Memo

To:	Harold Ledda	**From:**	Nigel McKenzie
Cc:		**Date**	
Subject:	Engineering Bulletin – Sulphur in IFO		

Harold,

In response to the tech question regarding sulphur in IFO, please enjoy the following response.

In regards to your question - what happens to the sulfur? When high sulfur heavy fuel oil is combusted either in an engine or a furnace without additives present, the sulfur ends up as a mixture of sulfur oxides. These oxides are sulfur dioxide (SO2) and sulfur trioxide (SO3), the ratio of the two being largely dependent on how much vanadium is present in the heavy oil. SO2 is considered an undesirable pollutant in that when released into the atmosphere it can ultimately produce acid rain, but it's not particularly harmful to the engine or furnace. SO3 on the other hand is the precursor to sulfuric acid (dissolve it in water and you have the acid!), and it is extremely corrosive to both engines and furnaces. When there is vanadium in the fuel, it is oxidized during combustion to vanadium pentoxide, which is a strong catalyst for converting SO2 into SO3. Thus, without the proper additives, combustion of high sulfur, high vanadium fuels tends to produce very corrosive exhaust gases which lead to high rates of ring wear in engines and severe corrosion of furnace heat exchanger tubes.

Add to this the fact that vanadium pentoxide tends to produce a relatively low melting point, "sticky" slag that deposits on engine exhaust valves and on furnace heat exchanger tubes, and you have a real problem. It's this slag that requires furnaces to be shut down quite frequently for crews to go inside the firebox with pick axes to remove the tube deposits! The clear conclusion is that there really is a need to properly treat heavy, high sulfur, high vanadium fuel oils with additives before they are combusted.

While our additive contains multi-functional components, one of the key ingredients is a solubilized over-based magnesium surfactant that plays two major roles. First, the magnesium hydroxide, being basic, reacts with either SO3 or sulfuric acid to form magnesium sulfate, which other than being "Epsom Salts!" is a harmless solid that is easy removed from the exhaust with a filter bag. The SO2 can also react with the magnesium compounds, but it is generally of less concern. Removal of the SO3 leads to much longer ring life in engines and tube life in furnaces.

In addition to its reaction with SO3, the magnesium compounds react with vanadium pentoxide to form solid compounds that have a much higher melting point, and which instead of sticking to exhaust valves and tubes, simply blows past them and either out through the exhaust or into a filter bag.
This has an enormous effect on the time between shutdowns for scheduled maintenance.

Short question - long answer! Hope this helps.

Regards,

Mac

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