Reducing the Uncertainty of a

High Pressure, High Flowrate Calibration Facility

**T.M. Kegel, W.R. Johansen**

*Colorado Engineering Experiment Station, Inc. (CEESI)*

*54043 WCR 37, Nunn, Colorado, USA*

*E-mail: tkegel@ceesi.com*

For seventeen years CEESI has operated a high pressure, high flowrate, natural gas calibration facility near Gardner Iowa. In addition to periodic re-calibration of the turbine meter standards two programs are in place to monitor consistent system operation. The first program (SPC) involves obtaining data from multiple check meters; these data are obtained in conjunction with each calibration. The second program (TST) involves indirectly comparing standards using a transfer meter.

An effort is underway to reduce the uncertainty from the current 0.23% (95%CL); the goal is a value less than 0.20%. Three terms dominate the uncertainty: a systematic effect resulting from traceability, short term random effects and long term random effects. The random effects are quantified based on both SPC and TST programs. The SPC data monitor the uncertainty contributed by parallel combinations of standards, as well as single meters. The TST data provide tracking of individual meters. Control charts allow for independently quantifying long and short term effects.

Critical flow Venturies (CFV) have been traditionally applied to re-establish traceability, the low uncertainty is well suited to the task. The Iowa facility pressure cannot be controlled; a large number of CFVs have therefore been required to cover the flowrate range. The calibration artifact was large and expensive to ship; the calibration process was required complete shutdown of the facility. In addition the required density determination added uncertainty. A new approach has been adopted based on two turbine meters installed in parallel. The artifact is much smaller and can be installed and operated more efficiently within the commercial calibration schedule. The density determination, using air instead of natural gas, contributes less uncertainty.

This paper describes the uncertainty reduction contributed by: 1) turbine mete transfer standard, 2) SPC program, 3) TST program.