverage has exceeded the required minimum percentage coverage requirement for priority communities within the SMMI-wide monitoring areas (i.e. across all CNCs, not just Tri-Valley)
- Data gathered is sufficiently representative of the seasonal, time of day, and day of week variation across the monitored area (i.e. not biased by data collection at one specific time), such that they can support the objectives, sub-objectives and presentation plans as uniquely defined in this monitoring plan
- Data gathered is sufficiently representative of the spatial variation in air quality across the monitored area, such that they can support the objectives, sub-objectives and presentation plans as uniquely defined in this monitoring plan

The results of all quantitative evaluations of effectiveness listed above will be included in a Quality Assurance report to accompany the final project report.

13. Data analysis and interpretation

13.1 Preparation of finalized datasets

As described in Section 10 on data management (and in detail in the Data Management documentation in Appendix F), 1-second "finalized" data collected by all sensors and instruments will go through several data verification and validation protocols, and transformation steps before they are described as finalized and made available to CARB.

"Finalized" data is defined as sensor signals transformed to geophysical quantities of measurement (Level 2a), calculated using the sensor signal plus associated physical measurements directly related to the measurement principle such as temperature and relative humidity measurements. Data flagged for artifacts will also be included.

13.2 Aclima analysis, interpretation, and visualization of data

Mobile monitoring data gathered under this CAMP are intended to facilitate focused actions by communities and CARB, including any future work to identify and prioritize locations for more comprehensive community-scale air monitoring, or develop Community Emissions Reduction Programs (CERPs).

To support this potential future work, the monitoring team will generate a series of additional datasets that can help communities better understand and interpret the data in the context of the concerns detailed in this CAMP. These datasets will be in addition to the finalized 1-second data provided directly to CARB and require further processing as described in Section 10 in this monitoring plan. Appendix E Section 2.3 discusses the additional data that will be reported including the quantitative metrics that will be associated with enhancements). These datasets can support identifying and characterizing sources or identifying disproportionate spatial and temporal impacts within a community.

The following is a brief description of the different possible analysis and visualization approaches used by SMMI. In some cases, the analysis approaches are matched with specific monitoring approaches, but there can be various combinations of monitoring and analysis approaches that could be selected to appropriately achieve the desired monitoring objectives.

- **Clusters of enhancement detections on a map** - Identifying locations of pollutant enhancements (high concentrations above background levels) on a map. Clustering or grouping of pollutant enhancements refers to identifying locations where multiple enhancements of the same pollutants are detected at multiple different times over the course of monitoring.
- **Statistics on enhancement detections** - Statistical values that describe how often enhancements were detected in a specific location. Examples include number of detections, the number of detections per visit, or the number of distinct days of detections.
- **Chemical speciation bar graph or pie chart** - A bar chart or pie graph that indicates the relative concentration of different key pollutants of interest in a specific location. This can represent the pollutants within an enhancement detection, averaged across an enhancement cluster (i.e. multiple enhancements in the same location), or in ambient concentrations of background air.
- **Diurnal plot of enhancement detection events** - This analysis shows the frequency of enhancement detections in a particular location by hour of day. This analysis requires balanced sampling across different times of day in the same location.

- **Ambient concentration gradients over plume transects** - Displaying ambient concentrations as they vary in space in the downwind region of an air pollution plume. This type of analysis is generally paired with the plume transect monitoring approach, but a general survey approach may also be appropriate in certain situations.
- **Ambient concentration map of key pollutants -** Displaying a map of ambient concentrations that are generally representative over the time period that monitoring takes place. Typically, the general survey monitoring method or broad area monitoring is required for this type of analysis.
- **Area-wide chemical breakdown bar graph or pie chart -** A bar graph or pie chart showing the relative proportion of different pollutant concentrations detected on overage over a particular area of covered. Typically, the general survey monitoring method is most useful for this type of analysis

These example visualizations can help address the community specific concerns in Tri-Valley for the concerns assigned monitoring objectives in Table 4.1. The map of ambient concentration estimates shown in Figure 13.1, below, is directly responsive to the monitoring objective of identifying disproportionate impacts (e.g. mobile sources on I-580 and I-680). The heat map of locations of persistently elevated concentrations of TVOCs (Figure 13.2) is responsive to the monitoring objectives of characterizing sources (e.g. near waste management and industrial facilities). Note that broad area monitoring may result in visualizations that provide information (for example clusters of enhancements) about additional concerns not specifically assigned monitoring objectives or unknown sources not listed specifically as community concerns here.

Some example forms of final data visualizations are shown below.

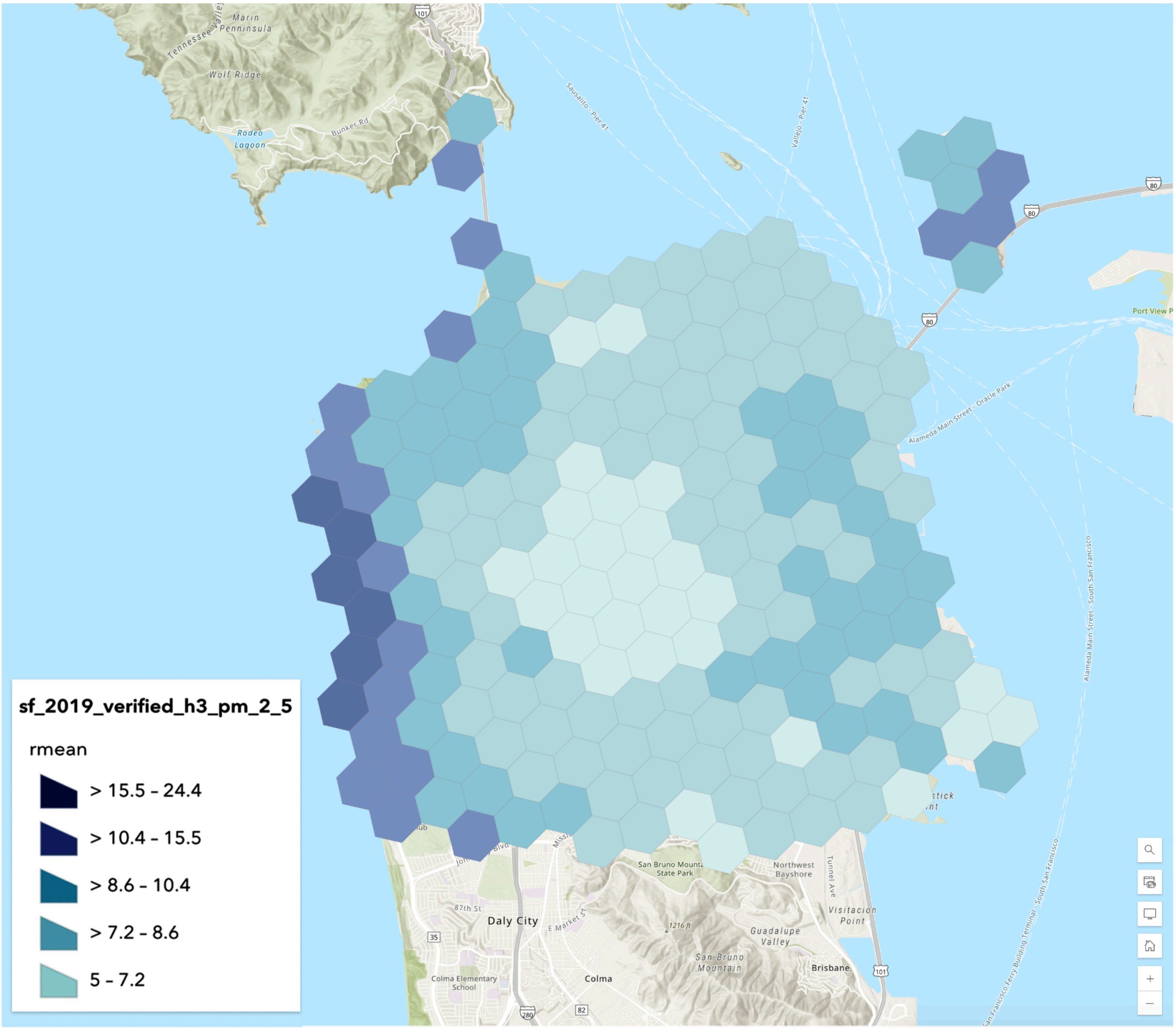


Figure 13.1: Example of a map of ambient concentration of $PM_{2.5}$ over a specific area plotted using hexbins. In this type of map, the color indicates pollutant concentration. In this example, colors indicate $PM_{2.5}$ concentrations for data collected over a one-year time period in San Francisco, CA. Map data © Mapbox, © OpenStreetMap.

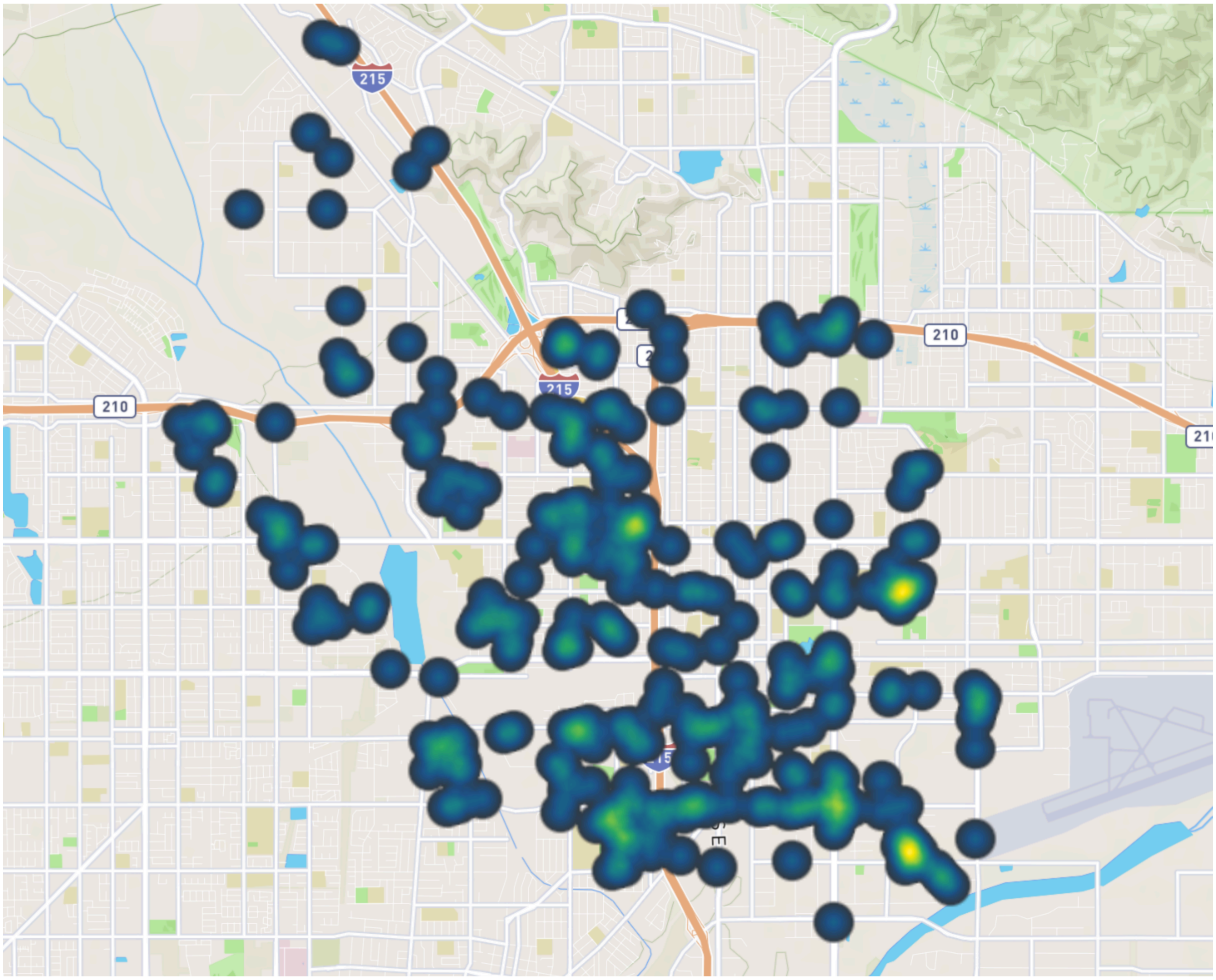


Figure 13.2: Example of plotting an enhancement-based dataset (TVOCs) as a heatmap. In this type of map, the density of individual enhancement events is shown, where the brighter colors indicate a higher density of detected enhancements. In this example, data collected over a three-month period in San Bernardino, CA are shown. Map data © Mapbox, © OpenStreetMap.

For the concerns assigned specific monitoring objectives in this monitoring plan, the analysis approaches are specified in Table 4.1, in Section 4.3. Appendices D and E provide more detailed descriptions of how different analyses are performed and the different implementations of the approaches that are possible. These appendices also list important limitations that will be taken into account at the analysis stage and will be communicated in the public presentation of results. The specific implementation of these approaches will be determined after the data is collected and evaluated. Data will be analyzed according to the general approaches outlined above.

14. Communication of results to support action

The mobile monitoring data collected in this community will be analyzed and presented to support focused action to reduce emissions or exposure. This requires an accessible visualization, of which Aclima has many. CARB has selected ESRI StoryMaps as their visualization platform.

The project offers Engagement Leads supplemental budgets for capacity building and relationship building to foster the partnerships necessary for translating data into emissions reduction actions.

14.1 Reporting of high concentrations prior to the end of the contract

The primary intent of the SMMI is not for real-time notification. However, during data collection, there may be instances where pollutant concentrations significantly exceed expected levels. To address these situations, a response protocol has been established to ensure that such anomalies are promptly reviewed and assessed in coordination with relevant agencies and shared with community stakeholders. If concentrations exceed the thresholds (defined below), and the detection is deemed viable after analysis and assessment by Aclima or a Partner Mobile Lab, Aclima will inform the local Air Districts or other relevant local authorities. Not every detection will trigger a report. Only after in-depth investigation by scientists in the field or remotely via data analysis will a detected event be deemed viable for reporting. Table 14.1 provides the overall framework of the assessment process and reporting structure.

The purpose of reporting observed high concentrations is to protect public health and safety, and while no regulatory action will occur as a direct result of data collected by SMMI, local regulators may decide to conduct additional monitoring or other types of investigations based on these reports. Additionally, while health-based thresholds are used in the notification framework, it should be emphasized that this process will not definitively determine whether a health threshold has been officially exceeded.

Table 14.1: Overall framework of the assessment process and reporting structure

Pollutant	Initial Assessment Protocol	Data Reporting and Communication to Local Air Districts or Other Relevant Local Authorities by Aclima	Community Updates
Methane/Ethane Relevant threshold: 100 ppm methane[a]	Aclima: ● Initial Detection ○ Detection above threshold ● Investigation ○ See Section 14.1 text for description	Aclima: ● If detection qualifies – Prepare and Submit Report: ○ Location/Time of Event ○ Historical detections in the area ○ Classification of methane source (thermogenic or biogenic) ○ Description of the local environment (land use, sources, notable features) ○ Placeholder for Summary of findings and next steps ● Notify local utility company (or air district as appropriate based on source) within 2-3 business days of verification ● Email the completed report to designated CARB contacts within 2-3 business days of verification	CARB: ● Monthly Summary Reports will be posted to the CARB website and will include: ○ A summary of reports generated ○ Locations and timestamps of detections ○ Results of preliminary analysis ○ Actions taken or recommended follow-up steps Aclima: ● A comprehensive summary will be included in the End-of-Campaign Report, covering: ○ All events detected over the course of the campaign ○ Historical patterns and trends ○ Overall progress and response efforts
Toxic Air Contaminants (see table 14.2 for additional details)	PMLs: Initial detection ● Detection above California OEHHA acute RELs at least twice in the same location Investigation: ● See Section 14.1 text for description	PMLs: If detection is deemed viable event after analysis and repeated monitoring: ● Air district will be notified by Aclima immediately upon verification of the event	CARB: ● Monthly Summary Reports will be posted to the CARB website and will include: ○ A summary of reports generated ○ Locations and timestamps of detections

		• PMLs will prepare and submit report within 3 days of verification: ○ Location/Time of Event ○ Pollutant and concentration ○ Historical detections in the area ○ Description of the local environment (land use, sources, notable features) Note: Reporting timelines may vary based on the instrumentation used, QA/QC protocols, and time required to validate findings.	○ Results of preliminary analysis ○ Actions taken Aclima: • A comprehensive summary will be included in the End-of-Campaign Report, covering: ○ All events detected over the course of the campaign ○ Historical patterns and trends ○ Overall progress and response efforts

a) Threshold for methane is not based on a specific health-based action limit, but is based on historical data collected by Aclima, indicating values typically associated with large significant natural gas leaks.
b) Air toxics contaminants are those that may be measured PMLs and monitored in real time by scientists aboard the mobile platform.

The following provides additional details on the investigation process that will occur after an initial detection above the indicated threshold concentrations. For methane, Aclima analysts initiate this investigation remotely typically within 24 hours of the initial detection. Follow up monitoring, if needed, may take days to weeks to complete. For air toxics (or methane detected on the PMLs), the PML teams have technical staff on-board to follow up in real time in most cases. Otherwise, the follow up monitoring will occur as soon as possible. The purpose of this process is to identify anomalously high pollution events and sources and Aclima reserves the right to revise the listed thresholds based on data collected over the course of monitoring (in collaboration with CARB) in cases where exceedances are frequent and follow up monitoring significantly detracts from the planned targeted area monitoring or the reporting of frequent exceedances as individual events become infeasible.

Methane

Detection of methane at the 100 ppm threshold or above typically (but not always) indicates a natural gas leak from residential distribution systems. The following process will be followed to investigate each triggering methane detection:

1. Measurement diagnostics check
2. Evaluate source type using ethane/methane ratio and presence of CO
    a. For Thermogenic (i.e. fossil in origin) source type (ethane/methane ratio between 1-10% and no concurrent CO enhancement)
        i. Check historical data and count the number of distinct days with enhancements > 5 ppm
        ii. Report locations where number of days is 3 or higher
        iii. Track locations with less than 3 days and follow up weekly

   iv. Check contextual information about location to determine whether there are obvious sources otherwise assume coming from underground natural gas distribution lines
   v. Report to local utility if gas distribution system suspected, otherwise to the air district
  b. For Biogenic source type (ethane/methane ratio <1% or no concurrent ethane detected):
   i. Check whether there is any correlation between ethane/methane to determine whether the source is a biomethane or renewable natural gas blend (biogenic methane blended with traditional natural gas), which typically has an ethane/methane ratio less than 1%. Follow instructions for natural gas source types above.
   ii. Check historical data and count distinct days with enhancements > 5 ppm
   iii. Check contextual information about location to determine whether there are obvious sources
   iv. Use scientific judgement and contextual information to determine whether to report to local air district
  c. For mobile source type (strong concurrent CO enhancement):
   i. No further action

Air Toxics

Detection of individual air toxics above the notification threshold (as indicated in Table 14.2) will trigger a follow up investigation according to the following process:

1. Measurement diagnostics check
2. On-board technical operations team determines whether the likely source is transient (e.g. a passing vehicle) or a possibly persistent stationary source or unknown source.
   a. Likely persistent stationary source or unknown source:
      i. Vehicle operator returns to location of initial detection as soon as possible to do follow-on measurements. The vehicle operator will consider whether immediate follow-up measurements would adversely impact the ability to measure a priority source, and will schedule a follow-up accordingly.
      ii. If the threshold is exceeded at least twice in the same location, a 1 hour average measurement will be collected in the vicinity of the initial detections. The measurement may be collected while parked or in motion to better characterize the plume extent, at the discretion of the on-board technical team.
      iii. The local air district is notified if 1 hour average concentrations of any pollutant measured reaches or exceeds an acute recommended exposure limit (CA OEHHA Acute REL), listed in Table 14.2. *Note that for benzene, toluene, and acrolein the uncertainty of these measurements in real-time (prior to post-processing and final QA/QC) may be as high as a factor of 2. Exceedance determinations for all species will also include uncertainties due to calibrations and ambient conditions (humidity, temperature, pressure), and judgement from the scientific team will be used to determine whether borderline cases should be reported or not.*
   b. Mobile or other transient source (for example, an exceedance detected while refueling the vehicle at a gas station):
      i. No further action is required

Table 14.2: Thresholds used for air toxics event notification

Pollutant	Action Threshold[a,b]
formaldehyde	45 ppb
benzene	8.5 ppb
toluene	1.3 ppm
acrolein	1.1 ppb
carbon monoxide	20 ppm

a) The thresholds are based on health action limits (California OEHHA Acute REL), however, it should be noted that these are limits only used as a benchmark to trigger follow up investigation and do not indicate that these health action limits have actually been exceeded. The event will only be reported if the scientists deem the detection to be a viable event based on their investigation. Additionally, the species detected by this method will be uncalibrated signals that may have high uncertainties (up to a factor of 2 in some cases)
b) Aclima reserves the right to update the action thresholds over the course of monitoring based on data collected over the course of monitoring, for example, if it is found that the number of threshold exceedances are higher than anticipated.

14.2 Public Data Access

Upon completion of the contract, CARB will make the finalized monitoring data available for public access through the CARB AQview website. Data for each region and pollutant will be provided in standardized, comma-separated values (CSV) format to ensure broad compatibility with commonly used data analysis tools and software. This approach supports transparency, encourages independent analysis, and facilitates community and academic engagement with the air monitoring results.

14.3 Community Story Maps

Aclima will deploy the finalized raw data and appropriately selected data analyses (described in Sections 13.2 and 13.3) in accessible online, public, interactive and free-to-use visualizations built on the Esri platform. These visualizations will be in the format of a customized platform built with Esri StoryMaps and hosted by CARB. A range of analyses are available to identify potential sources and to identify locations of disproportionate impact, drawing on data collected through both targeted area monitoring and broad area monitoring conducted by Aclima. Only finalized quality assured data will be incorporated into public facing visualizations.

14.4 Final Report

A final report will be delivered to CARB at the end of the contract, May 19, 2026. This report will provide a comprehensive analysis of the data collected by Aclima and the Partner Mobile Laboratories during the SMMI and will include the following sections:

Executive Summary: The report will include an executive summary to highlight the key takeaways, recommendations, or limitations of the report.

Summary and Timeline of Air Monitoring: The report will provide a summary of the air monitoring activities conducted and a timeline of when these activities took place. This will offer context and background on the project.

Discussion of Data Collection, Validation, and Analysis: The report will detail how the air quality data were collected using Aclima's mobile monitoring platforms and partner mobile laboratories. It will also explain the quality assurance and quality control (QA/QC) procedures implemented to ensure the data's integrity, including how the data were validated. Furthermore, the report will describe the methods used to analyze the collected data, potentially including analyses for identifying pollution sources and areas of disproportionate impact like diesel indications, locations of persistently elevated toxic air contaminants, and natural gas leaks.

Summary of Significant Findings and Conclusions: The report will present a summary of the key findings from the air monitoring campaign. This will include ambient concentrations and any identified pollution enhancements. These findings will be presented in a manner understandable to a non-scientific audience.

Recommendations and Next Steps: Based on the findings, the report will offer recommendations for potential next steps. This may include suggestions for tracking progress or verifying results achieved by community emissions reduction programs, or for future, more comprehensive monitoring efforts.

Dissemination Plan: The report will outline how the data and the findings will be disseminated and discussed with appropriate decision-makers so that the information can lead to the intended actions for emissions reduction and public health improvement. This will include the use of publicly accessible data visualizations such as ESRI StoryMaps. The report will also mention the virtual public meeting organized to explain project results and discuss possible next steps.

Public Meeting: To better help community members understand the content of the final report in an accessible manner, Aclima and California Air Resources Board staff will organize online meetings by air district (or sub-group within air district if necessary) to explain project results, answer questions, have community members share their experiences engaging with the project, and discuss possible next steps. Tri-Valley Air Quality Climate Alliance (TVAQCA) will play a major role in outreach and promoting community attendance at this meeting. This meeting will be conducted in English with Spanish interpretation and designated Spanish breakout rooms. To ensure further accessibility to results, Aclima will provide one-page result summaries for each community in both English and Spanish that Tri-Valley Air Quality Climate Alliance (TVAQCA) can distribute physically or via Whatsapp or text.

Input from Stakeholders: The final technical report will incorporate input from stakeholders across the initiative, including the Project Expert Group, community representatives, air quality officers, and environmental justice leaders.

Accessibility: Aclima will consider accessibility needs for the print document, such as alt text and color design.

The report will be provided to CARB in both PDF and the original electronic format.

Appendices

Full appendices are available here: https://aclima.earth/smmi-camp-appendices

- Appendix A: SMMI Community Engagement Plan (CEP)
- Appendix B: SMMI Community Mileage Allocation
- Appendix C: Aclima Quality Assurance System
- Appendix D: Aclima Hyperlocal Ambient Concentration Estimate Validation and Quality Assurance System
- Appendix E: Aclima Hyperlocal Enhancement-based Data Products Quality Assurance System
- Appendix F: Aclima Data Management Plan
- Appendix G: Partner Mobile Laboratory Quality Assurance Project Plan (QAPPs) and Data Management Plans
- Appendix H: Approach for Assigning Targeted Area Studies
- Appendix I: Complete Table of Pollutants and Instrumentation
- Appendix J: Public Comment and Response Documentation
- Appendix K: Community Meeting Evaluations