

Collaborative Lubricating Oil Study on Emissions

January 2011

Fact Sheet

The Issue

Ambient fine particulate matter, which consists of small particles suspended in the air and cause air pollution, has been associated with a wide range of particulate matter-related human health effects in general populations, including the aggravation of heart and lung disease, and premature death. Particulate matter from vehicles may be the most significant single contributor to ambient fine particulate matter levels. It is important to analyze the formation of particulate matter, some of which originates from engine lubricating oil. Additionally, particulate matter emissions may become a significant barrier to deploying beneficial alternative fuel technologies.

The U.S. Department of Energy's *Gasoline/Diesel Particulate Matter Split Study*¹ concluded that particulate matter from spark-ignition vehicles contributes significantly to particulate matter emissions in the Southern California Basin. However, the exact role of lubricating oil in producing particulate matter from motor vehicles has not been determined.

Project Description

This project will determine the sources of particulate matter and semivolatile organic compound emissions in vehicles. It intends to



Image credit: http://etopedia.com/images/stories/oil_change.jpg

quantify the fraction of emissions derived from the combustion fuel and engine lubricating oil, and determine the engine operating conditions that are responsible for the emissions. Also, this research will characterize the potential for reformulated lubricants to reduce particulate matter emissions from mobile sources, both from new vehicles and from the much larger in-use vehicle fleet.

Recognizing there are potential benefits to air quality and human health, the National Renewable Energy Laboratory, the South Coast Air Quality Management District, the California Air Resources Board, the Coordinating Research Council, and the American Chemistry Council Product Approval Protocol Task Group organized the Collaborative Lubricating Oil Study on Emissions.

This pilot study will conduct extensive chemical and physical characterizations of particulate matter and semivolatile organic

compound emissions from a small set of test vehicles fueled with gasoline, 10 percent ethanol in gasoline (commonly known as E10), diesel, biodiesel, and compressed natural gas.

Gaseous and real-time particle emissions will be measured, and particulate matter and semivolatile organic compound samples will be collected for subsequent chemical analyses. Physical particulate matter characterization will be conducted to obtain data on particle size and count, which will be investigated over the various driving test cycles run on the chassis dynamometers. This research will:

- Determine the contribution of lubricant constituents to particulate matter.
- Determine the effect of vehicles and fuels on the lubricant particulate matter contribution under various vehicle operating conditions, including changes in duty cycle and temperature.

PIER Program Objectives and Anticipated Benefits for California

This research supports efforts to reduce health and environmental impacts from air pollution and greenhouse gas emissions related to natural gas use. Further analysis of the formation characteristics of particulate matter emissions from natural gas vehicles will help develop particulate matter reduction technologies. This understanding, in turn, will reduce deployment barriers and help expand the availability of vehicles capable of using alternative fuels. Reformulating lubricating oils may possibly provide a significant particulate matter emissions benefit to new and existing vehicles under a variety of operating conditions.

Project Specifics

Contract Number: 500-06-043

Contractor: California Air Resources Board

Contract Amount: \$100,000

Contract Term: June 2007 to June 2011

Co-Funding: \$1,342,046 contributed by DOE/NREL, Coordinating Research Council, SCAQMD, Lubrizol.

All lubricants provided by the American Chemistry Council Petroleum Additives Panel: Product Approval Protocol Task Group.

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