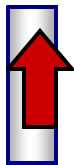


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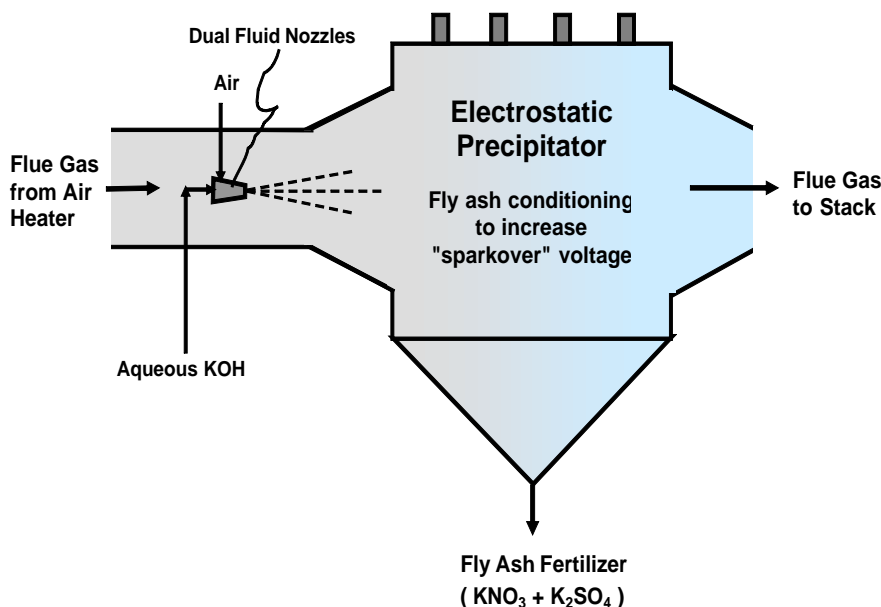


ClearGas™ Dry Scrubber

**SO₂, SO₃ and NO_x Removal
ESP Performance Enhancement**

ClearStack Combustion Corporation is developing a dry scrubber called ClearGas™ that uses potassium hydroxide (KOH) to remove sulfur oxides and nitrogen oxides from flue gases. Removal of sulfur trioxide (SO₃) also reduces flue gas opacity. The presence of potassium salts on a downstream electrostatic precipitator (ESP) increases the "spark over" voltage and improves ESP performance even though SO₃, a fly ash conditioning agent, is removed in the process. The process produces a byproduct of salable potassium nitrate-potassium sulfate-fly ash fertilizer. In 2001 ClearStack a US patent was allowed for this technology, U.S. Patent 6,363,869 "Potassium Hydroxide Flue Gas Injection Technique to Reduce Acid Gas Emissions and Improve Electrostatic Precipitator Performance".

Aqueous potassium hydroxide (KOH) is spray dried into the flue gas using in-duct injection or a dry scrubber. The KOH reacts with SO₂ to form K₂SO₄ and reacts with NO and NO₂ to form KNO₃, both salts of which are captured and removed with the flyash from a downstream electrostatic precipitator (ESP) or baghouse. The presence of potassium salts in an ESP, decreases the resistivity and increases the "spark over" voltage to improve particulate removal performance even though SO₃, a fly ash conditioning agent, is removed in the process. The process produces a byproduct of salable potassium nitrate, potassium sulfate-fly ash fertilizer.



Economics show that this dry scrubber technology is a low cost technique to bring coal-fired stokers into environmental compliance. It is less costly than a stoker replacement with a natural gas-fired boiler system or a conversion to coal-fired fluidized bed systems. It will also be evaluated for niche market use on large coal-fired electric utility boilers. It could be applied in combination with low NO_x burners; to meet the regulated 0.15 lb NO_x/10⁶ Btu limit imposed EPA during the ozone season, starting in year 2003 - 2004. A pilot unit has been built (picture at top) and ClearStack plans to test its dry scrubber technique.

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