AerodyneResearch

Attachment – C
Rough Order of Magnitude Cost Estimates

Rough Order of Magnitude I. Mobile Monitoring Campaign	
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.*	$ 319,014 per 1 month of measurements.
Estimated range of cost to complete a full year of monitoring.	$ 957,042 Maximum 3 months of measurements during a year.

Answers and Assumptions Used in Cost Estimate

Please answer, in as much detail as possible, the State's questions (1-4) below.
Also, please provide details pertaining to the assumptions, expectations, and/or performance parameters used as the basis of the cost estimate.

THE STATE's QUESTIONS and 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?

Aerodyne has two platforms currently active and available for in-motion mobile monitoring across the U.S. (Aerodyne Mobile Laboratory – "AML", Miniature AML – "minAML"). We have the ability to launch smaller dedicated platforms (e.g., single TILDAS - EtO) for prolonged efforts with short notice. Without internal or external funding (not anticipated at this time), no further platforms will be built. Each new platform requires approximately 1 year to build, regardless of size.

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

For a typical campaign, Aerodyne will operate 5-6 days per week (weekends included). For a month-long project alone, approximately 20-24 sample days could be performed. For long-term measurements, about a week per month, focusing on a small, targeted set of pollutants, is the limit and would need to be negotiated well in advance (3-6 months). Over the course of a year, 3-4 intense measurement campaigns (1-4 weeks) could be possible.

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?

There are no apparent limitations from the requirements noted. Our platforms are all self-powered (gas or diesel generators), real-time (1 Hz data or faster), self-propelled (trucks

and vans), and use techniques that can characterize source emissions at a distance. Our instruments have low LoDs and high precision. Data has been collected in communities across California using these platforms without issues. A few compounds or metals listed may require renting or borrowing equipment. Aerodyne needs sufficient notice and support to deploy our platforms, which could be a limitation.

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.

None of the goods or services provided in this RFI are available on a Federal GSA or State of CA LPA.

VENDOR'S ASSUMPTIONS:

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

We have assumed that this RFI relates to routine monitoring. The instrumentation available via Aerodyne Mobile Laboratories is also appropriate to research endeavors.

Costs Part I: Mobile Measurements for 1 month field campaign:

The following fully loaded costs are associated with 1 month of a mobile monitoring campaign and the associated tasks: QA/Field Logistics, Field Measurements, Data Processing, Data Analysis, and Final Report Writing. The total costs would be an estimated $319,014 as outlined below.

Labor	$ 146,239
Equipment Usage Fees	$ 69,138
Materials and Supplies	$ 19,757
Personnel Travel	$ 61,014
Mobile Lab Travel	$ 1,996
Fee	$ 17,913
TOTAL	**$ 319,014**

This table includes support staff costs, administrative overhead and associated insurance in the fully loaded costs.

<u>Direct Costs:</u>

Labor

A team of highly experienced personnel would be assembled to fulfill each task for the mobile measurements. Our core mobile measurements team and their capabilities are as follows:

Instrument and Mobile Laboratory Scientists: our mobile laboratory scientists have between 8 and 25 years of experience conducting mobile field measurements of trace gases, VOCs and particulate matter. They have visited a wide variety of industrial source types across the USA and

the world. In addition to their mobile laboratory experience, our scientists also have specific expertise in one or more core instrument types. Scientists divide their responsibilities between field logistics, field measurements, QA, data analysis and report writing.

A mobile lab technician will assist in preparing and driving the mobile lab to, from, and during the field campaigns.

Equipment Usage Fees

The costs requested for instrument usage fees covers the rental costs associated with using the mobile lab filled with a suite of Aerodyne instrumentation to target a majority of the requested species. For detection of additional species, there is space to include 3rd party or collaborator instruments in the mobile lab. Our estimated costs could fluctuate based on final instrument selection and configuration but are based on using the following instruments in our mobile lab.

In addition to the above instruments, below is a list of instruments we have used in recent similar sampling campaigns and the species they are capable of detecting:

Table 1. Sample Instrument Manifest for Mobile Measurements by the Aerodyne Mobile Laboratory

Instrument	Time response	Species Measured	**RFI Species**
Tunable Infrared Direct Absorption Spectrometers (TILDAS) x4	1-sec	CO, N_2O, H_2O CH_4, C_2H_6 Formaldehyde Ethylene oxide	**CO,** **CH_4,** **formaldehyde,** **ethylene oxide**
CAPS-NO_2 and CAPS-NOx Cavity Attenuated Phase Shift Spectrometers	1-sec	NO_2, NOx	**NO_2, NOx**
LI-COR 6262 CO_2 Non-Dispersive Infrared Carbon Dioxide Analyzer	1-sec	CO_2	**CO_2**
2BTech Ozone Monitor	2-sec	O_3	**O_3**
Vocus PTR-ToF	1-sec	VOCs and HAPs including aromatics	**Benzene,** **toluene,** **sum of ethylbenzne and xylenes,** **acrolein,** **sulfur containing compounds,** **Select PAHs,** **Unspeciated carbonyls,** **Methyl bromide**
GC-EI-ToF	30 min	isomer-speciated aromatics, C3-C12 alkanes, hydrocarbons, halogenated compounds, 1,3-butadiene, ethylene oxide, and numerous additional HAPs and VCPs (~35 compounds)	**Benzene, toluene, ethylbenzene, o-xylene, sum of m- and p-xylenes, methyl bromide, 1,3-butadiene, select PAHs**

Instrument	Time response	Species Measured	**RFI Species**
SP-AMS	1-10 sec	Speciated particulate matter mass: Organics, Sulfate, Nitrate, Ammonia, Chloride, Black Carbon, select metals (atomic/elemental) including lead, chromium, arsenic, cadmium, aluminum	**Black carbon** **$PM_{2.5}$** **Metals** **Arsenic (elemental)** **Diesel PM**
ARISense	10 sec	PM_1, $PM_{2.5}$, PM_{10}	**$PM_{2.5}$, PM_{10}**
RMYoung or Airmar Anemometers, GPS compass	1-sec	Wind Speed and Direction, GPS position, RH and temperature	

Materials and Supplies

This cost includes all the materials and consumables needed throughout the duration of the field campaign to include tubing, zero air, VOC standard, tow-behind generator, electrical work, and GC consumable items.

Personnel Travel

During a month-long mobile measurement campaign, personnel is swapped out half-way through, so the travel is split into 2, 2-week segments. The estimated costs for personnel travel for 2 separate trips, each with 4 scientists, to travel from Billerica, MA to Los Angeles, CA for 15 days and 16 nights. Additionally, it covers one person driving the mobile lab to California from Masschusetts round trip for 5 days and 4 nights. Air fares are estimated on current fares, Daily lodging and meal rates are equal to US Government guidelines, and other transportation costs are included to cover airport shuttles, fuel, parking, taxis, and/or public transit fares.

Mobile Lab Travel

These funds are an estimate for fuels, tolls, and parking to drive the mobile lab to California from Billerica, MA. Fuel prices, tolls, and parking costs are all equal to US Government rates.

Fee

A standard 7% fee is requested for this project. The fee is assessed on the total direct plus indirect costs, including equipment usage and consultant fees.

<u>Indirect Costs:</u>

All costs above are fully loaded prices that include support staff costs, administrative overhead and associated insurance in the fully loaded costs.

Any required permits would be determined at the time of site selection or deployment, and are not included in these totals at this time.

<u>Data Management:</u>

Costs associated with data management (raw data to analysis to final report) are included in total labor costs.

Invoices & Payments

For mobile measurement campaigns we invoice monthly or as costs are incurred.

Rough Order of Magnitude II. Mobile Laboratory Build	
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.*	$84,564 Average per month for 3 years, plus operational costs
Estimated range of cost to complete a full year of monitoring.	$3,044,300 in Year 1, plus operational costs. Operational costs only in subsequent years.

Answers and Assumptions Used in Cost Estimate

Please answer, in as much detail as possible, the State's questions (1-4) below.
Also, please provide details pertaining to the assumptions, expectations, and/or performance parameters used as the basis of the cost estimate.

THE STATE's QUESTIONS and VENDOR'S RESPONSE/ANSWERS:

5. 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?

Each new platform requires approximately 2 years to build, regardless of size.

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

A dedicated state-owned platform would be available at all times to perform measurements, dependent upon state staffing.

7. 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?

Aerodyne Research builds Mobile Laboratories with the understanding that the described suite of Aerodyne instruments would be included and installed.

8. 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.

None of the goods or services provided in this RFI are available on a Federal GSA or State of CA LPA.

VENDOR'S ASSUMPTIONS:

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

We have assumed a large truck platform, similar to the Aerodyne Mobile Laboratory, in order to accommodate a large suite of instruments. We have assumed an instrument manifest that covers most but not all species in the RFI. Other instruments and configurations are available within different price ranges and we are always available to discuss options and build custom configurations.

Costs Part II: Building an outfitted Mobile Laboratory:

Direct Costs

The following costs are associated with building a customized Mobile Laboratory outfitted with Aerodyne instruments, with space for 3rd party or collaborator instruments. This option will be the most cost effective for long-term, routine monitoring. At 3 month-long campaigns a year, the costs of a custom mobile lab build equates to about 3 years at the cost of using Aerodyne Mobile Measurement Services over the same time frame, in addition to having complete flexibility over when and for how long the mobile measurements take place. Purchase of the mobile lab includes in-depth training on mobile lab operation, instrument operation and analysis, and additional options for extended warranties and additional tech support (additional options not included in prices below).

Mobile Lab Build	$ 750,000
Aerodyne Instruments:	
TILDAS trace gas analyzers (Qty 4)	$ 657,800
CAPS NO_x Monitor	$ 75,000
Vocus-PTR	$ 453,000
GC-EI-TOF	$ 470,000
HTOF-SP-AMS	$ 638,500
TOTAL	**$ 3,044,300**

Mobile Laboratory Build

The $ 750,000 build cost includes the base vehicle, upfitting, labor at Aerodyne after upfitting, and integration of Aerodyne instruments. 3rd party instrument integration not included.

Aerodyne Instruments

Aerodyne Research builds Mobile Laboratories with the understanding that the described suite of Aerodyne instruments would be included and installed. Based on the pollutant list in the RFI, below is the list of Aerodyne instruments we would recommend for measuring a majority of the

pollutants on the list. Other configurations are possible. Discounts may be available for multi-instrument purchases, and we can create space for installing currently-owned instrumentation.

Table 2. Recommended Instrument Manifest for an Outfitted Mobile Laboratory.

Instrument*	Species Detected
TILDAS Trace Gas Analyzers (Qty 4 instruments**)	Ethylene Oxide Acrolein & Formaldehyde Ammonia Carbon Monoxide & Carbon Dioxide
CAPS-NOx	Nitrogen oxides
Vocus-PTR#	BTEX (need GC to speciate), Carbonyls (unspeciated), Methyl Bromide, Sulfur containing compounds (depends on functionality), Acrolein, Select PAHs
GC-EI-TOF#	BTEX, Acrolein, Sulfur containing compounds, Carbonyl (some aldehydes can be uncertain), 1,3-Butadiene, Methyl Bromide, Select PAHs
HTOF-SP-AMS	$PM_{2.5}$, Diesel PM, BC, Arsenic, (metallic/elemental), PAHs, Metals (elemental)

* Specific configurations of the above-listed instruments can be provided upon request. Other instruments and configurations are available within different price ranges and we are always available to discuss options and build custom configurations.

** The above TILDAS analyzers have been selected to maximize coverage of detected species, with the assumption that other small sensors can be used for species like ozone and H_2S. However, Aerodyne builds custom TILDAS analyzers that can be made to measure any of the following species in various combinations: Ethylene Oxide, Acrolein, Formaldehyde, Ammonia, Methane, Nitrogen Oxides, Hydrogen Sulfide, Carbon Monoxide, Carbon Dioxide, Ozone. CAPS analyzers are available for NO_2 or NOx.

Although the Vocus and GC detect similar species, the Vocus provides real-time measurements but measures the sum of isomers at a given mass (e.g. a measurement of the sum of all xylenes and ethylbenzene), while the GC measures a sample every 30 minutes but can provide isomer speciation of many of those same VOCs (e.g. individual quantification of ethylbenzene, o-xylene, and the sum of m- and p-xylene).

This mobile lab build option will be the most cost effective for long-term, routine monitoring. The cost of a custom mobile lab build equates to about 3 years of using Aerodyne Mobile Measurement Services (3 months per year) over the same time frame, in addition to providing complete flexibility over when and for how long the mobile measurements take place. Purchase of the mobile lab includes in-depth training on mobile lab operation, instrument operation and analysis, and additional options for extended warranties and additional tech support (additional options not included in prices below).

Invoices & Payments

For a Mobile Laboratory build, we request 50% prepayment up front and the remaining 50% upon delivery.