

# UTILIMAG<sup>®</sup> 40

## SO<sub>3</sub> Reduction Using Highly-Reactive Magnesium Oxide

### Coal-Fired Unit

A 485 MW coal-fired electrical generating facility conducted a trial using UtiliMag<sup>®</sup> 40 as a back end boiler additive to treat SO<sub>3</sub>. This unit burns 1.5 million tons of 3% sulfur coal annually with an average conversion to SO<sub>3</sub> of 1%. UtiliMag 40 was injected at two points 25 to 30 feet prior to the air heater. Typical gas velocity was 50 feet per second. SO<sub>3</sub> concentration prior to the additive injection site was 13 ppm-v to 14 ppm-v. After treatment with UtiliMag 40, SO<sub>3</sub> concentration was reduced to 5 ppm to 7 ppm. The feed rate of UtiliMag 40 (molecular wt = 40) was 50 - 60 pounds per hour. SO<sub>3</sub> (molecular wt = 80) was generated at a rate of 205 pounds per hour. The resulting UtiliMag 40 additive rate was 50% of stoichiometry. The SO<sub>3</sub> reduction rate was in the 50% to 60% range indicating that all of the MgO was consumed. Air heater ash analysis showed the formation of MgSO<sub>4</sub> as determined by X-ray diffraction.

### Coal-Fired Unit

A 150 MW coal-fired boiler-generator plant tested UtiliMag 40 with back end, dry injection for control of SO<sub>3</sub>/acid conditions in an extended exhaust duct leading to their limestone wet scrubber. UtiliMag 40 was injected into the exhaust duct from the air preheater prior to the electro-static precipitator. Gas samples were taken at the precipitator's outlet and ash samples retrieved from the precipitator. A 1.3:1.0 molar treatment ratio [MgO:SO<sub>3</sub>] resulted in a 27% decrease in SO<sub>3</sub> levels, with exit SO<sub>3</sub> levels dropping from 4.7 ppm-v to 3.4 ppm-v on average. Ash samples were effectively neutralized by the addition of UtiliMag 40 as demonstrated by the average ash pH increasing from 3.7 to 9.5 with MgO treatment.

### Coal-Fired Unit

A 300 MW coal-fired generating facility conducted a test trial using UtiliMag 40 as back end boiler additive to treat back end corrosion related to high SO<sub>3</sub> levels. This unit installed a SCR several years ago and has experienced significant back end corrosion. The unit burns ~ 0.9 % S coal and baseline gas samples at the ESP inlet indicate SO<sub>3</sub> levels averaging 39 ppm-v.

UtiliMag 40 was pneumatically injected into the system after the SCR and before the air heater. Molar treatment rates of MgO at 0.9, 1.1, and 1.4 to 1 (MgO to SO<sub>3</sub>) reduced SO<sub>3</sub> levels at the ESP by 55%, 60%, and 65%, respectively. Reducing the backend SO<sub>3</sub> levels from 39 ppm-v to 15 ppm-v effectively reduced the acid dew point by ~15 degrees (300°F to 285°F). Operating with lower exit gas temperatures (340°F reduced to 310°F) was possible as a result of this reduction.

### Oil-Fired Unit

A 585 MW oil-fired unit was tested at full load with UtiliMag 40 injection on the back end for SO<sub>3</sub> and opacity control. This plant typically burns oil containing 0.9% sulfur. The goal of this trial was the reduction of visible opacity attributed to SO<sub>3</sub>. UtiliMag 40 was pneumatically conveyed and injected into the exhaust duct from the air preheater prior to entering the electrostatic precipitator. Operating with the SCR on line, SO<sub>3</sub> levels

averaged 18 ppm-v at the injection point (post SCR) and 6.8 ppm-v at the stack with initial visual opacity at 15+%. Injection of UtiliMag 40 was tested at 0.5, 1.0, and 1.5 to 1 molar ratios [MgO:SO<sub>3</sub>]. Opacity was successfully reduced from +15% prior to injection to ~10%, +5%, and less than 5% at the respective treatment rates. SO<sub>3</sub> levels at the stack also dropped accordingly. Greater than 90% reduction in SO<sub>3</sub> levels at the stack was achieved with near zero opacity. The following table summarizes test results with the SCR on line with and without MgO injection:

<b>Molar Treatment – MgO : SO<sub>3</sub></b>	<b>Baseline</b>	<b>0.5 : 1.0</b>	<b>1.0 : 1.0</b>	<b>1.5 : 1.0</b>
SO <sub>3</sub> (ppm-v) Average	6.8	1.4	3.6	0.6
Opacity (%)	+15%	~ 10 %	+5%	< 5 %

To learn more about UtiliMag® 40 for SO<sub>3</sub> removal, please contact Martin Marietta today.

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