STATEMENT OF CAPABILITIES

HYDROGEN SAFETY CONSULTING SERVICES

Risk-Informed, Performance-Based Engineering + Consulting

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JENSEN HUGHES

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Maximize Hydrogen Throughput | Minimize Risk and Safety Burden

Jensen Hughes empowers the hydrogen industry to unlock its full potential. Our safety, risk engineering, fire protection, and emergency management expertise goes beyond ensuring regulatory compliance. We utilize risk-informed, performance-based solutions to streamline the path to production while mitigating operational hazards. By implementing the appropriate safeguards and procedures, we ensure a safe and efficient operating environment, giving you the confidence to achieve smooth startup and maximize production. We are your partner in powering the future of clean energy.

Risk-Informed, Performance-Based Engineering for Hydrogen Generation, Storage, Transport, and Utilization:

- Integrated solutions that address risk reduction and ensure business continuity.
- Solutions beyond traditional process safety.
- Data-driven risk assessments and performance-based solutions to optimize safety while maximizing production throughput.

Industry Involvement

- NFPA 2, Hydrogen Technologies Code Committee
- American Society of Mechanical Engineers (ASME) B31 Mechanical Design Committee
- Center for Hydrogen Safety (CHS)
- Nuclear Hydrogen Initiative (NHI)
- US Hydrogen Alliance (USHA)
- Alliance for Renewable Clean Hydrogen Energy Systems (ARCHES)
- Pacific Northwest Hydrogen Association (PNWH2)
- Electric Power Research Institute (EPRI)
- National Renewable Energy Laboratory (NREL)
- Hydrogen Cluster Finland
- American Institute of Chemical Engineers (AIChE)
- Center for Chemical Process Safety (CCPS)
- National Fire Protection Association (NFPA)
- Society of Fire Protection Engineers (SFPE)
- International Code Council (ICC)

Service Offerings

CODE CONSULTING + REGULATORY COMPLIANCE

- Code Consulting
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- Egress Modeling
- Hazardous Area Classification (HAC)
- Hazardous Materials Inventory Statement (HMIS)
- Hazardous Materials Management Plan (HMMP)
- Training

DESIGN ENGINEERING + FAILURE ANALYSIS

- Life Safety System Design
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- Alternative Design Solutions
- Risk-Informed, Performance-Based Design (RI-PBD)
- Incident Investigations
- Laboratory Services
- DataAdvisr™
- Training

RISK + HAZARDS

- Explosion Prevention and Protection
- Blast Analysis
- Process Hazard Analyses
- Combustible Dust Hazard Analysis
- Hazards and Operability Study (HAZOP)
- Hazardous Materials Safety
- Quantitative Risk Assessments (QRA)
- Process Safety Audits
- RiskAdvisr™
- HazAdvisr™
- Training

SECURITY + EMERGENCY MANAGEMENT

- Emergency Action Plans
- Emergency Response Planning
- Security Risk Management
- Threat & Vulnerability Risk Assessment (TVRA)
- SMARTPLAN™
- Training

CODE CONSULTING + REGULATORY COMPLIANCE

For 80+ years, we've navigated partners through code compliance challenges, from planning and through operation. Our multidisciplinary team, including active participants in codes and standards development, get involved early in the design process. We identify and interpret code requirements to mitigate potential compliance issues. By performing drawing reviews at key design stages, we resolve issues and develop solutions to save time and cost, all while maintaining intended form and function. We facilitate discussions and negotiations with the Authority Having Jurisdiction (AHJ).

Code Consulting

Identifying the correct building and fire safety criteria that apply to your project is the first step in code compliance. We help navigate the complex landscape of regulatory agencies to reduce delays, decrease costs and expedite construction. We conduct third-party plan reviews to independently assess code compliance.

Industrial Fire Protection

We advocate a cohesive design philosophy from concept to project execution that results in a feasible, practical, goal-oriented fire protection design. Our services cover a wide range of facility and project needs, including:

- Conceptual Planning
- Detailed Designs, including Calculations
- Existing Fire Alarm / Emergency Voice Alarm Communication System Audits
- Field Review of Installed Systems
- Facility Master Planning
- Fire Response Planning and Evaluations
- Fire Risk Assessments
- Fire Protection and Alarm System Design
- Fire and Gas Detection Design
- Functional and Acceptance Testing
- Bid Packages and Specification Preparation
- Pre-Fire Planning
- Review of Bids, Preliminary Design Packages
- Underground Fire Water Modeling

Egress Modeling

We apply advanced computer modeling to simulate evacuations during emergencies, creating 3D visualizations to assess a facility's egress design. These performance-based life safety design solutions can achieve compliance with the intent of prescriptive building codes for available safe egress time compared to the required safe egress time.

Hazardous Area Classification (HAC)

The National Electrical Code, NFPA 70, provides specific guidance around protection and install of electrical equipment in facilities using hazardous materials. Through electrical classification, we help ensure that electrical equipment doesn't serve as an ignition source. Where appropriate, we apply advanced techniques to limit the extent of your classified areas compared to the conservative, prescriptive zones.

Hazardous Materials Inventory Statement (HMIS)

To address common hazardous materials challenges, our HazAdvisr platform is a cloud-based chemical database, interactive inventory design tool and risk analysis review all in one. With your projects in HazAdvisr, you can easily export Hazardous Material Inventory Statements (HMIS), control area and high hazard inventory summary reports. HazAdvisr streamlines the chemical hazard analysis and fire code compliance challenges often faced by industrial, manufacturing and laboratory facilities. For more information visit: hazadvisr.jensenhughes.com.

Hazardous Materials Management Plan (HMMP)

The ongoing management of hazardous materials in use, storage or transport is imperative to maintain the established level of safety and code compliance. We help you develop a management plan through inventory statements, mapping of protection systems and coordination with local fire authorities. Where gaps between existing conditions and best practices exist, we will partner with you to develop prioritized remediation plans.

RISK + HAZARDS

We provide safety solutions to protect workers, assets and environments, so they can focus on operating their facility.

Explosion Prevention + Protection

We identify potential hazards associated with hydrogen production, storage, transportation, and handling and evaluate with refined approaches from code-based to advanced simulation. Our experts design venting systems to prevent explosions if leaks should occur, design for consequence mitigation, and train employees on safe handling procedures.

Blast Analysis

Our team provides blast assessment and blast design engineering services to protect people, systems and infrastructure from natural hazards, man-made or accidental extraordinary events and deliberate attacks. Our engineers and scientists solve problems through an understanding of the mechanics and dynamics of conventional and developmental materials subjected to extraordinary events and loads

Process Hazard Analyses

Our certified PHA staff can help you and your team prepare for and document a PHA at the design stage, prior to startup and during re-validations. We can develop a tracking and prioritization system to resolve PHA findings. Our team can lead your Hazards and Operability (HAZOP) studies, What-If Analyses, Failure Modes and Effects Analyses (FMEA), Fault Tree Analyses (FTA) and Event Tree Analyses (ETA).

Combustible Dust Hazard Analysis

Combustible dust explosions can be one of the most under-recognized hazards in industrial facilities. Our state-of-the-art combustible dust hazard characterization lab provides an unbiased assessment of your facility's dusts; this input allows us to customize our dust hazard analysis (DHA) for your facility. Processes and building areas are evaluated for combustible dust fire, deflagration and explosion hazards, and any gaps in protection are identified. We work with your operational team to prioritize recommendations against corporate risk objectives in consideration of operational and capital budgets.

Hazards + Operability Study (HAZOP)

Hazards and Operability Study (HAZOP) is a structured hazard identification and gap analysis tool. Our multi-disciplinary team that interacts and questions aspects of the facilities beyond their usual sphere of activity. A HAZOP systematically examines the process design of a facility, including normal and abnormal operations.

Hazardous Materials Safety

We help our clients identify, evaluate and control physical, environmental and health hazards. The safe and compliant classification, handling and processing of hazardous materials is critical to life safety, business continuity and loss prevention. Our global experts draw on our code, design and analysis expertise to create a prioritized mitigation strategy through onsite evaluations, hazard assessments, software solutions and training.

Quantitative Risk Assessments (QRA)

Quantitative Risk Assessment (QRA) is a comprehensive accounting of risk that allows for a fully informed decision-making process. Because it is the most resource-intensive version of PHA, this approach is typically reserved for enterprise applications with high risk and high cost of remediation.

Process Safety Audits

Process safety needs evolve throughout the lifecycle of a facility — from design to decommissioning. In addition to stated regulatory compliance mandates, process safety programs should reflect the current state of the facility. We are available to provide a full audit team or a subject matter expert to lead an internal team.

RiskAdvisr™

RiskAdvisr, designed for comprehensive fire protection analysis, can be a valuable tool for hydrogen facilities. By modeling potential emergency scenarios involving hydrogen hazards, RiskAdvisr can help identify weaknesses in current safety protocols and optimize fire protection strategies. This data-driven approach can improve the resilience of hydrogen facilities, minimizing risks to personnel, assets, and the surrounding environment.

HazAdvisr™

HazAdvisr software can streamline safety practices at hydrogen facilities by enabling comprehensive hazardous materials management. HazAdvisr tracks chemical inventory, classifies them by hazard level, and ensures compliance with regulations specific to hydrogen storage and use. This allows facility managers to identify potential risks, allocate appropriate safety resources, and maintain a clear understanding of the materials they handle.

DESIGN ENGINEERING + FAILURE ANALYSIS

We design safety solutions to protect workers, assets and environments exposed to potential. hydrogen hazards.

Life Safety System Design

Working with building owners, designers and architects, we provide fire alarm, mass notification, smoke control, and other life safety system designs for new and existing facilities, including non-buildings such as outdoor campus installations. We determine system performance requirements, produce detailed design drawings and documents, perform manufacturer specific calculations and evaluate the installation of systems. Fire Suppression From water-based, gaseous and special suppression systems, the fire suppression system we design will give you the peace of mind that comes with knowing that the protection strategy is the right one for your operation. Our fire protection engineers can determine system performance requirements, evaluate water supply systems, perform hydraulic calculations, and assess code compliance. We can also assist you from bid through construction to ensure that the system is installed according to plan.

Alternative Design Solutions

When the prescriptive nature of the building and fire codes doesn't allow the elements that architects and building owners desire, we work with clients and code authorities to develop alternative methods to achieve code compliance along with a project's objectives, often providing savings in terms of cost, schedule or both.

Risk-Informed, Performance-Based Design (RI-PBD)

Our experts untangle complex requirements in to simpler solutions with RI-PBD methods. Our analysis methods identify the most likely hazards with consideration of event frequency and magnitude and then design to quantifiable success criteria to withstand those demands with high confidence. This performance-based design can optimize safety while potentially reducing unnecessary construction costs. Ourr expertise in areas like hazard analysis, venting systems, and staff training ensures a comprehensive approach to keeping hydrogen facilities safe

Incident Investigations

Our forensics expertise enables us to investigate process failures and industrial incidents and provide litigation support. With our demonstrated track record, we can support your team in understanding the cause and origin of process failures and establish corrective actions to prevent recurrence.

Laboratory Services

Our forensics expertise and multiple lab facilities enables us to (1) analyze failed components to pinpoint the cause (material degradation, hydrogen embrittlement etc.) (2) reconstruct the event with explosion investigation methods, and (3) identify design or operational weaknesses that contributed to the failure with data analysis and modeling. All of these re-inform future design for risk mitigation and improved safety.

DataAdvisr™ AI/ML Software Solutions

DataAdvisr can streamline data processing and maintenance requests at hydrogen facilities. By automating tasks like screening and prioritizing reports using machine learning, DataAdvisr significantly reduces manual work and expedite identifying critical issues. This allows hydrogen facility staff to focus their time and expertise on addressing the most important maintenance needs..

SECURITY + EMERGENCY MANAGEMENT

We provide safety solutions to protect workers, assets and environments.

Emergency Action Plans

Our emergency management team can help you develop easy-to-follow procedures to address emergency situations including evacuations, earthquakes, fires, fire alarms, gas leaks, power outages, elevator failures, active shooter situations and workplace violence. We work to identify the emergencies most likely to impact your organization and create an emergency action plan that is customized to your risks and response needs.

Emergency Response Planning

We develop standard operating procedures that outline the necessary pre-incident planning and time-critical actions that must be taken during an emergency event as well as post-event recovery to return to normal operations.

Security Risk Management

Before you invest in new or improved security capabilities, you need to understand your risks. Whether you're in charge of enterprise-wide security, manage security for critical infrastructure, or handle executive protection or special event security, it is important to assess the risks, threats and vulnerabilities you face. Our services include assessments of:

- Risks, threats and vulnerabilities
- Security operations and programs
- Physical and technical security protecting facilities

Risk, Threat + Vulnerability Risk Assessment

We assess a wide range of natural, technological and human threats within the DHS framework that defines risk as a function of threats, vulnerabilities and consequences to people, assets, capabilities and operations. The outcome is a transparent, score-based platform that can be used to rationalize, plan and align ongoing investments in security operations and emergency response capabilities in a manner that reflects both the risk environment and your organization's unique objectives, capabilities and constraints.

SMARTPLAN™ Software Solutions

SMARTPLAN™ improves operational resilience with a reliable web-based solution to create and maintain emergency response and business crisis plans, backed by a team of planning experts. Our technology greatly improves plan efficiency, consistency, accuracy, and accessibility for multiple locations. The approach offers efficiency and consistency advantages over internal systems and paper-based methods. Complex planning is streamlined so businesses can easily maintain best-in-class response strategies that meet evolving compliance requirements enterprise-wide.

Featured Projects

Project Experience

Our team of experts has supported over 125 hydrogen projects (90+ since 2019). These have included hydrogen generation, storage, transportation, and utilization projects across multiple occupancies, including Laboratories, Petro-Chemical, Manufacturing, Warehouse/Storage, High Tech/Computer, Electric Utilities, Transportation and other Industrial Facilities. The following is a sampling of our experience.

CODE CONSULTING + REGULATORY COMPLIANCE

Nuvera Fuel Cells

Cambridge, MA
Sommerville, MA
Boston, MA
Billerica, MA
Riverside, CA

Fire Protection and Life Safety Code Consulting Services, Process Hazard Analysis

Since 2006, we have provided code consulting, fire alarm design, and process hazard consulting services for multiple projects at Nuvera Fuel Cell Facility locations.

Notable work includes fire protection and life safety code consulting services for the installation of a hydrogen generation, storage and fueling process at Nuvera's Cambridge fuel cell facility. Services provided included a review of the proposed installation design to verify compliance with NFPA 50A, NFPA 52, NFPA 55, and the Massachusetts Building and Fire Codes. We advised the facility EH&S manager and design team on necessary modifications to the installation based on code requirements. We also participated in discussions with the local officials to determine local emergency planning requirements.

We were also engaged to review a proposed hydrogen installation at a new facility in Billerica, MA. Our scope of services focused on issues surrounding the outdoor installation of hydrogen generation, storage and dispensing equipment. We researched and documented the site licensing requirements from the Massachusetts Fire Prevention Regulations for storage of flammable gas above the allowable quantity threshold. We documented the major fire protection and life safety code requirements for bulk hydrogen storage on site, documented the major fire protection and life safety code requirements for hydrogen generation and dispensing on-site, and compared the major fire protection and life safety code requirements for gaseous and liquefied hydrogen storage.

Additional projects include a process hazard analysis (PHA) for various Hydrogen Fueling Stations and code consulting services for the hydrogen generation and dispensing operations at a food distribution location planned to contain a 150kg/day hydrogen generation capacity with two indoor plug power dispenser units that have electronic dispensing and contain a 100+kg storage vessel and tube trailer located adjacent to the dispensing building.

Confidential EPC Firm Facility

Confidential Nuclear Power Plant

Code Consulting Services

We provided code consulting and regulatory compliance for a proposed 200+ MW hydrogen electrolyzer powered from an existing nuclear facility.

Air Products and Chemicals, Inc. *La Porte, TX*	*Code Consulting and Regulatory Compliance Services* Our team is providing code consulting for a proposed hydrogen liquefaction plant. The project is adding a new HyCO 4 unit at the existing facility which will produce approximately 30 MMSCFD of CO and approximately 15 MMSCFD H2.
HC Stark *Newton, MA*	*Fire Protection and Life Safety Code Consulting Services* We provided fire protection and life safety code consulting for hydrogen storage and use in a tantalum processing area. Our work included research, interpretation and reporting on the applicable code requirements for hydrogen storage containers, piping, extent of electrical classification, ventilation, and fire/gas detection. We surveyed the process areas, understood the operations and made recommendations on facility improvements for code compliance. *In addition, we provided fire protection and life safety code consulting, focusing on possible scenarios for re-location of certain tantalum processing equipment into renovated space, resulting in the creation of high hazard occupancies. We reported on the fire protection and life safety features that would be required for introduction of a high-hazard occupancy into an existing building.*
General Motors *Detroit, MI* *Brownstone, MI*	*Code Consulting Services* Hydrogen fuel dispensing stations including the bulk hydrogen storage were to be deployed in a Factory Zero fabrication facility operated by General Motors Company (GM). A portion of the existing facility extends across the boundary between two cities of Detroit and Hamtramck, Michigan. In order to verify the applicable fire codes for two cities, our firm performed a code study. This effort included document review and code research on the Michigan Building Code, International Fire Code, NFPA 2, Hydrogen Technologies Code, and other referenced codes and standards.
Arizona State University (ASU) *Mesa, AZ* *Tempe, AZ*	*Fire Protection and Life Safety Code Consulting Services* Our firm provided a code review for the relocation of a hydrogen fuel cell system at the ASU Polytech and main Campus in Mesa, AZ. The code study outlined the major fire/life safety requirements for the relocation of the fuel cell power system and the associated hydrogen gas supply. At the ASU Tempe campus, our team provided code consulting services related to the laboratory renovation and storage/exhaust of hydrogen, hydrogen sulfide and oxygen.
The Raymond Corporation *Greene, NY*	*Code Consulting Services* Our firm provided code consulting for hydrogen fueling installation.

Novartis Institutes for BioMedical Research *Cambridge, MA*	*Fire Protection and Life Safety Code Consulting* We provided fire protection and life safety code consulting services related to the new hydrogenation process at the 250 Massachusetts Avenue and 100 Tech Square Novartis tenant spaces.
Saint-Gobain *Worcester, MA*	*Code Consulting* Since 2014 we have been providing code consulting services to Saint-Gobain High Performance Solutions Projects have included the assessment of their existing hydrogen furnace/oven and hydrogen delivery system, a laboratory study for hazardous materials and building compliance and code consulting for the installation of a new air condition unit for an existing R&D building, which was previously heated only, and houses hydrogen burning furnaces used for fuel cell research.
SM Engineering & Heat Treating *North Attleboro, MA*	*Code Consulting and Regulatory Compliance* We provided fire protection and life safety code consulting services for the S.M. Engineering & Heat facility hydrogen system. The facility utilized an existing hydrogen system for the manufacturing process within the facility which was piped in from a storage shed adjacent to the primary building. The client proposed to design a replacement hydrogen system with a new manifold and copper tubing with brazed joints/fittings. Our analysis assisted the client in adhering to the local and state requirements while the system upgrade was designed and implemented. Existing building code considerations were included in the approach.
General Motors *Detroit, MI* *Brownstone, MI*	*Fire Protection and Hazard Analysis* Our team provided fire protection and life safety code consulting services for a new fuel cell testing/laboratory spaces at an existing GM facility in Brownstown. We provided overall project support with high level guidance for fire and life safety code compliance to meet GH2 "control area" criteria per NFPA 2, Hydrogen Technologies Code (2016 Edition). We are currently providing code consulting services for the installation of a Process Gas Supply system that will be used to support manufacturing and testing of hydrogen fuel cells. The process gas supply system will consist of bulk storage outside the building and will provide gaseous hydrogen and nitrogen to the interior of the building.
8655 Boundary Road *Vancouver, Canada*	*Code Consulting Services* Working with AECOM, our firm provided fire consulting services for new commercial real estate and mixed-use facility. It consists of a new underground fuel tanks, a surface hydrogen storage tank, hydrogen station module, HVAC unit, and garbage facilities, hydrogen fueling with dispenser, 2 units of EV fast charge spaces with dispensers, 4 regular fueling dispensers.

DESIGN ENGINEERING + FAILURE ANALYSIS

Korea Gas Technical Corporation
Pyeongtaek, Korea

Fire Alarm Design

We are currently providing fire alarm design services for the Pyeongtaek Hydrogen Project.

Sunny Engineering
Icheon, Korea

Fire Alarm Design, Water Based Suppression Design

Our team is providing fire alarm and water-based suppression design services for the SK Airgas M16 hydrogen and helium storage facility project design.

Neville Chemical Company
Pittsburgh, PA

Fire Protection and Life Safety System Evaluation

Neville Chemical is currently in the final stages of engineering for a new plant expansion at its Neville Island facility. The plant will produce hydrogenated hydrocarbon resins such as heat polymerized cycloaliphatic and aromatic modified cycloaliphatic products in a broad range of glass transition temperatures.

Hydrogenated resins are “water-white” odorless tackifiers used in adhesives, sealants, coatings, tires, polymers, film and wax modification markets. This new process will include a three story, open sided structure with a sloped roof, along with piping, tanks, reactor, and process equipment. This new structure will house the majority of equipment required for this new process.

Originally retained to provide fire protection engineering services, we are currently providing hydrogen gas detection services and drainage/containment evaluation services.

Statue of Liberty VI Vessel Design
New York, NY

Design, Fire Hazard and Equivalency Analysis

Our firm provided fire hazard and equivalency analysis of the unique hazards associated with the proposed Statue of Liberty VI vessel design. The primary regulatory code issues associated with the vessel design were based upon the proposed use of a hydrogen propulsion system, with associated hazards of the hydrogen storage, hydrogen fuel piping and battery systems.

New Flyer Manufacturing
Ontario, CA
St. Cloud, MN
Anniston AL

Code Consulting, Programmatic Support and Loss Control

Our team provided fire protection/life safety consulting services regarding the adequacy of automatic sprinkler systems protecting areas within the facility where lithium-ion batteries could be present and to evaluate the requirements for hydrogen-powered buses in manufacturing facilities located in Ontario CA and St. Cloud, MN.

Additional projects have included the evaluation of hazard and design of a hydrogen gas alarm system and performing a risk assessment on the manufacturing process for hydrogen-powered and lithium battery-powered municipal transit buses.

Emerald Kalama Chemical

Henry, IL

Design + Consulting Services

Our team provided consulting services for a preliminary study and engineering study for the fire alarm system replacement at a chemical processing and resin manufacturing facility in Henry, IL. A portion of the facility includes buildings/processing areas that are owned by Emerald Kalama Chemical, and the other portion is owned by Mexichem Specialty Resins. The site-wide fire alarm system is shared by Emerald and Mexichem, with the main fire alarm control panel located in the guard building adjacent to the parking lot. The site consisted of approximately 35 buildings; most of which are small, single-story structures. Other areas include outdoors processing areas, chemical storage tanks, and similar uses. General material hazards of higher concern include flammable liquids and gases, and toxic gases, such as vinyl chloride, hydrogen sulfide (H2S), and nitric oxide.

Services provided include a preliminary study of the site-wide existing fire alarm system (including all of the Emerald Kalama Chemical and Mexichem buildings), a preliminary design narrative that includes a decision matrix and cost estimates for system replacement/upgrades, and relevant site and building drawings (more details in scope items). The second phase of the scope of services will include an engineering study with the ultimate goal of preparing a bid package that includes engineering drawings and specifications.

RISK + HAZARDS

Umicore

Attleboro, MA

Providence, RI

Hazardous Materials and Code Consulting Services

We provided hazardous materials, combustible dust analysis and code consulting for a bulk hydrogen storage and use project at the Attleboro facility.

As a separate project we provided an independent code evaluation of the new hydrogen-related process for the Umicore facility located in Providence, RI.

FM Solutions, Arizona Public Service Company

Northern AZ

Hazard Assessment

Our firm performed a hazard assessment at the Arizona Public Service Company (APS) 4 Corners Generating Plant in northern Arizona. We conducted an in-depth and technical review of hydrogen storage and use operation. We assessed on a base-line level what type of storage and use occurs and the potential hazards. Due to the unique nature, hazard, and sophistication of Hydrogen storage (in gas or liquid form), we analyzed the storage and use in accordance with nationally recognized standards. Based upon the site survey and code analysis, our team also developed a control of use and mitigation strategy that included a descriptive risk characterization.

Iwatani Corporation of America *Fontana, CA*	*Hazardous Material Code Consulting* We provided hazardous material code consulting services for this Hydrogen Fueling Station project. A new 3,200 square foot equipment enclosure as well as a 21-foot-tall awning was installed along with four hydrogen fuel dispensers. Associated mechanical and electrical systems were also installed along with safety system, signage and site improvements. An existing propane tank and dispenser was also relocated.
National Renewable Energy Laboratory (NREL) *Golden, CO*	*Process Hazards Analysis* We participated as an input source and third-party reviewer for process hazards analysis, for experimental hydrogen fuel cell installation in NREL's High-Performance Computing Data Center in the Energy Systems Integration Facility (ESIF).
Cummings, Inc. *Downey, CA*	*Risk and Hazard Analysis + Process Safety Consulting Services* Our firm provided hazard evaluation and physical inspection for the Cummins Services Facility; a two-building facility separated by unprotected openings. The facility services diesel and compressed natural gas vehicles, as well as hydrogen fuel cell electric vehicles.
ASML San Diego *San Diego, CA*	*Risk and Hazard Analysis* Our firm provided a process hazard analysis (PHA) for the existing Hydrogen Abatement System at the ASML facility. We provided a HAZOP (Hazardous Operability Study) for the venturi-based hydrogen abatement system.
Entergis *Billerica, MA*	*Risk and Hazard Analysis, Materials Classification* Our firm provided fire protection engineering and life safety code consulting services including hazardous material classification and quantity analysis of chemicals and a detailed review of outdoor hydrogen gas storage. Our scope of work included a kickoff meeting, survey of the existing hydrogen storage, review of the chemical classifications and quantities, a report and a strategy development.

SECURITY + EMERGENCY MANAGEMENT

Southern Nuclear *Baxley, GA*	*Emergency Response, Planning and Management* Our firm provided Pre-Fire Plans (PFPs) for the Hydrogen and Oxygen Storage Area (Fire Zone 0809), located outside the southeast corner of the Unit 2 Cooling Tower yard, and the Service Building Tunnel, an extension of the Unit 2 Turbine Building West Cableway, located beneath the Service Building for Plant Hatch.

6k Inc. *North Andover, MA*	*Gap Analysis and Hazardous + Process Safety Consulting* Our firm performed a third party code review, hazard review, gap analysis and forensic type review and HAZOP for this mixed-use non-separated area with offices, manufacturing, warehouse and accessory spaces. A gap analysis was conducted to understand environmental, health and safety best practices for the facility. As part of our involvement, we also reviewed the conducted HAZOP for differences in likelihood and severity associated with the proposed feedstock change to 100% hydrogen, reviewed applicable building design information and building, fire, mechanical and environmental codes to identify any required or recommended construction or remediation. The analysis was conducted with an actionable path to incorporating the feedstock change with minimal impact on operations.
General Motors *Detroit, MI* *Brownstone, MI*	Our firm set up the fuel cell system manufacturing (FCSM) facility in GM smart plan application. This effort included adding standard GH RCRA plan template to FCSM facility, populating FCSM RCRA plan with client-provided data and updating use accounts to provide access to new plan.

Featured Staff

PROJECT TEAM PROFILES

Biographies of our key staff are provided below. Full resumes are available upon request.

PAUL AMICO

Vice President, International Power + Industrial Practice

Paul has over 40 years of experience in risk-informed, performance-based (RI-PB) engineering for facility design, safety, and operations. He has over 100 articles, presentations, publications and reports on risk and reliability, and is recognized in the industry as a subject-matter expert. He is a member of the ASME/ ANS Joint Committee on Nuclear Risk Management (JCNRM) and represents Jensen Hughes in the United States Hydrogen Alliance and the Nuclear Hydrogen Initiative. While most of his experience over his 40+ years in the industry has been focused on nuclear power, he has also brought his RI-PB expertise to systems and facilities in petrochemical production, hazardous chemical destruction, radioactive waste disposal, medical treatment, and space exploration. He has established himself as an expert in the development and adaptation of methods for risk management and risk-informed decision-making and regulation and has been an advisor to various international organizations in over 20 countries.

WES BRINSFIELD

Senior Engineer, Energy + Utilities

Wes is a Senior Engineer with extensive professional experience in the use of risk assessment in a variety of applications. He has managed, participated in or served as an independent reviewer for multiple projects to address facility operations, safety, plant design, and regulatory issues in areas as diverse as brown fielding, missile launch, proton radiation cancer treatment, and electric power generation. Wes contributed to developing risk assessment methodologies and applications and served as a Risk Assessment Mission Expert for the International Atomic Energy Agency. Wes participates in the United States Hydrogen Alliance and the Nuclear Hydrogen Initiative on behalf of Jensen Hughes.

JENS CONZEN, MBA, MSC., DIPL.-ING.

Vice President, Business Development

Jens is Vice president of our Midwest Subregion, as well as a Subject Matter Expert in Industrial and Process Safety. He has hands-on experience in various disciplines such as engineering design, international and local engineering standards, simulation, and testing. He leads an interdisciplinary team that supports industrial customers in projects that require either a standard or customized solution approach. For customized solutions, he leverages scientific principles and confirms those with an experimental basis (i.e., data driven solutions). He serves various industries which include power generation (nuclear, conventional, renewable, including hydrogen) and storage, manufacturing, pharmaceutical, and chemical production. Areas of emphasis include reactive chemical hazards (e.g., thermal runaway), operational issues with power generating facilities, power storage equipment, chemical process plants, fire and explosion safety. He supported numerous international projects as well as first-of-a-kind projects.

LEONARD DEONARINE, CIT, OHST, CEM, MEMS, ABCP

Senior Director, Security Risk Management

Leonard has extensive experience in the emergency preparedness field, having managed the fire and other protection programs for Fortune 200 corporations and other organizations at the executive level. He is specifically adept with hazard analysis; planning; program management; regulatory compliance; business continuity; incident command; curriculum development; and disaster simulation design, planning and evaluation. For 11 years, Leonard served as the senior emergency management executive at Tenet Healthcare, a U.S.-based, Fortune 200, publicly traded healthcare corporation, where he oversaw the plans, programs and incident command responsibilities for 65 hospitals.

FATIMA IBRAHIM, PE

Senior Consultant

Fatima is a fire protection and hazardous materials consultant working with high-risk facilities to assess the extent of fire, reactivity, and health hazards of chemicals in diverse settings through the lens of building and fire codes and OSHA regulations. She has a background in chemical hazard analysis, special hazards protection, hydrogen hazards, combustible dust, and the occupational safety of industrial processes. Previously, she conducted research in the fields of toxicology, medical physics and biophysics.

ALWIN KELLY

Senior Director, Mid-Atlantic Region

Alwin is a Senior Director within the Mid-Atlantic Region. He has diverse fire protection engineering experience, including conducting process hazard, dust hazard and fire hazard analyses; directing fire tests; integration and application of regulations, codes and standards; preparation of compliance strategies for storage and use of flammable and combustible liquids, and other hazardous materials; development of alternate compliance means for existing facilities and unique operations; interpreting, revising and developing naval fire doctrine; and performing fire protection system design, review and commissioning in various occupancies. Alwin is a member of multiple NFPA technical committees responsible for storage and use of flammable and combustible liquids (NFPA 30 and 30A), and hazardous materials (NFPA 400). He is the current chair of the NFPA 30 TC for Fundamentals. Alwin has assisted a variety of industrial clients solve their unique safety and regulatory challenges, including nuclear power plants, electricity distribution facilities, and chemicals manufacturing, processing, storage and distribution facilities. He liaises with local code authorities and insurers on behalf of clients to find solutions that respect operational needs.

SUNIL LAKSHMIPATHY, PHD

Computational/Development Engineer

Sunil has multiple years of experience developing computational tools and methods and performing advanced computational analysis in industrial process safety, transportation, and aeronautics sectors. Before joining Jensen Hughes, Sunil was involved in industry-funded research programs to improve the CFD tools' performance while being a developer of FLACS and DLR TAU.

At Jensen Hughes, Sunil is a lead consultant in performance-based design analysis for various engineering applications involving industrial process safety and transportation. Sunil is a participating member of the NFPA 2, Hydrogen Technologies Code Committee.

NISHANT NAYAN, PHD

Director, Transportation

Nishant specializes in tunnel ventilation design, having commenced his career in building services and industrial ventilation. He also specializes in 1D and 3D modelling techniques related to tunnel ventilation, to which he has dedicated most of his career. He is an experienced user of various computational software to solve a variety of mechanical engineering applications and is knowledgeable in the use of road and rail environment modeling software such as Subway Environment Simulation (SES). His multidisciplinary experience in the application of computational simulation techniques across multiple industries has allowed him to "cross-pollinate" the engineering practice, resulting in innovative and simple solutions to tunnel ventilation system designs from the preliminary to the final stages of a project.

ADRIAN PIERORAZIO, MSC., P.ENG., CREI, FEC

Global Service Line Leader, Industrial Process Safety

Adrian is Global Service Line Leader for Industrial Process Safety (IPS) at Jensen Hughes. He also leads the Canada East region of Jensen Hughes, with responsibility for all staff and offices in the region. Adrian has spent the technical part of his career actively involved in explosion consequence assessment, risk assessment, methodology development, accident investigation/litigation support activities, and instructing classes. He has been involved in such landmark cases as Sunrise Propane, BP Texas City, and Sonatrach LNG (Skikda, Algeria). He volunteers his time to several organizations, contributing to standards development, providing guest lectures at a number of universities, performing workshops, organizing and running large symposia, and serving on the executive committee of several engineering organizations. In recent years, he has been called upon to assist in the development of regulations, testify as an expert to a Provincial Commission, and to mediate between the risk acceptance criteria of overlapping regulatory bodies.

ERIC SUTMAN

Senior Director, Security Risk Management

Eric brings over three decades of commended, applied experience in planning, implementing, maintaining and managing physical security systems, technical investigative services, and technical support for executive protective operations. As Branch Chief, Physical Security Specialist for the U.S. Secret Service, Eric was responsible for coordinating electronic security systems and technical investigative support in all US Secret Service offices and facilities within his district.

DANIEL WALSH, MPA

Senior Director, Security Risk Management

Daniel (Dan) leverages his experience in homeland security, preparedness, public health and resilience to enhance the risk intelligence, security operations and emergency response capabilities of private and public organizations across the globe. Before joining the firm, Dan worked at Argonne National Laboratory, and he served as the Resiliency Assessment Lead for six Department of Homeland Security (DHS) Regional Resiliency Assessment Program (RRAP) projects. He also served as the Director of Planning for the Chicago Department of Public Health's Bioterrorism Preparedness Program and led the Department's federal, state and local Cities Readiness Initiative Anthrax Response Project.

Firm Overview

SINCE 1939, WE HAVE DEDICATED OURSELVES TO FIRE PROTECTION ENGINEERING, INITIALLY IN THE UNITED STATES AND NOW WORLDWIDE.

Today, our expertise, commitment and passion extend across additional domains — including accessibility consulting, risk and hazard analysis, process safety, forensic investigations, security risk and emergency management as well as digital innovation across many of our services.

We help our clients face the most critical issues in our industry and world, including:

Critical Infrastructure Protection

As a strategic partner to global public and private enterprises with fixed asset portfolios, we help clients anticipate risks and take action before harmful incidents occur. We provide services for everything from interstate pipelines and mission-critical data centers to nuclear power facilities and government landmarks.

Environment, Communities + Standards

As an industry leader, we build a better world by providing innovative solutions for the most complex issues facing society. We assist wildfire risk, consult on energy storage system solutions, safely advance carbon-free infrastructure like nuclear power, and commercial workplaces, and strive to set an example in our industry for diversity, equity and inclusion.

Protecting People Before, During + After Crises

As experts, we protect people wherever they work, live or play. We uncover root causes, investigate structural defects and product failures, intervene when an employee poses a risk of violence, and champion new ways for police departments to answer the needs of communities.

Large-Scale Design + Construction

As a preferred partner to the most respected architectural and engineering firms in the world, we help bring to life the safest, most secure and most resilient infrastructure — like the tallest buildings, strongest dams and longest tunnels as well as new cities in emerging markets.

Industry Leadership

We have served on more than 450 committees for international standards-setting organizations and have been instrumental in the development and revision of safety codes. Through our client service, recruitment and training, we help drive the adoption of codes and standards worldwide.

Industry Leadership + Standards Development

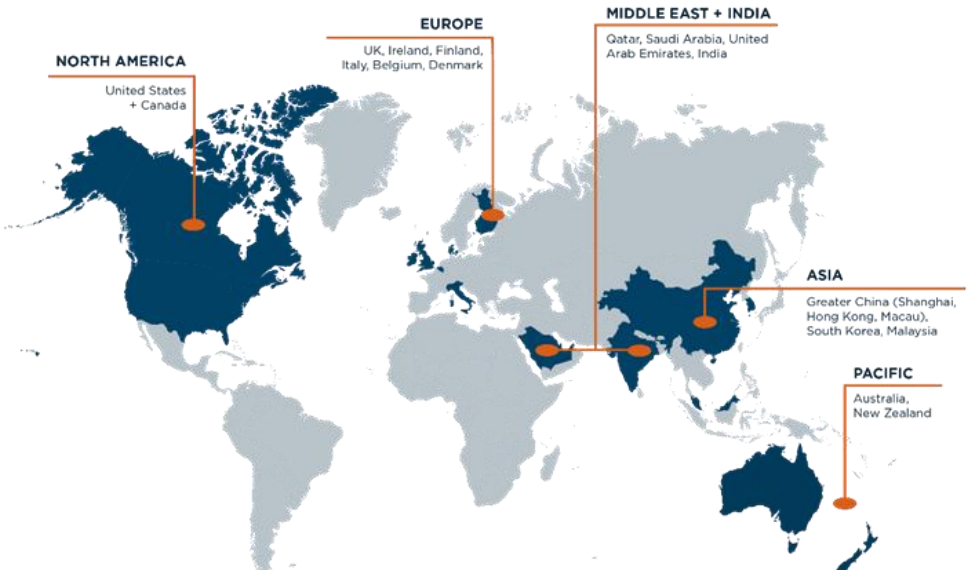
Every year, we invest deeply in research and development at the forefront of safety, security and resilience issues. From in-house lab modeling and dust combustibility testing to automation machine learning and digital innovation, we are driven by our commitment to discovery and exploration in order to make the world a better place for all. We also move our industry forward by actively participating in professional organizations and over 450 committees dedicated to the development and revision of safety codes and standards. We are founding editors of the Society of Fire Protection Engineers (SFPE) Handbook on Fire Protection Engineering and are contributors to this day. Our team supports industry policy and research through work with the Nuclear Energy Institute (NEI) and Electrical Power Research Institute (EPRI). We're also a training partner of the Automatic Fire Alarm Associates (AFAA) and instructors for the National Fire Protection Association (NFPA®) program.

ASSOCIATIONS + MEMBERSHIPS

- National Fire Protection Association (NFPA)
- Society of Fire Protection Engineers (SFPE)
- International Code Council (ICC)
- Institute of Electrical and Electronics Engineers (IEEE)
- Underwriters Laboratory (UL)
- Fire Protection Research Foundation (FPRF)
- American Society for Testing and Materials (ASTM)
- Automatic Fire Alarm Association (AFAA)
- American Society of Mechanical Engineers (ASME)
- American Nuclear Society (ANS)
- American Institute of Steel Construction (AISC)
- American Iron and Steel Institute (AISI)
- American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
- ASIS International (ASIS)
- Council on Tall Buildings and Urban Habitat (CTBUH)
- National Association of Fire Investigators (NAFI)
- Joint Army-Navy-NASA-Air Force Safety and Environmental Protection (JANNAF)
- World Organization of Building Officials (WOBO)
- Canadian Standards Association (CSA)
- Canadian Commission on Building and Fire Codes (CCDFC
- Accessibility Standards Canada (ASC)
- Institution of Mechanical Engineers (IMechE)
- Chartered Institution of Building Services Engineers (CIBSE)
- Technical Committee of Building Fire Safety, China association for Engineering Construction Standardization (CECS)
- Hong Kong Institution of Engineers (HKIE)
- Macau Institute of Engineers
- Korea Fire Facility Association (KFFA)
- Korea Engineering & Consulting Association (KENCA)
- Korean Institute of Fire Science and Engineering (KIFSE)
- Finnish Association of Civil Engineers RIL
- Institution of Fire Engineers (IFE)
- British Standards Institution (BSI
- Smoke Control Association (SCA)
- Italian National Unification (UNI)
- European Fire Sprinkler Network (ESFN)
- International Water Mist Association (IWMA)
- Various Fire Inspector and Fire Chiefs Associations Nationwide
- Society of Women Engineers (SWE)
- Women in Nuclear (WIN)

Global Reach, Local Presence

With more than 100 offices and 1,900 employees worldwide, we work as a global team to meet the needs of our clients wherever they are. In every market, our teams are deeply entrenched in local communities – enabling us to deliver solutions that meet the specific needs of our clients and the communities we serve.



An 80-Year History of Innovation

Jensen Hughes was launched in 2014 through the historic merger of Hughes Associates and Rolf Jensen & Associates (RJA), two of the most experienced and respected fire protection engineering companies at the time. Since then, we've expanded through strategic acquisitions, growing our global presence and service offerings. Through the integration of more than 30 engineering and consulting firms, our global reach has expanded significantly, establishing a market presence 7x larger than that of our closest competitor. Our legacy firms trace their origins back to 1939, a rich history that spans over 80 years of knowledge and innovation worldwide