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Correlation Between Slaking Water Temperature and Lime Consumption In Flue Gas Desulphurization

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There are several factors that affect lime consumption in semi-dry FGD. To list a few:

incoming slaking water temperature;

the lime feed rate as a percentage of maximum capacity of the slaker;

quality of quicklime such as:

- soft or hard burned,
- fresh lime or air slaked lime,
- percentage of CaO available;
- quality of slaking water.

It should be noted that the factor that affects the quality of slaked lime the most is the temperature at which slaking takes place, not necessarily the temperature of the incoming water.

As a general rule, the higher the slaking temperature, the finer the particle size of hydrate. The finer the hydrate particles, the more surface area available to react with gas thus a more efficient process. However, from a practical point, there is an optimum slaking temperature from the point of operation and safety to operating personnel. In practice, a temperature range between 175°F to 185°F is an optimum slaking temperature.

The energy required to bring the slurry temperature to let's say 180°F must come from either an exothermic reaction of lime and water or from an external source such as a water heater.

In slurry slakers that have insulated bodies to reduce heat loss, using a high reactive lime that produces about 460 BTU's per pound, you can achieve 180°F slaking temperature with incoming water temperature of 60°F, as long as the slaker feed rate is about 60% of its maximum rated capacity. If the slaker is run at a low feed rate, let's say 20% to 30% capacity, and we desire a slaking temperature of 180°F, there is not enough BTU's in the lime to compensate for the heat losses and bring the slurry temperature to 180°F. In this case, the additional BTU's required must come from the slaking water. To determine what

the incoming water temperature should be, in this case, requires a heat balance calculation, taking into account water volume, lime volume, pounds of lime fed, slaker heat losses through the slaker walls, and heat losses due to steam removal by D & V systems.

In any case, my experience shows that except for rare extreme cases, heated slaking water of 85°F would be adequate in most cases. However, it should be noted that if the slaker is run at over 50% rated capacity with 85°F slaking water, the percentage of $Ca(OH)_2$ solids in the slurry would be much lower than 20% solid.

Hard burned limes generally produce less BTU's per pound of lime versus soft burned limes, therefore, may require higher temperature slaking water even at high slaker feed rate. This would result in an increase of solids in the slurry, which may impede the flow of slurry out of the slaker.

Powdery air slaked lime will not generate much heat during slaking and using hot water to increase slurry temperature will not help, since the hydrate particles are already very large, and have a very small surface area.

Limes with high percentage of MgO will not slake well in standard slakers. Dolomatic limes require a temperature of about 200°F and pressure in the slaking vessel to hydrate fully.

The percentage of CaO available has an important impact in overall lime consumption. The CaO available should be at least 85%.