State of California
AIR RESOURCES BOARD

DESIGN AND DEVELOPMENT OF AN INSTRUMENT FOR TOXIC-METAL AEROSOL REAL TIME ANALYSIS (TARTA)

RESEARCH PROPOSAL

Resolution 18-8

March 22, 2018

Agenda Item No.: 18-2-3

WHEREAS, the California Air Resources Board (CARB or Board) has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2814-288, titled, "Design and Development of an Instrument for Toxic-metal Aerosol Real Time Analysis (TARTA)," has been submitted by the University of California, Davis for a total amount not to exceed $399,999;

WHEREAS, the Research Division staff has reviewed Proposal Number 2814-288 and finds that in accordance with Health and Safety Code section 39701, the results of this study will sponsor the development of an instrument capable of portable, real-time screening technology to detect ambient concentrations of toxic metals that may drive health risk concerns; and

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee has reviewed and recommends funding the Research Proposal.

NOW, THEREFORE BE IT RESOLVED, that CARB, pursuant to the authority granted by Health and Safety Code section 39700 through 39705, hereby accepts the recommendations of the Research Screening Committee and staff and approves the Research Proposal.

BE IT FURTHER RESOLVED, that the Executive Officer is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the Research Proposal as further described in Attachment A, in an amount not to exceed $399,999.

I hereby certify that the above is a true and correct copy of Resolution 18-8 as adopted by the Air Resources Board.

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Rana McReynolds, Clerk of the Board

Resolution 18-8

March 22, 2018

Identification of Attachments to Board Resolution 18-8

Attachment A:
"Design and Development of an Instrument for Toxic-metal Aerosol Real Time Analysis (TARTA)" Summary and Budget Summary

ATTACHMENT A

"Design and Development of an Instrument for Toxic-metal Aerosol Real Time Analysis (TARTA)"

Background

The objective of this project is to sponsor the development of an instrument capable of portable, real-time screening technology to detect ambient concentrations of toxic metals that may drive health risk concerns. Although technologies to screen for toxic compounds, such as benzene, toluene and many criteria pollutants are available, the same level of efficacy for community monitoring is not available for toxic metals. Deploying portable devices that can monitor for toxic metals in real-time will help CARB, local air districts, and communities to determine the source of these metals and develop strategies to reduce their emissions. The current state of toxic metals measurement does not encompass the capabilities outlined in this research. Examples of the need for such a device are found in the investigation of hexavalent chromium in the Paramount area of Los Angeles and the airborne lead emissions from the now closed Exide battery recycling facility in Vernon, California.

Objective

The contractor will develop, test, build, and deliver an instrument to CARB using proven technology which has not yet been developed into an instrument to fill the goals stated above. The contractor will promote the instrument into commercialization which will make the instrument available to many agencies and environmental groups.

Methods

The contractor will test the design and build a metal-detecting instrument that fulfills the project objectives above which include the detection of many metals simultaneously at atmospherically relevant concentrations, including aluminum, antimony, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, vanadium, and zinc. Two methods for detecting metal composition by producing a spectrum of light are laser-induced breakdown spectroscopy (LIBS) and spark-induced breakdown spectroscopy (SIBS). The contractor will test these two methods to determine the most ideal suitability of these technologies to meet different project goals and optimum operating parameters. The contractor will use traceable samples prepared for calibration of reference instruments to test the combinations of method and detector. The contractor will test a range of spectrometers as detectors ranging from a low-cost, lower detection capability to a higher cost, higher detection to find the optimal combination of price and performance. The contractor will test and report the accuracy and precision for each instrument combination. Features such as portability, flexibility, small power budget, and relatively low cost for large-scale community-level deployment will be targeted.

Expected Results
The project team will test methods and detectors to develop a system which will fill the needs of a portable instrument for measuring ambient concentrations of metals. The project team will also target commercialization of the instrument to enable wide adoption and use of this instrument. An instrument as described in this project will have broad applications, including continuous emissions monitoring of industrial sources, regional and local air quality monitoring for source apportionment, as well as citizen science applications in neighborhoods, with associated constraints on size, weight, and budget to analyze different concentration regimes. At the end of the project, the project team will deliver at least one working instrument to CARB for use in research studies. The team will work with a commercializing company and CARB to identify markets and the TARTA configuration most suitable to that market.

Significance to the Board
TARTA will complement CARB's current air toxics monitoring efforts with improvements to real-time measurement capability, multiple element response, portability, and other key features. It will also support efforts under Assembly Bill (AB) 617 Community Air Protection Program by advancing the state-of-the-science in air toxics measurements, and promoting the development of resources that are inexpensive to manufacture and deploy, and can be more readily obtained by community groups to study toxic metal emissions and exposures in their neighborhoods.

Contractor:
University of California, Davis

Contract Period:
36 months

Principal Investigator (PI):
Dr. Anthony Wexler, Ph.D.

Contract Amount:
$399,999

Basis for Indirect Cost Rate:
The State and the UC system have agreed to a 25 percent indirect cost rate.

Past Experience with this Principal Investigator:
Dr. Anthony Wexler and his project team are well suited to champion this project. Dr. Wexler has a degree in Mechanical Engineering, and has extensive experience in designing, building, operating, and characterizing aerosol generation systems for use in the UC Davis CNPRC Inhalation Exposure Facility as well as at the UC Davis Center for Health and the Environment. Since 2007, Dr. Wexler has worked as a staff researcher in the Air Quality Research Center on projects examining the health effects of inhaled aerosols. His experience includes design and fabrication of aerosol sampling systems, development of experimental instruments, arranging controlled and well-characterized

aerosol exposure environments, and preparation of samples for imaging using a variety of techniques. Dr. Wexler has extensive experience designing and fielding new aerosol instrumentation, including one of the first single particle mass spectrometers and a thermophoretic particle sampler. Dr. Wexler's office and laboratory also have ample space to perform this work. His research staff have experience with elemental standards to be used in testing instrument configurations and sensitivities, and he has access to high resolution spectrometers and high powered lasers to test the resolution and pulse energy needed for the optimal instrument at the UC Davis campus.

Dr. Wexler also has had prior funding and collaborative relationships with a number of instrument companies in California, and will be able to leverage these relationships to commercialize this instrument and bring it to market. This section should describe the PIs qualifications, specifically relating to the proposal and any other CARB related experience.

Prior Research Division Funding to University of California, Davis:

Year	2017	2016	2015
Funding	$ 812,097	$ 650,000	$ 1,468,460

B U D G E T S U M M A R Y

Contractor: University of California, Davis

DIRECT COSTS				
1.	Personnel (Salary and Fringe Benefits)	$ 215,853		
2.	Travel	$ 4,110		
3.	Materials & Supplies	$ 32,916		
4.	Equipment	$ 83,900 [1]		
5.	Electronic Data Processing	$ 0		
6.	Consultant(s)	$ 0		
7.	Sub-recipient(s)	$ 0		
8.	Other Direct Costs	$ 0		
	Total Direct Costs		$	336,779
INDIRECT COSTS				
1.	Indirect (F&A) Costs	$ 63,220		
	Total Indirect Costs		$	63,220
TOTAL PROJECT COSTS			**$**	**399,999**

NOTE:
[1]The contractor requires procurement of the development of the optics portion of the instrument requires the use of equipment listed in the budget. The equipment budget for the contract includes two IsoPlane spectrometers to be purchased from Princeton Instrument at a unit cost of $30,450 each ($60,900 total) and one Viron Q-switched YAG laser will be purchased from Quantel at unit cost of $23,000. These instruments are necessary for the development of the detection method and to quantify the range of metals which will be detectable. The listed equipment will enable UCD to quantify the sensitivity of the methods needed to develop the instrument. The high-resolution spectrometer in the budget will be used initially to obtain the highest quality spectra for each detection technique.