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Decade-Long Performance of a Single Ultrasonic Flow Meter at CEESI Iowa

Jason Johansen, CEESI

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Agenda

- Introduction
- Meter and Installation
- Operating Envelope
- Data Analysis
- Discussion and Takeaways

Motivation and A Unique Dataset

- SPC meter with 10 years of data
- In operation with no calibration or adjustment
- Operated in series with CEESI Iowa working standards
- In constant comparison with multiple low uncertainty CEESI Iowa working standards

What is SPC?

- **Statistical Process Control**
  - Uses statistical methods to monitor and control a process
- **Detects drift or changes before they impact results**
- **Ensures reliable, accurate calibrations and ISO 17025 compliance**
- **Monitors process behavior over time (not a reference used in calibration).**

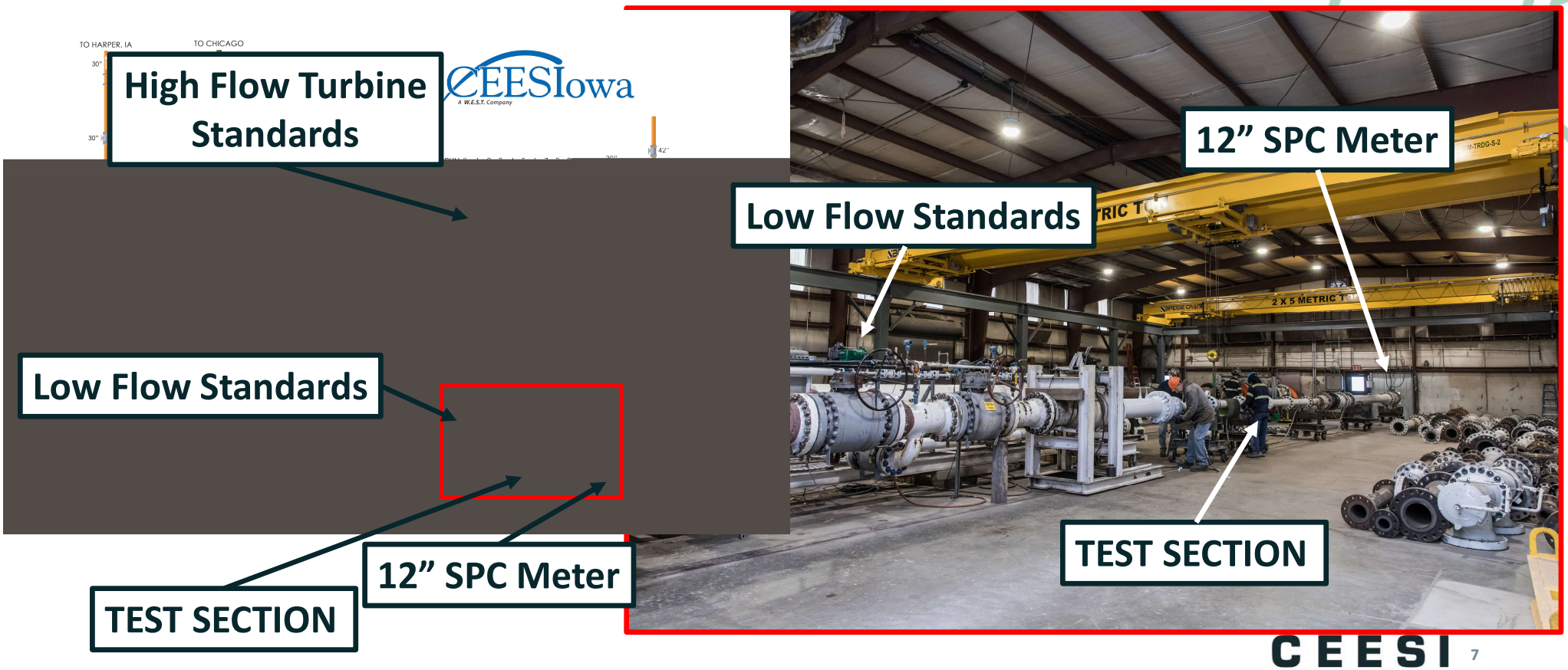
Methodology

- **15,000 datafiles for this meter**
- **Selected based on the following criteria**
  - Velocity range 2 ft/s to 90+ ft/s
  - More than 12 data points per file
  - One data file per month
- **112 datafiles selected**
- **2700 data points analyzed**

Meter Overview

- 12” ultrasonic meter
- Originally a 4+4 meter, transducers have been swapped and electronics upgraded to make it a true 8-path meter
- Inspected regularly, diagnostics monitored
- Meter identity anonymized to focus on methodology, not product

Installation



Operating Envelope

	Max	Min	Average	
Volume Flow	456077	6946	128065	ACFH
Velocity	163	2	46	ft/s
Reynolds Number	8.34E+07	9.64E+05	2.07E+07	-
Temperature	80	62	71	°F
Pressure	1262	790	1029	PSIA
Density	5.26	2.91	3.97	lb/cuft
Methane	90.77	78.11	84.07	%
Ethane	17.18	6.71	11.95	%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Results Discussion

- Mean error remained within +/-0.2% across the full 8 year period
- Annual drift averaged approximately 0.017% per year, well within typical performance expectations
- No significant step changes were observed during the entire study period
- Consistent speed of sound performance over entire period
- Varying temperature, pressure, density, and gas composition showed minimal impact on meter error, with overall strong performance across operating conditions and only slight sensitivity observed at lower velocities.

Takeaways

- SPC monitoring provides continuous confidence in lab stability, reflecting strong agreement across multiple reference meters
- Stability without a reference is just consistency, calibration is what proves its accuracy
- Calibration is essential for establishing traceability and defensible validation for custody transfer and regulatory purposes
- Results are specific to this installation and operating environment

Questions?

Jason Johansen
jjohansen@ceesi.com