

Exponent®
Engineering & Scientific Consulting


# Timothy Morse, Ph.D., P.E., CFEI

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## Professional Profile

Dr. Morse is a licensed professional mechanical engineer who specializes in failure analysis, failure prevention, and design risk assessment for thermal and flow processes, products, and equipment. His project experience includes turbines, compressors, engines, generators, valves, heat exchangers, boilers, furnaces, refrigeration systems, piping systems, heat transfer systems, flammable liquids, cryogenic liquids, consumer products, and medical devices.

Dr. Morse's expertise is used in a variety of litigation matters, and he has experience testifying at both trial and international arbitration. Dr. Morse also has experience with intellectual property matters involving mechanical engineering principles, including medical devices, consumer products, and industrial equipment.

Dr. Morse applies his expertise to the investigation and prevention of fires, explosions, floods, and equipment failures. He has conducted fire origin and cause investigations involving electrical appliances, electrical systems, consumer products, heating appliances, and other combustion equipment. Dr. Morse performs testing and analysis of HVAC systems and components, including the analysis of the production and spread of carbon monoxide. Dr. Morse also investigates the origin and cause of motor vehicle fires, including post-collision fires.

Dr. Morse has performed engineering analysis for the oil and gas industry, ranging from offshore oil and gas extraction facilities to retail motor fuel stations. Dr. Morse has investigated flow-induced vibration issues over a wide range of applications, including heat exchanger tube bundles, pipelines, and offshore structures.

Dr. Morse has extensive experience with power generation equipment and facilities, including nuclear power plants, fossil fuel power plants, and renewable energy. He has investigated failures in heat exchangers, generators, compressors, turbines, and boilers. In the renewable energy area, Dr. Morse has investigated wind turbine failures and wind turbine fires.

Prior to joining Exponent, Dr. Morse was a researcher in the Fluid Dynamics Research Laboratories at Cornell University where he conducted research on the wakes of stationary and oscillating structures in a flow and particularly on how flow-induced vibration due to vortex shedding causes fatigue and failure of structures.

## Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Cornell University, 2009

M.S., Mechanical Engineering, Cornell University, 2007

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B.E., Mechanical Engineering, Cooper Union, 2003

National Science Foundation Fellowship, 2004-2008

National Defense Science and Engineering Graduate Fellowship, 2004-2007

Tau Beta Pi Engineering Honor Society, 2002

Pi Tau Sigma Mechanical Engineering Honor Society, 2002

## Licenses and Certifications

Professional Engineer Mechanical, California, #35464

Professional Engineer Mechanical, Florida, #83952

Professional Engineer, Kansas, #PE24740

Professional Engineer Mechanical, Massachusetts, #52419

Professional Engineer Chemical and Mechanical, New Hampshire, #13976

Professional Engineer, New York, #110148

Professional Engineer, Pennsylvania, #PE084735

Professional Engineer, Rhode Island, #PE.0011724

Professional Engineer Mechanical, Vermont, #018.0126189

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

Certified Fire and Explosion Investigator (CFEI)

## Professional Affiliations

American Society of Mechanical Engineers

American Clean Power Association

• Wind Technical Standards Committee Member

National Association of Fire Investigators

National Fire Protection Association

• Alternate Member: NFPA Technical Committee on Vehicular Alternative Fuel Systems (VAF-AAA), responsible for NFPA 52: Vehicular Natural Gas Fuel Systems Code.

• Alternate Member: NFPA Technical Committee on Liquified Petroleum Gases (LPG-AAA), responsible for NFPA 58: Liquified Petroleum Gas Code.

Society of Automotive Engineers

## Publications

Davies WA, Wolf MI, Barry M, O'Hern SC, Morse TL. The Effect of Valve Closure Time on Water Hammer. ASME 2021 International Mechanical Engineering Congress and Exposition. November 2021. Paper No. 71153.

Morse TL, Cundy M, Kytömaa, HK. Vehicle fires resulting from hot surface ignition of grass and leaves. SAE Technical Paper 2017-01-1354. 2017.

Stern MC, O'Hern SC, Morse TL, Bishop J, Kytömaa HK. Fire risks due to unintentionally energized metal structures. Journal of Fire Sciences. 2017; 35(5):415-426.

Ponchaut NF, Morse TL, Bigham GN, Castro J. Degassing dissolved carbon dioxide. Drilling & Exploration World. January 2017; 26(3):77-84.

Ponchaut NF, Morse TL, Bigham GN, Castro J. Degassing Africa's Lake Kivu for population safety and power generation. Scandinavian Oil-Gas Magazine No. 11/12 2016; 44:26-29.

Morse TL, Ponchaut NF, Bigham GN. Plume modeling in Lake Kivu, Rwanda for a gas extraction facility. Offshore Technology Conference. Houston, TX. June 2016.

Morse TL, Kytömaa HK. The effect of turbulence on the rate of evaporation of LNG on water. Journal of Loss Prevention in the Process Industries 2011; 24:791-797.

Morse TL, Williamson CHK. Steady, unsteady, and transient vortex-induced vibration predicted using controlled motion data. Journal of Fluid Mechanics 2010; 649:429-451.

Morse TL, Williamson CHK. Prediction of vortex-induced vibration response by employing controlled motion. Journal of Fluid Mechanics 2009; 634:5-39.

Morse TL, Williamson CHK. Fluid forcing, wake modes, and transitions for a cylinder undergoing controlled oscillations. Journal of Fluids and Structures 2009; 25(4):697-712.

Morse TL, Williamson CHK. The effect of Reynolds number on the critical mass phenomenon in vortex-induced vibration. Physics of Fluids 2009; 21(4):045105.

Morse TL. Investigating phenomena in vortex-induced vibration of a cylinder using controlled vibration. Ph.D. Thesis, Cornell University, 2008.

Morse TL, Govardhan RN, Williamson CHK. The effect of end conditions on the vortex-induced vibration of cylinders. Journal of Fluids and Structures 2008; 24:1227-1239.

Morse TL, Williamson CHK. Understanding mode transitions in vortex-induced vibration using controlled motion. Proceedings, 9th International Conference on Flow-Induced Vibrations (FIV-2008), Prague, Czech Republic, 2008.

Kysar JW, Gan YX, Morse TL, Chen X, Jones ME. High strain gradient plasticity associated with wedge indentation into face-centered cubic single crystals: Geometrically-necessary dislocation densities. Journal of the Mechanics and Physics of Solids 2007; 55(7):1554-1573.

Morse TL, Williamson CHK. Understanding mode transitions in vortex-induced vibration using controlled vibration. Proceedings, 5th Conference on Bluff Body Wakes and Vortex-Induced Vibration (BBVIV-5), Costa do Sauipe, Brazil, 2007.

Morse TL, Williamson CHK. Employing controlled vibrations to predict fluid forces on a cylinder undergoing vortex-induced vibration. Journal of Fluids and Structures 2006; 22:877-884.

Gan YX, Kysar JW, Morse TL. Cylindrical void in a rigid-ideally plastic single crystal II: Experiments and simulations. International Journal of Plasticity 2006; 22(1):39-72.

Morse TL, Williamson CHK. Employing controlled vibrations to predict fluid forces on a freely vibrating cylinder. Proceedings, 4th Conference on Bluff Body Wakes and Vortex-Induced Vibration (BBVIV-4), Santorini, Greece, 2005.

### Presentations and Conference Papers

Morse TL, Wolf MI, Kytömaa HK. Ignition of fuel gas jets from leaks in residential gas piping. International Symposium on Fire Investigation. Orlando, FL, September 2024

Morse TL, Watson H, Buehler C, Kytömaa HK. Ignition due to electrostatic discharge in multi-phase hydrocarbon flows. Mary Kay O'Connor Process Safety Center 2022 International Symposium. College Station, TX, October 2022.

Morse TL, Stern M, Watson H, Buehler C, Kytömaa HK. Experimental evaluation of electrostatic discharge in multi-phase hydrocarbon flows. AIChE Spring Meeting, 18th Global Congress on Process Safety, Houston, TX, April, 2022.

Morse TL, Wolf MI, Davies WA. Residential Fuel Gas Explosions. Oakland County Association of Arson and Fire Investigators, Inc. OCAAFII Quarterly Training. November 2020.

Morse TL, Barry MT. Combining Wind Power with Compressed Air Energy Storage. CleanPower 2020: Stronger Together Virtual Poster Reception. June 2020.

Kytomaa HK, Barry MT, Colella F, Natarajan, S, Lee, K, Morse, TL, Investigating Burn Injuries. AEGIS 2018 Claims Seminar. October 2018.

Morse TL. Wind Turbine Fires and Fire Investigation. Onyx Insight Wind Turbine Technical Symposium. Golden, CO. September 2018.

Morse TL, Colella F, Wolf MI, Barry MT. Space Heater Fires and Fire Investigation. International Symposium on Fire Investigation. Itasca, IL, September 2018.

Morse TL, Sipe JE, Wright SA. Rooftop Solar Fire Investigation. International Symposium on Fire Investigation. Itasca, IL, September 2018.

Morse TL. Plume Modeling in Lake Kivu, Rwanda for a Gas Extraction Facility. Society of Petroleum Engineers (SPE) New York and New England Petroleum Section Invited Lecture Series. Cambridge, MA. November 2017.

Whittlesey R, Morse TL, Morrison A. Analysis of the Relevance of WAF Preparations to Field Mixing Conditions. International Oil Spill Conference. Long Beach, CA. May 2017.

Kane Driscoll SB, Whittlesey R, Hauri J, Kulacki K, Schierz P, Morse T, Morrison A, Yozzo K, McArdle M, Edgington A, Edwards M, Aldea M. The Influence of mixing energy on the concentration and composition of oil in laboratory toxicity tests. Society of Environmental Toxicology and Chemistry. 7th SETAC World Congress. North America 37th Annual Meeting. Orlando, FL, November 2016

Stern MC, O'Hern SC, Morse TL, Bishop J, Kytömaa HK. Fire risks due to unintentionally energized metal structures. Internal Symposium on Fire Investigation, Scottsdale, AZ, October 2016.

Morse TL, Ellison AD, Kytömaa HK. Electrical fault damage to corrugated stainless steel tubing in a house fire. International Symposium on Fire Investigation, University of Maryland, September 2014.

Morse TL, Whittlesey RW. Wind turbine fire origin investigation. International Symposium on Fire Investigation, University of Maryland, September 2014.

Marr KC, Verghese PM, Braff WA, Morse TL. Analysis of arc erosion on thermal switch contacts. International Symposium on Fire Investigation, University of Maryland, September 2014.

Morse TL, Ponchaut NF, Bigham GN. Gas extraction from Lake Kivu: The dynamics of the degassed water plume. World Environmental and Water Resources Congress. Portland, OR. June 2014.

Ellison AD, Morse TL, Kytömaa HK. Lightning related structure fires. International Symposium on Fire Investigation Science and Technology, University of Maryland, October 2012.

Morse TL, Ibarreta AF, Kytömaa HK. Explosions in transformer tanks due to arcing events. AIChE Spring Meeting, 8th Global Congress on Process Safety, Houston, TX, April 2012.

Morse TL, Kytömaa HK. Variations in the evaporation rate of a cryogenic liquid on a water surface. Mary Kay O'Connor Process Safety Center 2010 International Symposium. College Station, TX, October 2010.

Morse TL, Kytömaa HK. The effect of turbulence on the evaporation of cryogenic liquid spills on water. AIChE Spring Meeting, 10th Topical Conference on Natural Gas Utilization, San Antonio, TX, March 2010.

Morse TL, Williamson CHK. Understanding mode transitions in vortex-induced vibration using controlled motion. 9th International Conference on Flow-Induced Vibrations (FIV-2008), Prague, Czech Republic, 2008.

Morse TL, Williamson CHK. Understanding mode transitions in vortex-induced vibration using controlled vibration. 5th Conference on Bluff Body Wakes and Vortex-Induced Vibration (BBVIV-5), Costa do Sauipe, Brazil, 2007.

Morse TL, Williamson CHK. Employing controlled vibrations to predict fluid forces on a freely vibrating cylinder. 4th Conference on Bluff Body Wakes and Vortex-Induced Vibration (BBVIV-4), Santorini, Greece, 2005.

Morse TL, Williamson CHK. An investigation of wake mode transitions and amplitude jumps in vortex-induced vibration using controlled vibration. 60th Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics, Salt Lake City, UT, 2007.

Morse TL, Williamson CHK. Understanding mode transitions in vortex-induced vibrations of a circular cylinders using controlled vibration. 59th Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics, Tampa, FL, 2006.

Morse TL, Williamson CHK. Predicting the response of a cylinder undergoing vortex-induced vibration using controlled vibrations. 58th Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics, Chicago, IL, 2005.

Morse TL, Williamson CHK. Forces on a cylinder with periodic transverse motion in a free stream. 57th Annual Meeting of the American Physical Society (APS) Division of Fluid Dynamics, Seattle, WA, 2004.

Morse TL, Watson H, Buehler C, Kytömaa HK. Ignition due to electrostatic discharge in multi-phase hydrocarbon flows. Mary Kay O'Connor Process Safety Center 2022 International Symposium. College Station, TX, October 2022.

Morse TL, Stern M, Watson H, Buehler C, Kytömaa HK. Experimental evaluation of electrostatic discharge in multi-phase hydrocarbon flows. AIChE Spring Meeting, 18th Global Congress on Process

Safety, Houston, TX, April, 2022.

**Book Chapters**

Somandepalli V, Morse TL. PIV in combustion systems. Laser Diagnostics in Combustion. Lackner M(ed), Verlag ProcessEng Engineering GmbH, 2009.

## Peer Reviews

Journal of Fluid Mechanics

Physics of Fluids

Journal of Fluids and Structures

Journal of Wind Engineering

International Journal of Heat and Fluid Flow

Journal of Loss Prevention in the Process Industries

Energy and Fuels

Nuclear Technology