Summary

Demonstration of On Line Coal Loadings and Particle Size Determinations *

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INTRODUCTION

Implementation of low-NO_x burners to comply with the 1990 Clean Air Act Amendments has tended to increase LOI from utility boilers. This increased LOI has been further exacerbated by coal switching by many utilities. A key aspect of maintaining or decreasing LOI centers on the performance of the coal pulverizers. There are two aspects to pulverizer performance. First is the grinding performance in terms of particle size distribution. Second is the performance of the entire fuel delivery system in terms of equally balanced coal feedrates to each burner.

Traditionally, the coal loadings in each pipe and the accompanying particle size distribution are determined by extracting a sample from the individual coal pipes and sieving the collected sample. There are a number of devices and procedures currently used to extract the samples, including the ASME technique, the RotorProbe device and SMG-10. Common to all of these approaches is the determination of the particle size distribution by sieving the collected sample. While sieving the samples is straightforward, it is relatively time consuming, involving a drying step prior to sieving. This basically means that the particle size results cannot be obtained in a timely manner, which in turn impacts the ability to set pulverizer classifier settings. During the current study, a test program was conducted to

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assess the feasibility of using a laser-based particle size instrument to obtain on-line particle size distribution from the pulverizer. This was accomplished by integrating a RotorProbe coal sampler with Insitec's laser diffraction particle size analyzer.

The RotorProbe is an extractive coal sampler consisting of a rotating head with four sample holes, a control box, and a cyclone that collects the sample. Coal samples are obtained from the entire cross section of the pipe as the RotorProbe head is indexed through 360 degrees. The coal sample is collected with the cyclone and the particle size distribution determined by sieving.

Insitec's Ensemble Particle Concentration and Size (EPCS) monitor was used to continuously analyze particle size and concentration along with the RotorProbe. The EPCS system measures light extinction and near-forward angular scattering intensity as a function of particle size. The intensity of the unscattered incident beam is also measured for calculation of particle concentration. To provide a direct comparison, the EPCS instrument was located between the RotorProbe and the RotorProbe cyclone.

RESULTS

Measurements were made in one coal pipe from an ABB/CE mill that had the capability to adjust the classifier setting while on-line. Tests were conducted at two classifier settings. It should be noted that the RotorProbe/cyclone determines the coal loadings directly on a mass basis. However, the EPCS laser diffraction instrument measures the volume fraction of coal particles in the air stream. The mass loadings collected by the RotorProbe and the volume fractions measured with the optical EPCS instrument can be related quantitatively using the bulk density of the pulverized coal. For this work, a bulk density of 1.35 gm/cm^3 was used to reduce the EPCS data.

Table 1 summarizes the loadings measured by the two techniques. As can be seen in Table 1, the coal loadings measured with the two techniques are in good agreement. Even if the specific gravity is not precisely known and there is some difference in the absolute values, the EPCS measured the same change in loading with a change in classifier setting as the RotorProbe. This is an important observation in that the coal pipe measurements are made in order to balance coal flows pipe-to-pipe. As such, it is only necessary to know the coal loadings on a relative basis in order to balance the burner-to-burner coal flows.

Table 1
Coal Loadings

Classifier Setting	RotorProbe lb air/lb coal	EPCS lb air/lb coal
1	2.11	2.27
2	2.79	2.74

One of the primary advantages of the laser-based EPCS instrument is the ability to obtain on-line, real time particle size distributions. This greatly facilitates the ability to make classifier adjustments to pulverizers which have on-line adjustment capability. During the current test program, on-line EPCS particle size measurements were made along with collection of a pulverized coal sample with the RotorProbe instrument. The collected coal sample was then dried and sieved per ASTM D 197. In addition to the on-line EPCS measurements, the EPCS instrument was used to measure the particle size, off-line, of the sample collected in the cyclone and dried for sieving.

Figure 1 compares the collected, dried and sieved samples to the on-line particle size measurements with the EPCS. There is very little difference in these particle size distributions although the on-line measurements show a slightly coarser particle size, particularly in the larger sizes. To determine what role the drying step played prior to sieving, The EPCS was used to measure the collected sample both before and after drying. For these measurements the sample was entrained through an eductor into an air stream. The results were virtually identical to those shown in Figure 1. This indicates that the drying step results in some small amount of deagglomeration.

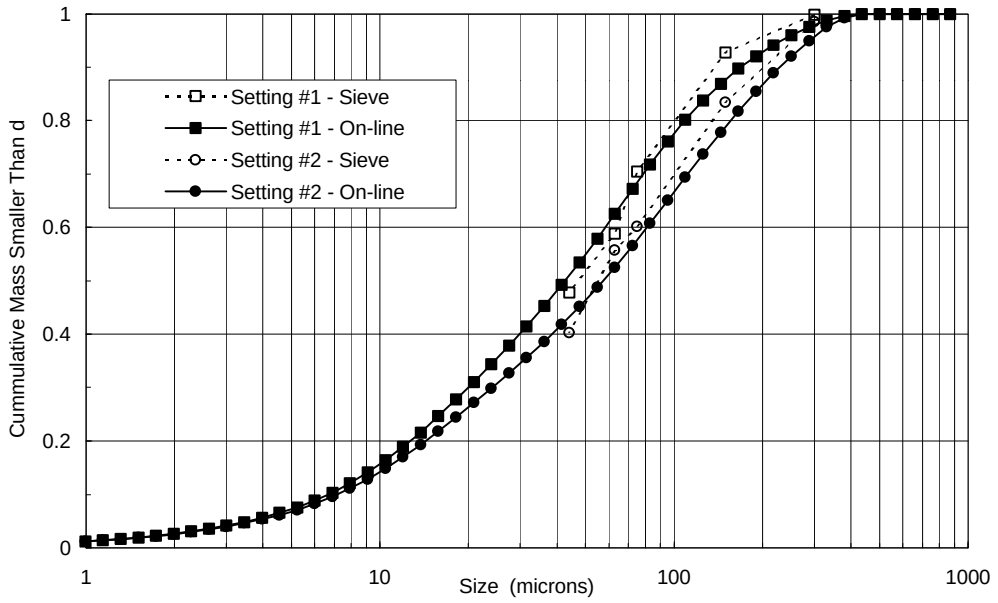

Figure 1. Comparison of Particle Size Distribution Measurements of Sieved vs. On-line EPCS

CONCLUSION

Overall, the EPCS provides a good approach to making on-line coal loading and particle size measurements from coal pipes. There was very little difference between the EPCS

measurements on-line and the collected and sieved samples. The EPCS was able to determine, on-line, difference in both loading and size due to a change in classifier setting.