

**John R. Fessler, Ph.D., P.E.**  
**Senior Managing Engineer**

**Professional Profile**

Dr. Fessler is a Senior Managing Engineer in Exponent's Mechanical Engineering practice. His areas of expertise include building mechanical systems, gas and liquid flows, heat transfer, thermodynamics, manufacturing, and risk assessment. In addition to routinely providing consulting services over a wide range of mechanical engineering issues, Dr. Fessler specializes in two areas: testing and analysis of fluid-thermal systems, and risk/safety analysis. The fluid-thermal work frequently consists of performance testing and analysis of building mechanical systems including heating, ventilation and air conditioning (HVAC) systems, piping and plumbing; temperature, humidity and moisture control; and gas and liquid pipeline flow and leak analyses. Typical components and sub-systems studied have included pumps, valves, chillers, fan-coil units, ventilation systems, heat exchangers, compressors, plumbing systems, and process piping. Dr. Fessler's risk assessment work typically relates to risk and reliability analyses of new products and systems that are under development. Such systems have included consumer appliances, medical devices, hybrid vehicles, automotive components, security/anti-terrorism technology, and telecommunications equipment. Specific analysis techniques used by Dr. Fessler include Preliminary Hazards Analysis (PHA), Failure Modes and Effects Analysis (FMEA), Hazards and Operability (HAZOP) studies, Fault Tree/Event Tree Analysis, and Mean Time Between Failure (MTBF) evaluations.

Prior to joining Exponent, Dr. Fessler was an Acting Assistant Professor in the Mechanical Engineering Department at Stanford University, where he conducted research and taught graduate and undergraduate classes in experimental heat transfer and fluid mechanics.

**Academic Credentials and Professional Honors**

Ph.D., Mechanical Engineering, Stanford University, 1995  
M.S., Mechanical Engineering, Stanford University, 1991  
B.S., Mechanical Engineering, Rice University (*summa cum laude*), 1990

Phi Beta Kappa; Tau Beta Pi; National Science Foundation Graduate Fellowship

**Licenses and Certifications**

Registered Professional Mechanical Engineer, California, #M32049  
Registered Professional Engineer, Texas, #98012  
Registered Professional Engineer, Colorado, #PE-43557  
Registered Professional Engineer, North Carolina, #037568  
Certified Smart Card Industry Professional

## **Publications**

Osteraas J (ed), Fessler J (contributing author). General Guidelines for the Assessment and Repair of Earthquake Damage in Residential Woodframe Buildings. Section 8 Mechanical, Electrical and Plumbing Systems. Consortium of Universities for Research in Earthquake Engineering, CUREE Publication No. EDA-02, February 2010.

McGoran B, Ross B, Nunes S, Buehler C, Reza A, Kemal A, Fessler J, Belanger J. Evaluation of a chemical plant explosion and lessons learned. Proceedings, Chinese Mechanical Engineering Society Annual Meeting and First Annual Meeting of the Chinese Academy of Engineering, Safety and Reliability, Mechanics and Transportation Engineering Division, pp. 252–257, 2006.

Roy CM, Fessler JR, Medhekar S. Managing post-production change. Proceedings, Materials and Processes for Medical Devices Conference, ASM International, St. Paul, MN, August 2004.

Roy CM, Fessler JR, Foulds JR, Latanison RM, Taylor DE. Do all RPV head penetration leaks have the potential to cause head wastage? Proceedings, ICONE-12, 12<sup>th</sup> International Conference on Nuclear Engineering, Arlington, VA, April 2004.

Elkins CJ, Fessler J, Eaton JK. A novel mini calibrator for thermochromic liquid crystals. Journal of Heat Transfer 2001; 123(3):604–607.

Fessler JR, Eaton JK. Turbulence modification by particles in a backward-facing step flow. Journal of Fluid Mechanics 1999; 394:97–117.

Fessler, JR, Link G, Nickel A, Prinz F. Rapid tooling inserts using shape deposition manufacturing. Materials and Manufacturing Processes 1998; 13(2):263–274.

Fessler, JR, Nickel A, Link G, Prinz F. Functional gradient metallic prototypes through shape deposition manufacturing. Proceedings, Symposium on Solid Freeform Fabrication, University of Texas at Austin, Austin, TX, August 1997.

Fessler JR, Eaton JK. Particle response in a planar sudden expansion flow. Experimental Thermal and Fluid Science 1997; 15:413–423.

Fessler, JR, Merz R, Nickel A, Prinz F. Laser deposition of metals with shape deposition manufacturing. Proceedings, Symposium on Solid Freeform Fabrication, University of Texas at Austin, Austin, TX, August 1996.

Fessler, JR, Kulick JD, Eaton JK. Preferential concentration of heavy particles in a turbulent channel flow. Physics of Fluids 1994; 6(11):3742–3749.

Kulick JD, Fessler, JR, Eaton JK. Particle response and turbulence modification in a fully developed channel flow. Journal of Fluid Mechanics 1994; 277:109–134.

Eaton JK, Fessler JR. Preferential concentration of particles by turbulence. *International Journal of Multiphase Flow* 1994; 20, Supple:169–209.

## **Project Experience**

### ***Heating, Ventilation and Air Conditioning (HVAC)/Plumbing***

Performed extensive testing and analysis of performance of large thermal energy storage system that was not meeting the design energy storage capacity. Determined degree of underperformance and source of underperformance via test data.

Analyzed contribution of HVAC systems to widespread mold contamination of two high-rise hotel towers. Evaluated relative impact of design versus construction defects.

Reviewed HVAC design for high-rise and low-rise hotel/condominium guest rooms and public spaces with respect to construction defect claims of inadequate design leading to underperformance, inadequate indoor air quality, condensation, and mold growth.

Performed proactive risk/reliability evaluation of HVAC system designs at 15 large hotel-casinos throughout the country. Made recommendations regarding potential areas to improve reliability and minimize outages due to loss of HVAC systems.

Investigated root causes of coil ruptures in various applications including office buildings, industrial installations, and apartment buildings.

Investigated root causes of compressor and chiller failures in various applications including nursing homes and hotels.

Performed condition and remaining life assessments of HVAC equipment at hospitals, hotels, office building, and other dwellings.

Performed post-earthquake and post-hurricane HVAC equipment assessments at two hotels and a large shopping mall.

Investigated root causes of water leaks/ruptures on water supply/distribution lines as well as various individual home appliances/fixtures.

Investigated the effects of water hammer on various plumbing fixtures with respect to the potential to generate water leaks.

Investigated root causes and corrective actions for poor humidity control and/or condensation issues in a variety of applications including high-rise hotels, laboratories, nursing homes dormitories, museums, athletic facilities, and single-family residences.

## ***Pipelines***

Calculated hydrocarbon release rates and total release volumes for several different large-scale pipeline ruptures based on recorded data, rupture geometry and geography.

Calculated hydrocarbon release rates and total release volumes for numerous smaller (i.e., pinhole) leaks based on hydrostatic test data. Reviewed historical test data to identify line sections where leaks may be occurring.

Calculated release rates and total release volumes for small leaks in an ammonia refrigeration system and an ammonia delivery truck.

## ***Risk Assessment***

Performed qualitative risk assessments (e.g., PHAs or FMEAs) on a variety of products/systems including:

- Three different hybrid-electric bus propulsion systems
- Drug delivery devices
- Surgical medical devices
- Automotive fuel pump
- Novel all-in-one computer designs
- Electrical systems for numerous hotel-casinos, two telecommunications centers and a wafer fabrication facility
- Geothermal brine process train
- Anthrax detection device
- Amusement park ride

Performed quantitative risk assessments (e.g., Fault Trees, Event Trees) for a variety of adverse events including:

- Failures of a hybrid-electric propulsion system for passenger cars
- Fires or explosions due to landfill gas under various designs for a proposed landfill site
- Fires or explosions due to unintentional releases of hydrocarbon refrigerants
- Water leaks due to failed plumbing components
- Catastrophic failures of a refrigerated cargo container for airliners
- Fires or electrocutions for various consumer electric devices such as plug-in air fresheners and gasoline-powered toys
- Failures of a flywheel-based uninterruptible power supply (UPS) unit
- Production outages at several crude oil and liquefied natural gas (LNG) production facilities
- Pipeline failures and electrical outages due to derailments of railroad cars

Performed Mean Time Between Failure (MTBF) analyses for a variety of products/systems including:

- Numerous telecommunication and networking components
- A wearable computer system for military combat use
- A portable surveillance system for military combat use.