Demonstration of SBS Injection for Fluid Catalytic Cracking Unit (FCCU) SO3 Control

Texas Council on Environmental Technology (TCET)

Air Pollutant Emission Reduction Technology
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Project Abstract

FCCU's can produce high levels of SO_3 during the regeneration of spent catalyst, and emissions of SO_3 pose both direct and indirect adverse health effects. Due to increasingly stringent environmental regulations, many refiners are considering the application of emission control equipment including Selective Catalytic Reduction (SCR) for NO_x control and wet scrubbing for SO_2 and particulate control. SCR oxidizes a portion of the SO_2 in the exhaust gas to SO_3, adding to the SO_3 already present in the regenerator exhaust gas. Wet scrubbing converts SO_3 to sulfuric acid mist, which is difficult to remove in a wet scrubber and results in a visible and less buoyant plume.

Reducing the concentration of SO_3 in the FCCU exhaust gas would result in a direct improvement in the air quality by reducing particulate emissions and by alleviating the nuisance and persistent opacity associated with a visible plume. However, the SBS process has not yet been demonstrated in an FCCU application, and such a demonstration is key to the commercial acceptance of any emerging technology.

URS Corporation (URS) and it's teaming partners Codan Development (Codan) and Belco Technologies (Belco), are proposing a "Demonstration of SBS Injection for Fluid Catalytic Cracking Unit (FCCU) SO_3 Control". The Sulfite/Bisulfite (SBS) Injection Technology has been successfully commercialized for utility boiler applications, where visible sulfuric acid plumes have resulted from both the application of wet scrubbing and increased SO_3 production associated with selective catalytic reduction (SCR) installations. The objectives of the demonstration are as follows:

- Demonstrate the capability of the SBS process to remove SO_3 and reduce particulate emissions from FCCU exhaust gas streams;
- Utilize the existing wet scrubber blowdown stream as the reagent for SBS injection and quantify any differences in performance with this reagent in comparison to high-purity sodium sulfite/bisulfite;
- Quantify SO_3 and particulate removal rates as a function of the reagent material, the reagent injection rate, and key scrubber operating characteristics such as gas-side pressure drop.
- Utilize EPA standard methods and specialized test methods as necessary for quantifying gas composition upstream and downstream of the wet scrubber, both with and without the SBS process in operation.

To accomplish these objectives, it is proposed that a slipstream of the flue gas upstream of the scrubber be diverted to a pilot unit for treatment. Belco will provide a skid-mounted pilot unit that contains smaller versions of the wet scrubbing and particulate removal equipment they employ on full-scale applications. This equipment, which has been used for demonstrating the effectiveness of their full-scale equipment in previous test programs, contains all of the components necessary for the demonstration. SBS injection equipment will be added to the pilot system. SBS reagent will be obtained from the pilot scrubber blowdown, or alternatively, from the blowdown stream of the existing, full-scale scrubbing system, and injected into the slipstream duct upstream of the pilot scrubber. Measurements of vapor- and liquid phase SO_3/H_2SO_4 and total particulate will be obtained upstream and downstream of the scrubber to quantify process performance. It is anticipated that testing would be performed over a two- to three-week period.