



Exponent[®]
Engineering & Scientific Consulting

John Fessler, Ph.D., P.E.

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Professional Profile

Dr. Fessler's areas of expertise include building mechanical systems, gas and liquid flows, heat transfer, thermodynamics, manufacturing, and risk assessment. He frequently analyzes temperature, humidity, comfort, indoor air quality, moisture control, equipment failure and other issues related to heating, ventilation and air-conditioning (HVAC) systems in commercial, industrial and residential buildings.

Dr. Fessler has particular expertise in investigating temperature/humidity control issues related to HVAC systems, including situations where high humidity and/or condensation have led to water damage, fungal growth and/or mold contamination. Dr. Fessler also routinely investigates issues related to gas and liquid plumbing and piping systems, including the causes of leaks in those systems and the resultant leak rates. Typical components and sub-systems studied have included pumps, valves, chillers, fan-coil units, ventilation systems, heat exchangers, compressors, plumbing systems, cooling towers, boilers, heaters and process piping.

Dr. Fessler also has significant experience in risk assessment, including risk and reliability analyses of new products and systems that are under development. Such systems have included consumer appliances, medical devices, hybrid vehicles, large-scale energy storage systems, automotive components, security/anti-terrorism technology, telecommunications equipment, and over a dozen large, international oil and gas refinery/storage facilities. 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, Mean Time Between Failure (MTBF) evaluations, Quantitative Risk Assessment (QRA), Reliability, Availability and Maintainability (RAM), and Safety Integrity Level (SIL) studies.

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 & Professional Honors

Ph.D., Mechanical Engineering, Stanford University, 1995

M.S., Mechanical Engineering, Stanford University, 1991

B.S., Mechanical Engineering, Rice University, 1990

Phi Beta Kappa

Tau Beta Pi

National Science Foundation Graduate Fellowship

Licenses and Certifications

Professional Engineer Mechanical, California, #32049

Professional Engineer, Colorado, #PE-0043557

Professional Engineer Mechanical, Florida, #75868

Professional Engineer Mechanical, Louisiana, #PE.0047514

Professional Engineer, Maryland, #41622

Professional Engineer Mechanical, Nevada, #26620

Professional Engineer, North Carolina, #37568

Professional Engineer, Oregon, #96699PE

Professional Engineer Mechanical, Texas, #98012

Professional Engineer Mechanical, Wyoming, #PE 17248

Certified Smart Card Industry Professional (CSCIP)

GIAC Security Leadership Certification (GSLC)

Publications

Anderson DM, Fessler JR, Pooley MA, Seidel S, Hamblin MR, Beckham HW, Brennan III JF. Infrared radiative properties and thermal modeling of ceramic-embedded textile fabrics. Biomedical Optics Express 2017 Mar; 8(3).

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, 12th 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

Investigated root causes and corrective actions for poor humidity control and/or condensation issues in a variety of applications including high-rise hotels, low-rise hotels, condominiums, laboratories, nursing homes, hospitals, dormitories, museums, athletic facilities, cold storage facilities, warehouses, natatoriums, and single-family residences. Analyses frequently involve considerations such as contribution of design versus construction for the HVAC systems, controls, operational/performance issues, building pressurization, and/or relative contribution of HVAC systems versus building envelope issues.

Investigated temperature control/comfort issues, including those related to building glazing systems, in condominiums, office buildings, schools and a mall.

Investigated root causes of HVAC coil leaks or ruptures in various applications including office buildings, industrial installations, data centers, and apartment buildings.

Investigated root causes of compressor and chiller failures in various applications including nursing homes, schools, cold storage facilities, and hotels.

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

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

Performed HVAC equipment assessments after natural disasters (earthquake, hurricane, fire, flood, hail) at office buildings, apartment complexes, hotels and a shopping malls.

Investigated odor issues and/or hydrogen sulfide-related corrosion of drain/waste/vent pipes in various applications such as hotels, condominiums, country clubs, and grocery stores.

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.

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

Pipelines

Calculated hydrocarbon release rates and total release volumes for numerous 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., PHA, FMEA and HAZOP) on a variety of products/systems including:

- Utility-scale and facility-scale energy storage systems, including those based on batteries and flywheels
- Three different hybrid-electric bus propulsion systems
- Various consumer products (e.g., coffee maker, fitness trackers, consumer electronics)
- Various medical devices (e.g., unique drug delivery devices, surgical devices)
- Novel refrigeration systems and refrigerants
- 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 or fire sprinklers
- 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.

Performed design-stage risk assessments on over a dozen large, international oil and gas storage and refining facilities in the Middle East and Indonesia including:

- Quantitative Risk Assessment (QRA) studies to determine risk contours due to combined effects of various releases and their consequences (e.g., fire, explosion and toxic gas).
- Reliability, Availability and Maintainability (RAM) studies to determine the availability capacity of the facility over a 20 to 30 year lifetime.
- Safety Integrity Level (SIL) studies on required reliability of sensors and other safety devices based on risk level.