

**EFFECT OF SAMARIUM-COBALT FUEL LINE FILTER ON HEAVY TRUCK FUEL ECONOMY**

**Background**

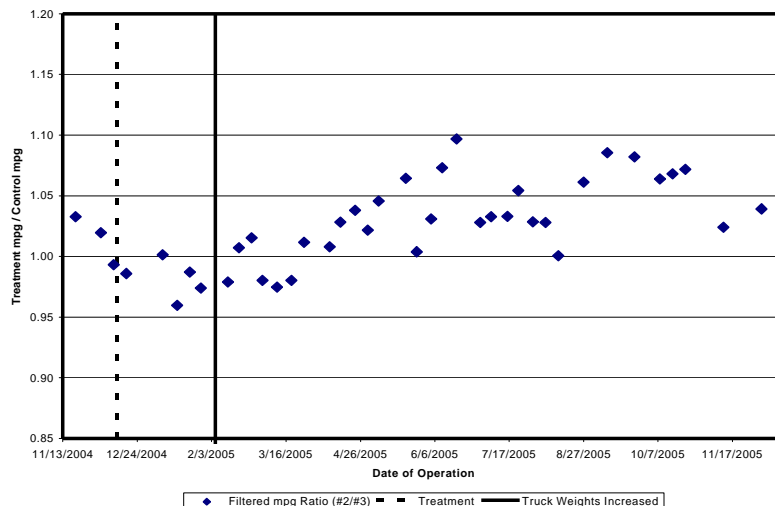
The NCAT Pavement Test Track is a 1.7-mile oval test facility on which a fleet of 5 heavy triple trucks each run over 3000 miles a week in order to damage experimental pavements. A design lifetime of truck traffic (10 million equivalent single axle loadings, or ESALs) is applied to each 200 ft test section within a 2-year period in an accelerated manner. Funding for this research is provided by state departments of transportation (plus the Federal Highway Administration), who rely on results to determine which methods and materials produce pavements with lower life cycle costs. Interest in the Track is not limited to pavements, and the operation of the heavy truck fleet in a highly controlled environment provides an excellent opportunity to study the effect of various treatments on fuel economy.

**Work Plan**

A work plan was developed based upon the TMC/SAE Recommend Practice #1102, which describes a Type II in-service fuel consumption study. In this procedure, fuel economy measurements in a test vehicle (T) are compared to measurements from a control vehicle (C) before and after treatment. The difference between the before and after T/C ratios are used to calculate a percent improvement presumably resulting from the treatment. For the purpose of this study, a trip is defined as a day of travel. The same 2 drivers were generally used to complete a trip for each day over 2 shifts, and both the treatment and control vehicles traveled the same distance around the Track at identical speeds. The amount of fuel to complete each trip was monitored with a calibrated external pump, and odometers were used to determine the distance traveled with GPS distance as a backup. The T/C ratios for all trips were calculated, and all ratios within an operational week that fell within a 2 percent filtering band were used to compute an average value. If at least 3 out of the 5 trips did not fall within the prescribed 2 percent band, no T/C average was computed for that operational week.

**Findings**

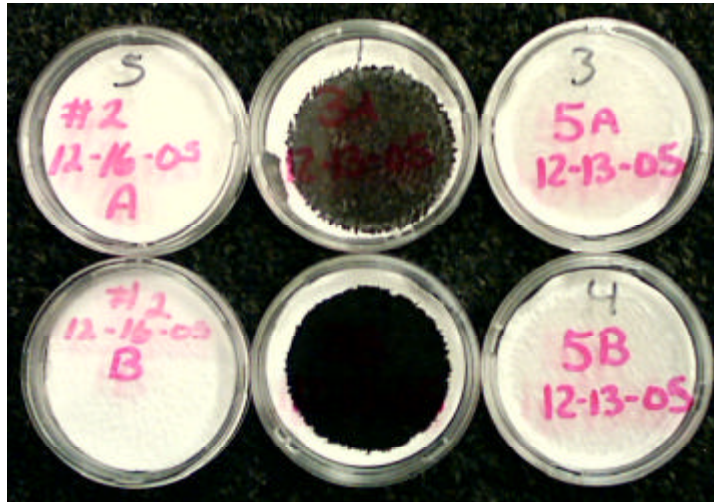
Treatment is defined as the installation of a Samarium-Cobalt fuel filter (a SuperVos Flame provided by the Florida-based Vostecs Company) directly in the fuel inflow line, which was completed on 12/13/04. As seen in Figure 1, a gradual improvement in fuel economy was observed over the course of the experiment. Based on a linear approximation of all qualified data after the installation of the filter, **a fuel economy increase of approximately 9 percent was observed.**



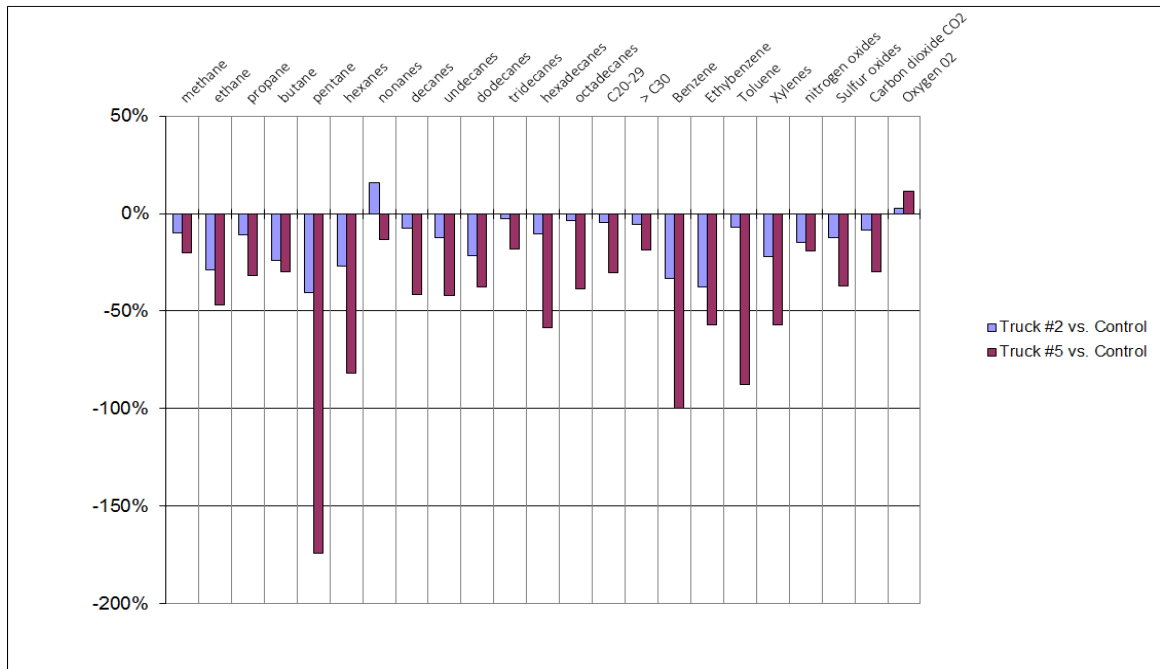
**Figure 1 – Fuel Economy Ratios from 1 Month Before Treatment Through 160,000 Miles**

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A dramatic improvement in fuel economy of this magnitude would seem to necessitate a change in the chemistry and composition of engine emissions over the same period of time. In anticipation of potential differences, emission testing was conducted before the installation of the filters, after 30,000 miles of operation, and finally after 140,000 miles of operation. As seen in Figures 2 and 3, a dramatic reduction in emissions appeared to accompany the observed increase in fuel economy.



**Figure 2 – Particulate Emission Samples (2 Control Filters in Middle Surrounded by 4 Treatment Filters on Outside)**



**Figure 3 – Results from Testing After Treatment Installation**

### Certification

The results of this research project are an unbiased and accurate representation of Auburn University's experiences in fleet operations at the NCAT Pavement Test Track.

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