



AMY E. GRAY, Ph.D., P.E., CFEI

PRINCIPAL

DIRECTOR, THERMAL

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Dr. Gray is a Principal and a Director in the Fire and Explosions Technical Group with Engineering Systems Inc. (ESi). She is experienced in mechanical and chemical engineering and failure analysis, with specialization in fire and explosion origin and cause, thermal-fluid analysis, mechanical systems, and product analysis. Her expertise includes mechanical product failure, gas explosions, dust explosions, tank and boiler ruptures, natural gas pipeline and utility incidents, gas appliances, aviation fire analysis, and chemical processing plant incidents. Dr. Gray has employed blast dynamics, dispersion, and fire dynamics analyses in many of these investigations, as well as performed numerous on-site and laboratory investigations. Additionally, Dr. Gray has expertise in Computational Fluid Dynamics (CFD), Dust Hazard Analysis (DHA), Process Hazard Analysis (PHA) and Computed Tomography (CT) data analysis. She has been involved in US court cases and international arbitration.

Her graduate research related to the gas transport and internal-reforming chemistry of alternative fuels within various solid oxide fuel cell anode support materials. She designed, built, and optimized a unique experimental reactor, a protocol utilizing both mass spectrometry (MS) and gas chromatography (GC), and a computational fluid dynamics model including gas-phase and catalytic reactions for the analysis of fuel cell anodes. Dr. Gray also has experience with ceramics processing, material microstructure characterization, and in the dispersion and measurement of aerosols. Prior to joining ESi, she gained experience in the design and implementation of aircraft cooling systems.

Areas of Specialization

Fire and Explosion
Fire Dynamics
Computational Fluid Dynamics (CFD)
Gas Dispersion Analysis
Explosion Blast Effects
Thermal-Fluid Sciences and Heat Transfer
Chemical and Manufacturing Processes
Industrial and Process Safety
Aviation
Computed Tomography (CT)
Gas Chemical Analysis
Dust and Process Hazard Analysis
Consumer Product Analysis

Education

Ph.D., Mechanical Engineering, Chemical Engineering Minor, Colorado School of Mines, 2012

M.S., Mechanical Engineering, Colorado School of Mines, 2010

B.S., Mechanical Engineering, Texas A & M University, 2006



Licensed Professional Engineer (P.E.)

State of Florida.....License No. 84063
State of Louisiana.....License No. 43069
State of North CarolinaLicense No. 044997
State of South CarolinaLicense No. 34957
State of TexasLicense No. 118830
State of Arkansas.....License No. 19420
NCEES RecordID No. 15-278-12

Other Certifications

Certified Fire and Explosion Investigator (CFEI).....License No. 19458-10979

Professional Affiliations/Honors

American Society of Mechanical Engineers (ASME)

American Institute of Chemical Engineers (AIChE)

Contributing Member, AIChE Division of Safety and Health, 2016-2018

Committee Secretary, AIChE Global Congress on Process Safety Loss Prevention Symposium,
2020-Present

International Association of Arson Investigators (IAAI)

National Association of Fire Investigators (NAFI)

National Fire Protection Association (NFPA)

Committee Member, NFPA 715 Fuel Gases Warning Equipment, 2022-Present

Society of Fire Protection Engineers (SFPE)

Society of Women Engineers (SWE)

Positions Held

Engineering Systems Inc., Miami, Florida

Principal, 2023-Present

Director, Thermal, 2022-Present

Senior Managing Consultant, 2020-2022

Senior Consultant, April 2019 – 2020

Manager of Miami Operations, April 2019 – July 2022

Engineering Systems Inc., Charlotte, North Carolina

Senior Consultant, 2017 – April 2019



Manager of North Carolina Operations, 2018 – April 2019

Engineering Systems Inc., Dallas, Texas

Senior Consultant, 2017
Senior Staff Consultant, 2015 - 2016
Staff Consultant, 2013 – 2015

L-3 Communications, Greenville, Texas

Mechanical Systems Engineer, 2012 – 2013

Colorado School of Mines, Golden, Colorado

Research Assistant, 2008 - 2012
Teaching Assistant, 2007 - 2008

Sandia National Laboratories, Albuquerque, New Mexico

Student Intern, Summers 2004 – 2005

Continued Education

Process Hazard Analysis (PHA) and Dust Hazard Analysis (DHA) Leader Training
ioMosaic, 2017

US DHS Toxic Inhalation Hazard Chlorine Release Modeling Test (by invitation)
Dugway Proving Grounds, 2015

Advanced Fire, Arson, and Explosion Training Program
National Association of Fire Investigators, 2014

Computer Fire Modeling
National Association of Fire Investigators, 2014

Hazardous Waste Operations and Emergency Response (OSHA HAZWOPER) 40-Hr Certification
Houston Area Safety Council, 2014

Fire Dynamics Simulator
Seneca College School of Fire Protection, 2014

Phast Software Training Course
Det Norske Veritas, 2013

Publications

1. D. Connolly, J. Forest, **A. Gray**. "Hit the Ground Running (Safely): Process Safety for the Early Career Engineer," *13th Global Congress on Process Safety Conference Proceedings*. American Institute of Chemical Engineers. March 2017.

2. M. Hanks, **A. Gray**, R. Pape. "Stratification During Vapor of Gas Freeing of Storage Tanks," *13th Global Congress on Process Safety Conference Proceedings*. American Institute of Chemical Engineers. March 2017.
3. R. Pape, **A. Richards**, M. Hanks. "Apparent Discrepancies in Methods for Predicting the Explosion Energies and Blast Effects of BLEVES," *12th Global Congress on Process Safety Conference Proceedings*. American Institute of Chemical Engineers. April 2016.
4. J. Jordan and **A. Richards**. "The New State of the Art in Evidence Preservation and Interrogation," *For the Defense*. November 2013: 64-68.
5. **A.E. Richards** and N.P. Sullivan. "The interdependence of macro- and microstructure on internal-reforming performance in Ni-YSZ SOFC anode supports," *Fuel Cells: From Fundamentals to System*. 13.4 (2013): 470-475.
6. **A.E. Richards**. "Gas Transport and Internal Chemistry of Solid Oxide Fuel Cell Anode Supports Operating on Alternative Fuels," Ph.D. Dissertation, Colorado School of Mines, May 2012.
7. D.M. Murphy, **A.E. Richards**, A. Colclasure, W. A. Rosensteel, and N.P. Sullivan. "Biogas fuel reforming for solid oxide fuel cells," *Journal of Renewable and Sustainable Energy* 4.2 (2012): 023106.
8. **A.E. Richards**, M.G. McNeeley, R.J. Kee, and N.P. Sullivan. "Gas transport and internal-reforming chemistry in Ni-YSZ and ferritic-steel supports for solid-oxide fuel cells," *Journal of Power Sources*. 196.23 (2011): 10010-10018.
9. **A.E. Richards**. "A Unique Experimental Tool for the Evaluation of Gas Transport and Internal-Reforming Chemistry within Solid Oxide Fuel Cell Anodes," M.S. Thesis, Colorado School of Mines, May 2010.

Presentations

1. **A.E. Gray**, "Explosions and Pressure Vessel Ruptures: An Overview with Claims and Litigation Considerations," presented to various legal and insurance audiences.
2. M.C.K. Sellers, **A.E. Richards**, "The Rainham Chemical Works Explosion: A 100th Anniversary Perspective," Materials Science & Technology 2016, Salt Lake City, Utah, October 2016.
3. M.D. Pratt, **A.E. Richards**, "Applications of New Technologies to Complex Explosion Investigation," *Propane Gas Defense Association Meeting, Invited Speaker*, New Orleans, Louisiana, September 2016.
4. M.E. Stevenson, **A.E. Richards**, "Emerging Technologies for Handling Complex Evidence," *Trial Attorneys of America Meeting*, Invited Speaker, Chicago, Illinois, June 2016.
5. **A.E. Richards**, "Technologies in Incident Investigation," *The Chlorine Institute Health, Environment, Safety and Security Seminar*, Invited Speaker, Dallas, Texas, April 2016.
6. A.R. Shah, J.G. Jordan, **A.E. Richards**, "Computed Tomography X-Ray Imaging – a Technique for Non-Destructive Examination of Plastic Products," *2015 SPE ANTEC® Conference*, March 2015.

7. R. Pape, **A.E. Richards**, M. Hanks, "Discrepancies in Methods for Predicting the Explosion Energy of BLEVEs," *AIChE Midwest Regional Conference*, Chicago, IL March 2015.
8. **A.E. Richards**, J.G. Jordan, "Uses and Capabilities of Computed Tomography in Forensic Engineering and Science," *Materials Science and Technology (MS&T) 2014 Conference*, Pittsburgh, PA October 2014.
9. **A.E. Richards**, N.P. Sullivan, R.J. Kee, M. McNeeley, and S. Babiniec, "Gas transport and internal reforming chemistry in SOFC anode supports and structures," *219th Meeting of the Electrochemical Society (SOFC XII)*, Montreal, Canada, May 1-6, 2011.
10. S. Babiniec, **A.E. Richards**, N. Faino, and N.P. Sullivan, "Development, fabrication, and testing of perovskite-based anodes for tubular solid oxide fuel cells," *219th Meeting of the Electrochemical Society (SOFC XII)*, Montreal, Canada, May 1-6, 2011.
11. D.M. Murphy, **A.E. Richards**, A. Colclasure, W. Rosensteel, and N.P. Sullivan, "Biogas fuel reforming for solid oxide fuel cells," *219th Meeting of the Electrochemical Society (SOFC XII)*, Montreal, Canada, May 1-6, 2011.
12. **A.E. Richards**, N.P. Sullivan, R.J. Kee, and H. Zhu, "Internal reforming chemistry in novel SOFC anodes and architectures," *European Fuel Cell Forum*, Lucerne, Switzerland, June 28-July 2, 2010.

Selected Project Experience

Consumer Product – Gas Absorption Refrigerators

Various fires occurred in which gas absorption refrigerator leaks were alleged to have been the cause. Testing was conducted to determine the propensity of these refrigerators to result in a fire in the manner alleged. Tests involving fire spread and gas dispersion (ammonia and natural gas) were conducted during the course of the analysis.

Consumer Product – Gas Grill Fires

Multiple projects involving personal injury and/or property damage as a result of consumer gas grill use. Analysis involved in determining the causes of these incidents included component failure and material analysis, CT scanning, gas dispersion (i.e., the timing of gas buildup in a compartment), and testing of grill components.

Consumer Product – Pressure Cooker

A burn injury occurred during the use of a pressure cooker, when the top of the cooker allegedly released while under pressure and allowed the hot contents to spray the user. Testing was conducted with an exemplar to characterize the pressure cooker's behavior under a variety of conditions. It was ultimately determined that the user overfilled the cooker with water above the manufacturer's indicated line in the pot, which resulted in the pressure cooker being subject to a pressure beyond design conditions.

Gas Migration and Dispersion – Natural Gas Leak and Fire

A fatality occurred as a result of an explosion caused by a natural gas leak. Analysis was conducted to determine the circumstances under which a flammable mixture could have been present, and ignition could have occurred. It was concluded that ignition would have only been possible in a small area and within a small window of time.

Aviation – Post-Crash Fire

A small general aviation plane experienced a fire after impact. The level of fuel in the tanks came into question during the post-crash investigation. Fire and fuel spread analysis was used to determine the relative level of fuel in each of the wing tanks.

Chemical Manufacturing Industry – Chemical Explosion

An explosion occurred during the batch manufacturing of a chemical. A blast damage analysis to the facility and surrounding area was conducted to approximate the energy needed to result in the observed damages. This analysis was combined with an inventory of available substances, employee interviews about activities at the time, and chemical testing to determine the cause of the explosion.

Manufacturing Industry – Regenerative Thermal Oxidizer (RTO) Failure

An overheating incident occurred in an RTO intended for emissions treatment at an insulation manufacturing facility. This incident caused significant damage to the RTO which ultimately required complete replacement. The investigation determined that the incident occurred due to a valve malfunction and a failure by the vendor to incorporate an excess temperature interlock in their design. The investigation involved an analysis of the as-built system as compared to design specifications and applicable codes, analysis of operational data including emissions testing results, and a Computational Fluid Dynamics (CFD) thermal analysis to assess temperature distribution within the RTO.

Petrochemical Industry – Vessel Rupture and Explosion

An explosion involving a pressure vessel occurred at a petrochemical plant. A full on-site investigation and subsequent laboratory inspection was conducted alongside the Chemical Safety Board (CSB) to determine the origin and cause of the incident. Metallurgical analysis revealed that the involved vessel ruptured at its weakest point, but above a pressure level that it was designed to sustain. Analysis of electronic plant data, interviews with operators, and plant conditions revealed that the sudden overpressure of the vessel occurred as a confluence of unforeseen circumstances.

Petrochemical Industry – Construction Defect Arbitration

Led multidisciplinary team in supporting an international arbitration dispute involving corrosion of piping that occurred during the construction phase of a petrochemical facility, resulting in a delay of startup. A database of key construction activities and the noted corrosion locations of involved piping was built from a voluminous amount of documentation. Analysis of the flushing, draining, and drying procedures was utilized to determine the cause of the corrosion. Computational Fluid Dynamics (CFD) was among the analysis tools employed. A 3D map of the damage in the piping was developed to assist with analysis and as a presentation tool. This project involved coordination among experts across several different countries.