NANOBYTE
Fuel Efficiency Additives

For The

Defense Logistics Enterprise Services Program (DLESP)

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NANOBYTE

Nanoenergy: Fuel Efficiency Additives

Problem:

The fuel efficiency problem within DoD impacts three areas: cost, emissions, and the logistics tail. In 2004, DoD spent $8.2 billion on energy; this was before the current increases in energy costs and changes in the fuel emission standards put into effect by the EPA.

Background:

In an effort to quantify the problem and the impact of just a 5% improvement in fuel efficiency the following is provided:

- Each day 1,350,000 gallons of fuel are consumed in Iraq; a 5% improvement would be a savings of 67,500 gallons (At $2.00 per gallon, a saving of $49.275 Million).
- Each day 2,000 trucks depart Kuwait with fuel for locations through out Iraq; a 5 % improvement would result in a saving of 36,500 trips annually (a reduction in the logistics tail of 100 + fuel trucks, 100+ drivers and all the attendant protection and support).
- Operationally and logistically, a 5% improvement would mean that a HMMWV could travel 17.5 miles farther on a tank of fuel and a M1 Abrams tank could travel an additional 25 miles on a tank of diesel.

A 5% improvement in fuel efficiency could have a tremendous impact on the DoD budget!

Discussion:

ManTech's nanotechnology study provided three potential nanotechnology fuel additives for investigation. They are not all nanoparticles; in fact, two of the three are advanced polymer chemicals that form nanoscale liquid micelles ("particles") in diesel fuel. Included within this memorandum are summaries of the three identified products.

Continuing Actions:

ManTech will continue to monitor this area of experimentation to identify further research breakthroughs for DoD.

Envirox™ Fuel Borne Catalyst

Manufacturer: Oxonica Energy (Kidlington, UK)

Technology: Cerium Oxide-based nanoparticles that control the release of oxygen and act as a combustion catalyst. The result is that negative work is reduced, combustion duration lengthened for more power, and combustion occurs at lower temperatures for a reduction in carbon deposits.

Field Test:

- Full-scale 12-month commercial trial performed by the Stagecoach Group in 1000 buses. Analyses conducted by an independent company showed an overall improvement in fuel economy over 6% in rural areas and over 5% in urban areas. In response to the successful trials in the north-west and London, Stagecoach decided in December 2004 to adopt the product at all major depots across the UK, covering in excess of 6,500 buses.
- Oxonica website indicates that a range of additional commercial evaluations is currently underway with a number of other fleet customers internationally.

Notes: BASF bought into Oxonica Energy and will be incorporating Envirox™ into a new ultra-premium diesel performance additive, Keropur™ DP 4540.

F2-21® NanoRon™ Gasoline and Diesel Fuel Enhancer

Manufacturer: H2Oil (Hayward, CA)

Technology: Surfactant polymer technology that creates 3-10 nm sized fuel droplets during fuel injection. "Inside the fuel tank, F2-21 is able to build an exceptionally stable three dimensional matrix consisting of extremely small (sub-microscopic) nano-clusters, all evenly distributed within the body of the fuel. These nano-clusters are physically, chemically or catalytically active (depending on the stage of the combustion cycle)."

Field Tests:

- H2Oil European distributor, CleanerGlobe, recently completed a long-term fleet testing of F2-21 fuel additive that showed a 12.5% fuel savings and substantial emissions reduction. The Dutch trucking firm, Wesseling Transport, which operates a fleet of heavy-duty diesel trucks, was the test participant. The test included 36 trucks driving over a million kilometers. Wesseling announced it would continue using F2-21 in all its trucks.
- The Italian National Railways (Ferrovie) tested F2-21 in 2,000 horsepower diesel locomotives and found 8% fuel savings and 40% exhaust smoke reduction, as well as almost 100% removal of combustion chamber deposits in a 550,000 KM overhaul.

Notes: H2Oil also makes the F2-21® NanoTech Engine Oil Additive/Treatment, which exploits the fact that a small amount of oil gets into the engine during normal operation. This additive is intended to improve fuel efficiency in a similar manner to NanoRon™.

Green Plus®

Manufacturer: Biofriendly Corporation (Los Angeles, CA)

Technology: Green Plus® catalyzes fuel molecules causing the hydrocarbons to unbundled. At the same time, it exposes them to oxygen molecules, thus facilitating the reaction.

Tests:

- British Clean Fuels have been using Green Plus® in their garages since May of 2003. John Paul Byrne, the operator of the Paddington Basin Taxi Center (a station using British Clean Fuels) stated, "We have now been selling our diesel blended with the Green Plus liquid fuel catalyst for over a year. During that period we have seen our sales more than triple. The cabbies love Green Plus® because they save more than 10% on their fuel cost and their taxis pass the MOT emissions test with ease."
- Vehicle tests have been performed by FedEx Freight, Ford Motor Company, and others. Tests have shown an improvement in fuel economy by 6-9% depending upon the condition of the vehicle and the fuel used. Note that the tests described are on a small number of vehicles for relatively short durations.