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Carmeuse Lime Case Study

Location: East Kentucky Power H.L. Spurlock Station, Maysville, Kentucky

Situation: Use of High Magnesium Limestone in a Limestone Forced Oxidation Scrubber

High magnesium limestone proves to be a cost-effective solution with optimum SO_2 removal in LSFO scrubber.

The Problem: Faced with the option to purchase limestone for four new retrofit limestone scrubbers--two circulating fluidized bed boilers and two limestone forced oxidation scrubbers (LSFO)--East Kentucky Power H.L. Spurlock Station had to consider limestone cost and delivery charges carefully from all suppliers. H.L. Spurlock desired a limestone with low cost that could scrub Illinois Basin Coal effectively. To further complicate the decision, circulating fluidized bed (CFB) boilers require a larger stone size than LSFO scrubbers and can also tolerate a lower purity stone.

Carmeuse's Maysville mine is located in Maysville, Kentucky, and limestone from Maysville has a composition of 88% calcium carbonate ($CaCO_3$) and 8% magnesium carbonate ($MgCO_3$). Since Maysville limestone had acceptable purity and size for CFB boilers, H.L. Spurlock initially decided to utilize Maysville limestone in the CFB boilers and utilize another source of limestone in the LSFO scrubbers. However, H.L. Spurlock soon encountered material handling difficulties that forced them to try the Maysville limestone in the LSFO unit.

Limestone with greater than 3.5% $MgCO_3$ can be used in LSFO scrubbers to effectively remove SO_2.

The Solution: H.L. Spurlock has made the decision to try mostly Carmeuse's Maysville limestone in the LSFO scrubbers and another source of stone in the CFB boilers.

H.L. Spurlock had the flexibility to do this because byproduct gypsum is land filled. It is worth noting that high magnesium limestone is typically not specified for use in LSFO scrubbers.


Photo courtesy of
East Kentucky Power H.L. Spurlock Station

The high magnesium carbonate chemistry of the limestone produced by Carmeuse's Maysville Operation allows East Kentucky Power H.L. Spurlock (above) to use low cost Illinois Basin Coal.

NATURAL SOLUTIONS

The Results: What H.L. Spurlock found was impressive– Maysville limestone at times was capable of achieving 99.3% removal of SO_2 while also eliminating the material handling issues.

% SO_2 Removal
(Average from 1-1-2009 thru 12-31-09)

Unit 1	98.0%
Unit 2	97.9%

Average of 3 measurements taken in October 2009, January 2010, and April 2010

Alkali:S Stoichiometry (Ca+Mg:S)	1.065
Calcium Carbonate Utilization	93.3%
Magnesium Carbonate Utilization	74.0%
Gypsum Purity	90.4%

H.L. Spurlock has burned Illinois Basin Coal since the decision was made to use Carmeuse's high magnesium limestone in October 2008.

Limestone as specified today for SO_2 scrubbing is typically limited to 3.5% $MgCO_3$. However, H.L. Spurlock's use of Maysville limestone in their LSFO scrubbers is proof that limestone with greater than 3.5% $MgCO_3$ can be used in LSFO scrubbers to effectively remove SO_2.

Carmeuse has done extensive testing to quantify the reactivity of its limestone used for Flue Gas Desulfurization, including magnesium reactivity testing and X-Ray Diffraction analyses on Maysville limestone. Carmeuse has discovered that the magnesium carbonate in Maysville limestone is more reactive than a typical

dolomitic limestone and is released into scrubber liquor as calcium carbonate dissolves. Supporting this, Carmeuse has studied its limestone using the EPRI B7 Limestone Reactivity Test and found that the magnesium carbonate in Maysville limestone currently is on average twice as reactive as other limestone sold to FGD markets. Carmeuse has taken samples from around H.L. Spurlock's LSFO scrubbers to quantify the solubility of magnesium in typical operating scrubber liquor. It is understood that magnesium will exit a scrubber in the purge stream because of its solubility. Although H.L. Spurlock purges for chlorides, quite often because of the use of Illinois Basin Coal, under typical operating conditions there is still a very high quantity of magnesium in solution. This is because magnesium also enters the scrubber through washing of a Wet Electrostatic Precipitator (WESP) with commercial magnesium hydroxide. When magnesium is present in scrubber liquor, it takes precedence over calcium to pair with dissolved chlorides. The pairing of magnesium with chloride makes calcium more available in solution to react with SO_2. Maysville limestone provides benefits that high purity calcium carbonate limestones can not provide in association with Illinois Basin Coal. It is the high magnesium carbonate chemistry of Maysville stone that has allowed H.L. Spurlock to use low cost Illinois Basin Coal and exceed scrubber requirements.

Conclusion: H.L. Spurlock plans to continue to use highly reactive magnesium carbonate Maysville limestone.

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For additional information about Carmeuse lime products and lime related technology call us toll free at: 866-243-0965 or 866-780-0974

Carmeuse Lime & Stone
11 Stanwix Street, 11th Floor
Pittsburgh, PA 15222

Phone: 866-780-0974
Fax: 412-995-5515
E-mail: salesinfo@carmeusena.com
Internet: www.carmeusena.com