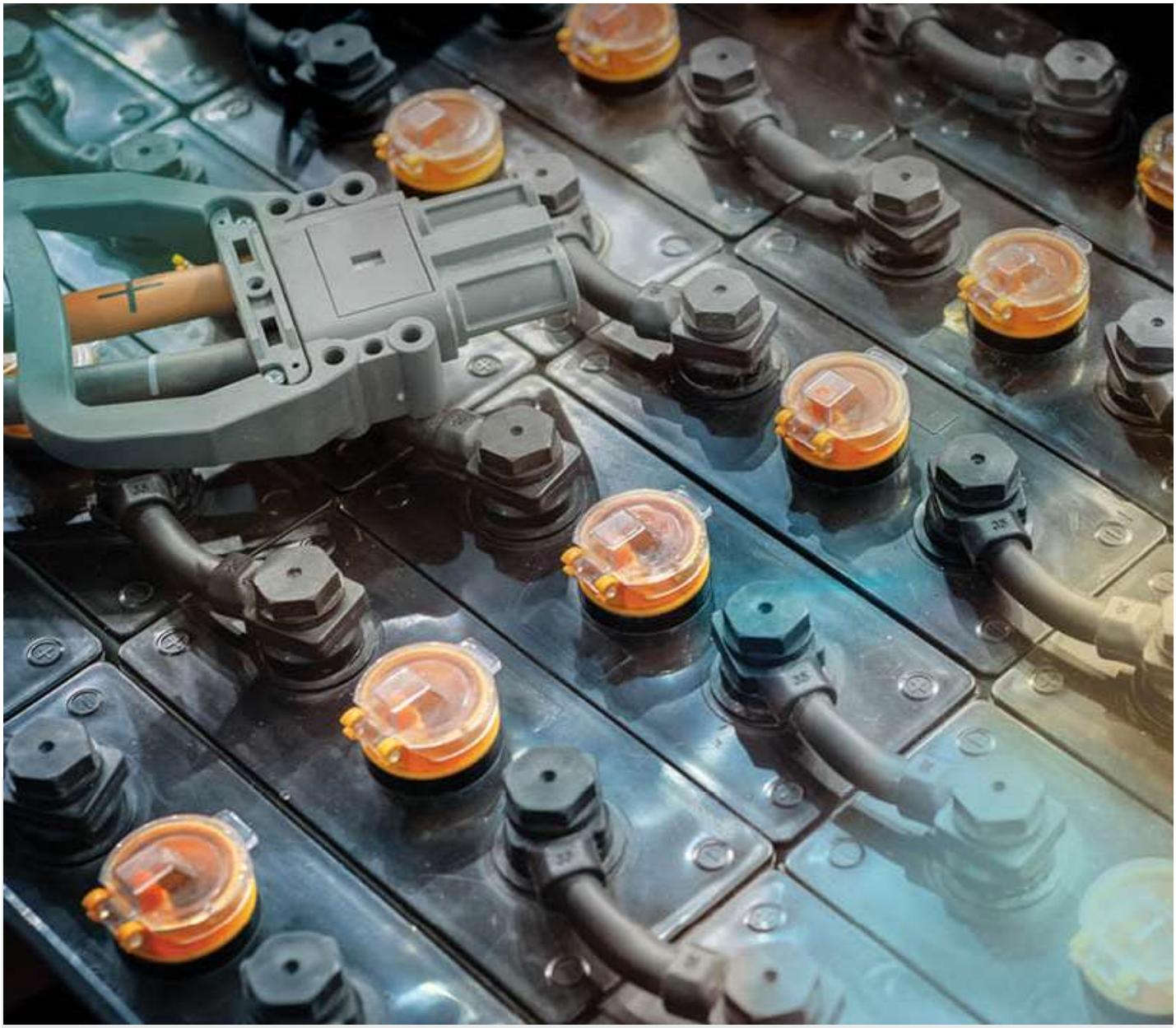
STATEMENT OF CAPABILITIES

EV BATTERY MANUFACTURING + STORAGE

Specialty Engineering + Consulting Services



JENSEN HUGHES

jensenhughes.com

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Electronic Vehicle Battery and Lithium-Ion Battery Manufacturing + Storage

A NOVEL SOLUTION POSING UNIQUE + NEW HAZARDS

Jensen Hughes routinely develops comprehensive fire risk and hazard analyses for major corporate clients associated with battery cell manufacturing, pack and module assembly, and energy storage system applications. These analyses include information from our own small- and full-scale battery cell performance testing conducted over the last 20^{+} years on a wide range of consumer product batteries. The purpose of the testing is to understand probable failure modes and successful detection/mitigation strategies for the unique battery chemistry, cell design, energy and orientation, storage configuration, state of charge, etc. In addition, we have conducted extensive document reviews of published data from UL and other public and private testing companies and organizations to continually advance our understanding of the hazards that may be present at each new facility and at each stage of manufacturing. When the technology is unique or proprietary and correlation with existing data is not deemed appropriate, we will recommend, design, and facilitate new testing, either within our own laboratories or with a partner lab, to obtain the most accurate information on the hazards expected to be present.

Working with owner/operators to understand their risk tolerance and business interruption needs, we design the most appropriate, cost-effective passive, active and live-action response plan. Using supporting data, test results and video footage from available sources, we identify a range of potential consequences for the hazard scenarios and work to properly assess the extent of these consequences, including both fire and explosion. This is necessary since most of our clients are designing new facilities that do not comply with the prescriptive requirements of any published building codes or standards. As such, we work with building architects, engineers, and the various stakeholders, as deemed appropriate by the owner (i.e., Authorities Having Jurisdiction, battery manufacturers, ASRS system designers, first responders, etc.), to recommend and then design detection and mitigation systems intended to meet the necessary level of performance. It is noted that, because we tailor the protection scheme to your risk tolerance, hazards and building design features, the protection will vary between the areas of the manufacturing process (high-temp, low-temp, charge/discharge, cure, etc.) and should multiple plants be designed concurrently, the protection will vary based on local and geographical considerations (proximity to adjacent buildings, local codes and standards).

Our hazard mitigation analysis includes developing an emergency response plan for your employees and first responders. Many individuals who may come into contact with batteries in your facility do not know the hazards associated with the manufacturer, charging, or storage processes. As such, we work with you to develop training and educate the teams as needed. This effort is part of the hazard mitigation analysis process, as we believe that how people are trained to react will either help to contain or exacerbate the expected consequences.



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Thought Leadership + Education

LEADERS IN THE EVER-EVOLVING ELECTRONIC BATTERY INDUSTRY

Jensen Hughes has continued to be a leader for the growing Energy Storage System (ESS), Electronic Vehicle (EV) and Lithium-Ion Battery industry for many years. In addition to our widely publicized educational presentations that provide thought leadership to the industry, we have curated information for specialized training in small-group settings to educate integrators, owner/operators and authorities having jurisdiction on their specific needs and areas of interest.

Recent Educational Trainings + Discussions

Below are some of our most recent educational training courses and discussions regarding this growing industry.

- The Battery Show North America 2024, Process and Safety Solutions for Lithium-Ion Battery Testing Facilities in a Laboratory Environment, Jens Conzen, Mark Suski, Jihan El Ouaragli
- National Fire Protection Association (NFPA) Annual Conference – June 17, 2024, Battery Energy Storage System Workshop, Jens Conzen, Sunil Lakshmipathy, Jihan El Ouaragli, Francisco Joglar
- PowerGen 2024, Energy Storage System Safety Best Practices: Ask the experts, panel discussion, Jens Conzen, Jim Biggins, Erik Archibald, Nick Warner, Robert Steele, Paul Hayes
- European Union ESS Safety Conference 2023, Explosion Control Challenges at Lithium-Ion Battery Energy Storage Systems, Jens Conzen
- The Battery Show North America 2023, Performance-Based Solutions for Lithium-Ion Battery Hazards in the Manufacturing Environment, Jens Conzen & Mark Suski
- PowerGen 2023, Lithium-Ion Energy Storage Systems Best Practices: Ask the experts, panel discussion, Jens Conzen, Noah Ryder, Nick Warner, Erik Archibald
- U.S. Department of Energy (DoE) - Energy Storage Safety & Reliability Forum 2022, Prevention System for Li-Ion Based Battery Energy Storage System, Jens Conzen
- The Battery Show North America 2022, Lithium-Ion Battery Hazards in EV and Manufacturing Environments, Jens Conzen & Mark Suski
- Society of Fire Protection Engineers (SFPE) Annual Conference – October 19, 2021, Trends in Energy Storage System Panel Discussion; Presenters – Adam Barowy, UL; Christina Francis, Tesla; Moriel Kaplan, Jensen Hughes
- Canadian Fire Safety Association (CFSA) Annual Education Forum – September 22, 2021
  - Lithium-Ion Batteries – Fundamentals and Hazards; Presenter – Amir Baraughi, P.Eng.
  - Introduction to Energy Storage Systems (ESS); Presenter – Daniel Gottuk, PhD, PE
  - Energy Storage Systems (ESS) a Case Study; Presenter – Jens Conzen
  - Handling, Storage & Fire Protection of Lithium-Ion Batteries; Presenter – Jason Sutula, PhD, PE
- Society of Fire Protection Engineers (SFPE) Member Webinar Series – September 27, 2021, Protecting the Future of Lithium-Ion Batteries; Presenters – Moriel Kaplan, PE and Daniel Gottuk, PhD, PE

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Recent Jensen Hughes Publications

We pride ourselves on being on the cutting edge of the industry. We regularly present and publish about our work on lithium-ion battery hazard mitigation:

- Kapahi, A., et. al., Experimental methodology and validation data for vented deflagrations in BESS enclosures, Process Safety and Environmental Protection Journal, Volume 210, 1 April 2026, **https://doi.org/10.1016/j.psep.2026.108646**
- El Ouaragli, J., et. al., White Paper – Advancing Li-Ion Bess Safety: Comprehensive Testing and Meta-Analysis For Optimized Hazard Mitigation, Limitations of UL9540A for Li-Ion BESS Hazard Analysis, March 2024, **https://s3.us-east-1.amazonaws.com/jensenhughes/uploads/Advancing-Li-ion-BESS-Safety.pdf**
- Conzen, J., et al., Lithium-Ion Battery Energy Storage Systems (BESS) Hazards, Journal of Loss Prevention in the Process Industries Volume 81, February 2023.
- Kapahi, A., et al., A CFD based methodology to design an explosion prevention system for Li-ion based battery energy storage system, Journal of Loss Prevention in the Process Industries Volume 83, July 2023.
- Lakshmipathy, S., et al., Modelling Methodology for Deflagration Vent Design of Battery Energy Storage Systems, Conference Proceedings 14th International Symposium on Hazards, Prevention, and Mitigation of Industrial Explosions, July 2022.

Risk Technology

For more than three decades, our engineers have pioneered the development of risk technology now in use across many industries worldwide. The scope of our contribution covers all aspects of risk technology, from systems to severe accidents and radiological release, covering all modes under all internal and external hazard conditions. Our engineers have also contributed to developing guidance for the first-of-a-kind application of risk technology across various other industries.

Our contribution to technology benefited from our extensive experience in plant design and operation, support in developing regulatory frameworks worldwide, and other considerations, such as risk and asset management (i.e., loss prevention).

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Competency, Capability + Experience

SAFEGUARDING LITHIUM-ION BATTERY PROJECTS: FIRE PROTECTION + LIFE SAFETY SERVICES

Lithium-ion batteries offer immense potential across various industries, but their unique characteristics can pose risks. Several incidents have shown that fire and explosion are credible hazards in Battery Energy Storage System (BESS) projects. Our expert team is dedicated to mitigating these risks, safeguarding your investments and protecting people.

Understanding Lithium-Ion Batteries

Understanding and mitigating the potential hazards (e.g., off-gassing, fire, and thermal runaway) associated with lithium-ion batteries is essential to personnel and asset safety and to the success of projects. Implementing rigorous safety protocols and employing advanced fire protection measures can help maximize the benefits of lithium-ion technology while minimizing risks.

We specialize in providing expert fire protection and life safety services tailored to safeguard lithium-ion battery projects. Having worked with government, industrial, and commercial clients to understand lithium-ion battery fire safety for well over 30 years, and with third-party stakeholders such as authorities having jurisdiction (AHJ), insurers, and manufacturers, our team has earned an excellent worldwide reputation.

Our firm has conducted approximately 15 years of research for the U.S. Navy, assessing the fire hazards associated with the spectrum of lithium (non-rechargeable) as well as lithium-ion batteries for use onboard Navy ships and submarines. We have been a leader in the energy storage industry since the early 1990s and globally supported projects ranging from small-scale EVs to the largest ESS and battery manufacturing plants in the world.

Fire Prevention + Hazard Mitigation Strategies

Fire prevention and mitigation strategies for large lithium-ion battery facilities are crucial to safeguard personnel, protect valuable assets and prevent catastrophic incidents.

This begins with proper site or facility design that prioritizes lithium-ion battery safety from the outset. Jensen Hughes' code analysis expert team supports our client in establishing appropriate design requirements globally. This assures compliance with regulations but also increases fire and life safety. Given our global footprint, leadership in standards committees (i.e., NFPA 855), task group for current issues, as well as research engagements, we are in a position to define “best practices” providing the best standard of care to our clients

Jensen Hughes will analyze certification reports and fire-test data (e.g., UL 9540A) to ensure appropriate prevention and mitigation measures are built into the design of the application (e.g., a battery energy storage system – BESS).



Providing Manufacturing + Storage Safety Solutions for

- People
- Property
- Process and Product

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Fire + Explosion Protection Systems

As incidents have shown (e.g., Carnegie Rd, Liverpool, UK or McMicken, USA), fire and explosion hazards can have catastrophic consequences for lithium-ion projects.

Jensen Hughes has designed protection schemes for indoor and outdoor battery storage, battery manufacturing factories, automatic storage and retrieval systems (ASRS), and warehouses storing products with batteries. Building owners and operators of facilities where lithium-ion batteries are stored (individually or inside products) utilize our expertise to design, review, and inspect for ways to reduce the threats posed by these new hazards.

Beyond the standard approach to fire protection in buildings, we work with the client to determine the most appropriate way to quickly detect and suppress a fire, should a failure event occur. Keeping costs and business continuity in mind, we will assess the hazards present and either modify existing fire protection systems (e.g., automatic sprinkler systems) or design new systems after evaluating potential fire scenarios, conducting flammability analysis, and reviewing local regulations. We subscribe to a philosophy of cohesive design from concept to execution, providing our clients with feasible, practical, and goal-oriented fire protection system design.

Lithium-ion batteries can release large amounts of flammable gas during an abnormal condition. Our experts are proficient in analyzing thermal runaway conditions, evaluating gas compositions and concentrations, using computational fluid dynamics (CFD) modeling to evaluate gas releases, and designing adequate explosion control measures such as deflagration venting for enclosures or rooms (i.e., NFPA 68) as well as explosion prevention systems (e.g., mechanical exhaust systems following the requirements of NFPA 69).



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Emergency Response + Evacuation Procedures

Developing comprehensive emergency response plans for battery-related incidents is key before facility operations begin. Through collaboration among on-site personnel, first responders, emergency response teams, and the local fire department, Jensen Hughes provides a customized approach to responding to potential failures to minimize danger to employees and the public.

Furthermore, our team can work with the client to develop, coordinate, and maintain emergency management. This may include training employees on proper evacuation procedures and safety protocols. Jensen Hughes can engage with local authorities and emergency services to present and discuss emergency response plans, assuring a quick and effective response.

Developed by the experts at Jensen Hughes, Jensen Hughes can provide digital solutions for emergency response planning. Our SMARTPLAN software provides a streamlined solution for your company's emergency preparedness program, whether you need to manage response plans across several locations or maintain multiple plans with limited resources. With an industry-leading selection of customizable response plan templates, SMARTPLAN is the most innovative, efficient and consistent response planning and emergency management digital solution on the market.

Key features and advantages include the following:

- Generation of complete plans ready for implementation
- Elimination of version confusion
- Accessible via web or mobile app
- Improved compliance and responsiveness

Code Compliance + Regulations

Compliance with regulations for lithium-ion battery projects is essential to ensure the safe deployment and operation of these technologies.

Jensen Hughes assures compliance with occupational health and safety, environmental, hazardous materials (hazmat), fire and life safety codes. Examples include:

- **International Fire Code (IFC):** Many jurisdictions adopt the International Fire Code or have their national (or state) fire codes that include specific regulations and safety requirements for energy storage systems, including those using lithium-ion batteries.
- **NFPA 855:** Standard for the Installation of Stationary Energy Storage Systems, which provides guidance on the installation and safety of energy storage systems, including lithium-ion batteries.
- **NFPA 68:** Standard on Explosion Protection by Deflagration Venting and
- **NFPA 69:** Standard on Explosion Prevention Systems
- **Insurance or end-user requirements**, such as FM Global Data Sheets

Our experts serve on the technical committees of many of the leading codes and standards.

While traditional code compliance may be acceptable for many buildings, codes limit design flexibility and can hinder architectural design intent for many complex, state-of-the-art projects. Where code requirements cannot be met prescriptively, performance-based solutions can be provided that demonstrate equivalent or better protection. Our engineers use advanced fire, smoke, toxic battery gas, egress modeling and risk assessment techniques for alternative or performance-based designs.

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Risk Assessments

To help determine if the facility presents an unacceptable risk or to support a code variance request, the AHJ can request that a risk assessment be submitted. Jensen Hughes can leverage different techniques. One is a failure mode and effects analysis (FMEA), which is a systematic technique for failure analysis. An FMEA is often the first step of a system reliability study and involves reviewing as many components, assemblies, and subsystems as possible to identify failure modes and their causes and effects. Another technique is bowtie modeling, which is a common, industry-accepted risk and hazard mitigation analysis tool used in the maritime, oil and gas, and utility industries.

Quantitative risk assessments can also be developed by Jensen Hughes through fault tree analysis. This is a systematic and analytical method used to assess and quantify the risk associated with the facility and its processes. It is commonly applied in engineering, safety analysis, and risk management to identify potential failure modes, evaluate their probabilities, and understand how different events contribute to the overall level of risk of a system.

The creation of the risk assessment should be initiated as early in the design process as practical to ensure that the fire protection and safety best practices have been evaluated. Jensen Hughes' experienced fire protection engineers can provide the required expertise.

Industry Involvement + Expertise



- NFPA 855, *Standard for the Installation of Stationary Energy Storage Systems*
- Various NFPA Standards for Explosion Control and Fire Alarm
- EPRI Committee Members

Engineering Simulations for Fire + Egress

For large-scale indoor facilities, our firm often utilizes computational fluid dynamics (CFD) modeling to evaluate fire scenarios and to inform evacuation decisions. Fire simulation and timed egress analysis are valuable tools for fire safety engineers and facility managers to assess, improve, and optimize the fire safety measures in large manufacturing facilities, ultimately enhancing the protection of personnel, assets, and the environment.

CFD analysis can predict the behavior of fire and smoke propagation within the facility. This information is crucial for understanding how fire can spread, the potential hazards it may create, and how it may affect occupants' egress routes. Furthermore, conducting physical tests in large facilities can be expensive, time-consuming, and impractical due to safety and operational concerns. CFD analysis allows for cost-effective virtual experiments, reducing the need for expensive physical tests and enabling the exploration of multiple scenarios without actual fire events.

In many regions, manufacturing facilities must comply with specific fire safety regulations and codes that can be challenging to meet prescriptively. CFD analysis allows engineers to verify compliance with these regulations and identify any potential gaps that need to be addressed. Visually compelling representations of fire and smoke behavior can be generated, aiding understanding of the complex interactions and patterns during fire scenarios. These visualizations can be valuable for communication and decision-making among stakeholders, such as the AHJ.

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Project Experience



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BATTERY MANUFACTURING + STORAGE PROJECT EXPERIENCE

Jensen Hughes has been supporting the industry on numerous BESS projects ranging from the kilowatt-hour to the giga-watt-hour scale. We have been fortunate to have supported the largest investments in the industry. This includes supporting leading power utilities, integrators, system designers, and battery original equipment manufacturers. Jensen Hughes is engaged in research and development as well as technical committee work. Furthermore, Jensen Hughes has been supporting the lithium-ion battery and EV manufacturing industries, which face similar challenges.

Confidential Multinational Transportation Company

Fire Protection Design, Code Consulting + Alternative Means and Methods for Commercial Scale Storage and Charging of Lithium-Ion Battery Powered E-Mobility Devices

Confidential Local Transportation Company, New York, NY, USA

Hazard + Risk Assessment Services for Lithium-Ion Charging Rooms

Confidential Multinational Electric Vehicle (EV) Company

Fire Protection Design + Code Consulting Services for Lithium-Ion Battery Manufacturing/Testing Facilities

Confidential EV Battery Recycling Company

Building + Fire Code Consulting Services

UL Solutions, North America Advanced Battery Laboratory, Auburn Hills, MI, USA

Fire and Explosion Hazard Assessment, Risk Assessment, Deflagration Vent Analysis + Testing Equipment Hazard Review

UL Solutions, Metroplan High Lev Project, Poland

Battery Hazard + Risk Assessment Services

CSA Group, Independence, OH, USA

Battery Hazard + Risk Assessment Services

Naval Surface Warfare Center (NSWC), High Energy Test + Abuse Facility, Crane, IN, USA

Subject-Matter Expert Services - Battery Hazard + Risk Assessment

Ford Motor Company, Project Hickory, Marshall, MI, USA

Code Consulting Services, Risk Hazard Analysis + Lithium-Ion Battery Cell Testing

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Ford Motor Company, BOSK, Stanton, TN, USA

Fire Protection Systems General Consulting + Fire/Smoke/Egress Modeling

Ford Motor Company, Ion Park, Allen Park, MI, USA

Code Consulting Services, Hazardous Materials Analysis, Risk Hazard Analysis + Fire Protection Systems General Consulting

General Motors, Warren Technical Center Battery Testing Areas, Warren, MI, USA

Code Consulting Services

Con Edison Battery Storage, New York, NY, USA

Fire Protection Engineering Services

Confidential Client, Lithium-Ion Battery Storage, Manhattan, NY, USA

Code Consulting Services

The Raymond Corp, Lithium-Ion, NY, USA

Code Consulting Services

GE Energy Battery Suppression Analysis, Schenectady, NY, USA

Fire Protection Code Consulting Services

Stanley Black & Decker, Proposed Lithium-Ion Battery Laboratory Facility, Towson, MD, USA

Fire Protection Hazard Assessment Feasibility Study

Concorde Battery Corporation High-Piled Storage Warehouse, West Covina, CA, USA

Fire Protection + Hazardous Material Code Consulting

Battery Reaction and Mitigation Research, U.S. Naval Laboratory

Fire Hazards Research + Testing

Confidential Grid Scale Solar + Storage Client, Apollo Beach, FL, USA

Risk + Hazard Fire Protection Engineering Consulting

US Naval Laboratory Lithium Batteries Hazards, Baltimore, MD, USA

Battery Reaction + Mitigation Research

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Electrical Power Research Institute (EPRI)

Member of the Industry Advisory Committee and Various Research Projects in the Areas of BESS Fire Prevention and Mitigation, as well as Hazard Mitigation Analysis

Confidential Battery Manufacturing Plant, Atlanta, GA, USA

Fire Protection, Life Safety, Building Code + Hazardous Material Consulting Services

RWE Clean Energy (formerly E.ON) Climate & Renewables North America, Various U.S. Locations

Fire Safety Code Consulting Regarding Risks and Hazards associated with the Fire Protection of Grid-Scale Lithium-Ion Battery Energy Storage Systems, and Emergency Response Procedure Review

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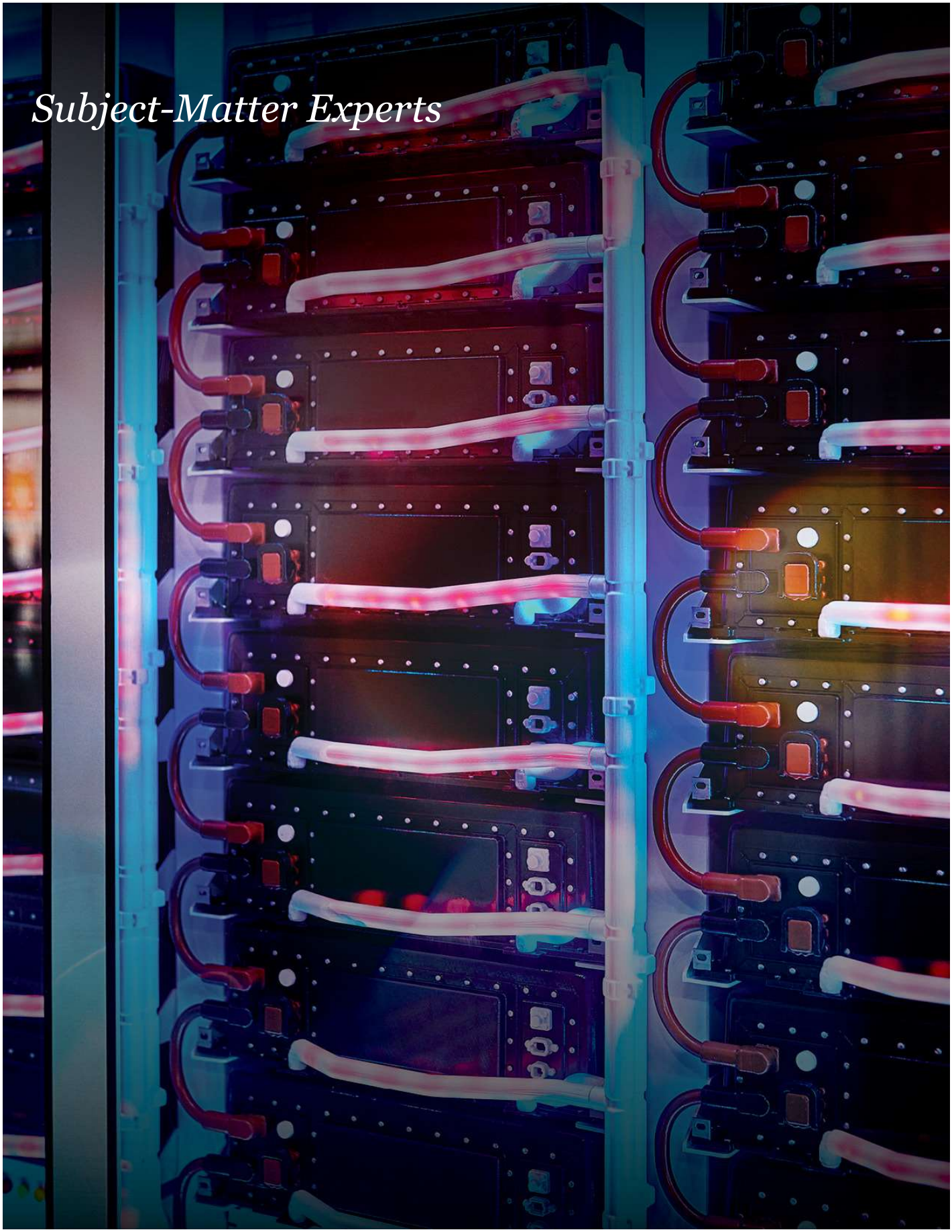
Subject-Matter Experts



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Subject-Matter Experts

With our specialized fire and life safety services, we offer a compelling value proposition that sets us apart from the competition, leveraging our deep expertise in lithium-ion battery safety, fire protection engineering and real-world experience. Our large pool of experts will ensure that project schedules are not jeopardized. It is our goal that our experts become your safety department when you need them.

Bios for all key personnel are provided below. Full CVs/resumes can be provided upon request.



Principal Technical Committee Member of NFPA 855

Industry Advisory Committee Member for EPRI on BESS Fire Prevention & Mitigation

JENS CONZEN, MBA, MSc., Dipl.-Ing., EUR ING

Vice President

Jens is a Subject-Matter Expert in Industrial and Process Safety. This includes direct, relevant experience in safe, compliant engineering design for the energy storage, nuclear, power, chemical and manufacturing industries. He is one of Jensen Hughes' technical leaders for lithium-ion battery fire prevention, mitigation and thermal runaway. In this role, Jens serves as an alternate technical committee member for NFPA Standard 855, the governing standard for energy storage systems and lithium-ion battery storage. Jens thoroughly understands international and local engineering standards, finite element analysis, explosion safety, and the design of emergency relief systems. Most notably, he is well-known for devising customized solutions for first-of-a-kind projects, developing new or performance-based solutions, and optimizing equipment and process safety.



MICHAEL TOWNSEND, CSP, SMS, CFPS

Market Director, Midwest Region + Industrial and Energy Storage

Michael has diverse experience in fire protection engineering and project management. His background spans a wide range of projects, serving as both a technical leader and project manager. These projects include ensuring compliance with NFPA codes and standards, conducting fire and safety audits, developing alternative safety program compliance strategies, updating fire protection systems, performing engineering analyses, and conducting fire hazard assessments. He is well-versed in navigating regulatory requirements, collaborating with stakeholders to develop practical, effective fire protection solutions tailored to each project's unique needs, and fostering community engagement through clear communication and education on fire safety best practices.

Michael is recognized for his ability to translate complex technical requirements into actionable project plans, guiding multidisciplinary teams from project conception through successful completion. He has led initiatives to integrate cutting-edge fire protection technologies, streamline safety protocols, and ensure ongoing regulatory compliance. His commitment to continuous improvement and safety excellence has resulted in enhanced fire protection strategies and safer environments for clients and communities alike.

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GERARD (JERRY) BACK, CFEI, CVFI, CFPS

Technical Fellow

Jerry is a senior fire protection engineer with over four decades of experience conducting Fire Investigations, Fire Hazard Assessments (FHAs), and Research and Development (R&D) programs for numerous federal agencies/DOD and commercial organizations.

He has conducted approximately 15 years of research for the U.S. Navy, assessing the fire hazards associated with the spectrum of lithium (non-rechargeable) and lithium-ion batteries for use onboard Navy ships and submarines. During these programs, a majority of the commercial off-the-shelf batteries, as well as the custom-made military batteries, were tested for several characteristics, including their response to physical damage, electrical abuse (e.g., short circuits and overcharging), and exposure to elevated temperatures. In all, over a million dollars of batteries (i.e., 250 types of batteries and battery configurations) have been assessed during these programs. The characteristics measured included the likelihood of ignition, types and quantities of gaseous reaction products, heat release rates, and the materials/evidence remaining after the event.



JIHAN EL QUARAGLI, PhD

Associate

Dr. Jihan El Ouaragli is an associate specializing in battery safety and fire protection, including battery storage and testing, battery energy storage systems (BESS), and e-mobility and electric vehicles (EVs). With a Ph.D. in Energy Storage from Worcester Polytechnic Institute (WPI), she brings over five years of expertise in designing innovative battery solutions and ensuring the reliable and safe operation of critical battery technologies. She focuses on enhancing fire and life safety measures for battery installations via hazard mitigation assessments and comprehensive mitigation strategies.

She is actively involved in safety standards, battery research and the development of testing protocols for various battery projects. Dr. Jihan's commitment to safeguarding lives and property through advanced fire protection solutions positions her as a leading expert in the field.

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ANIL KAPAHI, PhD

Team Leader, Research, Development, Testing + Evaluation

Dr. Anil Kapahi directs the Research, Development, Testing, and Evaluation (RDT&E) department at Jensen Hughes. He has over 20 years of experience in engineering consulting and academia. He has led numerous multidisciplinary teams in basic and applied research efforts to solve complex problems involving hazards related to fire, explosions, and toxicity affecting people and property. He is also a technical member of the NFPA 855 committee and a principal member of the NFPA 68/69 Technical Committee on Explosion Prevention and Protection Systems.



DONGRU LI, PhD

Staff Engineer

Dr. Li is a computational modeling and simulation engineer with more than 8 years of extensive experience in modeling, simulation, analysis, research, and development. He possesses proficiency in various commercial software packages, including FDS, FLACS, ANSYS, SolidWorks, CHEMKIN, and GridPro Meshing. Additionally, he is skilled in programming languages such as FORTRAN, Python, and MATLAB, and has experience running large-scale numerical simulations on supercomputers.



MANUEL JULIAN BARROS DAZA, PhD

Staff Consultant

Dr. Barros-Daza is a consultant in the RDT&E department at Jensen Hughes, which focuses on the intersection of computational modeling, data analytics and artificial intelligence. He has 7 years of experience in tunnel ventilation, fire dynamics modeling, and risk analysis. He has been involved in several projects related to fire/smoke management systems for commercial buildings, transit stations and tunnels. His experience includes the use of different computational software for research and commercial applications such as Subway Environment Simulation (SES), Fire Dynamics Simulator (FDS), Fluent, Consolidated Fire and Smoke Transport (CFAST), and Pathfinder.

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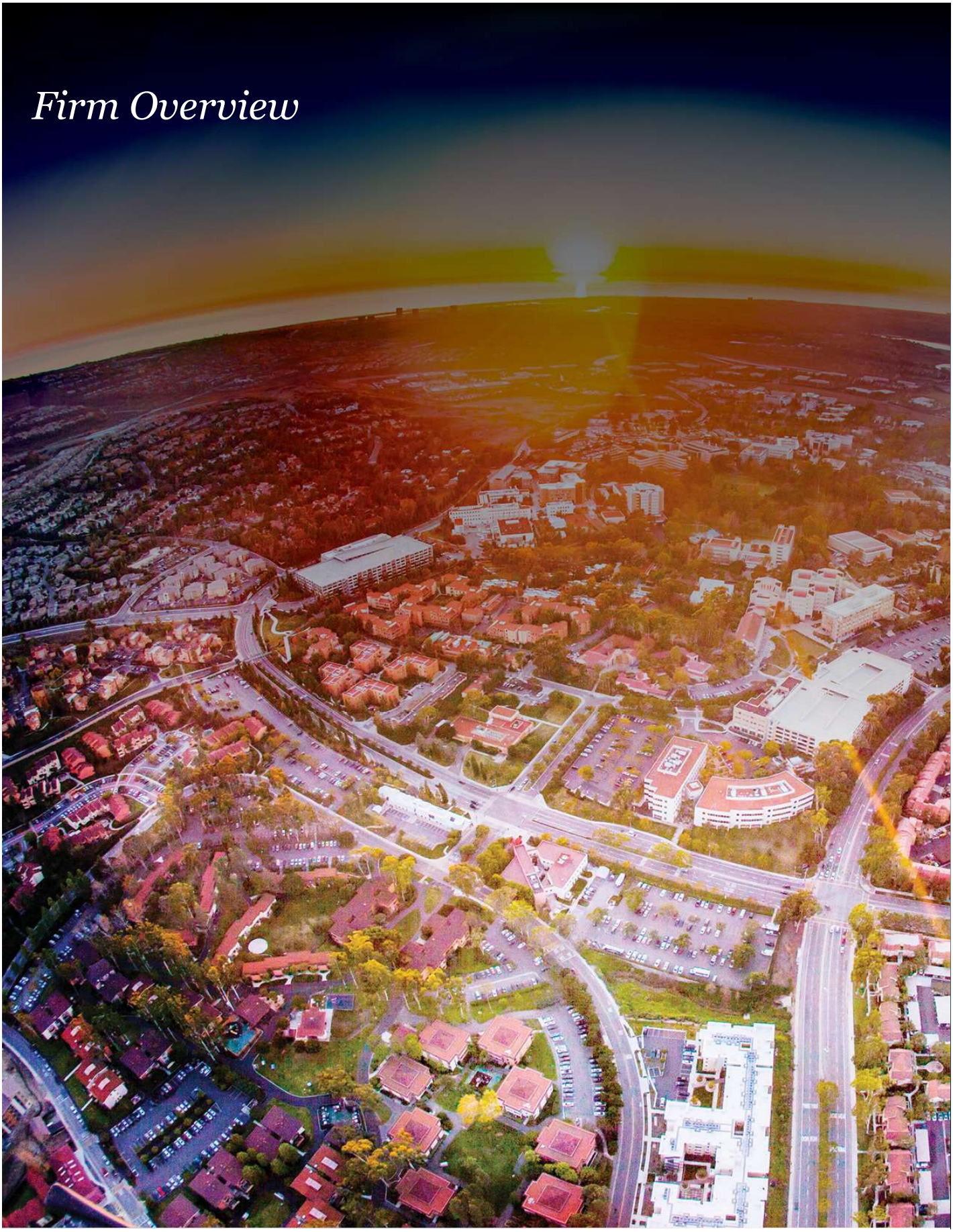
Firm Overview



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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 with 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.



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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 in over 200 committees dedicated to developing and revising 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)

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An 80-Year History of Innovation

A STORY OF GROWTH, INNOVATION + SUCCESS

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 have 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.



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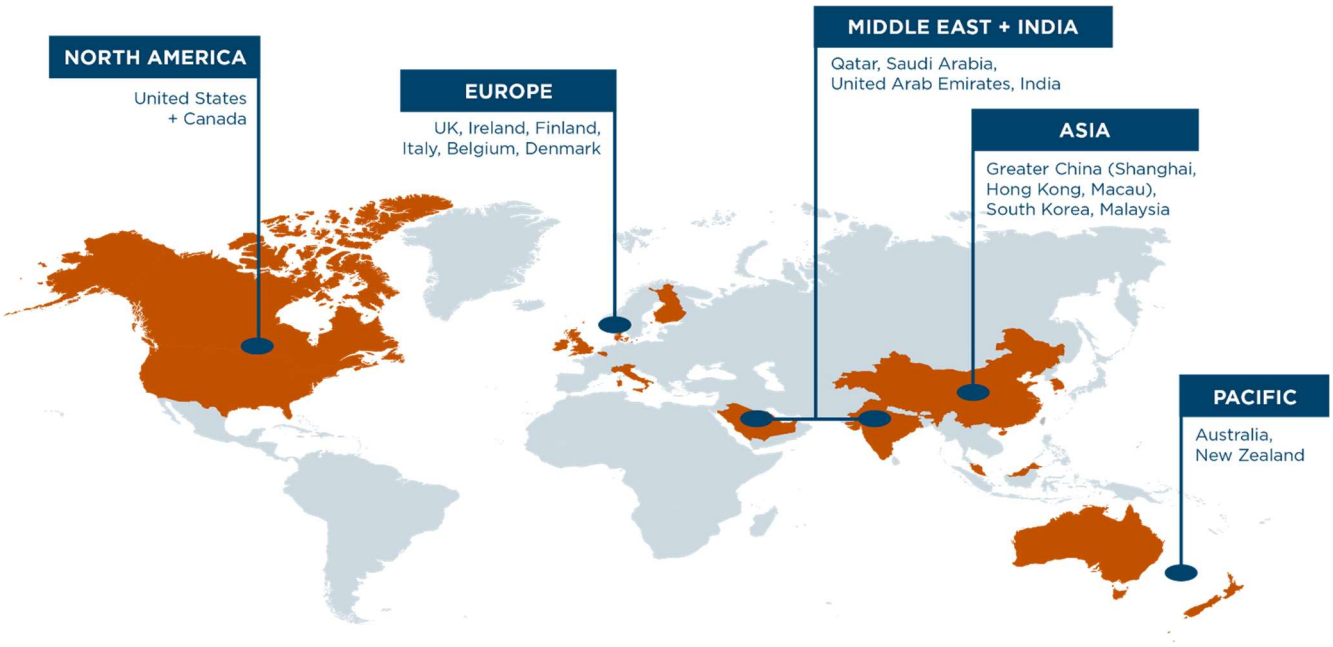
Global Reach, Local Presence

MEETING THE NEEDS OF OUR CLIENTS + THE COMMUNITIES WE SERVE

With offices worldwide and employees on the ground in North America, Europe, the United Kingdom, Asia, and the Pacific, we work as a global team to meet the needs of our clients wherever they are. You will not only benefit from our worldwide reach but also gain critical in-country knowledge and local service.



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