2023CARB_SMMI-RFI001 RFI submission cover letter

Delivered via e-mail to smmi@arb.ca.gov on 11/2/2023.

To: David Ridley and the SMMI team at the California Air Resources Board:

Please find attached Aclima, Inc.'s written response to RFI 2023CARB_SMMI-RFI001.

On behalf of the Aclima team, I certify that the information in the response is true and accurate to the best of my knowledge at the time of submittal.

Sincerely,

Beaudry Kock

Product Manager

699 Lewelling Blvd., Suite 146/335
San Leandro, CA 94579-1804
415-234-0626

beaudry.kock@aclima.io

Contents

Attachment A — Vendor profile **3**
Data products 6
Applications 9
Mobile measurement platform 9
Services 10

Attachment B — Vendor questions **15**
I. General questions 15
II. Engagement & coordination 22
III. Mobile monitoring technologies & capabilities 32
IV. Data collection, storage, & reporting 55
V. Feedback 63
Attachment C — Rough Order of Magnitude Cost Estimate **64**
I. Rough Order of Magnitude 64
II. Answers & assumptions used in cost estimate 66

Glossary **70**

© Aclima, Inc. 2023

Attachment A — Vendor profile

1	Identify the Company Name, address, city, state, and zip code, telephone.

Aclima, Inc.
699 Lewelling Blvd., Suite 146/335
San Leandro, CA 94579-1804
415-234-0626

2	Identify the name, title, address, phone number, and email address of the primary contact person for this RFI.

Beaudry Kock
Product Manager
699 Lewelling Blvd., Suite 146/335
San Leandro, CA 94579-1804
415-234-0626
beaudry.kock@aclima.io

© Aclima, Inc. 2023

3	Provide a brief overview of your company including number of years in business, number of employees, nature of business, and description of clients.

Aclima is a Public Benefit Corporation and climate tech company catalyzing bold climate action that reduces emissions, protects public health, and delivers clean air for all. Powered by its network of roving sensors, Aclima measures air pollution and greenhouse gases across cities, regions, and states with block-level resolution. The company's professional analytics software, Aclima Pro, translates billions of scientific measurements into interactive maps and analytics that are designed to inform and empower clean air decision-making, with a focus on intuitive tools that support communities — particularly those hardest hit by air pollution. Aclima's customers include regulators, utilities, companies, and communities working to reduce emissions and protect public health and the environment (Chambliss et al. 2021[1]; Riddell et al. 2021[2]; Solomon et al. 2020[3]; Apte et al. 2017[4]).

Aclima was founded in 2008 and is headquartered in San Leandro, CA. The company has 30-40 employees.

4	Identify any parent corporation and/or subsidiaries, if applicable.

N/A.

[1] Chambliss, S. E., Pinon, C. P. R., Messier, K. P., LaFranch, B., Upperman, C.R., Lunden, M.M., Robinson, A.L., Marshall, J.D.,and Apte, J. S.: Local- and regional-scale racial and ethnic disparities in air pollution determined by long-term mobile monitoring, PNAS 118 (37), https://doi.org/10.1073/pnas.2109249118, 2021.

[2] Riddell, C. A., Goin, D. E., Morello-Frosch, R., Apte, J. S., Glymour, M. M., Torres, J. M., and Casey, J. A.: Hyper-localized measures of air pollution and risk of preterm birth in Oakland and San Jose, California. International Journal of Epidemiology 50 (6), 1875-1885, https://doi.org/10.1093/ije/dyab097, 2021.

[3] Solomon, P. A., Vallano, D., Lunden, M., LaFranchi, B., Blanchard, C. L., and Shaw, S. L.: Mobile-platform measurement of air pollutant concentrations in California: performance assessment, statistical methods for evaluating spatial variations, and spatial representativeness, Atmos. Meas. Tech., 13, 3277–3301, https://doi.org/10.5194/amt-13-3277-2020, 2020.

[4] Apte, J. S., Messier, K. P., Gani, S., Brauer, M., Kirschstetter, T. W., Lunden, M. M., Marshall, J. D., Portier, C. J., Vermeulen, R. C. H., and Hamburg, S. P.: High-Resolution Air Pollution Mapping with Google Street View Cars: Exploiting Big Data, Environ. Sci. Technol. 51, 12, https://pubs.acs.org/doi/10.1021/acs.est.7b00891, 6999−7008, 2017.

© Aclima, Inc. 2023

5	Give a brief description of your company's product(s), platform(s), service(s), etc. that may be relevant to this RFI.

Aclima's solutions (products, platforms, and services) are built on more than a decade of operating experience and diverse partnerships in disproportionately impacted communities across California and nationwide. Aclima's hyperlocal mobile air monitoring system comprises tightly integrated vehicle and sensor platforms; data processing and storage; intelligent and dynamic planning and operations capabilities; and visualization and analytics software.

Aclima offers a suite of data products for pollutants, greenhouse gases, and air toxics, placed in context with socioeconomic data useful for helping communities identify and respond to disproportionate impacts. Aclima's web-based software products help stakeholders develop a shared understanding of air quality concerns and move quickly to emissions reduction. Aclima supports clients with additional services including dedicated customer success, natural gas leak monitoring, and stationary site data integration.

Practical, equitable impact

Aclima's hyperlocal mobile air monitoring solution is predicated on partnering with disproportionately impacted communities — and the regulators who serve them — to support practical applications of mobile air quality data towards emissions reduction. Aclima has demonstrated the largest scale of hyperlocal air measurements to date in New York State, covering 410,000 miles of roads, serving 5,200,000 people, and informing emission reduction plans across multiple disadvantaged communities across 10 urban regions. Aclima is supported by leading environmental justice advisors who have helped develop a model focused on providing timely, accurate, and user-friendly information on community exposure to air pollution that supports effective mitigation efforts. Aclima has worked since its inception to cultivate strong relationships with communities, which help ensure the company's suite of products and services are useful and effective.

Founded in rigorous science

Aclima's solution includes patented methodologies built by a team with decades of atmospheric, data science, and monitoring hardware experience, as well as strong ties to leading research in academia. Aclima has partnered with the world's most innovative institutions in air quality, including regulators such as California's Air Resources Board, Bay Area and South Coast air quality management districts, and a statewide partnership with New York State's Department of Environmental Conservation. Aclima has also partnered with leading research institutions such as the US EPA, UC Berkeley, Lawrence Berkeley National Lab, and Google.

© Aclima, Inc. 2023

Data products

Aclima provides a suite of data products for criteria pollutants, greenhouse gases, and air toxics: pollutant basemaps, indicators, and spotlights. These products vary by spatial and temporal resolution and address different needs.

Basemap

Aclima's Basemap product provides hyperlocal ambient concentration estimates across community, regional, or statewide areas for a range of core pollutants. The Basemap product complements stationary and community initiatives' data by providing pollutant concentrations at unprecedented spatial resolution across wide geographies, allowing regulators and agencies to identify high burden areas at a hyperlocal level, quantify the impacts, and track mitigation efforts over time.

Aclima's core pollutant coverage includes:

- Carbon dioxide (CO_2)
- Carbon monoxide (CO)
- Fine particulate matter ($PM_{2.5}$)
- Nitrogen dioxide (NO_2)
- Ozone (O_3)
- Black carbon (BC)

Users receive daily updates of the in-progress, sensor-collected data as well as quarterly summary updates. At the end of the data collection period, the basemap provides a long-term estimate (i.e. quarterly or annual) of ambient concentrations for individual 100 meter road segments. In addition to simple aggregation statistics (e.g., medians) of the individual samples over time, the final product includes a data-driven modeled output that removes temporal sampling bias while preserving persistent hyperlocal features in the data[5].

The final output also includes a rigorous QA/QC process that ensures high quality underlying verified data. More information about the scientific and engineering bases of Aclima's mobile monitoring platform is available here or by request.

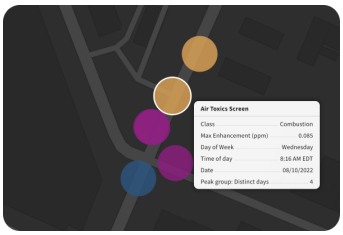
[5] Apte, J. S., Messier, K. P., Gani, S., Brauer, M., Kirschstetter, T. W., Lunden, M. M., Marshall, J. D., Portier, C. J., Vermeulen, R. C. H., and Hamburg, S. P.: High-Resolution Air Pollution Mapping with Google Street View Cars: Exploiting Big Data, Environ. Sci. Technol. 51, 12, https://pubs.acs.org/doi/10.1021/acs.est.7b00891, 6999−7008, 2017.

© Aclima, Inc. 2023

Indicators

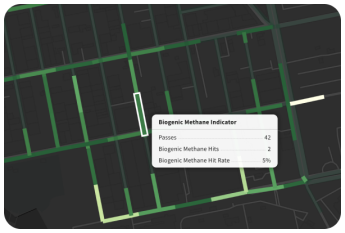
Aclima's Indicator data products help regulators and agencies more easily screen over large areas for actionable indications of specific sources of emissions including volatile organic compounds (VOCs), biogenic methane, natural gas, and diesel, so that they can move rapidly and confidently towards mitigation.

These products highlight locations where enhancements are detected demonstrating chemical signatures typical of certain emission types that can provide actionable data while collection is in progress. This product family informs source identification, expediting focused investigations, and mitigation by regulators.



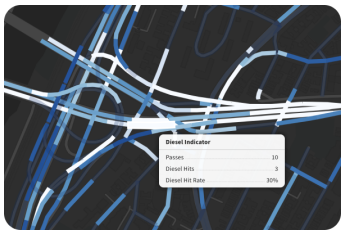
Air Toxics TVOC Screen

Covers a large spectrum of volatile organic compound emissions across dozens of potential sources. These might include evaporative sources (e.g., paint storage and manufacturing, foam and plastics manufacturing, refrigerant storage and manufacturing, gas stations, fuel storage facilities, and laundromats); combustion sources (e.g., mobile sources, power generation, flaring, etc); and more.



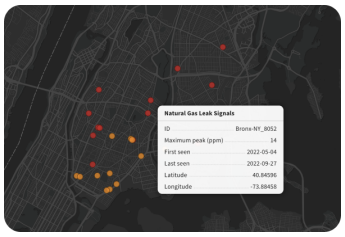
Biogenic Methane Source Indicator

Reports on emissions typically associated with farms (via livestock), wastewater facilities, landfills, and other areas where bacterial decomposition occurs.



Diesel Source Indicator

Uses proxy measurements to track emissions associated with combustion from diesel engines, including from heavy duty trucks.



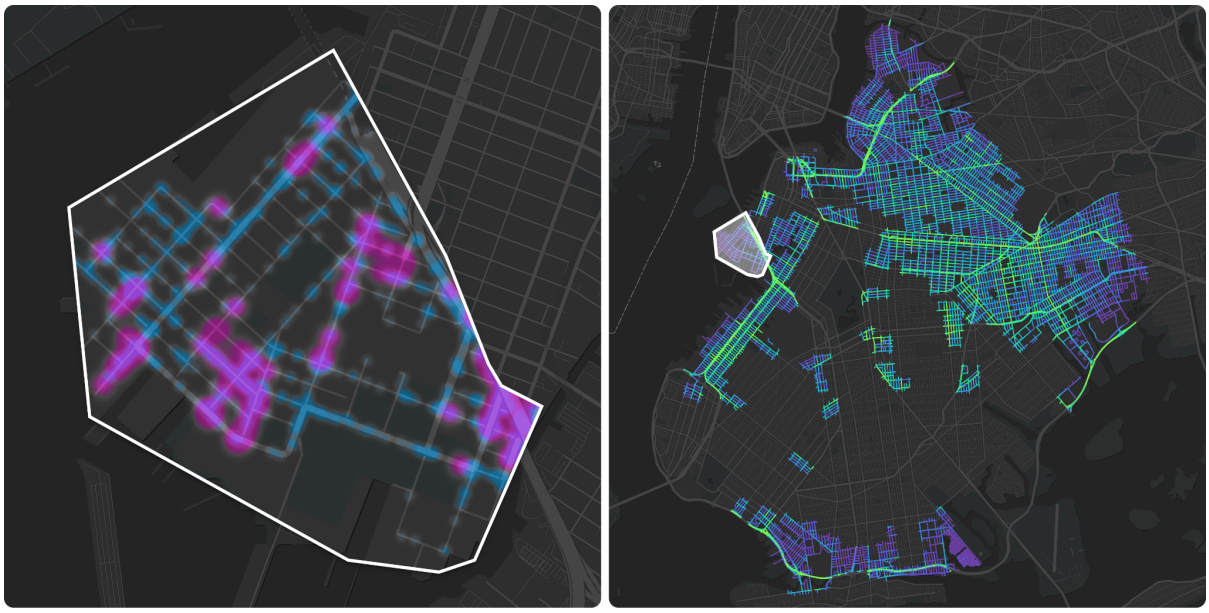
Natural Gas Leak Indicator

Highlights emissions typically associated with natural gas leaks. This data product aggregates an extensive set of methane enhancement detection events, evaluates them based on chemical composition indicative of gas leaks, and clusters the detections down to hyperlocal indications.

© Aclima, Inc. 2023

Spotlights

Aclima's Spotlight product enables responsive and timely investigations of community concerns and can help regulators and agencies assess mitigation efforts.



Left: Red Hook, NY Spotlight area
Right: Complete Brooklyn Basemap area

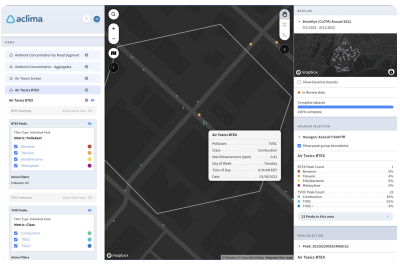
The Spotlight methodology involves short, intensive data collection campaigns in specific locations, and can target a variety of pollutants and sources. For example, BTEX (benzene, toluene, ethylbenzene, and xylene) Spotlights target air toxic hotspots (often identified by the Air Toxics TVOC Screen product) with speciated BTEX measurement capabilities. These data are displayed in the form of heatmaps to highlight the locations with the highest density of BTEX enhancements.

Community Impact and Investment Index

Available through Aclima Pro, the Community Impact and Investment Index helps communities and decision-makers identify and respond to disproportionate impacts. Delivered in partnership with Urban Footprint, the Community Impact and Investment Index dataset offers a range of indicators contributing to community risk including environmental exposures, climate, and health and socioeconomic factors. An example of deployment of the Index to highlight disparities in exposure to pollution based on race, income, and other socioeconomic factors is available here.

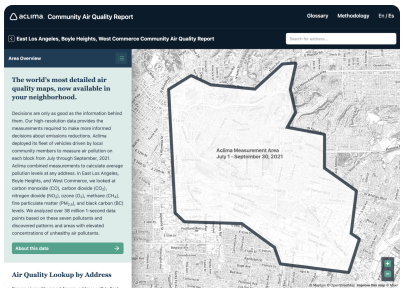
© Aclima, Inc. 2023

Applications



Aclima Pro

Aclima delivers most of its data products through Aclima Pro, a proprietary, geospatial analytics and visualization application that enables technical specialists to accelerate and enhance typical regulator and advocate workflows: identify areas of concern, compare across regions, assess impacts of mitigation efforts, and collaborate with stakeholders. Aclima Pro is accessed by licensed users through a web-based SaaS (software-as-a-service) subscription (other customer support models available).



Community tools

Aclima offers public-facing, interactive, and web-based interfaces for air quality regulators, community-based organizations, and the general public. These interfaces enable a diverse set of stakeholders to build a common understanding of air quality data and use it as a foundation for effective mitigation and climate action work.

Mobile measurement platform

Aclima has built and configured a broad range of sensors into a single device, referred to as Aclima Mobile Nodes (AMN), that it verifies, calibrates, and maintains. The AMN is the foundation of Aclima's scalable collection of high-quality hyperlocal air quality data. AMNs are installed in the company's fleet of low-emission vehicles (consistent with state goals, e.g., ACCII and Governor EO N-79-20) driven by Aclima employees hired from the community where monitoring is taking place.

Based on a defined geography and engagement with regulators and communities, Aclima designs an intelligent daily drive plan to its network of vehicles, optimizing for different data collection needs. For a given geography, data are collected block-by-block across community, regional, or state-wide

© Aclima, Inc. 2023

areas and transmitted in real-time to Aclima's end-to-end data platform for storage, processing, and analysis.

Aclima's mobile measurement platform is complementary to other supplemental monitoring initiatives like air districts' short-term mobile labs targeting specific pollutants.

Services

Customer success & implementation

Aclima complements its product offerings with a team of atmospheric scientists, data scientists, and engineers who provide active support to help customers and communities understand the data and conduct analyses to meet their objectives. These might include custom deconstruction of diurnal patterns across territories, short-notice investigations at commercial ports, or development of custom analysis projects.

Natural Gas Leak Standard Operating Procedure

In addition to the Natural Gas Leak Indicator data product, Aclima has also developed a Standard Operating Procedure (SOP) for reporting on leaks detected during mobile monitoring, which includes leak discovery, verification, and resolution. This SOP aligns key stakeholder groups — including utilities, regulators, community groups, and the public — to a shared understanding on natural gas leaks in the region where monitoring occurred as well as the mitigation efforts being made to reduce risk. Further, Aclima conducts post-mitigation monitoring in communities to assess the effectiveness of mitigation efforts.

Stationary monitoring location selection

The high resolution and large scale of Aclima's mobile approach allows the company's data science team to assist with recommendations for where to place future stationary monitoring sites and which types of sensors to use. These sites can support improved monitoring in areas of greatest concern.

© Aclima, Inc. 2023

6	List and briefly describe the projects and/or activities your company was engaged within the last ten (10) years that are similar to the project identified in the RFI.

Aclima has been pioneering mobile monitoring for over a decade. Beginning with a limited Google Street View partnership and mobile laboratories in 2014, Aclima's mobile monitoring platform and operations have evolved and grown considerably. Aclima's most recent large-scale deployment was for the state of New York.

Beginning with a partnership with Google Street View, Aclima used mobile laboratories equipped with research-grade instrumentation to develop methods to efficiently map urban areas at fine spatial scales over short time periods, starting with Denver in 2014 and expanding to map selected neighborhoods in the larger San Francisco Bay Area in June 2015 using Aclima's block-by-block, repeat pass (monitoring visit) methodology. At that time, dedicated staff and research partners manually performed drive/route planning.

In the spring of 2019, Aclima started mapping operations with its own dedicated fleet outfitted with the purpose-designed onboard mobile sensing device, the Aclima Mobile Node (AMN). Aclima's mobile platform deployment is supported by automatic drive plan generation and significant automation of data ingestion and Quality Assurance (QA) processes that make it possible to carry out routine mapping quickly and efficiently with limited need for trained technical oversight.

Table 1 lists all of the locations that Aclima has performed mobile mapping similar to that outlined in the RFI. The list includes areas where Aclima used a mobile laboratory with research-grade equipment and a dedicated fleet with Aclima's sensor-based mobile mapping platform.

Table 1: Mobile air monitoring projects

Location	Time Frame	Measurement Technology	Pollutants
Denver	July – Aug 2014	Research-grade	O_3, $PM_{2.5}$, NO_2, NO, BC
SF Bay Area	June 2015 – June 2019	Research-grade	O_3, $PM_{2.5}$, NO_2, NO, BC, CH_4, UFP
West Oakland	Summer 2019 – Summer 2021 (Quarterly)	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2
San Diego	Spring 2019 – Spring 2020	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2, BC
La Paz, MX	Spring 2019 – Spring 2022	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2, BC

© Aclima, Inc. 2023

Location	Time Frame	Measurement Technology	Pollutants
World Wide across 5 continents	Fall 2019 – Winter 2022	Aclima Mobile Node in Google Street View vehicles	O_3, $PM_{2.5}$, NO_2, NO, CO, CO
San Francisco Bay Area	Fall 2019 – Spring 2023	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2, CH_4
Sacramento	Oct 2020 – Feb 2021	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2
San Bernardino/Muscoy East Los Angeles/Boyle Heights/West Commerce	July – Sept 2021	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2, BC, CH_4
Bassett/Avocado Heights	July – Sept 2021, 2022, & 2023	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2, BC, CH_4
Bronzeville, Chicago & Rockford IL	Fall 2021 – Winter 2022 (4 quarters)	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2, BC, CH_4
Dublin, Ireland	Spring 2021 – Summer 2022	Aclima Mobile Node in Google Street View vehicle	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2
Hamburg, Germany	Fall 2021 – Winter 2022 (Annual)	Aclima Mobile Node in Google Street View vehicle	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2
NY State	Summer 2022 – Fall 2023 (Annual)	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2, BC, CH_4, TVOC, BTEX
Washington DC	June 2023 (2 week pilot)	Aclima Mobile Node	O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2, BC, CH_4

Aclima has monitored air quality in AB 617 communities for the San Diego Air Pollution Control District and the South Coast Air Quality Management District (SCAQMD). For SCAQMD, Aclima operated its mobile monitoring platform in the San Bernardino/Muscoy and the East Los Angeles/Boyle Heights/West Commerce communities. Aclima collected data on a suite of pollutants, including O_3 $PM_{2.5}$, NO_2, NO, CO, CO_2, BC, and CH_4 at 1 Hz on every street in the community, covering close to 50 square miles between July and September of 2021. Staff at the SCAQMD accessed the data through subscriptions to Aclima Pro. Aclima created interactive reports for the public that combined the hyperlocal air pollution concentration estimates with the locations of sensitive sites and stationary sources. The community reports also included indications of areas that were specifically influenced by diesel, automobile, and particulate matter sources.

© Aclima, Inc. 2023

Aclima has practical experience mapping large geographic regions on an annual basis. Aclima mapped five Bay Area counties and four partial counties totaling 5,580 square miles for BAAQMD, starting in the fall of 2019. In 2022, Aclima began a state-wide air quality mapping initiative in New York State for the New York Department of Environmental Conservation (NYSDEC) in support of the state's Climate Leadership and Community Protection Act (CLCPA). Aclima's mobile monitoring fleet measured in 10 urban regions across the state, from boroughs in New York City to upstate cities, focusing on communities overburdened by environmental pollution. Aclima's mobile fleet measured O_3, $PM_{2.5}$, NO_2, NO, CO, CO_2, BC, and CH_4 as well as air toxics. The data were provided via Aclima Pro to both NYSDEC atmospheric scientists as well as community-based organizations partnering with NYSDEC. The NYSDEC plans to use the data in partnership with community-based organizations to identify and implement solutions that reduce emissions impacting public health and the environment and achieve the goals laid out in the CLCPA.

© Aclima, Inc. 2023

7	Are there any of the requirements described in the Proposed Environment section not technologically feasible with your existing service(s), product(s), platform(s)?

> Aclima's mature, standardized, scalable, and versatile mobile monitoring platform is designed to target a core set of pollutants. It can also integrate, complement and efficiently target limited supplemental monitoring for air toxics. Any requirements to scale supplemental monitoring to the majority of disproportionately impacted communities in the same manner as the core pollutant monitoring would be prohibitively expensive, of limited utility, and is not recommended.

Aclima has focused on maturing a standardized, scalable, and versatile mobile monitoring platform that can measure a large suite of priority air pollutants and greenhouse gases in a routine and repeatable fashion. Aclima's approach can be scaled over multiple geographic areas throughout the state — a unique capability in the industry and well-suited to meeting SMMI objectives around characterizing community levels of exposure, source identification, and measuring mitigation effectiveness. Aclima's fleet also includes specialized vehicles capable of measuring an expanded suite of pollutants. These vehicles are operated as in-motion mobile platforms but also have the ability to be self-powered while stationary for durations longer than an hour and do not require technical staff to operate.

"Short-term mobile laboratories" are appropriate for detection of a secondary list of pollutants such as a broader suite of air toxics, but the successful operation of these laboratories requires dedicated and trained technical staff to oversee day-to-day operation of specialized instruments, data acquisition, and analysis. This model is prohibitively expensive to expand statewide under the same assumptions as the priority air pollutants (covering the majority of SB 535 populations and all AB 617 consistently nominated, disproportionately impacted communities) but can be used for targeted monitoring to supplement the mobile platforms, particularly if the mobile platform identifies areas of concern (e.g., elevated levels of BTEX and $PM_{2.5}$, observations by vehicle operator including visible emissions).

In an effort to reduce customer costs and efficiently identify sources, hyperlocal data from Aclima's monitoring platform can be used to direct the deployment of these types of mobile laboratories. The end-to-end data platform can also ingest and visualize mobile and stationary data from mobile laboratories operated by third parties.

© Aclima, Inc. 2023

Attachment B — Vendor questions

I. General questions

1	What scale of operation would be required to bid on a future RFP of the concept described here? Are there any minimum requirements necessary at which below you would not be interested in bidding on a proposal of this nature?

The SMMI aims to significantly expand air quality monitoring coverage and improve outcomes for disproportionately impacted communities.

Given authorized funding and reasonable assumptions, Aclima can conduct block-level mobile monitoring that covers more than 90% of the population in CES4 Disadvantaged Communities and all AB 617 consistently nominated communities as well as support numerous L-CERPs as described in the recently approved AB 617 Blueprint 2.0.

Aclima can deliver hyperlocal measurements and actionable analyses for a core list of pollutants, and timely hotspot screening for a range of additional pollutants such as VOCs, biogenic methane, natural gas, and for diesel proxies such as Black Carbon, all visualized with web-based software tools. Aclima can deliver more intensive, targeted measurement for core pollutants as well as BTEX.

The SMMI seeks to go substantially beyond the 19 communities selected under AB 617, with a broad mandate to deliver data to fill gaps for tens to hundreds of other communities statewide that are disproportionately impacted by poor air quality but have not yet received resources to implement community-specific air monitoring. This need is underscored in the AB 617 Blueprint 2.0 and was a key driver for integrating L-CERPs into the program. The SMMI can also support identifying as yet unknown inequities in unmonitored regions that are not designated as L-CERPs. This will require designing a mobile monitoring program at scale for a wide range of NAAQS pollutants as well as TACs and GHGs to match a wide range of potential budgets and with special attention to equitable monitoring. Given finite resources, CARB must also ensure the program design balances cost with geographic, temporal, and pollutant coverage. CARB must ensure a cadence of ongoing monitoring is established to continue to identify inequities and track effectiveness of mitigation work.

Given the authorized funding, Aclima is well positioned to deliver this balanced program. Aclima can conduct block-level mobile monitoring that covers more than 90% of the population in CES4 Disadvantaged Communities and all AB 617 consistently nominated communities, all in partnership with CARB, key stakeholders, and community groups. For this scale of geography, Aclima would deliver “Basemap” (hyperlocal measurements and actionable analyses on a core list of pollutants)

© Aclima, Inc. 2023

and “Indicator” (timely screening for actionable indications of specific emissions sources including VOCs, biogenic methane, natural gas, and diesel) products, initially over a year and then with subsequent monitoring dependent on emerging insights and in accordance with evolving community needs. This program would include Aclima’s core set of measurements (depending on the product): CO, CO_2, $PM_{2.5}$, O_3, NO, NO_2, TVOCs, BC, Methane, and Ethane.

To supplement this monitoring, Aclima can deploy additional “Spotlight” products. These can provide more intense coverage in targeted regions to further investigate sources, increase temporal coverage to understand patterns in emissions, and allow insights from statistics computed over a shorter time period, across Aclima’s core pollutants as well as for BTEX. This will allow the state to be responsive to community concerns and investigate hotspots in more depth.

More geographic coverage for a given budget can be accomplished with census tract-level instead of block-level aggregation of mobile monitoring in select areas, though this would change availability of data products. Other important determinants of operational scale include: the chosen spatial resolution of monitoring (such as sub-block versus census tract); relative amount of rural area coverage; and relative emphasis on supplemental and geographically-targeted monitoring, e.g., BTEX or to better characterize a specific community concern for a core pollutant.

© Aclima, Inc. 2023

2	What types of monitoring objectives have you explored using your company's mobile monitoring approaches?

Aclima supports a wide range of mobile monitoring approaches that are consistent with the objectives of this RFI, are community-centered, and have been validated with customers over years of field operations. These include: ambient concentration estimation (Basemap product); locations of air toxics emissions sources (Indicator and Spotlight products); locations of biogenic and industrial gas leaks (Biogenic Methane and Natural Gas Leak products); and assessment of disparities in air pollution burden and impact (Community Impact and Investment Index product).

Aclima has explored the following typical monitoring objectives in past projects:

1. **Provide ambient concentration estimates of pollutants in a geographic region at high spatial resolution through the Basemap data product:**

    - Produce yearly or seasonal estimates of ambient pollution concentrations from measurements balanced over the contract time period and at diverse times of day and night, weekdays and weekends, to adequately address seasonal and diurnal variations in the data.
    - Spatial distribution of data throughout the entire user-defined geographic area.
    - Annual or seasonal estimates delivered with confidence intervals at the contracted spatial resolution sufficient to enable assessment of the significance of differences in pollution levels.
    - Enable pollution estimates with confidence intervals at ~100 m road segments (sometimes referred to as "address-level").

    Pollutants:

    - O_3, NO_2, CO, CO_2, $PM_{2.5}$, and BC

2. **Identify probable locations of air toxic emissions sources through the Air Toxics Screen Indicators data product in combination with the BTEX Spotlight product:**

    - Produce geo-located clusters of TVOC source indications to support follow-up investigation by identifying enhancements above background.
    - Characterize emissions composition using BTEX measurements, targeting TVOC hotspots identified through the Air Toxics Screen product.

    Pollutants:

© Aclima, Inc. 2023

- TVOC, BTEX

3. **Show areas that indicate biogenic methane emissions sources through the Biogenic Methane Source Indicator data product:**

    - Produce geo-located areas where enhancements in methane indicate biogenic sources.

    Pollutants:

    - CH_4, C_2H_6

4. **Identify the precise locations of natural gas leaks from distribution systems through the Natural Gas Leak Indicator data product:**

    - Produce geo-located clusters of natural gas source indications to identify leaks in natural gas distribution pipelines.

    Pollutants:

    - CH_4, C_2H_6

5. **Identify disparities in pollutant levels across demographic indicators such as race, income, and other equity-based indices through a combination of the Basemap data product and the Community Impact and Investment Index:**

    - Use high spatial resolution ambient concentration estimates in combination with socioeconomic demographic data sets in order to understand trends across various equity-based indices.
    - Data collection target area contains a broad spectrum of communities across various socioeconomic indices.

    Pollutants:

    - O_3, NO_2, CO, $PM_{2.5}$, and BC

6. **Use mobile monitoring of $PM_{2.5}$ to transfer calibrations from regulatory instruments to low cost $PM_{2.5}$ sensors in a stationary network:**

    - Provide hyperlocal mobile monitoring within a network of regulatory and low-cost stationary monitors while also enabling calibration transfer between regulatory $PM_{2.5}$ measurements and the sensor network.
    - Proof of concept project successfully completed in collaboration with CARB scientists. Documented within CARB and presented by Aclima to external audiences[6].

[6] E.g., LaFranchi, B., Ridley, D., Trickett, C., Kwasnica, M., Chow, M., Lunden, M., George, K., Smith, J, and Vona, M.: Calibration of citizen sensor networks using a mobile air monitoring platform: A collaboration between Aclima and CARB. Air Sensors International Conference, Pasadena, CA, May 11, 2022.

© Aclima, Inc. 2023

3	What are the advantages and limitations of your company's mobile monitoring services?

Aclima has lengthy experience and expertise in large-scale mobile monitoring of a core suite of air pollutants and greenhouse gases. Aclima has built a high performance, tested, and scalable hardware and software stack covering a broad range of core pollutants. Geographic targeting integrates multiple sources of customer and community data. Collection planning is dynamic, intelligent, and efficient, updating daily. Sensor data are processed into geospatial time series of both ambient and hotspot pollutant concentrations. Aclima is committed to equity and has a track record working in and with disproportionately impacted communities. Aclima employs a wide range of credentialed specialists to support operations and drive innovation.

Aclima is limited by the range of pollutants that can be detected with a scalable mobile monitoring platform, but uses hyperlocal data to target deployments of additional BTEX-specialized vehicles. Temporal and spatial tradeoffs are addressed by ensuring monitoring is designed to cover scales that are most meaningful to communities. Aclima is aware of higher uncertainties for mobile monitoring systems operations and scale, and has worked to develop appropriate QA/QC processes to ensure high data quality.

Advantages of Aclima's mobile-first monitoring system

Experience in all aspects of mobile air quality monitoring: Aclima's core capability is large-scale mobile monitoring of a core suite of air pollutants and greenhouse gases. Aclima has experience executing these collection efforts in many different locations and across a range of scales. With this experience comes a deep understanding of the challenges involved in all aspects of collection and how to execute efficiently across all possible dimensions in order to maximize the value of the data and to quickly extract insights for customers.

Turnkey, vertically integrated solution: Aclima offers a complete end-to-end system – from sensing technologies to operations and customer-facing visualization tools – available today for statewide hyperlocal air quality data collection.

Broad range of pollutants: Aclima measures a broad range of critical pollutants for understanding air quality and emissions, including core pollutants, greenhouse gases, and other species of concern (e.g., BC). In addition, various combinations of pollutants can be used as proxies to infer source type, for example methane and ethane to infer natural gas sources, TVOCs and NO/CO/CO_2 to infer VOCs from mobile source combustion, and others.

© Aclima, Inc. 2023

Intelligent and efficient data collection: mobile monitoring is resource intensive. If not done well, this effort and resulting datasets can be compromised due to artifacts (e.g., sampling bias). Aclima's data collection planning automatically adapts to complex landscapes and unexpected events, is deployed continuously throughout the year in each region of operation, has been tested over years of real-world projects, and is always being improved.

Developed and expanding data product suite: Aclima offers a suite of aggregated data products via Aclima Pro including typical ambient concentration estimates of a suite of pollutants at 100 m road segment resolution and a number of enhancement-based or hotspot indicator data products that pinpoint the locations of persistent emissions sources.

Fully developed and tested hardware and sensor suite: building on Aclima's decade of experience with mobile monitoring, the current sensor platform has been real-world tested and proven over more than four years of mobile measurement deployments.

Mature quality assurance system: Aclima's technical operations team has developed and owns a robust quality assurance system that is tailored to Aclima's mobile monitoring operations. The QA system is well documented to ensure transparency to customers.

Sophisticated geographic targeting: Aclima integrates known data, key stakeholder inputs, and community engagement to identify priority communities to target. Aclima can fine-tune to critical metrics such as (but not limited to) total population covered, sensitive population covered, square miles covered, or road mileage covered.

Scalability built in: Aclima understands how to estimate and resource a mobile fleet and all required infrastructure to successfully execute monitoring across any predefined target area, using a combined hardware and software solution that is flexible to scale up or down as needed. This has been demonstrated in projects of varying size from targeting specific neighborhoods (e.g., West Oakland, CA) to regions (e.g., Bay Area, CA) and up to multiple municipalities across a state (e.g., NY State).

Track record in disproportionately impacted communities: Aclima is committed to meaningful community engagement and participation in the planning and execution of mobile monitoring. Aclima is anchored by broad experience working and coordinating with government, private sector, and non-profit stakeholders. This includes a track record of incorporating community feedback in monitoring design; hiring local drivers, fleet managers, hardware and calibration technicians; and developing well-received map and data portals for community and public consumption.

Experience with AQ regulator customers: Aclima has a track record of delivering to air quality regulator customers at the scales required, including past work with BAAQMD, SCAQMD, CARB and NYSDEC.

Broad and deep domain expertise: Aclima's team includes software engineers, data scientists, designers, urban planners, and air quality subject matter experts with training to MS and PhD level. This expertise is available for support in understanding data products and interpreting results.

© Aclima, Inc. 2023

Limitations of Aclima's system

Core versus supplemental monitoring capabilities: Aclima maintains specialized vehicles for monitoring BTEX, which can be a useful proxy for a wide range of co-emitted species from many sources. No operator can measure all pollutants of potential interest to CARB and communities statewide and hyperlocal resolution, nor is it cost effective or necessary to do so. Aclima deploys BTEX vehicles at small scales, with targeting using TVOC measurements from the core platform to increase success rates in uncovering air toxics hotspots.

Temporal versus spatial resolution: mobile monitoring in general relies on temporal aggregation, which can limit information about shorter temporal trends at hyperlocal spatial scales. Aclima designs its operations plans and overall project duration to ensure typical expected temporal trends can still be observed, e.g., rush hour and day of week trends in mobile source pollutants, diurnal and seasonal trends for photochemically-produced pollutants (i.e., ozone), and diurnal and seasonal trends of greenhouse gas enhancements above background such as CO_2 and CH_4. Aclima can also use the Spotlight product to capture more fine-scale temporal trends at small spatial scales and over shorter time periods, in a limited number of locations.

Impacts of non-traditional sensor technology and uncertainty characterization: Aclima's sensor technology is an innovative and flexible platform that does not conform to traditional means of quality control checks while deployed. Most sensors require calibration via collocation in a purpose-designed mobile calibration laboratory, and, therefore, mid-deployment weekly or monthly calibration checks (i.e., zeros or spans) are not possible for every sensor. Further, it can be cost-prohibitive at large scales and for deployments that are distributed over large geographic areas (i.e., statewide across California). Aclima has developed a QA system tailored to its platform and designed to maximize data quality and characterize uncertainty to the greatest extent possible for each species measured. Depending on the sensor, the resulting data may have higher uncertainty than traditional stationary monitors operating as Federal Reference or Federal Equivalent Methods, and, as such, the use cases for these data need to be considered with care. A critical aspect in the design of Aclima's data products is that they are able to extract useful insights within the constraints and limitations of the inherent uncertainty of each sensor. CARB should ensure that the awarded vendor has characterized uncertainty for all measured species and pairs these measurements with appropriate use cases.

© Aclima, Inc. 2023

II. Engagement & coordination

1	Describe your interpretation of what community engagement should look like throughout the process of conducting mobile air monitoring in communities.

> To maximize the value of the state's investment in mobile monitoring, SMMI's engagement with people and communities should be framed as joint problem identification and fact-finding, rather than consultation. Mobile monitoring vendors should follow some key principles and practices to ensure equitable and effective community engagement, including centering equity, resourcing communities well, and giving communities a meaningful role from the beginning.

SMMI's investment in mobile monitoring is rare and significant. Efficient and effective community engagement will be essential to maximize the value of this investment both to the state and to all implicated communities. Aclima recommends that CARB consider a joint problem identification and fact-finding approach. This means that communities should be engaged early as partners to do joint scoping, e.g., on collective needs, how the air quality monitoring program should be designed, and how results should be received and interpreted. This will not eliminate conflict nor always bridge differing values and expectations, but will help communities and CARB develop capacity, trust, and a shared foundation of scientific knowledge essential to the effective development of mitigation strategies.

In addition, CARB should expect a vendor to follow these practical principles and practices in designing community engagement for SMMI:

1. **Prioritize equity:** root process design and operations in equity concerns. Look for gaps in resourcing, access and capacity, and work to address them.

2. **Resource communities well:** communities should be provided with the necessary resources, training, and knowledge to participate in planning, stay engaged during monitoring, and understand and use the results over time.

3. **Give communities a meaningful role from the beginning:** engage communities from the start as equal partners. Design engagement instruments to meet communities at their level of expertise, and leave sufficient time for the community to ask questions or suggest agendas.

4. **Value community data and experiences:** enhance quantitative data with qualitative community-driven data that reflect observations, concerns, and lived experiences.

5. **Make data accessible and useful:** design existing (or new, when necessary) public websites to provide direct and usable access for communities.

© Aclima, Inc. 2023

6. **Ensure balanced community representation:** value and engage Community-Based Organizations (CBOs) for their expertise and reach, but ensure that other voices outside of CBOs are not neglected.

7. **Ongoing community engagement and feedback:** establish multiple options for securing ongoing community feedback on the monitoring campaigns including selection of monitoring routes, form of reporting and distributing data that is responsive to the language and culture of the communities, and any follow-up actions based on monitoring results.

© Aclima, Inc. 2023

2	What experience do you have with community and public engagement? Is any of this experience directly related to air monitoring activity and data dissemination?

Aclima has significant experience in engaging with communities, particularly in air monitoring, data sharing, and public education. Aclima is sensitive to the complexity and challenge of these engagements at a statewide scale. Recent successful engagements include supporting community steering committee meetings around California as part of the AB 617 program, and working side by side with CBOs in New York as part of the Climate Leadership and Community Protection Act (CLCPA).

Aclima's first-hand experience in community and public engagement — especially in the realms of air monitoring, data dissemination, and public education — helps it understand the concerns, needs, and aspirations of communities. Aclima's experience is that community engagement can be complex, sensitive, challenging, and even exhausting for participants, but also that these obstacles can be overcome with an emphasis on inclusivity, equity, and genuine collaboration. This is even more important at a statewide scale, where community interests and expectations can show significant variation.

Some relevant engagements include:

- **California's AB 617 program:** Aclima actively participated in Community Steering Committee meetings across the Bay Area, the South Coast region, and San Diego. During these sessions, Aclima presented monitoring findings and gathered concerns and feedback from community members. By collaborating with CBOs and residents, the design and execution of community-driven air quality measurement projects were tailored to local needs. These engagements influenced the development of public data portals, ensuring they met the needs of the impacted communities, communicated success where relevant, and placed data in regional geographic context. Training sessions and workshops were offered to give communities the necessary knowledge and skills to collaborate well with other stakeholders. This collective effort supported the creation of nation-leading Community Driven Emissions Reduction Plans (CERPs).

- **New York State's Climate Leadership and Community Protection Act (CLCPA):** As part of an engagement with the Statewide Community Air Monitoring Initiative, Aclima worked alongside CBOs and the Climate Justice Working Group, a segment of the Climate Action Council. Collaboration focused on identifying air measurement zones, pinpointing pollutants of interest, and addressing areas of concern highlighted by the communities. Aclima team members consistently attended and contributed to quarterly meetings, ensuring Aclima materials were comprehensive and actionable. By observing and listening to the communities, the team took steps to make air quality data more accessible and practical. For example, CBOs were given access to web-based data visualization and analytics software (Aclima Pro), and supplied interfaces to help communities understand progress and outcomes. Software tools, training

© Aclima, Inc. 2023

sessions, and workshops were designed to empower communities for meaningful collaboration, equipping them for active involvement in the development and selection of effective emissions reduction strategies.

© Aclima, Inc. 2023

3	What is your experience coordinating with community members, CBOs, regulated industry, academia, and governmental agencies when planning monitoring objectives and data analysis and communication?

SMMI aims to inclusively engage diverse stakeholders around shared air monitoring objectives, balance community interests and sustain scientific focus. Aclima has supported this kind of effort through past collaborations with air quality regulators, governmental agencies, community organizations, industry, and academic institutions in California and elsewhere. Through these partnerships, Aclima has helped align monitoring goals with regulatory and public health frameworks, integrated community-driven objectives, navigated industrial regulatory compliance, and all while ensuring scientific rigor.

Facilitating stakeholder processes for inclusive air monitoring objectives

Operating at a statewide scale requires meaningful engagement among a large and diverse range of stakeholders. This means that SMMI must balance a wide range of interests and needs, ensuring all voices are heard while keeping the scientific objectives of the project on track. A joint fact-finding mindset should apply equally to engaging and coordinating the full range of project stakeholders as it does to community engagement. Coordination should aspire to efficiently and effectively facilitate the full and equal participation of stakeholders as joint co-designers of a statewide project. Effective joint fact-finding requires an experienced, well-known and sensitive facilitator. As the examples below describe, Aclima has fulfilled this role on many occasions.

Collaboration with regulatory and governmental agencies

Aclima's collaborations with air quality regulators have included sensitive, complex, and intensive work with entities such as the Bay Area Air Quality Management District (BAAQMD), South Coast Air Quality Management District (SCAQMD), and San Diego County Air Pollution Control District (SDAPC) during the AB 617 process, and New York's Department of Environmental Conservation (NYSDEC) as part of CLCPA initiatives. Aclima has also engaged with state and local government agencies in California and New York, aligning monitoring objectives with regulatory frameworks and public health goals. Aclima has supported regulator partners by working with their community engagement and environmental justice teams in advance of public meetings.

© Aclima, Inc. 2023

Partnerships with Community-Based Organizations (CBOs)

Aclima has prioritized embedding community-driven objectives into the planning and execution of air monitoring initiatives in varied work with CBOs including:

- West Oakland Environmental Indicators Project (WOEIP)
- Mothers Out Front San Diego
- East Yard Communities for Environmental Justice
- South Bronx Unite

Engaging with industry

Aclima has used collaborations with natural gas utilities like SoCalGas and PG&E, and electric utilities like ComEd to navigate the complexities of industrial regulatory compliance and identify opportunities for reducing emissions in alignment with community objectives.

Involvement with academia

Aclima has had long-standing or past partnerships with academic institutions such as UC Berkeley, the University of Washington, and the University of Texas, as well as research collaborations with the US EPA. These partnerships have helped refine the company's methodologies and ensure scientific rigor. Aclima has collaborated on a number of research papers on mobile mapping methodology and exploring innovative approaches to analysis and applications including source identification and spatial variability[7], exposure and exposure disparities[8], and public health and epidemiology[9].

[7] Apte, J. S., Messier, K. P., Gani, S., Brauer, M., Kirschstetter, T. W., Lunden, M. M., Marshall, J. D., Portier, C. J., Vermeulen, R. C. H., and Hamburg, S. P.: High-Resolution Air Pollution Mapping with Google Street View Cars: Exploiting Big Data, Environ. Sci. Technol. 51, 12, https://pubs.acs.org/doi/10.1021/acs.est.7b00891, 6999−7008, 2017.

[8] Chambliss, S. E., Pinon, C. P. R., Messier, K. P., LaFranch, B., Upperman, C.R., Lunden, M.M., Robinson, A.L., Marshall, J.D.,and Apte, J. S.: Local- and regional-scale racial and ethnic disparities in air pollution determined by long-term mobile monitoring, PNAS 118 (37), https://doi.org/10.1073/pnas.2109249118, 2021.

[9] Riddell, C. A., Goin, D. E., Morello-Frosch, R., Apte, J. S., Glymour, M. M., Torres, J. M., and Casey, J. A.: Hyper-localized measures of air pollution and risk of preterm birth in Oakland and San Jose, California, International Journal of Epidemiology 50, (6), 1-11, https://doi.org/10.1093/ije/dyab097. 2021.

© Aclima, Inc. 2023

Stakeholder coordination best practices

Aclima has found the following practical approaches useful to multi-stakeholder coordination at a statewide scale:

- **Transparency**: Ensure transparent, and equitable allocation of resources. Acknowledge and respond to community sensitivities around the use of third party contractors.
- **Equity**: Provide financial or other support where and when needed to ensure no stakeholder feels a power imbalance in their participation.
- **Keep implementers on board**: Keep healthy relationships with local air districts, facilitating a supportive environment for implementation.
- **Showcase achievements**: Employ robust communication strategies that highlight achievements and successes.
- **Assign meaningful roles**: Facilitate communities to have substantive roles in planning, including decision-making, and budgetary allocations.

© Aclima, Inc. 2023

4 Please provide the number and size ($) of technical projects previously managed for coordination and communication with both community and technical contractors.

Aclima has played a key role in coordinating and communicating multi-million dollar mobile air quality monitoring projects across the country. See Table 2 for an example selection of projects.

Table 2: Coordination and communication activities and relevant project parameters

	Square miles of monitoring coverage	Number of people implicated	Data points collected	Number of community meetings supported	Public portals created
San Diego	44	216,048	68.6M	5-10	https://insights.aclima.tools/san-diego
Bay Area	5,580	7.54M	1127M	5	https://air.health/
SCAQMD	68	388,107	69.3M	10-15	https://aq.aclima.io/ca/elabhwc and https://aq.aclima.io/ca/sbm
NYSDEC	280	5.88M	464M	50	In progress
ComEd	23	241,621	83.1M	3-4	https://air.health/il

© Aclima, Inc. 2023

5	How would you apply your engagement and coordination model on a statewide scale?

Aclima has broad and deep experience implementing complex and high stakes engagement and coordination work at a statewide scale. Beyond the importance of listening and learning from past participants and outcomes, Aclima has found that the use of digital tools, templates, and standards improves efficiency. Sensitivity to existing leadership structures, power structures, and tensions can help avoid or reduce conflict. Transparent and generous data sharing builds trust. Actual dollar investments in capacity building and local hiring can have meaningful impacts on equity.

There is no substitute for practical experience with implementing complex and high stakes stakeholder processes, as teams at Aclima have learned across a decade of direct engagement and coordination work. No organization has performed comparable work at statewide scales. Drawing on this experience, Aclima believes that SMMI engagement and coordination should begin with listening and learning from individuals and teams involved in earlier phases of AB 617 work.

For deploying at statewide scales in California, Aclima would build on these lessons with insights learned from similar projects elsewhere:

Leverage digital tools

Aclima has implemented a range of digital tools for partners that were capable of handling a variety of community, stakeholder inputs, and datasets in parallel and communicated out complex data, visualizations, and training materials in a way that were flexible to stakeholder needs. These include ten public-facing websites for partners and communities in Illinois, several in the San Francisco Bay Area (including West Oakland and Richmond-San Pablo), and partners in Los Angeles (including Bassett and Avocado Heights, East LA, San Bernardino, and Carson-Wilmington) and San Diego.

Use templates, standards, & structure

To support efficient and focused community engagement and planning processes, Aclima has developed standard tools and templates for public engagement such as digital whiteboards, pre-mapping surveys, online feedback forms, accessible public mapping tools, and progress update presentations. Aclima has already deployed many of these across all projects in Los Angeles and the greater Bay Area.

© Aclima, Inc. 2023

Lean on existing leadership structures

In New York, designated disadvantaged communities each have leaders called “co-conveners.” In iterative design processes, Aclima leans on these leaders to provide user feedback so that the process can move quickly while leveraging local leadership for their expertise and understanding of primary community concerns.

Scale equitably

Aclima is committed to local hiring of drivers and other staff in every project and community. Aclima has fostered deep and broad relationships across community groups and maintains key CBO relationships in California that include The Energy Coalition, West Oakland Environmental Indicators Project, and Mothers Out Front San Diego. Aclima has always sought to provide consistent treatment across geographies and communities: in monitoring campaigns in Los Angeles, Aclima ensured engagement opportunities were available for all three communities, such as ride-alongs and in-person events, and quarterly meeting support.

Share openly

Aclima has learned that successful scaling means building diverse partnerships and being ready to share data and insights openly with other groups.

Acknowledge & address tensions

It is unreasonable to expect communities and stakeholders to agree on every point, given their diverse and differing needs. As a result, it is essential to identify and address potential tensions, statewide, as early as possible. Aclima has sensitively navigated tensions around third party service providers. Aclima has developed training, tools and processes for CBOs and other stakeholders to make data access equitable and share progress from campaigns with all stakeholders.

© Aclima, Inc. 2023

III. Mobile monitoring technologies & capabilities

1	How many mobile monitoring platforms do you currently own and operate? How long have these platforms been in operation?

> Aclima maintains flexible mobile monitoring capacity, capable of efficiently scaling based on project demands while minimizing capital costs. Past deployments have been upwards of 60 vehicles, supporting large scale operations over the past 4 years. Assets include easily deployable sensor packages and a large vehicle fleet for measuring a standard set of air pollutants and greenhouse gases plus specialized vehicles for detecting BTEX compounds.

A key strength of Aclima's mobile monitoring system is its flexibility to scale up for new projects and scale down as they conclude, minimizing direct capital costs to sponsors. Part of this capability lies in Aclima's large inventory of easy-to-deploy sensor packages (Aclima Mobile Nodes or AMNs), which can be installed in vehicles in hours.

Aclima's large fleet (upwards of 60 vehicles in past deployments) includes vehicles for monitoring, testing, and calibration as well as reserves, and has met the demands of other statewide operations over the past 4 years. The fleet can be scaled as needed based on scope of coverage, characterization, and other CARB and community expectations: this includes the potential to install AMNs in third party fleets. Most Aclima fleet vehicles fit CARB's definition of an "in motion mobile platform" and collect measurements while mobile and measure a core set of air pollutants and greenhouse gases, including NO, NO_2, O_3, $PM_{2.5}$, CO, CO_2, methane, ethane, TVOCs, and BC. Monitoring vehicles are supported by calibration vehicles used for on-road sensor testing and calibration, which contain reference-grade instrumentation and space for multiple Aclima Mobile Nodes.

Aclima also operates several specialized mobile platforms with speciated BTEX measurement capabilities. These BTEX vehicles are often operated as "in motion mobile platforms" because they have a fast enough response time and high enough precision to detect BTEX enhancements while mobile. However, they can also be operated and self powered via battery power while the vehicles are stationary for up to 3-4 hours when lower limits of detection may be required. They do not require longer collection times and the number of compounds measured is limited compared to a mobile laboratory with research grade instrumentation (e.g., a platform using mass spectrometry or chromatography).

© Aclima, Inc. 2023

1a	What areas/sources/locations do you have experience conducting mobile monitoring?

Aclima's more than 10 years of diverse air monitoring work has given us experience in conducting mobile monitoring across complex urban, suburban, industrial, and rural landscapes and in targeting a wide range of sources. Aclima's mobile monitoring plans are oriented towards the most efficient coverage and routing to best identify the pollution exposure of impacted communities: Aclima works to ensure that all data gathered by the company's mobile monitoring platforms have practical value to improving outcomes for people.

Areas & locations

Aclima deployments have included landscapes in and out of California, including dense urban (e.g., Manhattan and San Francisco), suburban (e.g., Silicon Valley), industrial (e.g., West and East Oakland, East Los Angeles, Hunts Point in The Bronx, New York), and rural (e.g., Marin and Sonoma counties in California). Aclima has also monitored across a range of meteorological conditions and climates, including year-round in northern and southern California, as well as across all 4 seasons in New York state, and internationally in Europe and Asia as part of a partnership with Google Street View (see Attachment A, question 6, for listed specifics of the locations mobile monitoring has been conducted).

Sources

The monitoring locations are guided by the need to serve impacted communities, regardless of source type. Sampled landscapes include a complex mix of sources. As a result, the Aclima platform can target sources of all types of ground-based emissions. Some of the sources targeted and/or observed in prior deployments include:

- Mobile sources, including diesel vs non-diesel emissions.
- Natural gas leaks from distribution systems.
- Biogenic methane sources (landfills, farms, water treatment, etc.).
- Evaporative emissions from fuel storage sites.
- TVOC emissions from various industrial sites.
- PM from construction sites or industrial facilities that are sources of coarse mode aerosol.
- Diesel particulate and NOx emissions from truck traffic associated with last mile warehouses.

© Aclima, Inc. 2023

1b	Has collected data been used to support community emission reduction, enforcement, or other actions? Please provide examples.

Aclima's data have been used to inform understanding and action by a wide range of stakeholders and communities, often via the Aclima Pro SaaS product or less technical websites purpose-built for public use. In some cases, Aclima data led to higher quality follow-on investigations by regulators, or helped communities ask better questions. In some interventions, like gas leak reporting, Aclima data facilitated faster repair outcomes for utilities. Project locations have included West Oakland, San Diego and across New York State.

Aclima teams and data have supported improved understanding and action by regulators, utilities, and communities across a wide range of projects. The selection below highlights the past use of Aclima data and tools to identify impacts, set targets, develop strategies and take quick response actions.

- Owning Our Air CERP, West Oakland, CA: WOEIP used Aclima data to identify impact zones and set emissions reduction targets. The CERP leverages block-by-block data to identify seven Impact Zones and design 89 interventions, a third of which are in active implementation as of July 2022. More details are available in this public report.

- Gas leaks, CA: Aclima's Gas Leak Indicator data product has helped utilities and regulators across New York and California identify high priority leaks through continuous monitoring (rather than one-time surveys) to enable faster repair of leaks that present safety and climate risk. Continuous monitoring of leaks in New York State has given state regulators visibility into the inventory of active leaks in their jurisdiction, the rate of repair for previously active leaks, and the duration of leaks.

- CLCPA, NY: Aclima data are being used by New York's DEC as part of the first phase of the CLCPA requirement to use hyperlocal measurement to identify sources, and will eventually be used to develop emissions reduction strategies.

- South Coast CERPs, CA: Aclima data were used to support emissions reductions in concert with SCAQMD CERP process and community steering committees.

© Aclima, Inc. 2023

2	Please provide operational information on your company's current mobile monitoring capabilities. This should answer the following questions:

Aclima has extensive fleet and device capacity to detect a core range of pollutants as well as a supplemental range of air toxics. These devices include a mix of instrumentation, from Aclima-developed devices incorporating several sensors, to dedicated individual sensors for monitoring pollutants like BTEX. The fleet is outfitted with these devices by Aclima operational specialists, who help to ensure quality control. Drivers receive daily direction, as often as seven days a week, through proprietary drive plan models. These models have been built over many years and projects to optimize the balance between maximum coverage and confidence in characterization across a range of variables. Aclima has proven success in striking this balance from municipal to statewide operational scales.

2a	What frequency can platforms be deployed?

Aclima mobile monitoring platforms can be deployed at a range of frequencies from daily to annually, depending on project objectives and parameters.

Aclima's drive planning algorithms compare data already gathered against predicted model outputs to optimize cost and frequency, which is essential to deliver as much value as possible for a given monitoring investment.

For a project exploring seasonal or annual pollution concentrations, Aclima deploys continuously for three months to a year. Measuring year-on-year change requires multiple years of continuous operation across the full geography of interest. If a project seeks to explore a specific place, Aclima can make hourly deployments within the context of a daily work plan.

Aclima's wide range of deployment frequency is enabled by staffing, calibration, and service models which maximize sensor platform uptime and allow flexibility of when and where to deploy vehicles. Planning algorithms allow cost optimization through intelligent prioritization against model predictions: some sites may be shown to be more predictable and so can tolerate lower frequencies, while others may show unexpected results and merit revisiting. This is a critical capability when considering CARB's objectives to expand SMMI's coverage to many more disproportionately impacted communities statewide, under the constraint of limited resources and time.

© Aclima, Inc. 2023

2b What days/hours are the platforms generally in use?

Aclima's usage patterns vary and are driven by project needs plus operational constraints, to ensure customer objectives can be met efficiently and useful data can be delivered within a defined cost constraint.

Aclima has conducted mobile monitoring on all days of the week. Across a given deployment (typically 3 months or a year), mobile monitoring might occur at all times of day, depending on how large or small the geographic deployment is. Larger regions will see monitoring at almost all times of day, every day of the week due to the higher number of vehicles and drivers required to cover. This may not mean operations are active at all times on every day, because intelligent algorithms ensure drive planning is optimized to community needs and not to any predetermined pattern or target.

2c What pollutants can be monitored and with what frequency?

The Aclima monitoring suite covers a core range of priority pollutants and GHGs, operating at a collection frequency of every second (1 Hz, with the exception of ozone which is measured at 0.5 Hz): carbon monoxide (CO), carbon dioxide (CO_2), nitric oxide (NO), nitrogen dioxide (NO_2), ozone (O3), methane (CH_4), ethane (C_2H_6), total volatile organic compounds (TVOC), fine particulate matter ($PM_{2.5}$), and black carbon (BC). These pollutants are measured across the full Aclima mobile fleet, with balanced coverage throughout a project region.

Aclima complements this pollutant list as necessary with additional monitoring, to the extent that hyperlocal ambient measurements indicate the need. Aclima operates several specialized vehicles that measure BTEX in addition to the suite of pollutants listed above. These vehicles can operate as both in-motion mobile platforms or as short-term mobile laboratories, depending on the need for a particular monitoring objective. The collection frequency is 1 Hz for these measurements. Vehicles are deployed in a targeted fashion based on areas of interest identified from the core monitoring fleet or as directed by CARB or community needs.

© Aclima, Inc. 2023

2d What types of instrumentation do you use? Describe all relevant methodologies.

Aclima outfits each vehicle with a comprehensive sensor suite integrated into an Aclima-built hardware package, called the Aclima Mobile Node (AMN).

The AMN is a self-contained device that houses a range of different sensors in a temperature-controlled enclosure. Methane/ethane and BC sensors are each standalone devices that sit alongside the AMN, which functions as the communications portal to transfer gathered measurements to the cloud and as backup storage in the event of any connectivity issues.

These devices sit inside the vehicle and use active flow sampling to draw ambient air from outside the vehicle. The AMN can also serve as a communications platform for additional sensors in custom applications. Table 3 summarizes the principle of detection used for each of Aclima's standard suite of sensors as well as the method for BTEX detection in short-term mobile laboratories.

Table 3: Detection principles of Aclima sensors

Pollutant	Detection Principle
O_3	UV Absorption
NO	Electrochemical
NO_2	Electrochemical
CO	Electrochemical
CO_2	Non-dispersive Infrared Absorption (NDIR)
CH_4	Infrared direct absorption
C_2H_6	Infrared direct absorption
$PM_{2.5}$	Optical, scattered light
BC	Aethalometer
TVOC	Photoionization detection
BTEX	UV-Differential Optical Absorption Spectroscopy

© Aclima, Inc. 2023

2e	What level of coverage or scale of monitoring can be accomplished within a community? (For example, how would you approach characterizing emissions from a source or identifying a leak? How long would that take?)

Aclima's mobile monitoring platform and operations are designed to provide a flexible solution to meet partner and community objectives in a timely fashion across diverse coverage scenarios, pollutant targets, and physical environments. Time to characterize is fast, but more effort may be needed to confirm the persistence of an air quality concern.

Mobile monitoring design is a balance of spatial and temporal coverage. The right balance depends on the end goal. For example, characterizing hyperlocal pollutant concentrations and diurnal patterns in a disadvantaged neighborhood in a major urban area would require very different spatial and temporal coverage than major source identification in an industrial area or natural gas leak identification across a regional transmission and distribution pipeline network.

Aclima provides a flexible solution that can address multiple scenarios including ambient hyperlocal (sub-block) concentrations, stationary, and mobile source identification and characterization, and leak detection. The Aclima system is built on a fleet of mobile monitors that produce 1-Hz multi-pollutant time series data, providing multiple concentration measurements over short spatial scales to capture and characterize both point and area source plumes as well as regional areas of elevated concentrations. Verification of sources or leaks can be fast relative to alternative approaches, but multiple visits to a location may be necessary to confirm a problem is persistent.

Aclima's approach to point source emissions such as natural gas leaks utilizes plume characteristics from the 1-Hz data and statistical models to address uncertainties inherent in applying mobile monitoring techniques to leak identification and characterization across large areas, complex road networks, and mixed land use characteristics. Aclima maintains and updates estimates of gas leak probability through a project region and uses these to inform deployments and routings: Aclima targets high-confidence leak areas to ensure vehicles drive through the most likely position of the leak based on an estimate of its spatial extent. Advanced drive planning systems allow Aclima to identify, prioritize, and characterize these leaks while concurrently sampling to support hyperlocal ambient concentration estimates.

© Aclima, Inc. 2023

2f How do you determine that you've adequately characterized a given area?

Aclima uses an active learning approach to dynamically evaluate pollutant characterization during monitoring. Instead of relying solely on initial estimates of necessary numbers of samples, real-time data collection is used to assess how well areas have been characterized. This flexible approach ensures daily deployments target poorly-characterized zones, improving efficiency and ensuring vital locations are not underrepresented. Characterization adequacy is gauged using observed versus expected concentrations, comparative data amounts from various locations, and other short-term signals.

Aclima dynamically evaluates and updates characterization adequacy during monitoring using an active learning approach. Since it is not possible to precisely define the amount of data that will adequately characterize the spatial and temporal variability of pollutants in an area *a priori*, Aclima initially estimates the amount of sampling needed prior to the start of collection. Once collection begins, active learning is used to determine how adequately areas have been characterized by polling models trained with the gathered data. Daily deployments are then updated to target areas that those models indicate are still poorly characterized relative to other areas.

Aclima takes a dynamic approach to determining adequate characterization because pre-planning deployments or targeting a specific amount of collection at any given location can lead to inefficiencies, and the most variable locations (often the most important to customers and communities) can be under-characterized in the final dataset.

The adequacy of characterization at a given location is evaluated via a combination of a) the magnitude of difference between the observed concentrations at a given location and time and the expected concentrations, b) the relative amount of data collected at a location to-date relative to all other locations in the area, and c) other possible short-term signals unrelated to background pollutant characterization.

© Aclima, Inc. 2023

2g What workflow processes or software do you have for managing mobile monitoring?

Aclima's workflows and software tools for managing mobile monitoring encompass a range of functional needs in managing mobile monitoring: drive plan generation and delivery, physical asset management, data quality tracking, operational metrics and safety assurance, and data analysis and visualization, among others.

As no existing off-the-shelf solution meets the varied needs of mobile monitoring, Aclima sources these tools from a mix of best-in-class vendor services, Aclima-created, and open-source applications. Aclima has spent years working to integrate these tools, including complex interface and data exchange challenges, to minimize cost, maximize uptime, and ensure partner and community needs can be well met at scale.

- Aclima's drive planning systems are developed in-house but use third-party cloud compute infrastructure. Plans are delivered as spatial files to a third-party mapping application on driver tablets, ensuring they are kept updated with new plans, and that plans can be responsive to community concerns. Aclima's asset management toolset uses a mix of off-the-shelf fleet management software and custom built tools where needed, to give visibility into fleet performance.

- Aclima has refined data quality control processes and software over years of experience with deploying a large network of mobile sensors. These tools include: in-house built and off-the-shelf tools for visualizing mobile data in both time and space, often in relation to stationary reference measurements, which helps with initial quality assessments; web-based status checks for drivers to check reporting status of sensors as well as automated alerting on sensor failure, to support proactive fault detection and minimizing downtime; and custom data processing and analytics to support scalable sensor calibration.

Beyond software tools, Aclima has developed operational standards for drivers and support staff to ensure safe and efficient operations, supported by live GPS and video feeds.

© Aclima, Inc. 2023

3	Describe your usual approach or strategy to mobile monitoring. Include, if possible [...]

Aclima's mobile monitoring strategy begins with dynamic drive planning tailored to the challenges of mobile monitoring and delivered daily to field staff. Aclima hires local drivers and other support team members. A staff of atmospheric chemistry and air quality monitoring experts manages and improves the hardware platform and resultant data products. Aclima maintains a holistic quality assurance and quality control program, developed and refined with researchers in academia as well as at the US EPA. Strict performance and acceptance criteria have been developed based on years of practical experience. Power- and data-efficient telemetry feeds sensor data to server-side pipelines and databases for further processing, and supports customer notification services for hotspots or leaks of concern.

Drive plan & operational logistics

Aclima's ability to intelligently design and execute mobile data collection is based on years of experience and development. Plans are designed to be adaptive, efficient, and deliver high data quality.

A number of factors make drive planning difficult for mobile monitoring in general, and for the scale of work outlined in this RFI, including but not limited to: handling a heterogeneous fleet, computing and integrating objectives for different air quality phenomena, determining "completeness" or sampling need across a wide variety of pollutants, and incorporating exogenous information that informs air quality.

Aclima's drive planning system is designed to respond to all these challenges. Every day, the system decomposes the collection area into a daily set of sub areas, where any sub area's size is determined by the concentration variance estimated from previously collected data (low variance corresponds to large sub areas and vice versa). The system determines which sub areas should be visited based on uncertainty in model predictions – be they mean, variance, or some other statistic – and generates a drive plan that seeks to visit the sub areas as efficiently as possible, while also controlling for sampling bias in the underlying road network.

Successful drive planning at statewide scales requires integrating complex and dynamic operational and logistics elements into drive planning. At Aclima, support staff and drivers work in tandem to coordinate vehicle and sensor platform service and maintenance. Drivers are empowered to assist in platform issues diagnoses and the system works to minimize idle time within a driving shift. Vehicle locations are flexible depending on evolving project needs. Everything updates daily through automatic and manual feedback loops to ensure resources are being spent efficiently to cover ground at least cost in a way that maximizes attention to community concerns.

© Aclima, Inc. 2023

Staffing

Aclima's commitment to efficient and effective planning and operations dovetails with a commitment to equity and harnessing local knowledge. Aclima commits to hiring local employees into operations, support and management roles for each project, working with local organizations to publicize openings.

The local connections and lived experience of local staff help Aclima improve product quality and sensitively solve challenges as they arise. Aclima's operations model is designed to give drivers consistent schedules and minimize downtime during a shift. All permanent local employees receive benefits, and promotion pathways are available. Many local staff have progressed to become part of Aclima's permanent, corporate-level team.

Aclima maintains an experienced staff of experts in atmospheric chemistry, air quality, sensor technology, data science and mobile monitoring. They not only manage and maintain the systems that provide quality controlled concentration data, but also research, develop, and deploy new data products.

Power requirements (e.g. battery powered, requires generator, etc.)

Aclima's mobile monitoring platform is compatible with the DC power available in any vehicle (internal combustion engine, hybrid and EV) and doesn't require external shore power, generators or additional batteries. This flexible approach enables Aclima to scale up quickly with any kind of vehicle.

Consumables

Aclima's mobile monitoring platform uses some consumable materials that are replaceable by driver operators or by hardware technicians in the field when required. Consumables are replaced quarterly to annually, either in the field or by hardware technicians during routine maintenance at calibration and maintenance facilities.

For example:

- Filter tape required for BC measurement, replaced by drivers every 2-3 months.
- Sample line filters, replaced quarterly to annually by hardware technicians or drivers if necessary.
- Scrubbers for background and interference removal, replaced annually by hardware technicians.

© Aclima, Inc. 2023

Quality control procedures

Aclima has a holistic quality assurance and quality control program, developed and refined over years of experience in partnership with researchers in academia as well as at the EPA (through a 10 year CRADA). An operational and logistical infrastructure has been built to support this QA/QC system at a large scale across a variety of environments. Aclima's history with regulator customers, both in California and elsewhere, has guided the development and documentation of QA/QC procedures.

Aclima's approach to designing a quality assurance system applies well beyond individual sensor performance. The objectives of the QA system are to ensure that:

- Performance (uptime, accuracy and precision) of each individual sensor platform is maximized.
- Advanced statistical models are applied to account for temporal sampling artifacts and generate associated confidence intervals for final data products.
- All distinct sources of uncertainty are characterized and quantified to the extent possible: from the device/sensor level, through the sampling methodology, to the statistical processing that goes into generating the final temporally aggregated geospatial data products.

Aclima's quality control procedures fall into two categories:

1. Device level: calibration, maintenance, alerting, and tracking occurs throughout the deployment life cycle.
2. Fleet level: uncertainty is characterized across the overall mobile network contributing to various data products, e.g., annual ambient concentration estimate maps, incorporating sampling uncertainty in addition to device level uncertainty.

Full QA/QC documentation and program details are available on request.

© Aclima, Inc. 2023

Performance & acceptance criteria (e.g. precision, bias, limit of detection)

Table 4 (below) lists the acceptance criteria that calibrated sensors must meet before being installed into an Aclima vehicle (note: sensor uncertainty is not the main driver for uncertainty in aggregated data products: a larger factor is sampling uncertainty from true variability). These criteria were determined after extensive characterization over different phases of development from prototype to the current version of the AMN and other sensors outside the AMN (BC, CH_4 and C_2H_6, TVOCs, and BTEX). The test method for deriving sensor performance metrics to compare against these criteria varies by pollutant measured:

- O_3, NO, NO_2, and CO_2 are calibrated via collocation with reference in a mobile calibration laboratory.
- CH_4 and C_2H_6 are calibrated using standard reference gas measurements.
- BTEX acceptance criteria for precision varies by species and is calibrated using standard reference gas measurements.
- TVOC is initially calibrated via standard reference gas measurements, which is followed by an evaluation of performance criteria via cross-comparison with other collocated AMNs in a mobile calibration laboratory.
- CO, and $PM_{2.5}$, are manufacturer calibrated. Pre-deployment performance checks are via cross-comparison with other collocated AMNs in a mobile calibration laboratory.
- BC is manufacturer calibrated and must pass a flow calibration check prior to deployment.

The acceptance criteria represent the upper limit (worst case) of what is expected from real-world (on-road) performance for a sensor at the start of deployment. Actual performance, which is characterized in Tables 5 and 6, is often better than these acceptance criteria, but can also degrade over time due to sensor drift. These performance values are best estimates to-date of typical[10] sensor performance and may change in the future as additional data are evaluated.

Sensor performance must be considered within the context of the intended data products and use cases. For this reason, Aclima reports sensor performance metrics in two groupings, based on the data products the measurements are used in. For ambient concentration estimates (i.e., the Basemap data product), bias, drift, and precision metrics are reported (Table 4). The precision metrics (Precision and Limit of Detection) are provided for 3 different time aggregations: 1 second, 8 seconds (representing a typical 100 m street segment pass), and 170 seconds (representing a typical 100 m segment aggregate having been sampled over 20 distinct passes). Precision is evaluated at typical ambient concentrations in urban environments, while Limit of Detection is evaluated at typical ambient background concentrations. For enhancement-based data products (i.e., the Indicator data products) (Table 6), the relevant metrics are sensor gain uncertainty (reported as a %) and limit of detection (reported as 3σ values). Drift and sensor baseline bias are less critical metrics for the enhancement-based data products.

[10] Defined as the median value across all sensors tested.

© Aclima, Inc. 2023

Table 4: Acceptance criteria for AMNs from pre-deployment QA checks

Pollutant	Acceptance metric vs. reference	
	Precision (± value)	Bias (± value)
O_3	3 ppb	3 ppb
NO	10 ppb	10 ppb
NO_2	5 ppb	6 ppb
CO_2	11 ppm	12 ppm
CH_4	10 ppb	50 ppb
C_2H_6	10 ppb	15 ppb
BTEX	10-25 ppb	10%
	Acceptance metric using other approaches	
	Precision based on R^2	Bias based on Slope
CO	>0.8	0.75 - 1.25
TVOC	>0.75	0.5 - 2.0
$PM_{2.5}$	>0.8	0.75 - 1.25
BC	Pass internal flow calibration procedure	

Table 5: Ambient concentration data product — typical In-field performance[1]

Pollutant	Bias	Drift	Precision			Limit of detection (2σ)		
			1 s	8 s	170 s	1 s	8 s	170 s
NO_2 (ppb)	2.4	4.6	4	3.1	2.1	6.4	5.2	3.4
O_3 (ppb)	1.5	1.5	1.8	1.8	1.2	3	2.8	1.8
CO (ppm)	0.03	0.03	0.028	0.026	0.023	0.028	0.02	0.012
CO_2 (ppm)	5.5	18.1	3.4	3.3	3	2.4	2.2	2
$PM_{2.5}$ (µg/m3)	0.6	0.6	1.4	0.9	0.5	1.6	1.0	0.4
BC (µg/m3)	0.23	0.14	1.7	0.6	0.26	2.8	1.2	0.72

© Aclima, Inc. 2023

These values are Aclima's best estimates to-date of "typical" sensor performance and may change in the future as additional data are evaluated. Typical is defined as the median value across all sensors tested and is not meant to be a performance specification.

Table 6. Enhancement data products — typical sensor gain uncertainty and limits of detection

Pollutant	Gain Uncertainty	Limit of Detection (1 second, 3σ)
Methane	1%	7.5 ppb
Ethane	1%	1.2 ppb
TVOC	32%	6 ppb
BTEX	5-30%	10-25 ppb
NO	20%	24 ppb
BC	10%	4.2 µg/m3

Data logging & storage

Aclima's end-to-end data management platform polls physical sensors then transmits the data via cellular telemetry to server-side processing. The backend channels these raw data into a data warehouse running on commercial cloud services. Extract, Transform, and Load (ETL) algorithms process the data into a variety of data products that drive customer-facing applications. Derived datasets are stored in a number of formats in cloud databases, with all transformations tracked and traceable.

- The AMN polls the physical sensors for data every second. All sensor data that are collected are time stamped and associated with the physical sensor source. Buffered sensor data are compressed and pushed to the cloud every few seconds. The system is robust to intermittent connectivity, storing locally until backlogs can be transmitted.

- Data are transmitted from devices via a lightweight transport format to minimize code footprint and network bandwidth. Transmissions are brokered by a robust, scalable, commercial Internet-of-Things (IoT) service. The simple pipeline persists data to cloud storage for long-term storage and subsequent processing by the ETL pipeline. All untransformed sensor data from the AMN is retained.

- Sensor data from individual sensors are processed through the ETL pipeline to derive the data products that drive customer-facing applications. This ETL pipeline performs a wide variety of transformations, including: application of models to convert sensor data into meaningful pollutant measurements, derivation of indirectly-measured pollutants, QA checks and subsequent data labeling, aggregation of high-density measurements to practical data abstractions, predictive models to fill in measurements gaps and plan subsequent data collection, and detection/description of areas showing high pollutant values.

© Aclima, Inc. 2023

- As data moves through the ETL pipeline, derived datasets are stored in appropriate database formats in the cloud. Such a complex collection and processing pipeline requires storage (and access) solutions capable of handling large data volumes while remaining flexible and performant to serve downstream consumers. The various storage technologies used afford fine-grained access control, ensuring data are only accessible to the intended audience. Data are formatted in such a manner that allows for traceability through the ETL pipeline, from sensor data to derived data product. Versioning of ETL pipeline and data track which transformations were applied to generate a final data product value.

Notifications & communication

Notification and communication of concentrations of concern is a standard component of Aclima's system. Notification and communication focuses on pollutants such as natural gas which are most suitable for rapid notification and communication but can scale to provide responses for a range of pollutants. Aclima's professional web interface emphasizes getting meaningful insights to customers and stakeholders even before monitoring is complete.

Aclima has standardized notification and communication of concerns, first developed in the Gas Leak Intelligence product. This follows a Standard Operating Procedure (SOP) which verifies that a detection is persistent and not impacted by sensor artifacts or transient sources before notifying both the local gas utility provider and regulator customers. Features of this SOP include:

- Daily alerting of signals detected above a certain concentration over a defined period, sent to Aclima technical staff.
- Staff investigation of high concentration signals to confirm sources and eliminate artifacts.
- Cross-checking against internal databases of existing detections and notifications.
- Feedback loops to operations to allow for further monitoring.
- For verified signals, direct and immediate reporting to responsible parties as well as roll-up reporting at regular intervals.

This formal SOP-based system is designed to be ready for scaling to a range of pollutants and partners. Aclima's other enhancement-based data products (TVOC Screen, biogenic methane, diesel indicator, etc.) provide another means to rapidly communicate the existence of an area of concern or hotspot. Event detection pipelines for hotspots run daily, generating detections over all monitored point source pollutants and serving those changes to Aclima Pro and other customer-facing dashboards and reports.

While not a notification product, Aclima Pro offers an "in-flight" view of data gathered while monitoring is still underway. This exposes temporal trends, and may enable stakeholders to begin identifying hotspots or validating known concerns before monitoring is complete.

© Aclima, Inc. 2023

4	Please provide an estimated cost to operate all applicable mobile monitoring platforms as a function of time (e.g. 1 week of monitoring) deployed and/or measurements taken.
4a	These cost estimates should include all costs associated with mobile monitoring operation. This includes but is not limited to: i. Direct costs – instrumentation consumables and repairs, vehicle operation costs, staff cost to operate platforms, recharging requirements. ii. Indirect costs – support staff costs, associated insurance for operation, administrative overhead, any required permits. iii. Data Management – costs to move data from raw data collected by instrumentation to the final data products requested by CARB.

> Aclima estimates costs of between $25M and $29M to operate all applicable mobile monitoring platforms to meet reasonable assumptions on CARB and community objectives and expectations, over an annual monitoring period.

Aclima uses cost ranges due to the contingent nature of mobile monitoring operations. It is assumed that CARB seeks coverage of SB 535 populations, and all AB 617 consistently nominated communities, to be as high as practicable. Other major assumptions are documented in response to the State's questions in Attachment C-II. The annual monitoring period is based on Aclima's assertion that this scale is best suited to capturing all CARB and community concerns statewide.

Direct costs $20M-$22M per year. Typical costs include vehicle operating costs and staff salaries to operate platforms.
Indirect costs $4M-$5M per year. Typical costs include non-driver staff, insurance, and calibration-related costs.
Data management $1M to $2M. Typical costs include telemetry and processing to ingest streaming data; daily processing of backlogged data; cloud compute costs; and other server and frontend costs for serving and visualizing data to users.

© Aclima, Inc. 2023

Costs will vary within these ranges depending on factors as diverse as: geographic coverage (both extent and distribution of geographic target areas relative to one another); monitoring resolution (e.g., sub-block versus census tract); community engagement expectations; data licensing agreements; choice of primary versus secondary pollutant targets and interrelations with coverage expectations; use of intensive Spotlight-style investigations versus standard hyperlocal monitoring; and staff hiring targets, strategies and ramp rate. CARB and community requirements will be a primary determinant of many of these cost levers.

4b	How often are invoices and payments typically required?

> Aclima provides an initial invoice for payment prior to launch. Subsequent invoices and payments can be expected monthly, to align with delivery milestones.

Aclima maintains a phased invoicing approach for all its air quality monitoring projects. At the outset of a project, an initial partial invoice will be issued, serving as a commitment fee or an advance for the work about to commence.

As the project progresses and specific milestones are achieved, Aclima will send additional invoices, aligned with the progress against defined objectives and specific deliverables of the monitoring project. This offers transparency and accountability to clients throughout the project's duration.

© Aclima, Inc. 2023

5	If an RFP is developed based on the information provided here, how much preparation time is required to deploy the platforms and begin monitoring?

Preparation time for any mobile monitoring effort is primarily constrained either by the duration of any community engagement that is defining monitoring objectives, or driver hiring, or both. Upfitting vehicles with sensors is not a constraint, given Aclima's reserve of sensing hardware and an installation process designed to be as fast and easy as possible. Under favorable conditions, preparation should be in the order of a few months. It is possible to ramp up monitoring over time.

AB 617's commitment to meaningful engagement with a wide range of communities presents a significant logistical challenge at a statewide scale. Engagement should be right-sized and crafted to deliver value to communities — ensuring they have a strong and decisive voice in planning — while keeping the overall planning process on track, meeting CARB objectives and staying within budget. Hiring must be organized by geography and should not start until final decisions are made on where mapping will occur.

With assumptions on a well-designed process at a statewide scale, preparation time is on the order of months. Aclima's experience upfitting vehicles, its standardized and optimized installation process, available reserves of Aclima Mobile Nodes and already-upfitted vehicles all mean that the upfitting process constitutes a small share of preparation time. CARB may consider a more ramped approach, where smaller operations can be spun up in weeks rather than months to target more limited geographic areas, but this depends on a well-designed community engagement process. This would allow CARB to increase operations over time and as community needs dictate, rather than switching everything on at once at a later date.

© Aclima, Inc. 2023

5a	Do you have recommendations for a minimum timeline to achieve potential monitoring objectives described here?

The SMMI includes a range of pollutants and potential objectives, which will require a range of timelines. Aclima recommends a minimum of a year of data collection to characterize pollutant concentrations and sources in a given area. However, certain data products are able to provide actionable data much sooner.

Collection timelines for Aclima's Basemap data product (ambient concentrations) must be tied to relevant timescales for the people who live, work, play, or go to school in the areas of interest on a typical day. In order to collect enough measurements that capture diurnal, weekly, and seasonal trends, as well as annual averages, a full year of data collection is critical.

To identify enhancements or "peaks" above a rolling background, indications of hotspot locations can become apparent within 1-2 months or in some cases sooner. Aclima's Indicator data products are designed to characterize the persistence of emissions sources in fixed locations. When a persistent signal emerges, that information can be used to take immediate action. With more monitoring over time the number of emissions hotspots detected will increase, providing a more complete picture, but this does not preclude CARB and partners from gaining insights sooner. Aclima's adaptive collection system is designed to efficiently target locations where high variability due to these enhancement detections occur, in order to focus deployed resources more rapidly and identify source locations that are meaningful to already overburdened communities.

Based on Aclima's experience with the Spotlight data product, CARB may want to consider a limited amount of short-term focused data collection over a small targeted area, which can deliver results in days to weeks. The Spotlight product was designed to provide this kind of high temporal and spatial resolution on a neighborhood scale, identifying diurnal and spatial trends in different pollutants including BTEX. Aclima's objective is a fast path to actionable data, to give disproportionately impacted communities a chance to reduce exposure sooner.

CARB should ensure that any monitoring fleet has the flexibility to meet these contrasting monitoring objectives: provide near-immediate and actionable value for communities while the data collection is in process, while also providing long-term ambient concentration estimates at hyperlocal scales that are relevant for broader regulator objectives.

© Aclima, Inc. 2023

5b	What is the maximum number of platforms that you could deploy by early 2025?

Aclima has demonstrated capacity to support statewide geographic coverage and a wide range of pollutant objectives, both in terms of sensor and vehicle availability and time to deployment. This is enabled by 10 years of experience pioneering, refining and deploying a tried-and-tested mobile monitoring platform, end-to-end data platform, and visualization and analytics interfaces, backed up by engineering and scientific specialists.

In Aclima's experience, the limit on deployment capacity and project timeline is not determined by the number of existing platforms (given existing reserves and scaling capabilities), but by hiring timeline/targets and community engagement dynamics.

© Aclima, Inc. 2023

6	Do you have experience developing Community Air Monitoring Plans (CAMPs) as defined by the CARB Community Air Protection Program Blueprint or similar? Please provide examples of community-focused monitoring plans or similar.

Aclima does not have direct experience with CAMP plan creation, but has gathered data in support of CAMP implementation with a strong track record of community engagement as well as air district partnering on monitoring efforts. Aclima also supported processes very similar to CAMP specifications across California and nationwide.

Aclima has collected data in support of CAMP plans, including for the Richmond CAMP in the Bay Area (BAAQMD) and as part of SCAQMD's broader CAMP strategy. Aclima also has extensive experience interfacing with community members and CBOs in the development and communication of hyperlocal, neighborhood-level air quality monitoring, including with processes that are similar to CAMP specifications.

- Aclima has experience building partnerships and supporting scoping. For example, with partners across California (including SCAQMD and BAAQMD), Aclima worked with public and community stakeholders to communicate monitoring plans, activities, and results, and be responsive to feedback.

- Aclima works with communities and partners to help them understand approaches to data quality and QA/QC.

- Aclima's commitment to local hiring and workforce engagement is a strong support for collaborative work planning. Aclima works with local partners to hire drivers and key support staff from the local communities where monitoring is taking place, as they are engaged with and know the community, and can share valuable perspectives in planning. Aclima also makes the observations and experience of these employees a key part of the quality assurance process, and provides pathways into more technical roles within the organization.

- Aclima is committed to giving partners and communities accessible, web-based tools to analyze, interpret and communicate actionable insights in a timely way. All clients receive access to Aclima Pro, a professional visualization and analytical software product for mobile air quality data. Aclima's public portals include but are not limited to San Diego, West Oakland, Richmond and Chicago, IL.

© Aclima, Inc. 2023

7	Do you have existing standard operating procedures (SOPs) or quality assurance project plans (QAPPs) for your mobile monitoring approach?

Aclima has developed a coordinated suite of procedures and supporting documents that provide detailed information on the company's Quality Assurance System. These documents are combined with a project-specific plan which outlines the project organization, overview, description, schedule, and requirements to form a Quality Assurance Project Plan (QAPP). This approach has been used for QAPP approval for projects funded by the US EPA.

Aclima's Quality Assurance System documentation describes the processes and procedures that result in mobile measurements that meet data quality objectives, and how analysis products account for the specific complexities that arise from the mobile measurement approach. The documents are as follows:

Aclima Quality Assurance System: Introduction & Management

Explains how to understand overall uncertainty in mobile data, data quality objectives, and how measurement techniques inform quality assurance approaches.

Mobile Ambient Air Pollution Measurement Quality Assurance System

Describes mobile monitoring methods, equipment, and sampling methodology, as well as information on sensor calibration and data review processes.

Hyperlocal Ambient Concentration Estimate Validation & Quality Assurance System

Outlines procedures for analysis of verified data to produce hyperlocal maps of ambient concentration estimates, as well as validation and verification processes.

Hyperlocal Enhancement-Based Data Products Quality Assurance Plan

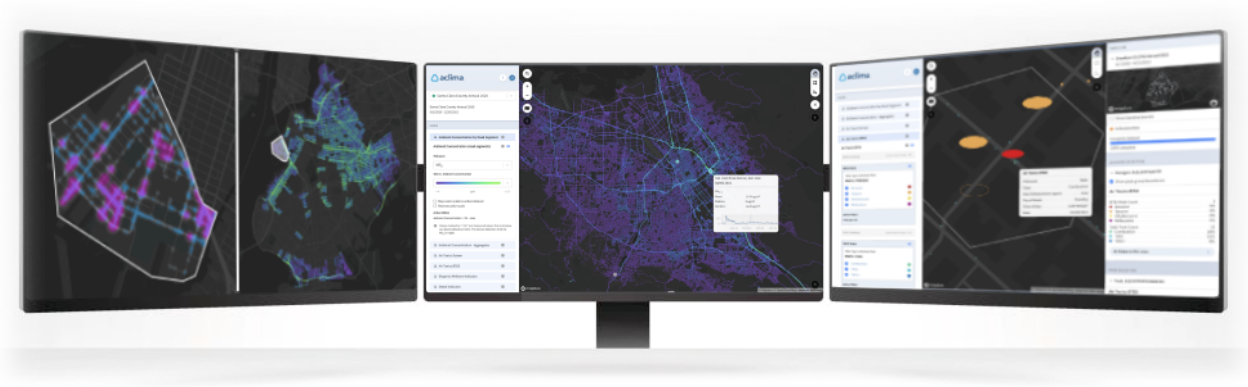
Explains the data processing methodology and quality assurance processes used in support of enhancement based data products.

© Aclima, Inc. 2023

IV. Data collection, storage, & reporting

1	In what format do you generally provide data to your clients? What is your final data product?

> Aclima provides data to clients via spatial and statistical visualization in Aclima Pro, the company's flagship geospatial analysis software product; through download of specific data selections from within Aclima Pro; and via a variety of standard geospatial file types, by request.



Client and community users typically interact with Aclima mobile monitoring data through Aclima Pro, a geospatial analysis software product tailor-made for hyperlocal air quality data collected via mobile monitoring. It provides stakeholders, both technical and non-technical, user-friendly access to hyperlocal air quality datasets, spatiotemporal filtering and aggregation functionality, and a curated set of contextual data layers (e.g., census data, land use, or environmental justice indices). This functionality allows users to understand the air quality in their communities and identify associations with socioeconomic factors. Users can also export data from Aclima Pro for use with other analytical and visualization tools.

Aclima's final data products are a broad array of mobile monitoring-derived and contextual datasets at multiple spatial and temporal scales, different levels of processing, and distinct air quality dynamics (ambient air quality and point source emissions), designed to provide timely, actionable insights to address partner and community concerns. These data products use a rigorous Quality Assurance process and are generated via advanced signal processing techniques and statistical modeling to address a variety of unavoidable artifacts inherent in mobile air quality monitoring.

Aclima has in the past provided data via multiple standard geospatial file types (e.g., GeoJSON, csv, etc.) to support a range of customer and community needs.

© Aclima, Inc. 2023

2	Do you have off-the-shelf, or modifiable-off-the-shelf, data management products compatible with mobile monitoring data?

> Aclima's end-to-end data platform is built, tested, and available to support statewide mobile air quality monitoring objectives without significant customization. It is built on reliable commercial cloud compute services, uses a range of open-source tools, and is otherwise tailor-built for the needs of managing mobile monitoring data and metadata.

Aclima's end-to-end data platform functions are tailor-built to the challenging needs of managing mobile monitoring data and metadata, and tested from large scale deployments over many years. It is complete, tested, and ready for use at statewide scales. The data platform works to:

- Ingest multi-platform mobile monitoring data, regulatory stationary site data, and external third party datasets.
- Integrate manual verification and quality control workflows.
- Apply cloud compute resources to generate data products and optimize sampling.
- Warehouse dynamic datasets and static backups in a mixture of formats.
- Serve data to many frontend applications for external and internal users.

Aclima has found over the last 10 years of research and large-scale deployments that third party off-the-shelf data management products cannot support these needs or are unreasonably expensive and complex to integrate. Where possible, Aclima has built on top of mainstream, reliable commercial cloud-compute services and uses open-source tools for compute and data management tasks.

© Aclima, Inc. 2023

3	What is your experience in mobile monitoring data analysis and visualization? Specifically, do you have any experience using ESRI products to manage and visualize data?

> Aclima's is committed to ensuring mobile monitoring has positive outcomes for disproportionately impacted communities. While Aclima has extensive experience in building, deploying, and maintaining data products and web-based applications for analyzing and visualizing mobile air quality data, it will also support partners who bring their own solutions.

Aclima's engineering and science teams build and maintain data products and web-based applications for visualizing and analyzing mobile air quality data, including Aclima Pro. These provide tools for regulatory, business, academic, and community stakeholders to develop a shared understanding of air quality concerns so they can better plan emissions reduction efforts.

Analytical data products

Aclima's data products are built on a decade of investment into scientific methodologies for mobile monitoring, processing and analysis. These methodologies have been validated by research institutions and top regulators and are designed to reduce analytical effort for customers. The devices that make up Aclima's mobile monitoring fleet produce geolocated time series data (the raw data product). This is transferred to the cloud and fed into an end-to-end data platform to transform and aggregate into customer-facing data products.

These products include:

Basemap

- Annual ambient concentration estimates for core pollutants at multiple spatial scales.

Indicators

- Air Toxics TVOC Screen
- Biogenic Methane Source Indicator
- Diesel Source Indicator
- Natural Gas Leak Indicator

Spotlight

- Any pollutant of community concern, e.g. BTEX

The components that generate these products employ state space modeling techniques to infer latent parameters that are of interest to Aclima customers, and statistical modeling techniques that leverage the spatiotemporal structure of the mobile sampling process to correct for artifacts and increase confidence in estimates derived from low numbers of samples. Data products can be

© Aclima, Inc. 2023

overlaid on top of important context, such as population characteristics or environmental hazards so that users can understand sources and impacts in the same place.

Purpose-built analytic software with human-centered design

Aclima has built accessible visualization and analysis tools that can accommodate diverse stakeholder backgrounds:

- Regulators, academics, and community leaders have access to Aclima Pro, proprietary web-based software designed for air quality data visualization and analysis. Experts can use Aclima Pro to build custom visualizations. Aclima data are integrated on an ongoing basis; no setup is required; and views of each data product are pre-constructed for specific use cases. Users also have access to tools for exploring the data, from high-level summaries to hyperlocal analyses, comparing the distribution of values between different neighborhoods, or layering multiple views to aid in source identification and on-the-ground context.

- For regulators and industry professionals with interest in a specific subset of pollutants Aclima collects (e.g., natural gas), reports and dashboards are produced and updated daily on the identification and characterization of leaks. These provide a consistent view of the data of interest to customers and allows them to incorporate Aclima data into monitoring workflows.

- For community leaders, Aclima offers an “in-flight” data experience that provides a simplified interface to access data during the monitoring process, prior to public availability. The in-flight data experience exposes temporal trends, and allows stakeholders to begin identifying hotspots or validating known concerns in a timely fashion.

- For community members and the broader public, Aclima provides publicly accessible interactive visualizations like the air.health website, which display average annual concentrations in neighborhoods at a hyperlocal level and helps people understand pollution concerns and health impacts. Aclima also offers narrative community reports that mix analysis and visualizations in the context of EPA and WHO guidelines and socioeconomic datasets. Each of these has been built with an intuitive, accessible design and plain language content navigable and digestible by non-experts.

Compatibility with other geoanalytic software products

For partners who bring their own analysis and visualization solutions (e.g., ESRI), Aclima works with them to determine which data are best shown through their existing tool (versus a purpose-built solution such as Aclima Pro), and then enables the delivery and display of Aclima’s data as needed. The team’s emphasis is on understanding and then agnostically supporting the fastest and best way for a partner to meet their analysis and visualization objectives, as well as supporting positive outcomes for impacted communities. Aclima has, in the past, delivered to regulatory agencies datasets formatted for ESRI products, generalized geospatial analytics software, and open source alternatives like QGIS.

© Aclima, Inc. 2023

4	What is your experience in public dissemination of complex information? To what extent have you generated data visualization for the public?

> Over the last 10 years, Aclima has built a large number of dedicated community websites, reports, and other means for visualizing complex air quality monitoring data and insights in meaningful and useful ways for public stakeholders. Aclima continues to explore how community concerns might be reflected back to regulators. Recent examples include dedicated web-based platforms for sharing mobile monitoring data and insights with the public in the Bay Area, Chicago, Los Angeles and San Diego.

Aclima's dedicated community websites, reports and other dissemination tools:

- Provide interactive, street-level reporting of air quality data, both in ambient concentration and for specific indicators such as diesel and biogenic methane.
- Search tools to help users focus on specific locations.
- Include geospatial layers to help users identify sensitive sites.
- Allow users to view air quality data over different timescales.
- Support comparisons with nearby locations.
- Provide guidance on actions users can take to help reduce air pollution in their communities.

Aclima's experience in developing these sites has highlighted the importance of:

- Defaulting to web-based tools wherever possible.
- Making scientific language accessible to all.
- Guiding the public towards the most important and meaningful data.
- Tying all our data to geographic scales and locations the public may find useful.
- Using comparisons, straightforward visualizations and incorporating standards to make data actionable.
- Explaining why certain air quality measures are important.

© Aclima, Inc. 2023

- Being transparent about methodologies.
- Showing sensitivity to community identities and preferred terminology.
- Exploring ways to support two-way communication between the public and regulators.

Aclima distinguishes between the needs of community-based organizations and members of a community. Public-facing sites are built for broad public access, while interested community-based organizations with appropriate expertise receive access to more technical tools such as Aclima Pro.

© Aclima, Inc. 2023

5	What suggestions do you have for handling large amounts of data from a variety of sources (e.g. multiple mobile monitoring platforms) into cohesive data visualizations?

Aclima's systems – whether backend processing or frontend geospatial visualizations – are built to accommodate and cohesively visualize large amounts of data from a variety of sources. Software and signal processing, appropriate temporal and spatial aggregations are all used to prepare data for visualization. Appropriate visualization styles, contextualization, simple designs, and plenty of structured guidance, among other techniques, are used to cohesively visualize multiple data types from multiple sources to a variety of users.

Aclima incorporates large amounts of data from the air quality monitoring work done by the company's own fleet (for criteria pollutants, BTEX, and TVOCs), from public stationary sites, and from other secondary data sources such as environmental justice indices. Based on this experience, Aclima follows a number of best practices in preparing data for cohesive visualization:

- Aclima transforms time series data into aggregations that are tethered to a variety of discrete geometries, e.g., OSM ways, census tracts, and h3 hexagons. This makes analysis and visualization easier when incorporating multiple different data sources. It allows the spatial scale of the geography to have physical meaning by virtue of being linked to the variability of the pollution and the response time of the instruments used.

- Signal processing is applied to establish common data products for pollutants coming from different platforms (e.g., TVOC peaks from the AMN and BTEX peaks from a specialized vehicle) when generating products for point source phenomena.

- Temporal aggregations or decimations (e.g., per second or per hour) are used to make disparate sources of air quality data, such as the AMN and stationary sites, comparable.

- Views are layered in order to identify visual associations between air quality data at street-level aggregation and socioeconomic data at the census tract aggregation.

Aclima cohesively visualizes multiple data types from multiple sources for a variety of users using different purpose-built web-based software. Aclima Pro supports more technical regulatory customers and community partners, while Air.health supports the less technical, more health- and impact-oriented needs of communities.

Best practices include:

- Choosing appropriate visualizations for data of different types, e.g., mobile versus stationary data.

© Aclima, Inc. 2023

- Contextualizing to make data distinctive and meaningful (e.g., adding explanatory and contextual details from secondary sources) such as with NO_2 in the Bay Area or giving road layers special treatments to ensure all data are visible.

- Simplifying to focus on primary data layers, progressively revealing additional data.

- Highlighting areas of concern, creating navigable lists, providing narratives to guide users through complex air quality data.

- Designing for specific types of user, e.g., expert regulatory analyst versus a non-profit advocate staff member.

- Provide direct answers to real world questions, such as “is my air good or bad?”: making clear what mobile monitoring data can and cannot be used for, and incorporating standards and providing comparisons where those are available.

© Aclima, Inc. 2023

V. Feedback

1	Provide input on the requirements or areas listed in this RFI. Specifically, CARB is looking for:
1a	Availability of existing systems that perform all or a portion of the requirements in Section II – C. New systems cannot be built using funds in a potential RFP.

Aclima's long experience has built up a wide range of scientific, physical, and operational assets and capabilities (as documented in this response). These are suitable to support statewide operations with a focus on geographic coverage of SB 535 and AB 617 communities — especially those omitted from previous rounds of monitoring and engagement — for a list of core pollutants and supplemental monitoring where reasonable, and embedded within an extensive and intensive community engagement process.

1b	Questions, suggested modifications, or additions to the proposed environment that would allow or encourage potential bidders. Please include justifications for any suggested changes and concept modifications.

Aclima suggests that the RFP should facilitate a broad spectrum of competitive responses that meet CARB's objectives. The RFP should be drafted to encourage creative business models and strategies for CARB to consider. First and foremost is allowing flexibility for data licensing models which can meet CARB's data transparency needs, enable vendors to protect proprietary IP, and provide cost efficiencies that support monitoring objectives (e.g., expand coverage of additional nominated but not selected AB 617 communities).

Aclima suggests that the RFP define primary (required) versus secondary (optional) suite of pollutants from the "Potential Pollutants and Source Categories" section. Many other supplemental pollutants could be included as optional for complementary monitoring by such methods as short-term mobile labs, stationary, or other approaches. This approach would enable vendors to efficiently and effectively support the state in using mobile approaches to expand air quality monitoring to more disproportionately impacted communities.

Aclima suggests that the RFP focus on the major cost levers in a vendor's business model. This will allow CARB to understand what flexibility a vendor has in meeting different monitoring objectives and operational scenarios.

© Aclima, Inc. 2023

Attachment C — Rough Order of Magnitude Cost Estimate

I. Rough Order of Magnitude

Effective and cost-efficient ambient concentration modeling at statewide scales requires at least a year of monitoring work. Given assumptions on CARB and community expectations and contextualized with Aclima's commitment to high quality data, CARB could see total annual costs ranging between $25M and $29M (major assumptions documented in the response to C-II). The bounds and extent of this range are impacted by several CARB and community choices. Including the number of communities, area and density of coverage, length of monitoring campaign, measurement frequency, etc. Aclima has the capacity to operate its vehicles at the spatial and temporal scales needed to deliver new insights and actionable data in a timely fashion for disproportionately impacted communities statewide.

Rough Order of Magnitude	
Estimated range of cost per month of full-time monitoring. This may be costs associated with conducting monitoring, engagement activities to support monitoring, or both. If this is not applicable, please specify a different time range or more appropriate metric to quantify your capabilities. Please describe what "full-time monitoring" looks like for you and itemize costs with as much specificity as possible.	$2M – $2.4M

Operating at statewide scale, across a priority set of pollutants plus supplemental monitoring, with appropriate QA/QC and wrapped in an effective and efficient community engagement process requires tens to hundreds of sensor platforms, significant driver hiring, support and technical staff time, and deployment of an existing stack of planning and operations tools.

Cost efficient ambient concentration modeling at scales relevant to communities and their concerns requires at least a year of monitoring work. Given reasonable assumptions on CARB and community

© Aclima, Inc. 2023

expectations and considering Aclima's core commitment to adequate geographic and pollutant coverage and high quality mobile monitoring data, CARB could expect total annual costs in the range of $25M to $29M, or $2M-$2.4M per month. Major assumptions are documented in response to Attachment C-II, below.

More important than the specific numbers here is that this range can go up or down depending on CARB and community choices on targets and scale of coverage and pollutants monitored. For example, a smaller total cost can be derived from reducing coverage of regions and communities that are far apart. A larger total cost might be driven by covering more geographies within California independent of population density. Other cost drivers can include: the chosen spatial resolution of monitoring, such as sub-block versus census tract; relative amount of rural area coverage, which tend to be higher cost per capita; and relative emphasis on supplemental and geographically targeted monitoring for, e.g., BTEX or to better characterize a specific community concern.

Aclima recommends working with communities to select the right mix of targets, coverage scale, pollutants and expected temporal and spatial resolution, and selecting a vendor that has a) an integrated hardware, software and operations system flexible enough to scale to those objectives within the constraints of the appropriated funds; and b) the ability to make reasonable adjustments throughout a monitoring campaign based on in-process learnings as well as CARB and community input.

Aclima's vehicles can and do operate at any time of the day or week. Granular deployment plans cannot be defined a priori: achieving mobile monitoring at scale requires intelligent, daily optimization of vehicle routing. Aclima defines "full-time monitoring" as the daily and weekly availability of sufficient vehicle and staff capacity to ensure the timely delivery of high quality raw data and the generation of useful air quality data products for end users.

Rough Order of Magnitude	
Estimated range of cost to complete a full year of monitoring.	$25M – $29M

Per the response above, total annual costs could range from $25M to $29M. Bounds and extent of this range are impacted by CARB and community choices on targets and scale of coverage, pollutants monitored, and other factors. Major assumptions are documented in response to Attachment C-II, below.

© Aclima, Inc. 2023

II. Answers & assumptions used in cost estimate

THE STATE's QUESTIONS & VENDOR'S RESPONSE/ANSWERS

1	What is the timeline for your mobile platform(s) (that is, how many platforms do you have operational right now, and what is your timeline for launching more)? Will your platform(s) depend on additional funding to reach and sustain maximum planned capacity?

Aclima has built an integrated but flexible system of hardware, software, and operations, and manages assets to accommodate a variety of geographic scales and project timelines. Aclima has experience running multiple parallel projects and operating at statewide scales with short ramp and turnaround times.

Assuming CARB and community expectations on geographic, temporal, and pollutant coverage, etc., are reasonable, Aclima has more than adequate capacity for statewide operations over a 1-2 year period.

Allowing flexibility in the data licensing model may enable cost efficiencies for the project as a whole, if the model balances meeting SMMI objectives for data sharing/use with protecting proprietary products and features.

© Aclima, Inc. 2023

2	Approximately how much monitoring can be accomplished in the period of a month? A year?

Aclima's data products (Basemap, Indicators, and Spotlights) are built on an annual model to achieve adequate temporal resolution and support analytics and emissions reduction actions on scales relevant to communities. Over this time frame, Aclima can conduct block-level mobile monitoring that covers more than 90% of the population in CES4 Disadvantaged Communities and all AB 617 consistently nominated communities, all in partnership with CARB, key stakeholders, and community groups.

Insights can be gained on multiple timescales within that annual period, from days to months, depending on the target and monitoring objectives (e.g., hyperlocal ambient concentration over large regions versus targeted BTEX assessment), but the overall annual monitoring scale is critical. Aclima does not recommend targeting a specific amount of productivity over a given time or region (unless to set a low minimum with flexibility to exceed based on monitoring learnings as well as CARB and community input), due to the importance of dynamically managing operations plans and to allow CARB and communities to iterate on their objectives as data are gathered and more is learned about air quality in each region.

© Aclima, Inc. 2023

3	Are there any requirements that would preclude you from competing should an RFP be released? If yes, what suggested changes would allow you to compete?

Aclima recommends a flexible, outcomes-based approach to requirements, welcoming creative responses from vendors to ensure that CARB can meet its coverage and equity objectives, and that communities stand the best chance of identifying and addressing their air quality concerns.

- More prescriptive requirements for data collection should be avoided. These can undermine attempts to maximize value and reduce uncertainty. Prescriptive requirements may also be operationally infeasible. If requirements are outcome- and performance-oriented, vendors can draw on their expertise and past experience to choose the most effective and cost-efficient solution.

- Sensor requirements for mobile monitoring at scale should be systems-based, balancing the need to sample a highly variable atmosphere at scale with an appropriate suite of sensors to address the objectives of the program.

- More ambitious prescriptions on required pollutants could prove problematic if no viable and proven measurement strategies exist at the desired scale. CARB should work to establish primary (required) and secondary (optional) tiers of pollutants, factoring in community input.

- Prescriptive community engagement process requirements should be avoided. They may not be based on real-world experience and prove problematic at statewide scale. Equitable community engagement is a fast-evolving field and the state-of-the-art may outpace prescriptions. CARB may want to consider setting outcome- and performance-oriented requirements that allow for vendor flexibility and iterative improvement. CARB could also establish minimum standards, while granting flexibility to exceed based on learnings before and during monitoring.

- The SMMI seeks to deliver a significant increase in air quality monitoring coverage for disproportionately impacted communities. Given a limited appropriation, this will require value engineering and efficient delivery. Creative data licensing models are one potential lever for cost effectiveness.

© Aclima, Inc. 2023

4	Are any of the goods, products, or services you've identified in your RFI response available on a Federal GSA or State of CA LPA? If yes, please identify the contract type, name, and number.

At this time, Aclima does not make any goods, products, or services identified here available via a Federal GSA or State of CA LPA.

VENDOR'S ASSUMPTIONS:

1	What assumptions have you made in preparing a response to this RFI?

Aclima has sought to provide high level cost estimates using a number of assumptions on the design of any eventual monitoring program. These include:

- That the program would focus on the core pollutants supported by Aclima's hyperlocal mobile monitoring platform. Supplemental monitoring (BTEX, etc.) is not included in the high level estimate since costs depend on deployment choices, which should be designed to meet CARB and community needs along with targeting based on results from core pollutant monitoring.
- That CARB seeks a target of at least 90% coverage of SB 535 populations and all AB 617 consistently nominated communities.
- That CARB and communities' needs are best served by a block-level monitoring resolution.
- That SMMI will expect a minimum of 1 year of monitoring. This is based on Aclima's experience delivering statewide monitoring programs and knowledge of what will deliver adequate temporal and spatial coverage to meet typical regulator and community needs.
- That prescriptive requirements on data collection, accuracy and precision of sensors, required pollutants and community engagement process, will be minimized. This allows maximum flexibility to deliver desired outcomes (e.g., data at a high enough quality and speed of delivery to support robust and timely action to reduce community exposure to a range of pollutants).

© Aclima, Inc. 2023

Glossary

Aclima Mobile Node (AMN): a broad range of hyperlocal air monitoring sensors combined and configured into a single device, and installed in Aclima's fleet of low-emission vehicles.

Aclima Pro: Aclima's proprietary, geospatial analytics and visualization application for technical specialists.

air.health: one of Aclima's public-facing tools for helping the general public visualize and understanding hyperlocal mobile air monitoring data.

Basemap: Aclima data product which provides hyperlocal ambient concentration estimates across community, regional or statewide areas on a range of core pollutants

End-to-end Data Platform: Aclima's software stack for ingesting, processing, analyzing and serving air quality data and data products to internal and external customers.

Extract, Transform and Load (ETL): the software means by which large datasets from multiple sources are combined into a central data repository or warehouse.

Indicators: Aclima data product to help regulators and agencies screen over large areas for actionable indications of specific sources of emissions and sources including VOCs, biogenic methane, natural gas, and diesel.

Mobile Monitoring Platform: Aclima's combined sensor and vehicle platform for monitoring a core range of pollutants.

Pass: a physical visit to a given street segment by an Aclima monitoring platform, to gather air quality data at that location.

Spotlight: Aclima air quality monitoring targeting hotspots. A Spotlight involves short, intensive data collection in specific locations, available for any supported pollutant but often used for supplemental monitoring, e.g., for BTEX (benzene, toluene, ethylbenzene, and xylene) using speciated measurement capabilities.

© Aclima, Inc. 2023