

## Novinda Case Study

### Novinda AS-HgX Shows Superior Hg Capture in Dry-Scrubbing Environment

#### **Introduction**

In numerous field trials over the past two years Novinda Corporation has demonstrated efficient and effective mercury capture from flue gas at dry-scrubbed plants burning PRB coal. These trials were conducted at plants equipped with both Spray Dryer Absorbers (SDAs) and Circulating Dry Scrubbers (CDSs). Some units had selective catalytic reactors for NO<sub>x</sub> control. Particulates were captured either in fabric filters or electrostatic precipitators. Novinda's Amended Silicates AS-HgX was injected upstream of the dry scrubber device to capture mercury from the flue gas. The AS-HgX was removed in a downstream particulate control device and subsequently recycled along with the scrubber solids and fly ash.

Trials at two plants operated by Black Hills Power are reported here as representative of performance in dry-scrubbed PRB coal-fired generation units. In both units the AS-HgX was injected using existing PAC equipment. One unit was fitted with an SDA and the second employed a CDS for SO<sub>2</sub> capture. Both stacks were equipped with mercury CEMs to measure vapor-phase mercury emissions. Both units were base-loaded during the trial periods included here.

#### **The Results**

Novinda conducted two trials at Wygen 2 to compare the performance of successive generations of Amended Silicates. Wygen 2 is a 100 MW unit that features a selective catalytic reactor (SCR) for NO<sub>x</sub> control, spray dryer absorber (SDA) to capture SO<sub>2</sub>, and pulse-jet baghouse for particulate collection. The unit is also equipped with a sorbent injection system to add a mercury control reagent to the flue gas downstream of the air heater and upstream of the SDA via four injection lances. The unit is also fitted with a

mercury CEMS at the stack that is operated and maintained by plant personnel.

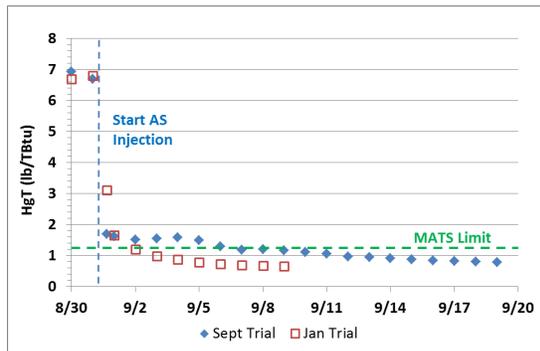
The objectives of the trials on Wygen 2 were twofold: 1) to determine an injection rate that provided sufficient mercury capture to meet the EPA MATS emissions limit, and 2) to compare the performance of the commercial AS-022 material to the second generation Amended Silicates product known as AS-HgX. The trial of AS-022 product was conducted in September of 2012 and the follow-on trial of AS-HgX was completed in early 2013.

Results from the two test series at Wygen 2 are plotted in Figure 1 below. The graph presents stack mercury measurements as a cumulative daily average value. That is, 24 hours of CEMs data is averaged for each operating day and used to compute a cumulative average by adding the daily averages from the start of injection and dividing by the number of days accumulated for each data point. The graph is marked with a dotted horizontal line to indicate the 2012 EPA MATS standard. The uncontrolled stack mercury emissions for this plant are seen to be less than 7 lb/TBTU. When injection of Amended Silicates is started, the daily average drops quickly and dramatically to reflect the mercury capture seen across the SDA and pulse-jet baghouse.

Figure 1 documents the performance of two different Amended Silicates products, AS-022 (the original product) and AS-HgX, the second-generation product manufactured in the 20-million lb per year facility. The AS-022 was injected at a rate of 2.2 lb/mmcf, while the AS-HgX was injected at a lower rate of 1.3 lb/mmcf. A short interruption in the feed of AS-022 is reflected in the slight rise in the cumulative average around September 4<sup>th</sup>. Feed was re-established, and the ability of the Novinda product to meet and exceed the mercury capture requirement of the EPA MATS standard on a consistent basis was

demonstrated for the following two weeks. Data collected during injection of AS-HgX is shown in comparison via the open squares of the plot. The superior performance of the AS-HgX at a substantially lower injection rate is seen in the data. After 10 days of injection the cumulative average is around 0.7 lb/TBTU, well below the EPA MATS mercury emissions standard.

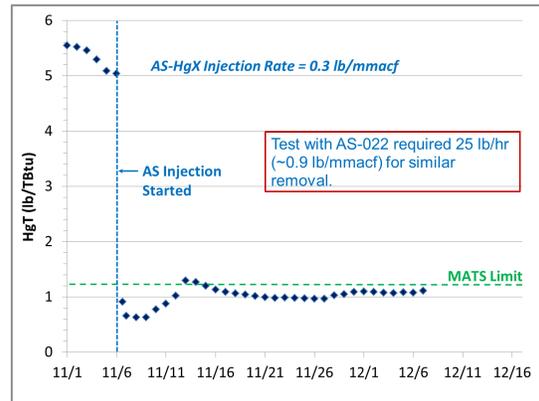
**Figure 1. Mercury Capture during Injection of Amended Silicates Products**



Success in meeting the EPA MATS standard at low Amended Silicates injection rates for Wygen 2 resulted in a decision by Black Hills Energy to conduct a 30-day trial in their Neil Simpson 2 unit. Amended Silicates HgX was injected downstream of the air heater and upstream of the circulating dry scrubber installed for SO<sub>2</sub> control. Results from this trial are presented in Figure 2. Data is again plotted as a cumulative daily average computed as described earlier, and the EPA MATS standard is indicated by the dotted line on the graph. Due to the very low injection rate for AS-HgX at which MATS was met in this unit, the gravimetric feeder was operated in a batch mode for the final 70% of the trial. The initial injection rate was reduced several times early in the trial, with adjustments resulting in a short-term loss of feed around the end of the first week. Once the batch mode operation was refined, injection on a long-term basis was consistently maintained, and response at the stack showed mercury emissions below MATS for the final three weeks. This low injection rate matched the best performance of Amended Silicates seen to date in field trials. The extended contact time and intimate interaction between the

Novinda material and the flue gas in the fluidized bed of the circulating dry scrubber is believed to contribute to the high efficiency of mercury capture by the AS-HgX in this unit.

**Figure 2. Mercury in FGD Slurry Liquid**



## Conclusions

- In extensive testing of Amended Silicates AS-HgX in dry-scrubbed units, stack mercury was maintained below the 2012 EPA MATS standard;
- Direct comparison of AS-022 with AS-HgX showed significant improvement in performance of the next-generation Novinda product as reflected in reduced injection rates required to maintain MATS compliance;
- Novinda AS-HgX injection rates were tuned to consistently meet MATS while minimizing reagent consumption;
- The Novinda product was effective and efficient in two different dry-scrubber technologies: Spray Dryer Absorber and Circulating Dry Scrubbers;
- Novinda's AS-HgX is available in commercial quantities for long-term contract deliveries to offer utilities a cost-effective solution to EPA MATS mercury compliance.