

Novinda Case Study

Novinda Product Shows Efficient Hg Capture in High SO₃ Environment

Introduction

In a recent field trial Novinda Corporation demonstrated efficient and effective mercury capture of mercury from the flue gas at a plant burning Eastern bituminous coal. The trial was conducted at Santee-Cooper's Winyah station Unit 4 in South Carolina. The host unit is equipped with a selective catalytic reactor (SCR) followed by parallel electrostatic precipitators (ESP) and wet flue gas desulfurization (FGD) modules. Novinda's Amended Silicates (AS) mercury reagent was injected to capture mercury from the flue gas before it entered the wet FGD. Tests were run with and without simultaneous injection of hydrated lime. The host unit burns a medium sulfur eastern bituminous coal yielding a concentration of 20 ppm SO₃ at the point of AS injection.

The trial was conducted to show compatibility of Amended Silicates use for mercury control with continued sale of wet FGD gypsum byproduct for wallboard manufacture. The existing Unit 4 wet FGD reduces stack mercury to a level near or below the EPA MATS standard, and injection of Amended Silicates offers the plant a means to *actively* control their mercury emissions to consistently meet the EPA standard. In addition, shifting mercury capture away from the wet FGD and upstream to the ESP reduces the potential for re-emission of elemental mercury from the wet FGD which can result in violations of emissions standards.

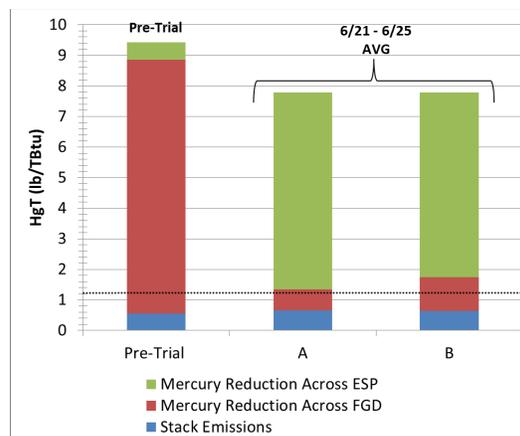
The Results

Parametric tests showed that the most efficient mercury capture occurred with injection at the air heater inlet with simultaneous injection of hydrated lime. A 100-hour test of continuous injection of AS-022 was then run to allow conditions in the wet FGD modules to reach a steady-state.

The injection of Amended Silicates resulted in a dramatic shift in where the mercury was captured from the flue gas stream, with most of the mercury being removed across the ESP and a small fraction captured in the wet FGD to reduce stack mercury emissions to well below the MATS standard.

Test results of the 100-hr continuous injection trial are summarized in Figure 1 below. The graph is color-coded to indicate the device in which the mercury is captured: red shows capture in the wet FGD, and green shows capture in the ESP. Blue segments in the stacked bar show mercury emissions at the unit smokestack, and the height of the bar indicates the total vapor-phase mercury in the flue gas before treatment. The dotted line at 1.2 lb/TBtu shows the EPA MATS Hg emission standard. Stacked bars labeled A and B show data from each of the two parallel flue gas trains in the host unit.

Figure 1. Mercury Capture during Injection of AS-022

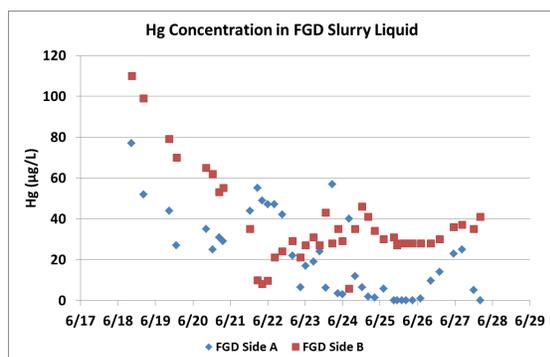


Pre-trial sampling with Method 30(B) traps indicated that almost all of the mercury was being removed in the wet FGD, with less than 10% captured in the ESP (left bar in Figure 1). During injection of Amended Silicates that was dramatically shifted to where over 80% of the mercury was captured in the ESP, and only 10% was captured in the wet FGD. This

allowed the utility to actively control the mercury content of the flue gas entering the wet FGD and to dramatically reduce the mercury content of the scrubber slurry.

Evidence of the reduced mercury content in the scrubber slurry is seen in the graph of Figure 2. The early dates on the x-axis show concentrations in the 80-100 ppb range at start of injection of AS-022. During the extended trial (6/21 to 6/27) there is a dramatic downward trend as mercury is captured in the ESP by the AS-022 and vapor-phase mercury at the inlet to the wet FGD is significantly reduced.

Figure 2. Mercury in FGD Slurry Liquid



Results of the continuous injection trials are summarized in Table 1. In addition to the 100-hr trial where both hydrated lime and AS-022 were injected, a shorter trial was completed where the AS-022 injection rate was reduced, followed by a trial where the AS-022 was injected without hydrated lime. All cases resulted in stack mercury emissions well below the MATS standard, even at the low AS-022 injection rate and without lime.

Table 1. Summary of Trial Results

Case	SCR Outlet	ESP Removal	WFGD Removal	Stack Emission
Pre-Trial Characterization (Method 30B)	9.42	0.56	8.31	0.55
Baseline: No Injection	8.21	3.30	3.66	1.26
AS-022 @ 400 lb/hr Hydrated Lime @ 500 lb/hr	8.70	7.13	1.08	0.49
AS-022 @ 220 lb/hr Hydrated Lime @ 500 lb/hr	8.99	6.75	1.29	0.95
AS-022 @ 220 lb/hr Hydrated Lime Off	9.04	5.79	2.51	0.74

Note: All Hg Concentrations in lb/TBtu
Green Indicates Hg level below MATS limit of 1.2 lb/TBtu

The Details

The Amended Silicates AS-022 reagent and hydrated lime were both injected via temporary gravimetric feed systems installed for the trial. Hydrated lime was injected upstream of the Amended Silicates above the air heater. Injection of AS-022 was evaluated at two locations- at the inlet to the air heater and just after the outlet of the air heater, upstream of the ESPs. Short-term parametric trials were completed to determine an optimum performance configuration for use in longer-term trials to characterize the impact of Novinda's product on gypsum byproduct of the wet FGD.

In addition, Continuous Emissions Monitors (CEMs) were installed to collect measurements of mercury concentrations at multiple locations throughout the flue gas flow path. These were positioned to allow determination of the mercury capture across the ESPs and across the wet FGD modules in the host unit. Thus the direct effect of Amended Silicates injection on mercury capture in the host unit emissions control devices could be quantified.

Samples were obtained from the wet FGD modules and tested for mercury content using standard EPA methods. Other FGD samples were analyzed to validate continued compatibility of gypsum byproduct for sale to a wallboard manufacturer.

Conclusions

- Throughout the extended trial period for AS-022 stack Hg emissions were maintained below MATS;
- Injection of AS-022 resulted in substantial capture of mercury across the ESP, upstream of the wet FGD;
- AS-022 efficiently captured Hg across the ESP in a flue gas with 20 ppm SO₃;
- Even at a lower injection rate and without lime use, AS-022 injection met MATS;
- Wet FGD byproduct gypsum quality was maintained to allow sale for use in wallboard throughout the trial.