Exponent®
Engineering & Scientific Consulting

Stephen Garner, Ph.D., P.E., CFEI

Managing Engineer | Thermal Sciences
Chicago
+44 20 7864 9756 tel | sgarner@exponent.com

Professional Profile

Dr. Garner applies his expertise as a mechanical engineer to the scientific investigation of incidents, both domestically and internationally, involving failures of combustion and mechanical systems, thermal fluid systems and heat exchangers, and boilers, as well as the investigation of fires and explosions. He has analyzed failure in a wide range of equipment, applications, and industries including, agricultural, agrochemical, petrochemical, power generation systems including concentrating solar power system, mining equipment, mineral processing, raw material production, boilers and boiler safety devices, pneumatic and hydraulic systems, and turbine and turbomachinery equipment.

Further, Dr. Garner has investigated claims related to alleged incomplete or incorrect commissioning of plant systems in a variety of industries. In addition to these industrial applications, he also has experience with various consumer products and residential appliances.

Dr. Garner is active in the field of combustion safety and he sits as a principal voting member on NFPA 37 – Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; he is an alternate member on four separate committees within NFPA 85 – Boiler and Combustion Systems Hazards Code as well as NFPA 86 – Standard for Ovens and Furnaces.

As a retired NCAA Division 1 gymnast, Dr. Garner has also investigated and opined on various aspects related to gymnastics equipment and trampolines.

POWER GENERATION AND GAS TURBINES

Dr. Garner's work in power generation systems encompasses a number of different thermal and mechanical systems and equipment including coal fired boilers, natural gas fired boilers, waste to energy (refuse derived fuel) boilers, biomass boilers, various concentrating solar power (CSP), and combustion gas turbines employed in both simple and combined cycle operations. Dr. Garner's expertise includes system-level analyses of process and operational data, evaluation and application of engineering codes and standards, evaluation and analyses of commissioning planning and execution, and analyses of equipment failures.

Dr. Garner has experience designing, testing, and commissioning combustion gas turbines. Prior to joining Exponent, Dr. Garner developed next generation aviation propulsion systems, including partial premixed lean burning combustors for gas turbine engines (jet engines), at General Electric. During his time at GE-Aviation, he routinely designed and tested jet engine combustors and combustor components as well as performed root cause analyses on failed hardware and tests.

INDUSTRIAL PROCESSES AND EQUIPMENT

Dr. Garner has experience analyzing design, commissioning, and operational issue related to various types of industrial process equipment employed in numerous process applications including agro-chemical and fertilizer production, baby formula and food production, agricultural material processing, and pyrometallurgical. Dr. Garner's equipment experience in these industrial processes includes fluid heat exchangers, dryers, ovens, pumps, boilers, boiler water chemistry, fired and unfired pressure vessels, and both liquid and gas fired burner systems.

CONSUMER PRODUCTS AND APPLIANCES

Dr. Garner has experience analyzing design and failure of various consumer products and appliances including ovens, ranges, cooktops, refrigerators and coolers, refrigerant compressors, dehumidifiers, HVAC systems, residential boiler systems, water heaters, and hot-water radiant heating systems. Dr. Garner experience also includes fires/thermal damage involving exercise equipment as well as leaks/failures of both fuel gas and water valves, plumbing adapters and fittings, and piping systems.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of Illinois, Chicago, 2011

B.S., Mechanical Engineering, University of Illinois, Chicago, 2006

Art Adamson Award Nominee for fuel nozzle design (GE), 2012

Art Adamson Award Nominee for combustor testing (GE), 2012

Prior Experience

Engineer/Technologist, GE-Aviation, 2011-2013

Research/Teaching Assistant, University of Illinois at Chicago, 2006-2011

Visiting Researcher, Centre National de la Recherche Scientifique, Orleans, France, 2007 and 2008

Professional Affiliations

Principal Member: Technical Committee on Internal Combustion Engines, NFPA 37 Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines, National Fire Protection Association International

Languages

French

Publications

S. Garner, N. Sinenian, S. Kennett. Engineering Merit Assessments in International Arbitration. Repositioning the value of early technical review in complex international arbitration disputes. January 27, 2022 https://www.exponent.com/knowledge/thought-leadership/2022/01/engineering-merit-assessment-ia/?pageSize=NaN&pageNum=0&loadAllByPageSize=true

E. Elnakly, P. Atkinson, S. Garner. Leveraging Expert Determination. Is expert determination poised for greater use in alternative dispute resolution? May 19, 2022

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Bobbitt B, Garner S, Cox B, Martens J, Fecke M. Manual vs. automatic boiler controls: A historical perspective from relevant codes and standards. Proceedings of the ASME 2017 Power and Energy Conference 2017.

Garner S, Cox B, Bishop J, Fecke M. Area Zoning, its role in a Risk-Based Process Safety Program for Combustible Dusts. Institution of Chemical Engineers (UK), Hazards 27, Birmingham, UK, May 10-12, 2017.

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Garner S, Cox B, Bobbitt B, Parrish B, Ogle R. Managing the Chemical Reactivity Hazards associated with Hazardous Waste. Institution of Chemical Engineers (UK), Hazards 27, Birmingham, UK, May 10-12, 2017.

Garner S, Ibrahim Z. Gas Turbine Common Issues, Failure Investigations, Root Cause Analyses, and Preventative Actions. 016 ASME Power & Energy Conference, June 26-30, 2016, Charlotte, North Carolina, USA; 59352.

Fecke M, Garner S, Cox B. Review of Global Regulations for Anhydrous Ammonia Production, Use, and Storage. Institution of Chemical Engineers (UK), Hazards 26, Edinburgh, UK, May 24-26, 2016.

Cox BL, Garner SW, Carpenter AR, Fecke M. Hazards Inherent to Control Systems: Case Studies and Lessons Learned. American Institute of Chemical Engineers, 2016 Spring National Meeting, 12th Global Congress on Process Safety, Houston, TX, April 10-14, 2016.

Ibarretta A, Marr K, Garner S, O'Hern S, Myers T. On the Use of Laminar Burning Velocities in Process Safety. American Institute of Chemical Engineers, 2015 Spring National Meeting, 11th Global Congress on Process Safety, Austin, TX, April 27-April 29, 2015.

Fu X, Garner S, Aggarwal S, Brezinsky K. Numerical study of NOx emissions from n-Heptane and 1-Heptene counterflow flames. Energy Fuels 2012; 26:879-888.

Garner S, Dubois T, Chaumeix N, Dagaut P, Brezinsky K. Biologically derived diesel fuel and NO formation: Part 2, model development and extended validation. Combustion and Flame 2011; 158:2302-2313.

Garner S, Brezinsky K. Biologically derived diesel fuel and NO formation: An experimental and chemical kinetic study, Part 1. Combustion and Flame 2011; 158:2289-2301.

Garner S, Sivaramakrishnan R, Brezinsky K. The high-pressure pyrolysis of saturated and unsaturated C7 hydrocarbons. Proceedings, Combustion Institute 2009; 32:461-467.

Garner S, Brezinsky K. Possible chemical sources of increased NOx from biodiesel. Poster presentation, 33rd International Symposium on Combustion, Beijing, China, 2010.

Garner S. Combustion of components of biodiesel surrogates in a high pressure shock tube and jet stirred reactor. University of Illinois at Chicago, February 2010.

Garner S, Sivaramakrishnan R, Brezinsky K. High pressure pyrolysis of saturated and unsaturated C7 hydrocarbons. Poster presentation, 32rd International Symposium on Combustion, Montreal, Canada, 2008.

Garner S. Combustion of biodiesel surrogates in a high pressure shock tube. Centre National de la Recherche Scientifique, Institut de Combustion Aerothermique Reactivite et Environnement, Orleans, France, May 2008.

Garner S. High temperature and high pressure pyrolysis and oxidation of saturated and unsaturated C7 hydrocarbons. Centre National de la Recherche Scientifique, Institut de Combustion Aerothermique Reactivite et Environnement, Orleans, France, Aug. 2007.

Thought Leadership

S. Garner, M. Fecke. Is Your Boiler or Mechanical System Ready for Restart? Safely Restarting Operations after Extended COVID-19 Shutdowns. August 27, 2020.

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Project Experience

Coal Fired Power Generation

- Coal fired power generation facility with carbon capture – Investigated construction and commissioning claims associated with thermal fluid, plant utility, and balance of plant systems, which included boiler, steam, and hot fluid systems, as well as pumps and compressors. (Arbitration)
- Investigated plant and boiler system operation during restarts, over-pressure events, and system operational data.
- Investigated boiler combustion system operation following an explosion.

Concentration Solar Power Generation

- Concentrating Solar Power (CSP) with Thermal Energy Storage (TES) – Investigated design, construction, and commissioning claims associated with thermal energy storage systems, heat exchangers, and plant operation. (International Arbitration, ICC)
- Concentrating Solar Power (CSP) with Thermal Energy Storage (TES) – Investigated design, construction, and commissioning claims associated with fired fluid heaters. (International Arbitration, ICC)

Gas Turbines

- Investigated the post-maintenance compressor and combustor failure that resulted from the control and fueling of a duel-fuel gas turbine.
- Investigated operation of gas turbine operation and performance in combined cycle operation when fuel with non-specified fuel. (International Arbitration, ICC)

Process Plants

- Investigated boiler water chemistry control and process operation in fertilizer production plant waste heat recovery boiler system. (International Arbitration, ICC)
- Investigated the design and commissioning of mechanical and process equipment employed in a pyrometallurgical production facility. (International Arbitration, ICC)
- Investigated the design and commissioning of process equipment employed in the manufacturing of baby formula.
- Investigated fires and explosion that occurred at food manufacturing facilities involving combustible dusts and oils.

Biomass Fired Power Generation

- Investigated explosions that occurred in wood pellet fuel boiler fuel handling system during commissioning.
- Investigated an explosion that occurred in agricultural waste fueled boiler.

Consumer Appliances

- Investigation of an alleged explosion from a gas range
- Investigation of fires involving refrigerators and coolers
- Investigation of mechanical failures involving refrigerators components
- Investigation of fires involving dehumidifiers
- Investigation of fires/thermal damage to various countertop small electric cooking appliances
- Investigation of residential HVAC systems, boiler systems, water heaters, and hot-water radiant heating systems

Consumer Products

- Investigation of fires/thermal damage to exercise equipment
- Investigation of leaks/failures of both fuel gas and water valves, plumbing adapters and fittings, and piping systems
- Investigated flammability and flame projection from aerosol products

Commercial and Industrial Products

- Investigation of gas-driven diaphragm pumps
- Investigation of multistage water pumps
- Investigation of multiple boiler appearances and safety devices
- Investigation of industrial oven explosions

- Investigation of fires and explosions in dust collection systems and involving combustible dusts

Gymnastics Equipment

- Investigation of trampoline related claims in trampoline park / amusement facility
- Investigation of trampoline related claims in gymnastics training facility