



**Exponent**<sup>®</sup>  
Engineering & Scientific Consulting

## Michael Barry, Ph.D., P.E., CFEI

Managing Engineer | Thermal Sciences  
1075 Worcester St. | Natick, MA 01760  
(508) 652-8505 tel | mbarry@exponent.com

### Professional Profile

Dr. Barry specializes in the engineering analysis of thermal and fluid flow systems. He has broad expertise in experimental analysis of flow systems, including bio-fluids, fluid-structure interactions, and microscale flows. He possesses expertise in fluid mechanics, heat transfer, and thermodynamics, and he has applied this expertise to projects involving lithium-ion battery failures, assessments of burn injury risk, testing of consumer products, medical devices, structural fires, vehicle fires, HVAC systems, industrial equipment (heaters, pumps, valves, compressors, furnaces, boilers) and intellectual property matters.

Dr. Barry applies his expertise to the investigation of fires, equipment failures, and accidents. Dr. Barry has conducted origin and cause investigations involving storage facilities, commercial facilities, residences, and vehicles (automobiles, utility vehicles, lawnmowers). He conducts investigations into failures of HVAC systems and related equipment in both residential and commercial settings. HVAC-related project work includes overall system design review, kitchen exhaust systems, hydronic systems, packaged and vertical terminal air conditioning units (PTAC/VTAC), chilled beam systems, piping to HVAC equipment, and water losses (due to frozen pipes or component failure).

Dr. Barry employs analytical and experimental techniques to assess the risk of burn injury in consumer products such as electronics and household appliances as well as in industrial processes. Dr. Barry is a member of ASTM committees E37 (Thermal Measurements) and C16 (Thermal Insulation), which includes *ASTM C1055 Standard Guide for Heated System Surface Conditions that Produce Contact Burn Injuries*.

Dr. Barry performs testing and assessments related to the safety of batteries, particularly related to catastrophic failures such as thermal runaway of lithium-ion cells and batteries. His project work related to battery safety has included testing the integrity of cell container components, the measurement of gas quantity and gas species evolved during various abuse conditions, quantifying the explosibility of battery vent gases, as well as involving those measurements in toxicological assessments of the releases during battery failure. Dr. Barry has experience in experimentally measuring the thermal properties of battery cells in order to generate thermal models to assess heat propagation that can affect performance, safety and reliability of battery pack assemblies. Dr. Barry is a member of the standard technical panel for *UL 9540 Standard for Energy Storage Systems and Equipment*.

Dr. Barry applies his engineering expertise to intellectual property disputes. He has worked on multiple aspects of intellectual property including validity/invalidity, infringement/non-infringement, Markman hearings, trade secrets, and copyright. His intellectual property work is varied and has involved issues such as fluid flow in toys, the fire safety properties of building materials, and medical devices.

Prior to joining Exponent, Dr. Barry used engineering tools to research biological questions, such as the swimming of micro-organisms and the mechanics of human phonation. He has experience with a range of

experimental techniques including particle image velocimetry, digital holography, particle segmentation and tracking, and the design and fabrication of microfluidic devices. Prior to his work at MIT, Dr. Barry worked as an eighth grade mathematics teacher in Brooklyn, New York as a member of the New York City Teaching Fellows. Prior to that, he designed HVAC systems for large commercial buildings at Jaros, Baum, and Bolles in New York City.

## Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Massachusetts Institute of Technology (MIT), 2014

M.S., Mechanical Engineering, Rutgers University, 2005

M.S., Teaching, Pace University, 2008

B.S., Mechanical Engineering, Rutgers University, 2004

B.A., English, Rutgers University, 2004

National Science Foundation Graduate Research Fellowship, 2009-2012

## Licenses and Certifications

Licensed Professional Mechanical Engineer, California, #38065

Licensed Professional Engineer, Connecticut, #PEN.0032929

Licensed Professional Engineer, Massachusetts, #55974

Licensed Professional Engineer, New Jersey, #24GE05661400

Certified Fire and Explosion Investigator

40 Hour HAZWOPER certified

Blasting Certificate of Competency, Massachusetts, #BL-007235

## Professional Affiliations

American Society of Mechanical Engineers (ASME)

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

National Association of Fire Investigators (NAFI)

National Fire Protection Association (NFPA)

ASTM International

Society of Fire Protection Engineers (SPFE)

## Publications

Barry MT. Shear-induced orientational dynamics and spatial heterogeneity in suspensions of motile phytoplankton. *Journal of the Royal Society Interface* 2015; 12(112).

Barry M. Mechanisms of reorientation in phytoplankton: fluid shear, surface interactions, and gravitaxis. Ph.D. Thesis, Massachusetts Institute of Technology, 2014.

Molaei M, Barry M, Stocker R, Sheng J. Failed Escape: Solid Surfaces Prevent Tumbling of Escherichia coli. *Physical Review Letters* 2014; 113:068103.

De Lillo F, Cencini M, Durham WM, Barry M, Stocker R, Climent E, Boffetta G. Turbulent fluid acceleration generates clusters of gyrotactic microorganisms. *Physical Review Letters* 2014; 112(4):044502.

Durham WM, Climent E, Barry M, De Lillo F, Boffetta G, Cencini M, Stocker R. Turbulence drives microscale patches of motile phytoplankton. *Nature Communications* 2013; 4.

Krane MH, Barry M, Wei T. Dynamics of temporal variations in phonatory flow. *The Journal of the Acoustical Society of America* 2010; 128:372-383.

Krane MH, Barry M, Wei T. Unsteady behavior of flow in a scaled-up vocal folds model. *The Journal of the Acoustical Society of America* 2007; 122:3659-3670.

### **Conference Proceedings**

Barry M, Vickery J, Spray R, Myers T. Understanding how testing conditions affect hazard quantification in lithium-ion battery abuse tests. Energy Storage Association Virtual Annual Meeting (August 2020)

O'Hern SC, Barry M, Sipe J. Ventilation and Hazard Considerations of Lithium-Ion Battery Processes: Current Status and Future Needs. ASHRAE 2020 Virtual Conference, 2020.

Barry M, Horn Q, Harding J. Lithium-ion batteries: what fire protection engineers should know, part 2: abuse testing, quantifying hazards, and investigations for lithium-ion batteries. SFPE Premium Webinar Series (July-August 2020). Speaker and panelist.

Morse T and Barry M. Combining Wind Power with Compressed Air Energy Storage. American Wind Energy Association Spring Virtual Learning Series (June 2020).

Barry M. Hazards Due to Thermal Runaway. PlugVolt Battery Seminar, July 16-18, 2019, Plymouth, MI.

Barry M, Vickery J, Spray R. Variation in thermal runaway characteristics in lithium-ion cells from different manufacturers. IEEE Symposium on Product Compliance Engineering. Boston, MA, November 12-13, 2018.

Morse T, Colella F, Wolf M, Barry M. Space heater fires and fire investigation. International Symposium on Fire Investigation. Itasca, IL, September 24-26, 2018.

Spray R, Barry M. Understanding downstream risk from lithium-ion battery thermal runaway and designing for safety. Battcon Conference Proceedings. Nashville, TN, April 22-25, 2018.

Spray R, Barry M, Brown C, Marr K. Understanding downstream risks from battery thermal runaway and designing for safety. IEEE Symposium on Product Compliance Engineering. Boston, MA, November 6-7, 2017.

Barry M, Durham WM, Chengala A, Sheng J, Stocker R. Characterization of gyrotactic swimmers using digital holographic microscopy. 65th Annual Meeting of the APS Division of Fluid Dynamics, San Diego, CA, November 18-20, 2012.

Barry M, Durham WM, Climent E, Stocker R. Shaken, but not stirred: how vortical flow drives small-scale aggregations of gyrotactic phytoplankton. 64th Annual Meeting of the APS Division of Fluid Dynamics, Baltimore, MD, November 20-22, 2011.

Barry M, Krane M, Wei T. Design of apparatus for studying aerodynamics of voice production. American Society of Mechanical Engineers International Mechanical Engineering Congress and Exposition, Anaheim, CA, November 2004.

Barry M, Krane M, Wei T. Flow in a scaled-up vocal folds model. International Conference on Vocal Fold Biomechanics and Physiology, Marseilles, France, August 2004.

Barry M, Krane M, Wei T. Measurements of scaled-up glottal flow: experiment design. 56th Annual Meeting of the APS Division of Fluid Dynamics. East Rutherford, NJ, November 23-25, 2003.