

**NAFE Summer Meeting Technical Program – Saturday, June 25, 2016 – Dallas – Expected Presentations:**

**GENERAL SESSION “A” – morning**

**Author:** John Certuse, PE (NAFE 708 Fellow)

**Title:** Forensic Engineering Analysis of Fuel Usage and Thermostat Settings

**Abstract:** The Insurance Institute has reported that frozen pipes are one of the leading causes of building damage in the United States. In the forensic engineering analysis of building damage due to burst pipes, fuel tank runout or excessive thermostat setback are common causes of these losses and may lead to a fuel provider being culpable for a late fuel delivery or the property owner being responsible due to excessively turning down thermostats levels. This presentation will address the relationship between thermostat settings and fuel consumption. Using this relationship, demonstrated fuel consumption rates of occupied buildings can be adjusted to identify the resulting consumption rate (in between fuel tank deliveries or meter readings) in cooler unoccupied buildings. This provides the ability to analyze fuel consumption rates when demonstrated values are not available. Department of Energy values for fuel savings in relation to thermostat setback will be discussed as well as a fuel usage study in an exemplar home. Forensic case examples utilizing this relationship will also be presented.

**Author bio:** John Certuse is a licensed professional engineer and director of engineering at ISE Engineering in Attleboro, MA. ISE Engineering performs forensic engineering examinations for the insurance industry with a large concentration based upon heating system failures.

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**Author:** William Rowley, PhD, PE (NAFE 907 Fellow) and Laura Liptai, PhD (NAFE 887 Associate Member)

**Title:** Forensic Engineering Analysis of Cervical Spine Trauma, Specifically Quadriplegia and Other Paralyzing Injuries from Diving Accidents

**Abstract:** Spinal cord injuries from diving accidents are one of the most debilitating and life-altering injuries that can occur in swimming pools and natural bodies of water. Forensic investigations into cervical spine trauma from diving injuries require a forensic biomedical analysis and a forensic trajectory analysis in order to determine cause. Through these analyses, forensic experts can determine if the physical evidence is consistent with the history of the event or if evidence indicates other causes. This forensic investigation will analyze how spinal cord trauma from diving injuries occurs and identify measures to prevent or reduce these occurrences.

**Author bio:** Dr. Rowley is a Major General (retired) of the United States Air Force Reserves and has been professionally involved in the design of residential and large commercial swimming pools for more than 40 years. He has designed and monitored the construction of more than 675 major commercial swimming pools throughout the world, including more than ninety 50-meter swimming pools, the 1984 and 1932 Olympic swimming pools, and the White House pool. Dr. Rowley has been involved in more than 900 aquatic cases (of which more than a hundred were quadriplegic diving accident cases) in both Superior Court and Federal Court over the last 40-plus years.

**Author bio:** Dr. Liptai (BioMedical Engineering, PhD, MS; Mechanical Engineering, BS) specializes in biomedical engineering analysis of human trauma and accident reconstruction. Dr. Liptai has testified in more than 100 trials in the United States as well as military assignments on the North American continent, Europe, and South America. She serves on five boards (AAFS, IBFES, LEADR, UCDBME and SFES as President) and had the privilege of reviewing the engineering chapter in the Reference Manual on Scientific Evidence, 2nd Edition for the Judicial Research Center in Washington, DC.

**Author:** Reza Mirshams, PhD, PE (NAFE 933 Correspondent)

**Title:** Two Case Studies on Using Fatigue and Corrosion Analysis in Forensic Engineering

**Abstract:** Material failures occur in products due to changes in the original characteristics that prevent satisfactory performance of a functional system on their intended purpose and could produce great losses to human life and economic infrastructure. Metal characteristics change due to cyclic stress or strain and corrosion. This paper presents two case studies on the application of fatigue and corrosion fundamentals in determination of origin of failures in metallic parts: fatigue failure in a moving sidewalk and galvanic corrosion in a water system. Metallographic examination, chemical analysis of the parts, and fractography were conducted, and the cause of failures were determined as fatigue and galvanic corrosion.

**Author bio:** Dr. Reza Mirshams has PhD and MS degrees in industrial metallurgy and metallurgical engineering and is a licensed Professional Engineer with industrial and academic experience. He is a tenured full professor in mechanical engineering technology at the University of North Texas and has taught courses in the areas of mechanical metallurgy, manufacturing processes of materials, corrosion, failure analysis of materials, product design and process development, and materials selection. His research interests include mechanical metallurgy, corrosion assessment and mitigation methodologies, fracture mechanisms, and application of advanced materials in mechanical systems. His industrial experience includes services in the steel industry and engineering consulting.

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**Author:** Mark McAlpine, Esq. (NAFE 921 Correspondent)

**Title:** The Flint Water Crisis: A Case Study on the Engineer's Ethical Obligation as Whistleblower and a Forensic Evaluation of the Applicable Standard of Care

**Abstract:** This paper examines the potential legal ramifications of the current class action litigation against professional engineers in relation to the City of Flint's water treatment plant (the "Flint water crisis") and its effect on the ethical duties and standards of care applicable to professional and forensic engineers operation in the water treatment field. The paper is a case study of a lawsuit that maintains the engineers violated their duty to protect the public health and safety of the citizens of Flint by failing to warn of the consequences of choosing not to use anti-corrosive treatment in the water, leading to lead exposure (as well as other contaminants) and potentially poisoning more than 100,000 users of the treated water. The research looks at the evolution of the professional engineering ethical standard of care, the duty to whistle blow, and the possible implications of these lawsuits in the water and wastewater industries, amongst others.

**Author bio:** After nearly 35 years as a construction litigation attorney, Mr. McAlpine is consistently recognized by legal peer review organizations as one of the top construction lawyers in the United States. He has litigated hundreds of cases involving the professional liability of engineers, many involving public water and wastewater treatment systems. He has been instrumental in the review and drafting of various families of standard construction contract documents, such as those published by EJCDC, AIA and ConsensusDoc. He has been a member of the adjunct law faculty of the Wayne State School of Law, is widely published in the construction law field, and has served as a frequent lecturer to organizations such as APWA, AGC, EJCDC, WEMA and many others. He served as an adjunct member of the Management Committee of the AGC Public Utilities Division and is active in many industry associations serving the public utility industry.

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## **FIRE INVESTIGATIONS AND PREMISES LIABILITY TRACK “A” - afternoon**

**Author:** R. Vasu Vasudevan, PE (NAFE 619 Fellow)

**Title:** Forensic Engineering Analysis of a Home Fire

**Abstract:** A fire had occurred in a single family home where a family of four was living. The family was asleep when the daughter woke up, saw smoke in the bedroom, and alerted the other family members. They moved toward the front of the house for egress, but the fire intensity and smoke made their attempts futile. They retreated to one of the bedrooms, and two exited by breaking through the window glass. The other two were overcome before exiting and were later found deceased. No one heard a smoke detector, and brief searches by the investigators did not find any detector remains. Forensic engineering analyses of the evidence were performed, and the Fire Dynamics Simulator (FDS) was used to analyze multiple fire origins, smoke detector activation, and egress times. Fire growth, THIEF (thermally induced electrical failure), glass breakage, smoke detector activation, and tenability (CO levels, temperature and visibility) analyses were validated and verified by the combination of factual information, timelines, fuels derived from the burning item database (BID), and witness depositions. The analyses were used to show to the trier of the facts (jury) the most probable origin and cause of the fire and the most probable egress times for the residents.

**Author bio:** Mr. Vasudevan received his MS in engineering from UCLA in 1972 and worked in small engineering companies until he ventured out on his own in 1987. In 1971, he started to perform failure and risk/hazard analyses, and in 1979 he performed fire analysis of a large oil storage/handling facility. Since then, he has performed fire and explosion analyses ranging from wildland, industrial/manufacturing facilities, vehicles, appliances, and single/multiple family dwellings. He has performed analytical analyses of fires/explosions using FPETOOL, Hazard I, CFAST and FDS (Fire Dynamics Simulator by NIST) and has testified in court.

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**Author:** Joseph Leane, PE (NAFE 524 Senior Member)

**Title:** Solid Fuel-Burning Appliance Fire Investigations

**Abstract:** Solid fuel-burning fireplaces and wood stoves are popular because they provide heat and aesthetically pleasing environments. They also provide a heat backup to gas and electric building heating systems. However, they also provide a risk of a structure fire if not properly installed and maintained. This paper describes the basics of conducting a forensic engineering investigation involving a suspected fireplace or wood stove involved in a building fire. The paper will describe the types of appliances available, the types of chimney systems, and related design standards and building codes. Case studies highlighting common failure modes will also be presented.

**Author bio:** Mr. Leane has a bachelor's and master's degree in mechanical engineering from the University of Illinois. He is a licensed Professional Engineer in multiple states, and is a Certified Fire Investigator by the International Association of Arson Investigators. Mr. Leane has been a board-certified diplomate in forensic engineering by the National Academy of Forensic Engineers since 1996. He is a member of various engineering and safety organizations and owner of Hazard, Keefe & Leane Engineering located in the Chicago area. He has been a practicing forensic engineer since 1988, and has conducted thousands of accident investigations.

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**Author:** John Laughlin, PE (NAFE 760 Senior Member)

**Title:** Forensic Engineering Investigation of Slips and Falls Using Surveillance Video

**Abstract:** Slip and fall accidents are a serious public health concern, which, according to OSHA, cause 15% of all accidental deaths. Second only to motor vehicles as a cause of fatalities, these types of accidents are often very personal in that they are unwitnessed by anyone other than the claimant. This often makes it difficult to analyze the possibility that the fall actually occurred — or if the claimed injuries are consistent with having resulted from a fall. However, surveillance cameras are a ubiquitous part of modern society. These videos, which often record these accidents as they occur, can be a great aid in determining the validity of a claim. In

this discussion, two case studies will be presented. The first is a claim in which the defendant doubted the validity of the fall scenario. A forensic engineering analysis was able to demonstrate that the events captured on the video were not consistent with the physics of a slip event. The second case study is a claim in which a plaintiff's attorney wanted to know if his client's injuries, as related in his medical records, were consistent with having resulted from a slip event that was recorded by a surveillance camera. Frame by frame analysis was performed to deconstruct the video into discrete events in order to make this determination. Both of the author's clients were able to settle their cases favorably.

**Author bio:** Mr. Laughlin is a licensed biomedical and mechanical engineer with the State of Texas and a senior member of NAFE. He has been practicing forensic engineering and medical device engineering since graduating with his master's degree in 1995. He currently practices forensic engineering at the Laughlin Engineering Firm in Houston, Texas.

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**Author:** Juan Charles, PhD, PE (NAFE 695 Fellow)

**Title:** Forensic Investigation of Slips, Trips, and Falls on Access Ramps

**Abstract:** This presentation will discuss direct and indirect factors that contribute to pedestrian accidents on access ramps caused by slips, trips, or falls. It will also provide a systematic methodology to analyze such accidents as well as establish potential sequence of events that can occur in certain scenarios. Testing different hypotheses to help reach final conclusions in these situations, the paper will also offer recommendations based on the results of several similar cases and examine the fundamental facts that must be evaluated in order to prove this type of case in court.

**Author bio:** Dr. Charles has more than 39 years of experience in manufacturing, consulting, forensic engineering, and investigation work, especially in electromechanical device design and manufacturing, motor vehicle, loading vehicle, building inspection, accident reconstruction, fire and explosion investigation, vehicle fire investigation, power plant fire investigation, codes and standards, and safety in power plants, buildings, working spaces, etc. He is the author of one book, more than 10 peer-reviewed technical publications, and more than 50 conference papers. During the last 26 years, he has been a consulting engineer and forensic engineering investigator in the areas of building defect, motor vehicle accident reconstruction, pedestrian accident reconstruction, and slip, trip and fall accident reconstruction.

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#### **VEHICLE TRACK "B" - afternoon**

**Author:** Jerry Ogden, PhD, PE (NAFE 561 Fellow) and Mathew Martonovich, EI (NAFE 456 Correspondent)

**Title:** Forensic Engineering Tools and Analysis of Heavy Vehicle Event Data Recorders

**Abstract:** Since the 1990s, domestic passenger vehicles have been equipped with increasingly sophisticated supplemental restraint system event data recorders (EDRs) that have become the norm in collision analysis. Many collision analysts are aware that most heavy commercial vehicles are likewise equipped with heavy vehicle event data recorders (HVEDRs), which may trigger during a hard braking or sudden deceleration event — or when the driver activates some type of signal to trigger an event to the system. Some heavy commercial vehicle engine manufacturers also provide an additional record of the last stop of the vehicle. Unfortunately, there are no uniform standards as to the information recorded or even the triggering criteria for an event with regard to heavy commercial vehicles. HVEDR records oftentimes provide valuable information that assists the forensic engineer in analyzing collision or failure events. This paper provides the forensic engineer with HVEDR engine manufacturer download coverage and tools needed as of the presentation of this paper, and explores anomalies in event recording that the forensic engineer should be aware may exist. A case study containing an HVEDR record of a commercial vehicle having a peculiar recording anomaly will be presented. This paper outlines the process of how the anomaly was resolved, how the case was reconstructed, and the process of plotting the sequence of the events for courtroom presentation.

**Author bio:** Dr. Ogden is on the Board of Directors of the NAFE as Treasurer. He received a BS from Eastern Oregon University and an MS in Civil Engineering and PhD in Engineering and Applied Science (Civil and Mechanical) from the University of Colorado Denver. Dr. Ogden is the principal engineer of OEC Forensics (a division of Ogden Engineering & Consulting, LLC) in Littleton, Colo., having a multi-disciplinary focus in vehicular collision analysis, mechanical failures, highway work zone traffic control analysis, and highway design issues during his more than 25 years of forensic practice. Much of Dr. Ogden's work involves the analysis of commercial vehicle collision events to include the download and interpretation of data extracted from the Electronic Control Modules (ECM) and Anti-Lock Braking System (ABS) of heavy vehicles.

**Author bio:** Mr. Martonovich is a senior analyst and associate with OEC Forensics in Littleton, Colo. He received a BS from Metropolitan State University of Denver in mechanical engineering with a minor in mathematics, and is currently completing his MS in civil engineering with additional studies in mechanical engineering at the University of Colorado Denver. Mr. Martonovich has a multi-disciplinary focus in vehicular collision analysis and mechanical failures, and has been with OEC Forensics for more than seven years. He specializes in the analysis of commercial vehicle collision events, braking system, and mechanical failures — and the download and interpretation of data extracted from the Electronic Control Modules (ECM) and Anti-Lock Braking System (ABS) of heavy vehicles.

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**Author:** David Gillingham, P.Eng (NAFE 935 Associate Member)

**Title:** The Impact of the Lack of Marine and Rail Shipping Standards on the Transportation of Large Power Transformers

**Abstract:** Power transformers (>10MVA) are often shipped from the factory by rail or marine cargo ship. In these harsh shipping environments, transformers are subjected to a number of vibrational and impact forces. Even if these forces are within specified tolerances, the transformers could be damaged, resulting in premature failure. There are very few guidelines that describe the best practices for shipping transformers to monitor, and, more importantly, mitigate such stresses. Furthermore, manufacturers, railways, and marine shipping companies do not always have this information available, particularly for refurbished units. This paper will discuss the impact of this documentation drought on the affected parties and look at some of the available mitigation options.

**Author bio:** Mr. Gillingham is an electrical engineer with 20 years of design and maintenance experience in several fields, including heavy industry, municipal works, renewable energy, and utilities. In 2014, he expanded this experience with electrical equipment failure analysis and fire investigations at CEP. He is currently leading the development of a utilities group within CEP to focus on large industrial and utility losses. Mr. Gillingham has investigated and assisted on several cases involving transportation damage of transformers and other equipment throughout Canada.

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**Author:** George Hall, PE (NAFE 659 Senior Member)

**Title:** Forensic Engineering Case Study and Evaluation of Event Data Recorder Validity in a Police Collision

**Abstract:** In November 2009, an Arkansas State Police (ASP) cruiser collided with a civilian vehicle at an intersection, causing a fatality (civilian driver). An ASP officer reconstructed the collision speed of the police cruiser based on conservation of linear momentum, while independently another officer was tasked with downloading the Event Data Recorder (EDR) from the police vehicle. The reconstructed speed was significantly different than the speed obtained via the EDR download, and the officers involved could not agree on the speed at collision. Subsequently, the author was asked to review all the available information and to make an independent determination as to whether the EDR speeds were correct and valid. Subsequent to this effort, the ASP trooper was charged with manslaughter, and the author served as an expert for the special prosecutor as well as an expert for the ASP at a wrongful termination hearing. The methods used to determine the validity of the EDR speeds are discussed, along with specifics of the testimony.

**Author bio:** Mr. Hall is a forensic engineer who specializes in incident reconstruction and offers services to the insurance and legal communities through his firm, Hall Consulting, P.L.L.C. Mr. Hall earned a master of science degree in civil engineering from

Oklahoma State University, and is licensed as a Professional Engineer. He has been involved with the Bosch Crash Data Retrieval (CDR) technology since 2000 and has taught the technician course numerous times. He has testified as an expert on CDR issues in Oklahoma, Arkansas, and Missouri.

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**Author:** Jesse Grantham, PhD, PE (NAFE 597 Fellow)

**Title:** Forensic Engineering Assessments of Defective Welds in Mobile Oilfield Fracking Tanks

**Abstract:** Mobile hydraulic fracturing (fracking) tanks for oil-well drilling operations were purchased for more than \$5 million by a leasing company for use in Alaska and northern states. The 200 tanks were intended to transport drilling fluids and store liquids. The tank manufacturer warranted the tanks to meet all regulatory requirements. The forensic engineer confirmed that the tank welds did not achieve industry standards or satisfy regulations. The forensic engineer investigated and reported that the leaking welds were defective, and the tanks did not comply with Environmental Protection Agency (EPA) requirements.

**Author bio:** Dr. Grantham's specialties are welding, metals and nondestructive testing. He testifies about compliance with codes, contracts and safety regulations. He owns and operates Welding & Joining Management Group™ in Frederick, CO. In his laboratory, he conducts mechanical testing, nondestructive testing, and alloy analysis. He is a certified welding inspector, certified educator, certified radiographic interpreter, and certified nondestructive testing expert. He writes welding procedures and certifies welders. He testifies about weld failures and welding safety. He is a life member of the American Welding Society and American Society of Nondestructive Testing.