Exponent®
Engineering & Scientific Consulting

Sean Dee, Ph.D., P.E., CFEI

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Professional Profile

Dr. Dee applies the fundamentals of chemical engineering to help clients address the risks associated with accidents, losses, and injuries. His core areas of expertise include chemical process safety, fire and explosion investigation, alternative energy, and high purity oxygen systems. He services clients in many diverse industries including insurance, legal, and chemical processing.

Dr. Dee is a frequent speaker and session coordinator the Global Congress on Process Safety (GCPS) and served as the symposia chair for the Center for Chemical Process Safety (CCPS) in 2022. As a guest lecturer and online instructor, Dr. Dee teaches process safety concepts and shares his expertise with audiences from industry and academia to further promote process safety in the chemical industry. He is also a voting member of several technical committees that develop standards to address the hazards and risks of fires in oxygen enriched atmospheres and safe manufacturing, storage, and use of aerosols.

Prior to joining Exponent, Dr. Dee earned his doctorate in Chemical Engineering at the University of California, Berkeley. His graduate thesis focused on alternative energy and the production of biofuels from biomass-based energy crops. He also holds undergraduate degrees in Chemical Engineering and Sociology from Case Western Reserve University. Dr. Dee also worked in the polymer and specialty chemical manufacturing industries while completing his studies.

A selection of Dr. Dee's project experiences is included following the list of presentations and publications below.

Academic Credentials & Professional Honors

Ph.D., Chemical Engineering, University of California, Berkeley, 2012

B.A., Sociology, Case Western Reserve University, 2007

B.S., Chemical Engineering, Case Western Reserve University, 2007

Licenses and Certifications

Professional Engineer Chemical, Arizona, #70561

Professional Engineer, Colorado, #PE.0058270

Professional Engineer Chemical, Hawaii, #PE-21663

Professional Engineer, Illinois, #062065967

Professional Engineer, Kentucky, #35469

Professional Engineer, Louisiana, #PE.0050193

Professional Engineer, Maine, #PE18598

Professional Engineer, Michigan, #6201069766

Professional Engineer, Missouri, #2020007484

Professional Engineer Chemical, Nevada, #034481

Professional Engineer, New Mexico, #26757

Professional Engineer, New York, #111427

Professional Engineer, Ohio, #PE.90469

Professional Engineer, Pennsylvania, #PE095540

Professional Engineer Chemical, Texas, #125884

Professional Engineer, Virginia, #0402069667

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

Certified Fire and Explosion Investigator (CFEI)

Professional Affiliations

American Institute of Chemical Engineers

American Society for Testing and Materials

National Association of Fire Investigators

National Fire Protection Association

Leadership

Session Chair, 39th Center for Chemical Process Safety (CCPS) International Conference, AIChE 2024 Spring National Meeting and Global Congress on Process Safety, New Orleans, Louisiana, March 24 - 28, 2024.

Elected Director, AIChE Process Safety Division, Executive Committee, 2023-2025.

Session Chair, 38th Center for Chemical Process Safety (CCPS) International Conference, AIChE 2022 Spring National Meeting and Global Congress on Process Safety, Houston, Texas, March 12 - 16, 2023.

Conference Chair, 37th Center for Chemical Process Safety (CCPS) International Conference, AIChE 2022 Spring National Meeting and Global Congress on Process Safety, San Antonio, Texas, April 10 - 13, 2022.

Session Chair, 37th Center for Chemical Process Safety (CCPS) International Conference, AIChE 2022 Spring National Meeting and Global Congress on Process Safety, San Antonio, Texas, April 10 - 13,

2022.

Conference Vice Chair, 36th Center for Chemical Process Safety (CCPS) International Conference, AIChE 2021 Spring National Meeting and Global Congress on Process Safety, (virtual), April 18 - 23, 2021.

Session Chair, 36th Center for Chemical Process Safety (CCPS) International Conference, AIChE 2021 Spring National Meeting and Global Congress on Process Safety, (virtual), April 18 - 23, 2021.

Session Chair, 35th Center for Chemical Process Safety (CCPS) International Conference, AIChE 2020 Spring National Meeting and Global Congress on Process Safety, (virtual), August 17 - 21, 2020.

Session Chair, 34th Center for Chemical Process Safety (CCPS) International Conference, AIChE 2019 Spring National Meeting and Global Congress on Process Safety, New Orleans, Louisiana, March 31 - April 4, 2019.

Principal, National Fire Protection Association, NFPA 30B Code for the Manufacture and Storage of Aerosol Products, Served as Alternate beginning in 2013, Appointed to Principal in 2022.

Principal, National Fire Protection Association, NFPA 53 Recommended Practice on Materials, Equipment, and Systems Used in Oxygen-Enriched Atmospheres, Appointed to Principal in 2013.

Voting Member, ASTM International, Technical Committee G04 on Compatibility and Sensitivity of Materials in Oxygen Enriched Atmospheres, Granted Voting Member status in 2018.

Reviewer, Process Safety Progress.

Publications

Ogle R, Dee SJ, Mastalski I. Process Safety in Bioenergy with Carbon Cpature and Storage Systems (BECCS). Process Safety Progress. 2024; 1-8. https://doi.org/10.1002/prs.12657.

Dee SJ, Faraji S. A Chemical Engineer’s Introduction to ChatGPT. CEP Magazine, 2024, August: 19-25.

Dee SJ, Buehler CS, Ogle RA, Reding R, Zanganeh, N. The Dogma of Process Safety. CEP Magazine, 2024, March: 28-33.

Ott B. Delafontaine L, Welchert NA, Dee SJ, Reza A. Ensuring natural gas infrastructure is suitable for hydrogen service. Process Safety Progress, 2023; 42(2): 213-224.

Dee SJ, Hietala DC, Sulmonetti TP. Process hazard considerations for utilization of renewable methane from biogas. Process Safety Progress 2022; 41(4): 670-677. Published in online in Early View. DOI: 10.1002/prs.12389.

Walters MS, Dee SJ, Ogle RA, Balaster MM. How to leverage attorney-client privilege for effective incident investigations. CEP Magazine, 2022, March: 35-41.

Dee SJ, Ogle RA, Walters MS. Writing in the margins: Considerations for safe operating limits. Process Safety Progress 2022; 41(2): 253-260.

Dee SJ, Cox BL, Ogle RA, Walters MS. Deciding between short-term and long-term solutions for aging infrastructure. CEP Magazine, 2021, August: 20-27.

Walters MS, Dee SJ, Ogle RA. Two plants, one fence line: Process safety management in shared facilities. CEP Magazine, February 2020; 39-44.

Dee SJ, Cox BL , Ogle RA, Walters MS. Evaluating inherently safer design with multiattribute utility theory. Process Safety Progress 2019; 38(3): DOI 10.1002/prs.12022.

Dee SJ, Cox BL , Ogle RA. When the fail open valve fails closed: Lessons from investigating the “impossible." Process Safety Progress 2019; 38(3): DOI 10.1002/prs.12031. This paper was also used for a Process Safety Beacon highlight in June 2020 (https://www.aiche.org/ccps/resources/process-safety-beacon/archives/2020/june/english).

Dee SJ, Cox BL, Ogle RA. Development of a slip hazard: partially wetted floors and film formation. Materials Performance and Characterization 2016; 5(1): 272-287.

Dee SJ, Cox BL, Ogle RA. Process safety in the classroom: the current state of chemical engineering programs at US universities. Process Safety Progress 2015; 34(4): 316-319.

Ogle RA, Dee SJ, Cox BL. Resolving inherently safer design conflicts with decision analysis and multi-attribute utility theory. Process Safety and Environmental Protection 2015; 97: 61-69.

Dee SJ, Cox BL, Hart RJ, Farina R, Morrison DR. Effects of cooking on the thermal ignition behavior of vegetable oil. Proceedings, 2015 Fire and Materials Conference, San Francisco, CA, Interscience Communications Limited, London, February 2015, pp. 889-904.

Cox BL, Dee SJ, Hart RJ, Morrison DR. Development of a steel component combustion model for fires involving pure oxygen systems. Process Safety Progress 2014; 33(3): 299-304.

Dee SJ, Cox BL, Ogle RA. Using near misses to improve risk management decisions. Process Safety Progress 2013; 32(4):322-327.

Ogle RA, Carpenter AR, Dee SJ. Promoting commitment to process safety. Process Safety Progress 2013; 32(4):319-321.

Ogle RA, Morrison DR, Dee SJ. Using assessments to improve process safety culture. Process Safety Progress 2014; 33(2): 148-151.

Dee SJ, Bell AT. Effects of reaction conditions on the acid catalyzed hydrolysis of miscanthus dissolved in an ionic liquid. Green Chemistry 2011; 1467-1475.

Dee SJ, Bell AT. A study of the acid-catalyzed hydrolysis of cellulose dissolved in ionic liquids and the factors influencing the dehydration of glucose and the formation of humins. ChemSusChem 2011; 4:1166-1173.

Presentations

Faraji S, Dee SJ. Enhancing Process Safety through Chatbots: Exploring Challenges and Potential. 20th Global Congress on Process Safety, New Orleans, Louisiana, March 24-28, 2024.

Ogle R, Dee SJ, Mastalski I. Process Safety in Bioenergy with Carbon Capture and Storage Systems (BECCS). 20th Global Congress on Process Safety, New Orleans, Louisiana, March 24-28, 2024.

Enhancing Process Safety through Chatbots: Exploring Challenges and Potential, Artificial Intelligence Process Safety Management Users Exchange, January 17, 2024.

Dee, SJ. Management of Change: First Line Defense Against Accidents. Invited Keynote for Hatch Autoclave Operators’ Workshop, Niagara-on-the-Lake, Ontario. August 17, 2023.

Cox BC, Dee SJ, Hietala D, Walters MS. Ignition Sources Are Free: A Discussion of Common (and uncommon) Ignition Mechanisms for Gaseous Fuels and Combustible Dusts. 19th Global Congress on

Process Safety, Houston, Texas, March 12-16, 2023.

Dee SJ, Buehler CS, Ogle RA, Reding N, Zanganeh N. Catastrophic Explosion Investigation and the Dogma of Process Safety, 19th Global Congress on Process Safety, Houston, Texas, March 12-16, 2023.

Ott B., Dee SJ, Delafontaine L, Reza A, Welchert N. Ensuring Natural Gas Infrastructure is Suitable for Hydrogen Service. 19th Global Congress on Process Safety, Houston, Texas, March 12-16, 2023.

Dee SJ, Hietala DC, Stern MC, Sulmonetti T. Process hazard considerations for utilization of renewable methane from biogas. American Institute of Chemical Engineers, 2022 Spring Meeting and 18th Global Congress on Process Safety, San Antonio, TX, April 10-13, 2022.

Walters MS, Dee SJ, Ogle RA. When product safety becomes process safety. American Institute of Chemical Engineers, 2022 Spring Meeting and 18th Global Congress on Process Safety, San Antonio, TX, April 10-13, 2022.

Lardinois TM, Hietala DC, Cox BL, Dee SJ, Ogle RA, Walters MS. Learnings in material flash point characterization from the Lac-Mégantic rail disaster. American Institute of Chemical Engineers, 14th Midwest Regional Conference (virtual), March 1-2, 2022.

Hietala DC, Cox BL, Dee SJ, Ogle RA, Walters MS. So, What's the Point? Navigating Flammability Classification when Flash Point is Ambiguous. Mary Kay O'Connor Process Safety Center, 2021 International Symposium, October 19-21, 2021.

Dee SJ, Walters MS, Ogle RA. Writing in the margins: Considerations for safe operating limits. American Institute of Chemical Engineers, 2021 Spring Meeting and 17th Global Congress on Process Safety (virtual), April 18-23, 2021.

M. Balaster, Walters MS, Dee SJ, Ogle RA. How to leverage attorney-client privilege for effective incident investigations. American Institute of Chemical Engineers, 2021 Spring Meeting and 17th Global Congress on Process Safety (virtual), April 18-23, 2021.

Cox BL, Dee SJ, Ogle RA, Walters MS. Taking action on your DHA action items. American Institute of Chemical Engineers, 2021 Spring Meeting and 17th Global Congress on Process Safety (virtual), April 18-23, 2021.

Morrison DR, Dee SJ. Materials that set themselves on fire — Investigating spontaneous combustion. ADLA Seminar (virtual), March 25, 2021.

Dee SJ, Cox BL, Ogle RA. Combustible dust hazards and spray drying systems — Understanding NFPA 61's new requirements in a dust hazard analysis. American Institute of Chemical Engineers, 13th Midwest Regional Conference (virtual), March 17-18, 2021.

Nasir EF, Dee SJ, Smyth S. Understanding fire hazards in inert cryogenic systems. American Institute of Chemical Engineers, 13th Midwest Regional Conference (virtual), March 17-18, 2021.

Morrison DR, Dee SJ. Materials that set themselves on fire — Investigating spontaneous combustion. MCA/MDLA Joint Seminar (virtual), October 15, 2020.

Walters MS, Dee SJ, Ogle RA. Remember the à la mode: Lessons learned from ammonia release at frozen foods warehouse. Mary Kay O'Connor Process Safety Center, 2020 International Symposium (virtual), October 20-21, 2020.

Walters MS, Dee SJ, Cox BL, Ogle RA. Good practices for the control of hazardous waste emissions. 12th AIChE Southwest Process Technology Conference (virtual), October 1-2, 2020.

Dee SJ, Walters MS, Cox BL, Ogle RA. Is it time for an overhaul? Deciding between short-term and long-term solutions in aging infrastructure. American Institute of Chemical Engineers, 2020 Spring Meeting and 16th Global Congress on Process Safety (virtual), August 17-20, 2020.

Dee, SJ, Cox BL, Walters MS, Ogle RA. PPE – Can you have too much of a good thing? Mary Kay O'Connor Process Safety Center, 2019 International Symposium, College Station, TX, October 22-24, 2019.

Dee SJ, Walters MS, Ogle RA. Why some buildings don't explode: Lessons learned from an underground propane leak investigation. Propane Gas Defense Association, Fall Meeting, Las Vegas, NV, September 26-27, 2019.

Walters MS, Dee SJ, Ogle RA. Two Plants, One Fence Line: Understanding Process Safety Management Responsibilities in Shared Facilities. American Institute of Chemical Engineers, 2019 Spring National Meeting and 15th Global Congress on Process Safety, New Orleans, LA, April 1-4, 2019.

Dee SJ, Kornuta JA. More to the story: Cases of red herrings in failure analysis. Louisiana Association of Defense Counsel, North Louisiana Seminar, Shreveport, LA, March 22, 2019.

Sulmonetti T, Dee SJ, Fecke M. Chemical pretreatment of lignocellulosic biomass: Breaking down the challenges at the industrial scale. International Biomass Conference and Expo, Savannah, GA, March 19-21, 2019.

Stern MC, Bishop J, Dee SJ, Ibarreta A, Ogle RA, Myers TJ. Electrostatic hazards during pneumatic conveying of combustible dusts in flexible hoses. American Institute of Chemical Engineers, 2018 Spring National Meeting and14th Global Congress on Process Safety, Orlando, FL, April 22-25, 2018.

Dee SJ, Cox BL, Ogle RA, Walters MS. Evaluating inherently safer design with multi-attribute utility theory. American Institute of Chemical Engineers, 2018 Spring National Meeting and14th Global Congress on Process Safety, Orlando, FL, April 22-25, 2018.

Dee SJ, Sulmonetti T, Fecke M. Finding the hidden hazards in thermal conversion of biomass. International Biomass Conference and Expo, Atlanta, GA, April 17-19, 2018.

Rauchwerger D, Boardingham B, Dee SJ, Kearney J, O'Rorke A. Subrogating catastrophic industrial accidents: Finding the holes in the "swiss cheese." Claims Litigation Management, 2018 Annual Conference, Houston, TX, March 14-18, 2018.

Dee SJ, Kornuta JA. Epic fails: Case study insights to failure analysis techniques. Louisiana Association of Defense Counsel, North Louisiana Seminar, Shreveport, LA, February 23, 2018.

Garcia ME, Cox BL, Dee SJ. O2 no! – Safety considerations for oxidation reactions. American Institute of Chemical Engineers, 10th Midwest Regional Conference, Chicago, IL, March 13-14, 2018.

Traina N, Cox BL, Dee SJ. The sweet smell of ammonia hazards. American Institute of Chemical Engineers, 10th Midwest Regional Conference, Chicago, IL, March 13-14, 2018.

Walters MS, Cox BL, Dee SJ, Ogle RA. Defining "adequate" in "adequate ventilation." American Institute of Chemical Engineers, 10th Midwest Regional Conference, Chicago, IL, March 13-14, 2018.

Dee SJ. What I wish I had learned. 2017 Archer Daniels Midland Sponsored Faculty Workshop. American Institute of Chemical Engineers, Safety and Chemical Engineering Education. Decatur, IL, July 27, 2017.

Dee SJ, Errera M. Investigating chemical contamination cases. Property & Liability Resource Bureau, Claims Conference & Insurance Services Expo, Boston, MA, March 26-29, 2017.

Cox BL, Dee SJ, Ogle RA. When the fail open valve fails closed: Lessons from investigating the "impossible." American Institute of Chemical Engineers, 2017 Spring National Meeting and 13th Global Congress on Process Safety, San Antonio, TX, March 26-29, 2017.

Dee SJ. Feedstock specifications: Interpretations of off-spec feedstock. International Biomass Conference and Expo, Minneapolis, MN, April 10-13, 2017.

Dee SJ. Evaluating fire hazards in oxygen enriched atmospheres. American Institute of Chemical Engineers, 9th Midwest Regional Conference, Chicago, IL, February 28-March 1, 2017.

Morrison DR, Dee SJ. Combustible dust - a forensic incident investigation. 2016 Archer Daniels Midland Sponsored Faculty Workshop. American Institute of Chemical Engineers. Safety and Chemical Engineering Education, Decatur, IL, July 28, 2016.

Dee SJ, Fecke M, Morrison DR, Ogle RA. Becoming "wiser" in management of change. American Institute of Chemical Engineers, 2016 Spring National Meeting and 12th Global Congress on Process Safety, Houston, TX, April 10-14, 2016.

Dee SJ, Ogle RA. Lessons learned when evaluating the feasibility of emerging green technologies. American Institute of Chemical Engineers, 8th Midwest Regional Conference, Chicago, IL, March 3-4, 2016.

Dee SJ, Ogle RA, Lakhiani SD. Procedural safeguard reliability. American Institute of Chemical Engineers, 2015 Spring National Meeting and11th Global Congress on Process Safety, Austin, TX, April 27-April 29, 2015.

Morrison, DR, Kumar V, Dee SJ, Cox BL, Al-Shamary M, Al-Qabandi A. Fire from the cascading failure of an oxygen supply system. American Institute of Chemical Engineers, 2015 Spring National Meeting and 11th Global Congress on Process Safety, Austin, TX, April 27-April 29, 2015.

Dee SJ, Cox BL, Ogle RA. Ignition of flammable vapors in partially filled containers. American Institute of Chemical Engineers, 7th Midwest Regional Conference, Chicago, IL, March 13-14, 2015.

Cox BL, Dee SJ, Ogle RA. Hazards inherent to batch processing: Lessons learned from case studies. American Institute of Chemical Engineers, 7th Midwest Regional Conference, Chicago, IL, March 13-14, 2015.

Ogle RA, Cox BL, Dee SJ. Scaling analysis for confined dust flame propagation. American Institute of Chemical Engineers, 7th Midwest Regional Conference, Chicago, IL, March 13-14, 2015.

Dee SJ, Cox BL, Hart RJ, Farina R, Morrison DR. Effects of cooking on the thermal ignition behavior of vegetable oil. 14th International Conference, Fire and Materials, San Francisco, CA, February 2-4, 2015.

Dee SJ, Cox BL, Ogle RA. Process safety in the classroom: the current state of chemical engineering programs at US universities. American Institute of Chemical Engineers, 2014 Spring National Meeting and 10th Global Congress on Process Safety, New Orleans, LA, March 30-April 3, 2014.

Ogle RA, Carpenter RA, Dee SJ, Cox BL. Inherently safer design: lessons learned about the principle of simplification. American Institute of Chemical Engineers, 2014 Spring National Meeting and 10th Global Congress on Process Safety, New Orleans, LA, March 30-April 3, 2014.

Cox BL, Dee SJ, Ogle RA. Using near misses to improve risk management decisions. American Institute of Chemical Engineers, 6th Midwest Regional Conference, Chicago, IL, March 10-11, 2014.

Dee SJ, Ogle RA, Morrison DR. Applying game theory to understand process safety culture. American Institute of Chemical Engineers, 6th Midwest Regional Conference, Chicago, IL, March 10-11, 2014.

Viz MJ, Ogle RA, Dee SJ, Cox BL. Hydrogen sulfide exposure from molten sulfur — A forgotten hazard? American Institute of Chemical Engineers, 2013 Spring National Meeting and 9th Global Congress on Process Safety, San Antonio, TX, April 28-May 2, 2013.

Cox BL, Dee SJ, Hart RJ, Morrison DR. Development of a steel component combustion model for fires involving pure oxygen systems. American Institute of Chemical Engineers, 2013 Spring National Meeting and 9th Global Congress on Process Safety, San Antonio, TX, April 28-May 2, 2013.

Dee SJ, Cox BL, Ogle RA. Using near misses to improve risk management decisions. American Institute of Chemical Engineers, 2013 Spring National Meeting and 9th Global Congress on Process Safety , San Antonio, TX, April 28-May 2, 2013.

Ogle RA, Morrison DR, Dee SJ. Using assessments to improve process safety culture. American Institute of Chemical Engineers, 2013 Spring National Meeting and 9th Global Congress on Process Safety, San Antonio, TX, April 28-May 2, 2013.

Ogle RA, Carpenter AR, Dee SJ. Promoting commitment to process safety. American Institute of Chemical Engineers, 2013 Spring National Meeting and 9th Global Congress on Process Safety, San Antonio, TX, April 28-May 2, 2013.

Dee SJ, Hart RJ, Hetrick TH, Morrison DR. Hot surface ignition of bearing grease in horizontal and vertical orientations. National Association of Fire Investigators, International Symposium on Fire Investigation Science and Technology, College Park, MD, October 2012.

Dee SJ, Bell AT. Effects of reaction conditions on the acid catalyzed hydrolysis of miscanthus dissolved in an ionic liquid. American Institute of Chemical Engineers, 2011 Annual Meeting, Minneapolis, MN, October 20, 2011.

Dee SJ, Bell AT. A study of the acid-catalyzed hydrolysis of cellulose dissolved in ionic liquids and the factors influencing the dehydration of glucose and the formation of humins. North American Catalysis Society, 2011 North American Meeting, Detroit, MI June 9, 2011.

Dee SJ, Bell AT. Depolymerization of cellulose using mineral acids in ionic liquids. American Chemical Society Annual Spring Meeting, San Francisco, CA, March 24, 2010.

Dee SJ, Chidambaram M, Bell AT. Biomass dissolution and conversion to transportation fuels in ionic liquids. American Institute of Chemical Engineers Annual Meeting, Nashville, TN, November 11, 2009.

Project Experience

Select Project Experience

The following is a sampling of project experiences that demonstrate the range of Dr. Dee's chemical engineering expertise.

Chemical Process Safety and Incident Investigation

Dr. Dee provides accident investigation services for the chemical processing industry. His project experience includes supporting and leading root cause analysis of failures involving chemical processes and mechanical equipment. These investigations include evaluation of the elements of a process safety management system including requirements in OSHA’s Process Safety Management Standard, and good industry practices including the Center for Chemical Process Safety’s Guidelines for Risk Based Process Safety. Specific industries that Dr. Dee has helped support in these efforts include oil and gas, specialty

chemicals, food and agricultural products, hazardous waste handling and treatment, alternative energy and renewables, metals processing, aerospace, and polymers.

Dr. Dee also leverages this vast experience in accident investigation while providing process safety and risk assessment consulting. In these proactive projects, Dr. Dee assists chemical processing facilities as they identify, analyze, and control the hazards of their materials and processes to mitigate risk. Dr. Dee is also an active member in the American Institute of Chemical Engineer's Global Congress on Process Safety as a speaker, session chair, and symposium chair to share his expertise and lessons learned from his process safety consulting experiences.

- Line Break Chemical Exposure. Investigated a reported chemical exposure during a line break at a petrochemical plant. Scope of the investigation included review of the chemical processing equipment, preparation methods of the equipment for line breaking activity, the execution of the line break procedure by the workers, and the specified personal protective equipment (PPE) worn by the workers during the incident.
- Metal Processing Hazard Analysis. Provided risk assessments services for multiple metal processing facilities to identify and mitigate hazardous chemical exposure, fire, and explosion risk. Subject facilities handled a wide array of hazardous chemicals including corrosives, flammables, combustibles, and carcinogens.
- Hazardous Waste Treatment Chemical Burn Injury. Investigated a chemical burn injury reported during chemical waste treatment. Investigation included review of chemical waste composition and treatment chemicals, operating procedures for responding to process interruptions and error codes, and pressure relief design considerations for the treatment reactor and exhaust ductwork.
- Ammonia Release. Investigated the origin and cause of a release from an ammonia refrigeration system. Evaluation included a review of piping and valving materials of construction, their strength and performance at refrigeration temperatures, and the functioning of the emergency shutdown safety instrumented system.
- Polymerization Reactor Chemical Release. Investigated an environmental release in a polymerization reactor. Scope of the investigation included review of processing equipment, operational data in the timeframe leading up the incident, emergency cooling systems, operating procedures, and safety systems involved in the incident. Project also included customized chemical kinetic modeling to estimate the total mass released during the incident based on thermodynamics, heat transfer, mass transfer, and vapor/liquid fluid flow dynamics.
- Silo Collapse. Investigated collapse of an agricultural processing vessel. The investigation included a review of operational data, design specifications, material properties for ingredients used in the process, and coordination with a finite element analysis (FEA) modeling team to evaluate the strength and buckling stability of the vessel under various processing conditions.

Fire and Explosion Investigation

Dr. Dee is a certified Fire and Explosion Investigator (CFEI) and provides origin and cause investigations as outlined in the National Fire Protection Association (NFPA) Guide for Fire and Explosion Investigations (NFPA 921). His investigation experiences extend from chemical processing facilities to commercial and residential buildings. He has investigated fires and explosions covering a broad range of settings including industrial, commercial, and residential facilities. His experience includes fuel gas leak and explosion investigations involving natural gas, propane, and hydrogen. He has also led or assisted investigations of thermal failures involving various products and systems that can lead to fires and explosions including heating, ventilation, and air conditioning (HVAC) systems, household appliances

including ovens, dryers, ventless fireplaces, and furnaces, electrical systems, and consumer products that utilize lithium ion batteries.

- Apartment Natural Gas Explosion. Investigated a fire and explosion involving a natural gas leak in an apartment complex. Scope of the investigation included determination of the origin and cause of the fire/explosion, evaluation of the gas turn-on service that preceded the explosion, review of relevant standards for gas supply piping and systems, and the roles and responsibilities of the gas company, property management company, and occupants of the apartment in managing the hazards associated with gas service.
- Grain Silo Explosion. Investigated a silo explosion at a grain processing facility. Scope of the investigation included determination of the origin and cause of the explosion, and review of good practices for suppressing fires in silos, bins, and other grain storage vessels.
- FIBC Flammable Liquid Flash Fire. Investigated a flash fire that occurred during filling of a flexible intermediate bulk container (FIBC) with a combustible liquid. Analysis included review of electrostatic properties of the liquid being transferred at the time of the incident, bonding and grounding of the transfer piping system, and review of relevant codes and good practices for handling flammable and combustible liquids.
- House Explosion with Uncapped Gas Service Line. Investigated a residential natural gas explosion. Investigation included modeling of gas release to estimate total volume released, and review of relevant codes and practices regarding capping unused gas service lines.
- Fumigation Fire in Agricultural Facility. Investigated a fire that occurred during fumigation of an agricultural farm. Scope of the investigation included determination of the origin and cause of the fire, review of the relevant fumigant chemistry and potential to ignite other materials in the area of origin where the fire started.
- Oil & Gas Tank Explosion During Chemical Cleaning and Treatment. Investigated an explosion that occurred during a chemical treatment of an oil recovery and separations processing tank. Investigation included chemical incompatibility assessment of treatment chemicals and contents of the tank, evaluation of alternative ignition mechanisms including electrostatic discharges, and good practices for chemical cleaning and treatment of vessels that contain flammable and pyrophoric materials.
- Residential Propane Flash Fire and Explosion. Investigated a fire and explosion involving residential propane service. Scope of the investigation included determining the origin and cause of the explosion, review of relevant standards for propane gas supply systems, and soil chemistry contribution to corrosion of delivery piping.
- Spray Congealer Explosion. Investigated an explosion that occurred in a spray congealing system. Scope of the investigation included determination of the origin and cause of the explosion, and evaluation of hot work permit programs as a form of ignition source control.
- HVAC Unit Fire. Investigated several fires and ammonia releases in commercial heating, ventilation, and air conditioning (HVAC) units. Performed origin and cause analysis, and evaluated safety systems on the burner management system to evaluate gas supply shutoff during upset conditions.
- Hot Work Safety and Explosion Investigation. Investigated several explosions that occurred during hot work (cutting, grinding, welding) on containers that formerly held flammable and combustible materials. Analysis included evaluation of hot work safety programs, procedures for cleaning and preparing the vessel for hot work, and applicable standards and good practices.

- Fumigation Explosion at a Grain Processing Facility. Investigated an explosion that occurred during fumigation of storage silos at a grain processing facility. The investigation reviewed fumigation chemistry and its potential to generate flammable gases inside of equipment, migration of those gases throughout the process, and determination of the origin and cause of the explosion.
- Self-Heating Fire of Contaminated Vegetation. Assisted with an origin and cause investigation involving self-heating of vegetation contaminated with combustible materials. Scope of the investigation included testing to evaluate the flammability and ignition sensitivity of potential fuels, refuting of alternative hypotheses of fire cause, and fire spread dynamics related to fire suppression.
- Chemical Storage Warehouse Fire and Chemical Reactivity Hazard Assessment. Assisted in the investigation of the ignition source for a chemical warehouse fire. Scope of the investigation included determination of materials stored in the area of fire origin, evaluating potential incompatibility of chemicals in the area of origin, and calorimetric testing to characterize the potential for a reaction between incompatible materials to serve as an ignition source for the fire.
- Self-Heating Fire of Oil Soaked Laundry. Assisted with an origin and cause investigation involving self-heating of edible oils in laundered towels. Evaluation included testing of fire debris samples for identification of trace components, and evaluation of the factors that contribute to self-heating to spontaneous ignition of oil laden fibers.
- Fire at Poultry Processing Facility. Investigated a fire at a poultry processing plant. Scope of the investigation included determination of the origin and cause of a fire that occurred in the waste handling portion of the facility, and evaluation of potential ignition sources including self-heating of oil-laden food ingredients.
- Tar Distillation Unit Fire. Investigated the origin and cause of a fire on the flash column of a tar distillation unit. The scope of the investigation included review of collected evidence, inspection of the damaged unit, evaluation of potential damage from prior fires, and coordination with the team adjusting the loss for the insurance company.
- Compressor Fire. Investigate a compressor fire at an industrial mining facility. The investigation included documentation of the damaged equipment, review of maintenance and service activities on the compressor, and consulting with the client to improve the maintenance program and fire mitigation strategies for other compressors at the facility.

Alternative Energy and Green Manufacturing Consulting

Dr. Dee leverages his research background in biofuels and biomass processing to help clients develop and execute projects involving green manufacturing processes and alternative energy. Dr. Dee's project experience includes biomass processing and upgrading to chemicals and higher value products, alternative energy including biomass fueled utility boilers, biogas, and renewable natural gas (RNG) facilities, waste-to-energy (WTE) facilities, solar, wind, and energy storage including battery energy storage systems (BESS). Dr. Dee also supports clients by providing technical due diligence evaluations as projects are developed and executed, and assisting with litigation and arbitration on topics related to facility performance, alleged defect claims, or other relevant items in large construction contractual disputes.

- Anaerobic Digestor Expansion Due Diligence. Evaluated a proposed expansion of an anaerobic digestion biogas facility. Assessment included review of historical biogas output from the facility, feedstock supply and quality control programs, chemical kinetic modeling of the projected biogas

output after expansion, and evaluation of cleaning and separation technologies available to produce renewable natural gas (RNG) for pipeline injection.

- Biogas and Renewable Natural Gas (RNG) Facility Evaluation. Evaluated claims in an Engineering, Procurement, and Construction (EPC) contract dispute between an anaerobic digestion biogas facility owner and the EPC contractor. Scope of the evaluation included equipment design and selection, project scheduling and execution, evaluation of alleged defects, and analysis of alleged facility performance shortfalls related to biogas production and cleaning to renewable natural gas (RNG) for pipeline injection.
- Wood Fueled Boiler Environmental Permit Shortfall. Investigated cause of a utility boiler to fail to meet environmental permit requirements. Scope of the investigation focused on formation of nitrogen oxides (NOx) and its relationship to fuel quality (fuel nitrogen content). Analysis included review of fuel testing results, contractual specifications for fuel quality, literature review of typical variation in biomass fuel properties, refuting of alternative hypotheses (thermal NOx formation) and good practices for fuel handling and storage.
- Utility Boiler Fuel Conversion from Paper Processing Waste to Wood Fuel Dispute. Evaluated claims in a contractual dispute involving a sale of a paper mill black liquid recovery boiler that was converted to wood fueled utility boiler for electricity production. Scope of the investigation included review of the design and proposed conversion project, and facility performance post modifications.
- Chicken Litter Fueled Boiler Due Diligence. Evaluated a proposal for a chicken litter fueled utility boiler to generate electricity. Scope of the evaluation included review of feedstock and equipment specifications as well as preliminary design documentation.
- Concentrating Solar-Thermal Power (CSP) Facility Performance. Investigated claims of poor performance at a molten salt CSP plant. Scope of the investigation included review of commissioning documentation, performance guarantee testing results, alleged defect claims related to construction and supplied equipment, and performance of the plant after project turnover.
- Carbon Capture Plant Performance. Assisted with the investigation of poor performance of a carbon capture and storage retrofit project for a coal fired power plant. Scope of the investigation included review of carbon capture technology, review of commissioning and project turnover process, and investigation of plant operating conditions that could cause shortfall in performance.
- Bagasse Fueled Boiler Explosion. Investigated the cause of an explosion in a bagasse fired boiler in a sugarcane processing facility. Scope of the investigation included review of relevant codes and selection of materials of construction in the design process, and the inspection, maintenance, and operation of boilers fired on biomass based feedstocks.
- Landfill Gas Biological Desulfurization Process Failure. Investigated failure of a biobased desulfurization process at a landfill gas facility. Analysis included evaluation of biochemistry for the desulfurization process, impact of loss of power/utilities on the desulfurization equipment, and good practices for restarting and reconditioning the biological reactor post incident.
- Bioplastic Processing Feasibility Evaluation. Evaluated alternative biomass based feedstocks considered for production of plastic containers. Analysis included review of processing chemistry, scale-up considerations, and economic evaluation of production costs associated with location options for the potential production facility.
- Biomass Gasification to Sustainable Aviation Fuels (SAF) Due Diligence. Provided due diligence to a biomass gasification and Fischer Tropsch conversion to transportation fuels. Evaluation

included review of gasification technology, scale-up considerations, interface(s) with other technology providers in the project, and key areas of performance risk.

- Oil Shale Retort Hazard Identification and Risk Analysis. Evaluated design of processing equipment for shale oil recovery. Project focused on fire and explosion risk posed by various options for the retorting portion of the process.
- Pyrolysis and Biochar Due Diligence. Provided technical due diligence services for a proposed pyrolysis process to convert biomass to higher value solid and liquid products for fertilizers and soil amendments.
- Fertilizer Plant Conversion Due Diligence. Provided technical due diligence services for conversion and technology upgrade for a fertilizer plant to process and manufacturer alternative fertilizer products.
- Biodiesel Fueling Station Contamination Investigation. Investigated fuel quality complaints associated with production and blending of bio-based diesel fuel at a commercial fueling station. Investigation reviewed bio-diesel processing and quality testing, evaluated validity of engine damage claims, and assessed potential quality issues of other bio-based diesel fuel suppliers to the station.
- Biomass Pelleting Plant International Arbitration. Investigated claims of performance shortfalls for a biomass pelleting plant in Europe. Scope of the investigation included evaluation of claims of out-of-specification feedstock supply, equipment defects and deficiencies, and operational data from performance testing and early operation timeframe of the facility.
- Battery Energy Storage System Fire. Investigated the origin and cause of a fire that occurred in a battery energy storage system (BESS). The investigation included determination of the origin and cause of the fire, evaluation of the quality of supply for the BESS's modules and battery packs, and assessment of the BESS's fire suppression system.

Combustible Dust Incident Investigation and Hazard Analysis

Dr. Dee has extensive experience in combustible dust hazard analysis and investigation of fires and explosions involving combustible dusts. He has performed dust hazard analyses following the guidance in standards from the National Fire Protection Association and international standards in a variety of industries including grain processing, food and food grade additives, pigments, plastics, wood working, and biomass processing facilities. He has also investigated fires and explosions in various types of processing equipment/systems including, but not necessarily limited to, bulk solids transport, handling and storage, ingredient transport systems, dust collection, milling, grinding, drying and spray congealing. This experience encompasses a wide array of ignition mechanisms including electrostatic discharges, self-heating and thermal instability, hot work safety, mechanical sparks, and friction.

- Dust Hazard Analysis for Cheese Processing Industry. Performed dust hazard analysis for dairy, cheese, and whey powder manufacturing facilities. Assessments included ingredient transport systems, air-material separators, direct and indirect fired dryers, grinding, sizing/sieving, and packaging systems. Assessments included guidance related to compliance with relevant standards, materials testing, and prioritization of implementation strategies for addressing combustible dust risks.
- Spray Drying System Fire. Investigated the origin and cause of a fire in a pigment spray drying system. Scope of the investigation included sampling and testing of dust to determine combustible dust properties, determination of the origin and cause of the fire, and review of good practices to management and mitigation of combustible dust hazards.

- Grain Drying System Conveyor Fire. Investigated the origin and cause of a fire in a conveyor system of a grain dryer. Scope of the investigation included review of explosion dynamics and propagation through interconnected equipment, review of repair and maintenance records of milling equipment, and evaluation of potential cause hypotheses to determine the explosion's ignition source.
- Flash Fire and Explosion in Powder Addition to Flammable Solvents System. Investigated a series of flash fires and explosions in a powder addition system used to add catalyst (combustible dust) to a flammable solvent. Scope included determining the cause of failure for the inert gas blanketing system, testing to investigate heating of the powder when exposed to flammable solvent vapors, and change analysis regarding various revisions procedures for the powder addition process.
- Coal Dust Explosion. Investigated the origin and cause of a coal dust explosion in a solids handling system for an industrial utility boiler. Analysis included fire and explosion pattern analysis and damage mapping, review of equipment maintenance and repairs, evaluation of hot work safety and housekeeping programs, and testing of hypotheses related to smoldering and delayed ignition.
- Dust Hazard Analysis for Plastics Handling. Performed dust hazard analysis for a plastic manufacturing resin pellet handling process. Scope of the analysis include review a material handling equipment, combustible dust hazards, and relevant guidance in combustible dust standards.
- OSHA Citation Consulting. Assisted client with review and investigation of issues related to OSHA citations at a cheese processing facility. Scope of the investigation included analyzing requirements in historical standards, investigating root causes of dust released from processing equipment, and coordinating combustible dust testing in Exponent's Combustible Dust Testing Laboratory.

High Purity Oxygen System Design and Fire Risk Analysis

Dr. Dee has investigated fires and explosions involving processes that utilize high purity oxygen. He has spoken at technical conferences on the fire and flammability hazards associated with high purity oxygen. He has completed specialized training courses on high purity oxygen system design and oxygen fire risk analysis (OFRA). He is also a voting member of the National Fire Protection Association's recommended practice for oxygen system (NFPA 53) and ASTM International's Technical Committee G04 which oversees and develops various standards and recommended practices for oxygen system design, testing, and cleaning. Dr. Dee's project experience spans a broad range of industries including industrial gas supply, chemical manufacturing, medical, and aviation.

- Automotive Fire Involving Medical Oxygen. Investigated an automotive fire involving smoking during supplemental medical oxygen use. The investigation included evaluation of the origin and cause of the fire, manufacturing and quality controls quality assurance procedures for portable medical oxygen delivery systems, vapor dispersion in the passenger compartment of the subject vehicle, and warnings, labels, and training regarding the hazards of smoking and medical oxygen use.
- Oil & Gas Oxidation Reactor Fire. Investigated a fire in a large oxidation reaction portion of an oil processing facility. Analysis included evaluation of the origin and cause of the fire, and an evaluation of the suitability of metal and non-metal components in oxygen service on the oxidation processing line.

- Explosion at a Nitric Acid Production Facility. Investigated a catastrophic explosion in an oxidation reactor at a nitric acid processing facility. The investigation focused on the origin and cause of the fire, and the relevance process safety programs (as required in the OSHA PSM Standard – 29 CFR 1910.119) in mitigating the risks posed by utilizing flammable materials in oxygen systems.
- Operating Room Fire. Investigated a fire in an operating room during head and neck surgery. Scope of the investigation included review of fire hazards in operating rooms when open supplemental oxygen therapy is administered during anesthesia, evaluation of the flammability of surgical site preparation solutions and skin creams, and good practices for fire hazard risk mitigation.
- Oxygen Generator Fire. Investigated the cause of a fire involving an oxygen generator at a nursing home. Scope of the investigation included flammability of materials in the oxygen delivery system, variable (transient) oxygen concentration as equipment was turned off, and the hazards of smoking while using supplemental oxygen therapy.

Cryogenic Fluid Risk Analysis and Incident Investigation

Dr. Dee has investigated failures involving cryogenic storage systems and processes utilizing cryogenic fluids in the medical, food processing, cold chain transportation and industrial refrigeration industries. These experiences include thermal failures (inadvertent warming and defrosting of cold storage and refrigeration systems), over-pressurization (cryogenic fluid expansions in closed systems), fires, explosions, and asphyxiation hazards associated with accidental releases and confined space entry permitting.

- Fertility Clinic Sample Defrost During Transit. Investigated the cause of a sample defrost in a cryogenic dry shipping container during transit of a fertility clinic sample. Investigation included a review of the shipping container design, testing to evaluate failure mechanisms, and determination of the cause for defrost during transit.
- Liquid Nitrogen Explosion and Fire in a Food Manufacturing Facility. Investigation a fire and explosion in a food grade cryogenic process. The scope of the investigation included determination of the origin and cause of the explosion, review of design standards for cryogenic systems, and good practices for mitigating hazards in handling cryogenic fluids.

Consumer Product Failure Investigation and Risk Analysis

Dr. Dee has applied the fundamentals of his chemical engineering education to consumer product investigations across a wide array of applications. Dr. Dee has assisted clients as they navigate challenges involving customer complaints, regulatory compliance, manufacturing variation, and poor product performance. Typical issues include thermal, fire, or burn hazards, chemical handling and product stability, formulation chemistry, and fluid flow or mass transfer associated with product delivery. Dr. Dee is also a voting member of the National Fire Protection Association standard for aerosol product manufacturing and storage (NFPA 30B), and has assisted clients in investigation of incidents related to aerosol product performance and failures.

- Aerosol Air Freshener Performance Evaluation. Assisted a client in evaluating spray performance differences between products utilizing compressed gas propellants and hydrocarbon (liquified petroleum gas) propellants. Analysis investigated impacts on spray rate, particle size distribution, and spray quality.

- Aerosol Spray Adhesive Fire. Investigated a reported fire involving an aerosol-based spray adhesive in a residential fire. Investigation included determination of origin and cause of the fire, and coordination with mechanical engineering experts to evaluate container failure and relevant transportation regulations.
- Bug Spray Fire and Burn Injury. Investigated a reported fire alleged to be caused by a flammable solvent in an insecticide. Scope of the investigation included determination of the origin and cause of the fire, and labeling requirements.
- Candle Manufacturing Variation and Fire Risk Analysis. Assisted a client in evaluating the production variation in manufacturing of candles across several manufacturing lines. The investigation included testing of various samples and comparison with internal and external performance standards, review of quality assurance and quality control procedures, and assessment of potential fire risk associated with manufacturing variation.
- Gel Fuel and Fire Pot Burn Injury and Fire Analysis. Investigated a reported fire and burn injury during use of gel fuel fire pots and fire places. Scope of the investigation include comparison of material properties and performance of different formulations of gel fuels, and an investigation into the origin and cause of the incident.
- Ventless Fireplace Burn Injury. Investigated a reported fire and burn injury allegedly cause by a ventless fireplace. The investigation evaluated the subject ventless fireplace and its safety features, and included accident reconstruction testing to evaluate hypothesized failure modes that could lead to the report injury.
- Self-Heating Fire Investigation of Wood Stains and Varnishes. Assist client in evaluation of the self-heating tendency of wood stain and varnish products. Scope of the investigation included laboratory testing to determine tendency toward self-heating, its potential relationship to volatile organic compounds (VOCs) reported on the product, and the resulting fire risk due to self-heating to spontaneous combustion.
- Consumer Electronic Battery Fire and Risk Analysis. Led an investigation into root cause of battery failures in a small portable consumer electronic device. Project scope included failure investigation of units that underwent thermal runaway in the field, non-destructive evaluation of consumer returned units, quality audit of the battery manufacturing facility, and assistance with the development of a corrective action plan to address battery performance in existing and newly manufactured units.