Vendor Profile

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3. **Company Overview**: Entanglement Technologies, Inc. was founded in 2010 and has been developing, manufacturing, and subsequently deploying their flagship sensor platform, AROMA, for over 13 years. Entanglement Technologies was born out of research conducted at Stanford University and the California Institute of Technology that focused on studying the intricacies and potential applications of quantum entanglement in the modern world. From this work, Entanglement Technologies developed their AROMA analyzers, which are thermal desorption, broadband cavity ring-down spectroscopy (TD-CRDS) systems providing laboratory-grade analysis of volatile organic compounds (VOCs) in the field at the touch of a button. Entanglement Technologies holds multiple patents in the development of advanced chemical sensing and analysis technologies, including construction of high-finesse optical cavities used in cavity ring-down spectroscopy (CRDS), performance laser systems, low-noise photodetectors, complex electro-optical assemblies, and high-speed electronic feedback components. The Entanglement Technologies team is made up of nine people, five of whom hold Ph.D. degrees, and is primarily made up of physicists, engineers, and chemists. The Entanglement team offers a broad range of experience in atmospheric chemistry and air quality monitoring, instrument and application development for ambient chemical analysis, precision manufacturing, and open-source software development for laboratory equipment control. Entanglement Technologies supplies their AROMA analyzers to federal, state, and local/regional government agencies, academic institutions, environmental consultants, and industrial clients in the oil and gas, chemical manufacturing, and refining sectors.

4. No parent corporation and/or subsidiaries.

5. **Description of Product**: AROMA analyzers are thermal desorption, broadband cavity ring-down spectroscopy (TD-CRDS) systems providing sensitive, laboratory-grade analysis of air toxics, greenhouse gases, and other VOCs in the field and from vehicles at the touch of a button. AROMA analyzers have two main modes of operation: RapidScan and LabScan. RapidScan is a direct spectroscopy mode, where an air sample is directly analyzed by the CRDS core providing real-time measurement (2-10 seconds) of small molecules (methane, H2S, HCN, etc.) and large molecule compound classes (alkanes, aromatics, etc.). The LabScan operating mode utilizes the thermal separation front-end before CRDS detection. This provides near real-time measurements (8 – 30 minutes) of ethylene oxide, BTEX, and other VOCs at detection limits as low as 2 pptv. These modes represent the two listed in the *Potential Mobile Monitoring Categories* section as the *in-motion mobile platform* (RapidScan) and *short-term mobile laboratories* (LabScan). These modes can be used together for mobile monitoring; RapidScan for hyper-local mobile hotspot detection and LabScan for broad area surveys and stationary monitoring for more complex chemical profiling. AROMA can be connected with GPS and an anemometer and data from the analyzer can be output as a simple excel file or as a .kml file to be imported into Google Earth to generate mobile monitoring maps.

AROMA analyzers have been deployed in Nissan LEAF, minivans, SUVs, and other vehicles used by state environmental quality agencies. The system can be mounted in a rack or contained in a custom Pelican Case, so that the system can be easily anchored into any vehicle. We also own a Ford Sprinter van that has been used for several mobile monitoring deployments in Texas and most recently used for the hyper-local mobile monitoring project in Sacramento with Sonoma Technology.

6. More than a dozen specific projects using the AROMA instrument's mobile capability have been conducted at locations across the country. Some key projects include:

- San Antonio, TX – large area ozone precursor study
- Houston, TX – leak identification and source fingerprinting after Hurricane Harvey
- Carlsbad Caverns, NM – ozone precursor study by Colorado State University (Collett group) in collaboration with EPA Office of Research and Development (ORD) and National Park Service
- Atlanta, GA – monitoring ethylene oxide around sterilization facilities
- Longmont/Denver, CO – surveying various VOC sources around oil and gas activities
- Baton Rouge/New Orleans, LA – surveying ethylene oxide emitters by Louisiana Department of Environmental Quality (DEQ)
- Rotterdam, Netherlands – surveying the Port of Rotterdam by Rotterdam/Netherlands DCMR
- North Carolina – leak identification and surveys after Hurricane Florence
- Sacramento, CA – hyper local pollutant monitoring led by Sonoma Technology in collaboration with UC Davis

Entanglement Technologies' AROMA analyzers have been deployed by Harris County (Texas) Pollution Control Services and the City of Houston in city vehicles to measure hydrogen sulfide (H_2S), hydrogen cyanide (HCN), benzene, toluene, ethylbenzene, xylene(s) (BTEX), 1,3-butadiene, acrolein, and other air toxics species. Entanglement Technologies' team has also conducted mobile monitoring with AROMA analyzers in Houston after Hurricane Harvey in 2017, and after the Intercontinental Terminals Corporation fire in 2019. In 2022, California Air Resources Board acquired two AROMAs for community air toxics monitoring. Several universities including Colorado State University and Baylor University use AROMA to conduct mobile monitoring around oil and gas and industrial activities.

7. The only requirement in the *Proposed Environment* section not technologically feasible with our existing product, AROMA, is related to the potential pollutants to monitor. With regards to the listed pollutants, AROMA <u>cannot</u> measure particulate matter, black carbon, ozone, nitrogen oxides, formaldehyde, arsenic, hexavalent chromium, and other metals, methyl bromide, and polycyclic aromatic hydrocarbons.