

**INTER OFFICE CORRESPONDENCE**

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FROM: A.Kravets

CC:

SUBJECT: Eastern Instruments Flow meters.

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Gentlemen:

The following presents a summary of the CETF experience with the Eastern Instruments' (EI) flow meter.

In April of 2000 H.Wong has initiated a request for the field test of the Eastern Instruments' (EI) flow meter at CETF. Three locations were selected for the installation of these flow meters:

1. Secondary Air Duct (52"x52")
2. Flue Gas duct after Air Heater (41.5" DIA Before Baghouse)
3. Low-Volatile Burners vent lines (4" DIA), later replaced with probes for (6" DIA) vent lines

The results of testing indicated a reliable flow meters performance including flows with the essential solid loading were typical DP based flow meters could not be used. Most of the flow meters are presently in service excluding vent line meters removed due to changes in the CETF configuration. One of the former 4" flow meter was relocated from the vent line into new transport airline for the upgraded indirect system.

EI's sensor works in two positions in respect to a flow direction. The impulse-line for the total head either may face flow or be installed in the reversed position. For the latter one, a minor variation of the typical flow rate equation is required to set a proper DP vs. flow relationship. Per EI's recommendations the proper flow vs. DP relationships were configured in DCS and data was continuously recorded by the data acquisition system.

1. Multi-sensor probe consisting of four elements per EI design were installed in the secondary air duct (52"x52") upstream of the Air Monitor (AMC) sensors. EI sensors have an equal number and identical orientation as AMC sensors. The deviation between flow measurements obtained by AMC and EI were close while EI instrument indicated rates about 3% higher than AMC. Verification based on material balance of combustion offered somewhat better results when EI instrument data was used for material balances closure.
2. Three reversed flow sensors (60 degree apart, crossing at the duct center) were installed in the round duct downstream of the last section of the air heater. The intent was to replace the information provided by a so-called S-flow sensor or S-probe. S-probe was installed in the stack at the request of the local EPA authority to report the total flue gas flow to supplement in reporting hazardous emissions. Despite the

calibration of the S-probe, the readings it provides constantly overstate the flue gas flow rates, which can not be supported by the capabilities of the CETF equipment. After installation of the EI's sensors, the erroneous information was corrected. The sensors were made of anodized aluminum and provide a repeatable and consistent information (based on equipment installed and material balances).

At this time, these sensors remain in service for about 20 month. For the duration of their operation, the average and maximum ash content in the fuel was 15% and 38% respectively.

Unfortunately, from December 12, 2001 a few critical operational conditions have occurred. A water leakage in gas-cooler section was noticed in the middle of December 2001. On January 8, 2002 the loss of water pump resulted in an essential overheat of the flue gas passages. Since the last incident the flow meter provides output occasionally and thus requires some maintenance. The nature of output loss will be reported later upon completion of the maintenance schedule in the fourth week of January 2002.

3. A single, reversed probe was installed into each 4"DIA vent line of the low volatile burners. The probe was anodized and remained in service for about one month until the vent line size was increased up to 6"DIA. No wear was noticed after one month of the single probe operation, however, an occasional dust settlement inside of the probe was observed.

Two reversed sensors (90 deg. apart) were used for each the 6"DIA vent lines. They also employed an enhanced purge rate. The flow meter provided critical information on the vent flow, which is required for a proper operation of the LV burners and their performance optimization.

The probes remained in service for about 6 month until the LV burners dismantling. No essential wear was noticed. According to the iso-kinetic sampling, the Air-to-Coal ratio in the vent lines was ranging between 10 and 13.

#### Recommendations:

Based on the CETF experience, the Eastern Instrument flow meters can be recommended for:

- a) Secondary air flow measurements especially with the regenerative air heaters were particulate loading causes major faulting
- b) Any diluted two phase flow (solid/gas)
- c) Applicability of the EI flow meters design for balancing of the primary air and coal mixture after the mill needs to be tested to verify their performance and longevity.

Regards.