

Rapid Analysis of Diesel Engine Performance and Lubricant Sulfur Content on Exhaust Ash Accumulation Using a Sulfur Dioxide Tracer Technique and Thermogravimetry

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Marine and diesel engines are responsible for a considerable portion of controllable hazardous emissions in today's transportation industry. The Environmental Protection Agency has enforced regulations governing the emissions of these sources since the inception of the Clean Air Act of 1963. EPA regulations require significant reductions in heavy duty and light duty diesel engine particulate matter, one of its six criteria pollutants, by 2007. These requirements will lead to the first wide spread use of diesel particulate matter traps on US on road vehicles. These traps incorporate various regeneration techniques to combust particulate matter, leaving noncombustible ash which eventually clogs traps and requires cleaning. Lubricant oil consumption is believed to be a major contributor to this ash and therefore a greater understanding of the effects of oil consumption on ash accumulation is required. Typical studies of this phenomenon are conducted using long duration engine tests with subsequent weighing of particulate traps and lubricant remaining in the engine sump. This study aims at using a sulfur dioxide tracer technique to measure instantaneous oil consumption and thermogravimetric analysis of particulate matter filters to determine ash generation following short duration tests. The technique promises to reduce engine test runs from 200 hours to as little as 15 minutes. A detailed data acquisition system records and calculates emissions response and predicts particulate output based on user or test cell based input.