PERFORMANCE DIESEL, LLC
CHEMISTRY-DRIVEN PERFORMANCE

251 KING MUIR ROAD
LAKE FOREST, ILLINOIS 60045

www.performance-diesel.com
lremensnyder@performance-diesel.com
847-565-8150

Technical Topic

Lubricity

The EPA Clean Air Act set in motion the reduction of Sulfur in Diesel fuel. The EPA's objective in reducing the Sulfur content was to reduce HC, SOx, CO, NOx and PM. Prior to 1994, the Sulfur level of both on-road and off-road diesel was, on average, between 1000-2500ppm. In 1994, the maximum Sulfur level was reduced again to 500ppm for both on-road and off-road fuel. Then in June, 2006, ULSD (max 15ppm Sulfur) was introduced for on-road fuel. Several years later, off-road fuel was also reduced to 15 ppm Sulfur.

Refiners used Hydrotreating to reduce the Sulfur level. In addition, Hydrotreating also reduced the Aromatic content. The reduction in Sulfur in conjunction with the reduction in Aromatics resulted in significant Lubricity issues. The reduction of Aromatics in Diesel fuel resulted in thousands of single-stage fuel injectors to begin to leak. What transpired is that the injector O-rings with the higher Aromatic fuel swelled the O-rings which kept the seal tight. The low-Aromatic fuel caused the O-rings to shrink leading to thousands of truck engines to suffer injector leaking.

When fuel Lubricity problems started to appear, the recommended test-method of assessment was the Scuffing Load Ball-On-Cylinder Lubricity Evaluator (ASTM D6078). Due to poor correlation between the bench test and the real-world vehicle test, a new Lubricity test was developed--the HFRR, (ASTM D6079).

In June 2006, the Sulfur content was reduced from 500 ppm to less than 15 ppm for on-road fuel. In 2010, the Sulfur level of off-road fuel was reduced as well—to the same value. Today, both fuels are identical, except for the addition of 25ppm of Automate Red Dye which serves the purpose of designating that the fuel is off-road, tax exempt.

Diesel with <15ppm Sulfur is known as Ultra Low Sulfur Diesel (ULSD). Many believe that once the Sulfur is removed, the absence of Sulfur had no adverse effects on fuel Lubricity. This is inaccurate. During Hydrotreating, the fuel loses natural lubricity compounds and that, in combination with reduced Aromatics, has a pronounced negative impact on fuel Lubricity.

In 2006, the HFRR lubricity specification was 520micron wear scar (HFRR). The EMA's position was for fuel to meet a wear scar of less than 460 microns (the smaller the number the better Lubricity). The recommendation was therefore to add Diesel Additive

PERFORMANCE DIESEL, LLC
CHEMISTRY-DRIVEN PERFORMANCE

251 KING MUIR ROAD
LAKE FOREST, ILLINOIS 60045

www.performance-diesel.com
lremensnyder@performance-diesel.com
847-565-8150

packages containing an effective synthetic Lubricity Improver. It is important to emphasize that all Diesel fuel should meet the EMA specification or else premature Injector pump and Injector wear will occur.