BOARD MEETING DATE: December 4, 2026 AGENDA NO. 3

PROPOSAL: Execute Contract to Demonstrate Advanced Combustion Technology for Heavy-Duty Diesel Engines

SYNOPSIS: South Coast AQMD is partnering with the CARB and Sandia National Laboratories (Sandia) to develop and demonstrate ducted fuel injection (DFI) technology to reduce NOx and PM emissions from heavy-duty-diesel engines while improving engine efficiency. Previous Sandia research showed emission reductions using DFI in a heavy-duty on-road diesel engine. This action is to execute a contract with Sandia for up to $100,000 from the Clean Fuels Program Fund (31) to develop and demonstrate DFI technology for heavy-duty diesel engine applications.

COMMITTEE: Technology; November 20, 2026; Recommended for Approval

RECOMMENDED ACTION:
Authorize the Executive Officer to execute a contract with Sandia National Laboratories (Sandia) for an amount not to exceed $100,000 from the Clean Fuels Program Fund (31) to further develop and demonstrate ducted fuel injection (DFI) technology for heavy-duty diesel engines.

Wayne Nastri
Executive Officer

AK:MW:SC

Background
Heavy-duty diesel engines remain a significant source of NOx and PM emissions in the South Coast Air Basin. Although zero-emission technologies continue to be deployed, certain heavy-duty applications still face challenges related to cost, infrastructure availability, and demanding duty cycles, making them hard to electrify. Thus, developing other cost-effective technologies to reduce emissions from existing diesel engines is needed as an interim measure while zero-emission technologies continue to be developed for the heavy-duty applications.

Sandia developed DFI technology that uses small ducts below the fuel injectors within the engine combustion chamber to improve fuel-air mixing, reduce emissions, and improve engine efficiency. Previous research has demonstrated reductions up to 80 percent in PM2.5 emissions and up to 40 percent in NOx emissions from on-road vehicles. These results indicate potential for DFI technology as a cost-effective pathway across heavy duty diesel platforms, including in use on-road trucks, off-road equipment, locomotives, and marine vessels and other difficult-to-electrify applications.

Proposal
Sandia proposes to further develop and demonstrate DFI technology for larger diesel engines commonly used in freight locomotives and marine applications. Under the project co-sponsored by CARB, Sandia will conduct the project in three phases. Phase 1 will focus on developing and integrating DFI hardware into a locomotive engine, followed by Phase 2 testing on a single cylinder to evaluate emissions reductions, performance, and compatibility with different types of fuel. CARB will provide $500,000 to cover Phase 1 costs as well as part of the costs of Phase 2. South Coast AQMD proposes contributing an additional $100,000 to complete Phase 2 testing. The results from the first two phases will inform the feasibility of Phase 3, which would involve full-scale engine demonstration. Sandia anticipates Phase 3 to begin in approximately two years, pending successful completion of the initial phases; no Phase 3 funding is currently requested.

Sole Source Justification
Section VIII.B.2. of the Procurement Policy and Procedure identifies 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 interests of South Coast AQMD. Specifically, these circumstances are B.2.d.(l): Projects involving cost-sharing by multiple sponsors. CARB is also contributing financially to the Sandia DFI Research project. In addition, this request is also supported by B.2.c(1): the unique experience and capabilities of the proposed contractor or contractor team; and B.2.c(2): project involves the use of proprietary technology. Sandia developed the DFI technology proposed for this project and has specialized experience in its design and testing. The proposal also builds on Sandia's existing DFI research and technology for application to a larger diesel locomotive engine.

Benefits to South Coast AQMD
The South Coast Air Basin is classified as an “extreme” nonattainment area for ozone and a nonattainment area for PM2.5 under the Federal Clean Air Act. Projects supporting reduction of diesel heavy-duty engine emissions via advanced ducted fuel injection demonstration is in the Technology Advancement Office Clean Fuel Program 2026 Plan Update under the category “Emissions Control Technologies.” Successful demonstration of this project helps reduce ozone and PM2.5 air pollution, as well as

diesel particulate matter, a known carcinogen, while reducing emissions in overburdened communities and along major freight corridors and railyards. The Sandia project is intended to establish a practical and cost-effective retrofit pathway for reducing emissions from existing large diesel engines without requiring complete equipment replacement. Successful demonstration has the potential to support broader adoption of DFI technology across difficult-to-electrify applications.

Resource Impacts
The proposed contract with Sandia will not exceed $100,000 from the Clean Fuels Program Fund (31). The total project cost is $600,000, with funding sources as shown below.

Funding Source	Funding Amount	Percent
CARB	$500,000	83
South Coast AQMD (requested)	$100,000	17
Total	**$600,000**	**100**

Sufficient funds are available from the Clean Fuels Program Fund, established as a special revenue fund resulting from the state-mandated Clean 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.