

BOARD MEETING DATE: October 4, 2019

AGENDA NO. 3

PROPOSAL: Execute Contracts to Develop Methodology and Evaluate Onboard Emission Sensors for On-Road Heavy-Duty Vehicles

SYNOPSIS: Onboard sensors on heavy-duty vehicles have been identified as an important tool to ensure real-world emissions compliance. Onboard sensors are also used to provide real-time information to enable dynamic emission controls. A consortium comprised of the University of California (UCR)/CE-CERT and other industry, government and academia members has been formed to develop the next generation onboard sensors, analysis and reporting methodology. These actions are to execute two contracts from the Clean Fuels Program Fund (31) with: 1) Southwest Research Institute to perform laboratory evaluations of onboard NOx and ammonia sensors in an amount not to exceed \$50,000; and 2) UCR/CE-CERT to support the consortium's project to develop and demonstrate a low-cost onboard NOx and PM sensor-based measurement methodology under real-world operating conditions for heavy-duty vehicles in an amount not to exceed \$201,087.

COMMITTEE: Technology, September 20, 2019; Recommended for Approval

RECOMMENDED ACTION:

Authorize the Chairman to execute the following contracts from the Clean Fuels Program Fund (31) with:

- a) Southwest Research Institute to perform laboratory evaluations of onboard NOx and ammonia sensors in an amount not to exceed \$50,000; and
- b) University of California Riverside/CE-CERT to support the consortium's project to develop and demonstrate a low-cost onboard NOx and PM sensor-based measurement methodology under real-world operating conditions for heavy-duty vehicles in an amount not to exceed \$201,087.

Wayne Nastri
Executive Officer

Background

Heavy-duty on-road vehicles represent one of the largest categories in the NOx emissions inventory in the South Coast Air Basin (Basin). In order to meet the 2023 and 2031 ozone standards, NOx emissions need to be reduced by 45% and 55% from future business as usual scenarios, respectively, and most of the NOx in the basin is from mobile sources. Previous in-use emission studies, including studies funded by South Coast AQMD, have shown significantly higher NOx emissions from heavy-duty on-road vehicles than the certification limit under certain in-use operations, such as low power duty cycles.

In CARB's proposed Heavy-Duty On-Road "Omnibus" Low NOx regulation, multiple lower NOx standards will be phased in starting in 2022. In addition to the lower certification values, a low load test cycle, revisions to the not-to-exceed compliance test and NOx sensor data reporting are also proposed to ensure real-world emission reductions are realized over various duty cycles, especially those low power duty cycles in urban areas. An alternative proposed new methodology is to continuously measure real-time emissions from trucks with onboard sensors.

The Truck & Engine Manufacturers Association (EMA) and U.S. EPA are proposing a project with Southwest Research Institute (SwRI) to perform laboratory evaluation of NOx and ammonia sensors as part of a larger initiative to enable continuous emissions monitoring and demonstrate in-use compliance in the 2027-2030 timeframe. Concurrently, the University of California Riverside (UCR)/CE-CERT, along with other industry, government and academia members, has formed a consortium to develop the next generation of onboard sensors, analysis and reporting methodology. This project is part of a larger consortium effort to develop a cloud-based emissions/energy management system. Under these two projects, SwRI would initially conduct the lab evaluation and compliance testing and UCR/CE-CERT would perform the real-world emissions data collection for methodology development.

Proposal

SwRI

SwRI will evaluate NOx and ammonia sensors from five leading sensor suppliers and focus the effort on regulation-required verification in the laboratory setting. The key aspect of this evaluation is to characterize and explore interferences from real-world driving parameters under controlled conditions on sensor accuracy and durability. The SwRI work is expected to supplement the onboard sensor data used in UCR/CE-CERT's project.

UCR/CE-CERT

Under the consortium oversight, UCR/CE-CERT will develop and demonstrate a low-cost onboard NOx and PM sensor-based emissions measurement reporting methodology for heavy-duty engines. The low-cost system would be designed to enable

future capabilities, such as dynamic engine calibration control, in-use policy enforcement and a data-driven exposure model specific to the Basin. The proposed low-cost system will be demonstrated on up to eight heavy-duty trucks and up to two different vocations for up to 180 days. From the demonstration data, UCR/CE-CERT plans to investigate the activity patterns of the vehicle, the location of the routes being driven by the vehicle, cold start emissions and differences between the existing onboard diagnostic sensors and the advanced low-cost sensors' results. This project will provide valuable information in understanding the emission impacts of heavy-duty vehicle emissions for specific neighborhoods, including disadvantaged communities. The consortium will meet on a bi-monthly basis to receive project updates and solicit input from members.

Sole Source Justification

Section VIII.B.2 of the Procurement Policy and Procedure identifies four major provisions under which a sole source award may be justified. This request for a sole source award is made under provision B.2.d.: Other circumstances exist which in the determination of the Executive Officer require such waiver in the best interest of the South Coast AQMD. Specifically, these circumstances are B.2.d.(1): Projects involving cost-sharing by multiple sponsors. The proposed projects will include in-kind contributions and cost-sharing by CARB, U.S. EPA, EMA and its members, NGK Spark Plug (NGK), EmiSense Technologies, LLC (EmiSense), Center for Advancing Research in Transportation Emissions, Energy and Health (CARTEEH) and the Manufacturers of Emission Controls Association (MECA).

Benefits to South Coast AQMD

The proposed research projects will assist the trucking industry to monitor emissions, using sensors as one of the design platform options. Reduction of NO_x and PM emissions from mobile sources is imperative for Basin to achieve federal ambient air quality standards and protect public health. Projects to support development and demonstration of advanced technologies are included in the *Technology Advancement Office Clean Fuels Program 2019 Plan Update* under the categories of "Engine Systems."

Resource Impacts

The estimated cost for the SwRI project is \$433,780, of which EMA's cost-share is \$250,000. The U.S. EPA is currently in the process of obtaining funding approval in the amount of \$133,780, requesting cost-sharing of \$50,000 from South Coast AQMD. The contract with SwRI will not exceed \$50,000 from the Clean Fuels Program Fund (31).

Proposed funding sources and amounts for the SwRI project are in the table below:

Funding Source	Funding Amount	Percent
U.S. EPA	*\$133,780	30
EMA	\$250,000	58
South Coast AQMD (<i>requested</i>)	\$50,000	12
Total	\$433,780	100

*funding not yet fully secured

The estimated cost for the UCR/CE-CERT project is \$688,587. UCR/CE-CERT is in the process of securing additional funding for this project and has requested cost-sharing from the South Coast AQMD. Our cost-share will not exceed \$201,087 from the Clean Fuels Program Fund (31). Proposed funding sources and amounts for this project are in the table below:

Funding Source	Funding Amount	Percent
NGK (in-kind)	\$42,500	6
CARTEEH	\$80,000	12
EmiSense (in-kind)	\$115,000	17
EMA (cash and in-kind)	\$200,000	29
Other Entities (e.g., CARB, MECA, U.S. EPA)	*\$50,000	7
South Coast AQMD (<i>requested</i>)	\$201,087	29
Total	\$688,587	100

*funding (cash and in-kind) not yet fully secured.

Sufficient funds are available in the Clean Fuels Program Fund (31) for this proposed project. The Clean Fuels Program Fund (31) is established as a special revenue fund resulting from the state-mandated Cleans Fuels Program. The Clean Fuels Program, under Health and Safety Code Sections 40448.5 and 40512 and Vehicle Code Section 9250.11, establishes mechanisms to collect revenues from mobile sources to support projects to increase the utilization of clean fuels, including the development of the necessary advanced enabling technologies. Funds collected from motor vehicles are restricted, by statute, to be used for projects and program activities related to mobile sources that support the objectives of the Clean Fuels Program.