State of California
AIR RESOURCES BOARD

"Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines"

RESEARCH PROPOSAL

Resolution 14-13

May 22, 2014

Agenda Item No.: 14-4-1

WHEREAS, the Air Resources Board (ARB) 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 2774-278, entitled "Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines" has been submitted by the University of California, Riverside; and

WHEREAS, the Research Division staff has reviewed Proposal Number 2774-278 and finds that in accordance with Health and Safety Code Section 39701, results will provide estimates of the impacts of the Averaging, Banking and Trading (ABT) and Transition Program for Equipment Manufacturers (TPEM) program engine populations on California's air quality for the regions studied during the project. Furthermore, the results will inform ARB policy makers regarding the impacts of these national programs on California's air quality. Research Division staff recommends this proposal for approval;

WHEREAS, in accordance with Health and Safety Code section 39705, the Research Screening Committee recommends for funding:

> Proposal Number 2774-278 entitled "Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines," submitted by the University of California, Riverside, for a total amount not to exceed $300,000.

NOW, THEREFORE BE IT RESOLVED that the Air Resources Board, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendations of the Research Screening Committee and Research Division staff and approves the following:

> Proposal Number 2774-278 entitled "Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines," submitted by the University of California, Riverside for a total amount not to exceed $300,000.

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 effort proposed herein, and as described in Attachment A, in an amount not to exceed $300,000.

I hereby certify that the above is a true and correct copy of Resolution 14-13 as adopted by the Air Resources Board.

Tracy Jensen

Tracy Jensen, Clerk of the Board

ATTACHMENT A

"Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines"

Background

California is a participant in the Averaging, Banking and Trading (ABT) and Transition Program for Equipment Manufacturers (TPEM) programs, which are administered at the federal level by the United States Environmental Protection Agency (US EPA). California does not have independent ABT or TPEM requirements apart from the federal programs.

The ABT program is a permanent component of the off-road regulations that allows engine manufacturers the flexibility of continuing to certify engine families to less-stringent previous-tier standards, as long as the manufacturer also certifies a sufficient number of "counter-balancing" engines below the more-stringent current-tier standard, so that the manufacturer's entire fleet average is at or below numerical Tier 4 levels.

The TPEM program allows equipment manufacturers the flexibility to continue selling a portion of their new equipment with previous-tier engines to ease the transition to the new standards for up to seven years following the introduction of Tier 4 standards. The TPEM program also has a permanent component for providing hardship relief to equipment manufacturers.

These programs are administered only on a national level, so the specific sales fractions of Tier 4 and non-Tier 4 engines in California are unknown, and it is possible that the state or some localities within the state could receive a disproportionate share of higher-emitting engines, and have average emissions from new engines that are higher than the Tier 4 standards. Because California has areas in non-attainment with air quality standards, and has communities adversely affected by poor air quality, it is important for California to receive the benefits expected from the Tier 4 emission standards, and to verify that the ABT and TPEM programs are not adversely affecting either California as a whole, or specific communities in California.

Objective

The objectives of this project are to characterize the national ABT and TPEM off-road diesel engine populations, and the subsets of these populations sold and operating in California, and to assess the emissions impact of these engines in California.

Methods

The project will focus on three air basins that represent about three quarters of the off-road PM and NO_X emissions inventories: the South Coast Air Basin, the San Joaquin Valley, and the San Francisco Bay Area.

The contractor will first determine the percentages of ABT and TPEM engines sold nationally and in California from post-processed copies of the ABT/TPEM national database provided by the ARB. CE-CERT will determine the specific numbers of ABT

engines being produced by each engine manufacturer, and by each participating TPEM equipment manufacturer. The researchers will deploy surveys to off-road equipment fleet owners to determine specific California locations where ABT and TPEM engines have been deployed. Data analyses will be conducted to determine the impact of the ABT/TPEM programs on fleets in locations such as the ports, engines located on transportation refrigeration units (TRUs) and other similar locations with significant public or occupational exposure.

In the event that ABT/TPEM program engines are determined to represent a disproportionate fraction of national ABT/TPEM program sales, the contractor will determine the emissions impact of these engines.

Expected Results
The research will provide estimates of the impacts of ABT and TPEM program engine populations on California's air quality for the regions studied during the project.

Significance to the Board
Results will inform ARB policy makers regarding the impacts of these national programs on California's air quality.

Contractor:
University of California, Riverside

Contract Period:
24 months

Principal Investigators (PIs):
Robert Russell Ph.D.
Kent Johnson, Ph.D., co-PI
Tom Durbin, Ph.D., co-PI

Contract Amount:
$300,000

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

Past Experience with the Principal Investigators:
Co-PIs Drs. Kent Johnson and Tom Durbin have previously conducted HDT-related research projects for ARB, the US EPA, the Engine Manufacturers Association, and other clients, and have developed experience procuring and emissions testing diesel off-road equipment. Most recently (2013), Drs. Johnson, Durbin and Robert Russell successfully completed an ARB off-road diesel equipment emissions test projects for ARB emissions modeling staff.

Prior Research Division Funding to the University of California, Riverside:

Year	2013	2012	2011
Funding	$ 405,338	$ 0	$ 390,004

BUDGET SUMMARY

University of California, Riverside

"Evaluation of the Impacts of Emissions Averaging and Flexibility Programs for all Tier 4 Final Off-Road Diesel Engines"

DIRECT COSTS AND BENEFITS			
1.	Labor and Employee Fringe Benefits	$ 193,500	
2.	Subcontractors	$ 0	
3.	Equipment	$ 0	
4.	Travel and Subsistence	$ 26,566	
5.	Electronic Data Processing	$ 0	
6.	Reproduction/Publication	$ 0	
7.	Mail and Phone	$ 0	
8.	Supplies	$ 2,000	
9.	Analyses	$ 0	
10.	Miscellaneous	$ 56,286[1]	
Total Direct Costs			$ 278,352
INDIRECT COSTS			
1.	Overhead	$ 21,648	
2.	General and Administrative Expenses	$ 0	
3.	Other Indirect Costs	$ 0	
4.	Fee or Profit	$ 0	
	Total Indirect Costs		$ 21,648
TOTAL PROJECT COSTS			**$ 300,000**

[1] As an off-campus facility of the University of California, Riverside, CE-CERT recovers direct, lease-based facilities rental charges. Facilities rental is charged at 26 percent of Modified Total Direct Costs (MTDC; total direct costs less any equipment, graduate student tuition/partial fee remission, and subcontracts beyond the first $25,000).