



Thomas B. Morrow, Ph.D., P.E.
Flow Measurement Specialist

Education: B. S, M. S. and Ph.D., Mechanical Engineering, Stanford University

Expertise:

Flow meter installation effects
Experimental uncertainty analysis
Calibration and traceability

Natural gas properties
Experimental data analysis
Measurement training

Experience:

Flow Measurement Specialist, The Letton-Hall Group – January 2010 to Present.

- Providing flow measurement consulting services including: flow measurement and meter station assessment, measurement standards/practices development, technology evaluation, system balance analysis, and training program development.

Adjunct Professor, University of Texas at San Antonio, Civil and Environmental Engineering Dept., San Antonio, TX - 9/2005 to 01/2010.

- Taught undergraduate courses in thermodynamics, dynamics, mechanics of solids, civil engineering systems, and engineering mathematics.

Technical Advisor, Southwest Research Institute (SwRI), San Antonio, TX – 10/2002 to 4/2005

- Research task leader for ultrasonic meter, orifice meter, and liquid pipeline research tasks in the Gas Research Institute (GRI) Metering Research Facility (MRF) at SwRI.

Institute Engineer, Staff Engineer and Sr. Research Engineer, Southwest Research Institute (SwRI), San Antonio, Texas – 10/1977 to 10/2000.

- Principal investigator of the orifice meter installation effects experimental research program in the GRI MRF at SwRI.
- Manager/principal investigator of a project to develop a natural gas energy meter for GRI and the U.S. Dept. of Energy.
- Developed and validated a transient, compressible gas dynamics computer code to evaluate the sensitivity of leak detection methods during blow-down of a natural gas pipeline.
- Performed research to improve the efficiency of oil/water separation equipment.
- Developed/validated computer models for predicting dispersion of heavier-than-air toxic or flammable cargo vapors released from tanker ships and barges during cargo transfer.
- Developed a computer code for predicting downwind flammable boundaries for the vapor cloud that may result from an LPG pipeline rupture.
- Performed scale model experiments and developed an empirical correlation to quantify the effect of tank internal structure on the ventilation of tanker-ship cargo tanks containing an oxygen deficient/toxic gas atmosphere.

Licensing and Professional Affiliations:

- Registered Professional Engineer (Texas and Virginia)
- Member, Society of Petroleum Engineers (SPE)
- Member, American Society of Mechanical Engineers (ASME)
- Former Chair, ASME Fluids Engineering Division
- Member, Sigma Xi, Scientific Research Society of America
- Former member, API COGFM MPMS Chapter 14.3, Part 2 Working Group
- Classroom Teacher, Texas State Board for Educator Certification

U. S. Patents:

- **6,604,051**: *System and Method to Determine Thermophysical Properties of a Multi-Component Gas.*
- **6,704,660**: *System and Method to Determine Thermophysical Properties of a Multi-Component Gas at Arbitrary Temperature and Pressure.*
- **6,754,592**: *Indirect Measurement of Nitrogen in a Multi-Component Natural Gas by Heating the Gas.*
- **6,804,610**: *Indirect Measurement of Nitrogen in a Multi-Component Natural Gas by Measuring the Speed of Sound at Two States of the Gas.*
- **6,850,847**: *Device for Determining Thermophysical Properties of a Multi-Component Gas at Arbitrary Temperature and Pressure.*
- **7,010,433**: *Indirect Measurement of Diluents in a Multi-Component Natural Gas.*
- **7,197,403**: *Inferential Determination of Various Properties of a Gas Mixture.*
- **7,398,160**: *Gas Energy Meter for Inferential Determination of Thermophysical Properties of a Gas Mixture at Multiple States of the Gas.*

Honors:

- **ASME**: *Dedicated Service Award, 2000*
- **ISHM**: *Memorial Award (Non-Industry) for Best Paper, 2004*

Representative Publications:

Expansion Factor Tests in a 75 mm (three-inch) Diameter Orifice Meter Tube, **T. B. Morrow**, Paper FEDSM2005-77402, ASME Fluids Engineering Summer Conference, June 2005.

Multi-Path Gas Ultrasonic Flow Meter Performance at Low Velocity, **T. B. Morrow**, Paper FEDSM2005-77403, ASME Fluids Engineering Summer Conference, June 2005.

Minimizing Measurement Errors, **T. B. Morrow**, Pipeline and Gas Technology, Nov./Dec. 2006.

Effects of Abnormal Conditions on the Accuracy of Orifice Measurement, **T. B. Morrow**, 2006 ISHM.

Compact Orifice Meter Station Project, **E. Kelner** and **T. B. Morrow**, 4th International Symposium on Fluid Flow Measurement, June 27-30, 1999, Denver, CO.

Orifice Meter Installation Effects: Effect of Variable Spacer Length Between Two 90 Degree Ells Out-of-Plane, **T. B. Morrow** and **E. Kelner**, Paper 98-OP-038, 1998 AGA Operations Conference, Seattle, WA

Determination of Installation Effects for 100 mm Orifice Meter Using a Sliding Vane Technique, **T. B. Morrow**, J. T. Park and R. J. McKee, Flow Measurement & Instrumentation, Vol. 2, No. 1. 1991.