

# Advantages of Ultra Low Sulfur Heating Fuel

Bob Hedden

Oilheat Manufacturers Association

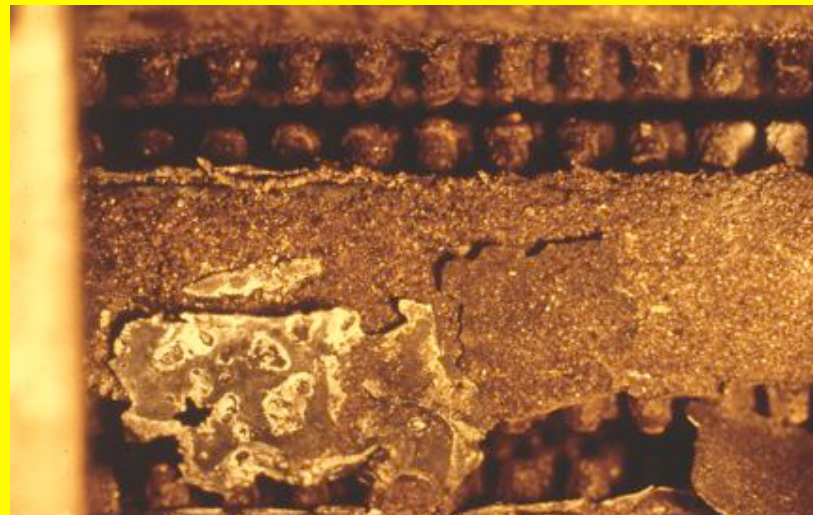




# Why Low Sulfur?

- About 99% of the burned sulfur becomes SO<sub>2</sub> - a PM 2.5 fine particulate pollutant. It irritates lungs, contributes to pulmonary disease, and creates haze.
- A small amount becomes SO<sub>3</sub>. Half of that becomes PM 2.5 and is emitted.
- The rest combines with water in the combustion gasses to create sulfuric acid. At about 220 degrees sulfuric acid starts to condense on heat exchangers and venting systems and turns into iron sulfate scale.
- Switching to ULS eliminates 99.5% of PM 2.5 emissions and eliminates scale deposits totally.

.04% (400 ppm) .18% and 1.08%



# Ultra Low Sulfur BNL-NYSERDA

- 500 ppm leads to very clean heat exchangers, 15 ppm leads to totally clean heat exchangers
- It also improves fuel thermal and storage stability. The hydrodesulfurization process converts some unstable, unsaturated double bonds into saturated bonds that are more stable.
- Sulfur in fuel increases oxidative degradation and the formation of sludge. Sludge has higher sulfur content than the base oil.
- The process that removes sulfur also reduces fuel bound nitrogen, which in turn reduces NO<sub>x</sub> emissions

# German R&D

- IWO: tested 50 ppm in condensing and wall hung units (.25 gph blue flame)- good thermal and storage stability, low lubricity (needs additive), metal dusting shows up in lab tests on some blue flame burners but does not seem to be a problem in the field.
- German sulfur levels- 2008: 1,000 ppm, 2012: 50 ppm. In Germany both 1000 ppm and 50 ppm are available but 50 ppm is not mandatory. This enabled manufacturers to sell very compact, wall-hung oil fired condensing boilers.

# Germany

- Since January 2009 Germany charges a higher tax on standard heating oil (max. 1,000 ppm sulfur) than ultra low sulfur heating oil. Sales of low sulfur heating oil increased.
- 25% of the heating oil demand is now 50 ppm
- German refineries are changing all production to low sulfur heating oil and in some areas of Germany only low sulfur heating oil is available
- In 2008 50% of the oil boilers sold were condensing and near condensing boilers
- In 2009 over 60% of the oil boilers sold were condensing

# Natgas and Heating Oil

- IWO testing shows that at 50 ppm the acidity and chemistry (i.e. sulfate concentration) of flue gas condensate was about the same for natgas and oil.

# Condensing Appliances

- We have two very good condensing units- a boiler and a furnace, however they are expensive because of the cost of the steel required to stand up to the acid
- Ultra low enables relatively low tech, inexpensive, reliable condensing technology that increases our AFUE ratings by 6.5%.
- It will enable us to produce a wide variety of competitively priced appliances with AFUE ratings above 90%

# Wall Hung Boilers

- When a boiler gets compact the heat transfer rates go up – you are getting the same amount of heat transfer in a smaller heat exchanger area.
- However, when you do this the mass transfer rates also go up – specifically the rate at which sulfuric acid gets deposited on the heat exchanger from the flue gas.
- So – if you did not use low sulfur oil – these compact heat exchangers get fouled very quickly.

# Low Firing Rates

- House sealing and insulation have improved dramatically
- As a result most of our equipment is way over sized. We are forced to fire to the shortcomings of the fuel and the chimney, instead of the heating load.
- To remain competitive we must have burners that fire reliably at less than half gallon and hour into low mass boilers. To do so we must improve fuel quality. Ultra low sulfur with Bio and a tight specification for the fuel will do that for us. (Diesel Fuel has a tight specification, heating oil needs one as well.)

# New Information

- NORA- Currently 200,000 barrels of US Refinery ULSD a day is being exported (total heating oil US demand 400,000 barrels a day) Undertaking a \$270,000 study with the National Biodiesel Board on ULS Bioheat
- PEI Survey on Accelerated Corrosion Events in ULSD Tanks and Equipment- 2/2010. (ULSD conversion 2006). 58% reported no problems. 42% variety of problems, most common- clogged filters (water was a key factor)
- BNL for NYSERDA- Ongoing field study reports some grooving of pump shaft seals causing seal leaks. Issue is probably lubricity. (Bioheat is a good lubricant)

# Advantages of Ultra Low Sulfur Fuel

- Eliminates scale build-up in heat exchangers caused by condensing on start-up and even during the run-cycle on high efficiency equipment. This reduces efficiency degradation through the heating season
- It reduces service time and therefore cost during the tune-up.
- It increases the life of the heat exchanger and venting components.
- Eliminates SO<sub>x</sub> emissions and fine particulate emissions.
- Better storage and thermal stability of the fuel.
- Enables condensing, wall hung, and more aggressive tune-up standards