



FIRE SAFETY ENGINEERING

SERVICES GUIDE

Since 1983, PLC Fire Safety Engineering (PLC) has provided professional engineering services in fire and explosion protection and prevention to clients across Canada, USA and internationally.

We excel in the development of innovative, practical, and cost-effective solutions to meet the fire and life safety goals of clients across many sectors, including:

- Nuclear
- Health Care
- Transportation and Transit
- Industrial
- Petroleum and Petrochemical
- Institutional
- Heritage Buildings
- Assembly
- Educational
- Commercial
- Residential

Specialized Expertise

Our experienced engineers actively contribute to the profession and stay up-to-date with the latest advances by participating in organizations including the Society of Fire Protection Engineers (SFPE), the National Fire Protection Association (NFPA), the Canadian Standards Association (CSA), and the Canadian Commission on Building and Fire Codes (CCBFC).

As a result, we are uniquely positioned to provide our clients with a comprehensive collection of services that meet their fire protection and life safety objectives.

Mission

To provide quality fire safety engineering services to support our clients' loss control objectives and assist in their understanding of technical issues related to fire and explosions.

Vision

To be a trusted leader in fire safety through the development of technical staff excellence, establishing a high level of ethical practice, and working with our clients to meet their safety objectives.

PLC Fire Safety Engineering - A Partner You Can Trust

We take our obligations very seriously and have implemented a number of programs to ensure we provide our clients with the best possible solutions.

Quality Management Program

To promote continuous improvement in service quality, we maintain a current ISO 9001:2015-registered quality management program.

This program ensures we meet the needs of our clients and other stakeholders while satisfying statutory and regulatory requirements related to our services.

Our quality management program is verified annually by a third-party certification body which provides independent confirmation that PLC meets the requirements of ISO 9001.



Additionally, our program is compliant with and audited against:

- CSA N286.7 Quality Assurance of Analytical, Scientific, and Design Computer Programs for Nuclear Power Plants
- CSA N255.1-16 Quality Assurance Program – Category 1
- CSA N286-12 Management System Requirements for Nuclear Facilities

Health and Safety Program

PLC understands our obligations under the Occupational Health and Safety Act, R.S.O., 1990 c.0.1 and related regulations, and we are committed to meeting them.

We maintain a corporate Health and Safety Policy that ensures employees are trained to carry out their duties in a diligent and responsible manner with due consideration for the health and safety of themselves, their co-workers, and their clients. Our program includes Workplace Hazardous Materials Information System (WHMIS), Violence and Harassment prevention, workplace inspections, and a system to report hazards and incidents.

PLC employees are provided with the appropriate level of training and personal protective equipment necessary to safely operate at our clients' facilities. Our Health and Safety Program also allows clients to provide site-specific training directly to our employees.

Corporate Security Program

We maintain federal security Designated Organization Screening (DOS) Clearance and Facility Security Clearance (FSC) for key staff and offices. Our electronic files are maintained on secured servers located in Canada.

As necessitated by projects, PLC technical staff will obtain client-specific security clearances.

Fire Protection and Life Safety Services

We build long-term relationships with our clients by applying proven engineering approaches to prevent and mitigate risks of fire and explosion

Our code consulting, design, and risk analysis services assist clients with planning and implementing designs and programs while meeting the safety objectives required by codes and standards

Engineering Assessments and Analyses		Code Compliance	Fire Protection Systems - Design Services	
Fire Hazard Assessments		Fire Code Consulting	Deluge Water Spray Systems	
Fire Risk Assessments		Building Code Consulting	Smoke Management Systems	
Dust Hazard Assessments		Gap Analysis	Sprinkler Systems	
Code Compliance Reviews		Code Compliance Reviews	Fire Alarm & Detection Systems	
Egress and Evacuation Analysis		Alternative Solutions/Performance Based Designs	Special Extinguishing Systems (e.g., Clean Agent, Fixed Aerosol, Commercial Cooking)	
Explosion Hazard Assessments		Inspection Order Reviews and Resolutions	Explosion Protection and Mitigation	
Fire Response Needs Analysis		Third-party Reviews	Standpipe Systems	
Wildland Fire Risk Assessments		Spill Control and Containment Review	Fire Separations (Fire Stopping, Fire Doors, Fire Dampers)	
Probabilistic Safety Assessments		Accessibility Reviews and Assessments	Foam Water Suppression Systems	
Fire Safe Shutdown Analysis for Nuclear Reactors			Deflagration Vent Design	
Fire Modeling		Fire and Life Safety Plan Reviews	Spill Control and Containment	
Flammable and Combustible Liquids Safety Reviews			Fire-Water Supplies (Fire Pumps, Water Storage, Distribution Systems, etc.)	
Hazardous Materials and Process Safety Reviews			Third-Party Design Reviews	
Fire Protection Systems - Other Services		Training & Fire Safety Planning	Fire Audits	Fire Event Investigations
Inspection Testing Maintenance Audits		Fire Safety and Building Safety Training	Fire Code Audits	Fire Origin and Cause
Integrated Testing Services		Fire System Inspection, Testing and Maintenance Procedure Development	Fire Safety Program Audits	Fire System Failures
Commissioning Services		Fire Safety Plan Development	Life Safety Audits	Fire Reconstruction
Third-Party Design Reviews		Emergency Response Drill Planning	Fire System Inspection, Testing and Maintenance Audits	Explosion Origin and Cause
Water Supply Flow Testing		Emergency Evacuation Planning		Expert Witness
		Pre-Fire Plan Development		

Applying technical methods to assist our clients' understanding of the impact of fire or explosion on their facilities

Our hands-on approach means our fire safety engineers can accurately document each facility's building configuration, fuel sources, potential ignition sources, and unique physical and operating characteristics

Fire Hazard Assessments

Fire Hazard Assessment (FHA) uses technical methods to identify possible fire ignition sources and conditions that may result in fire or explosion and to determine the appropriate fire protection systems for a facility.

PLC's understanding of the engineering fundamentals, enhanced by years of practical experience, means we bring crucial expertise and the right technologies for hazard identification, hazard quantification, and establishing the appropriate loss control measures.

Our hazard assessments are built upon extensive data collected through in-depth facility inspections. This hands-on approach means our fire safety engineers can accurately document each facility's building configuration, fuel sources, potential ignition sources, and unique physical and operating characteristics.

Wherever possible, our FHAs leverage fire simulation technologies, including our proprietary hazard assessment software.

For some clients—particularly in industrial sectors—assessments involve formal, defined methodology and have specific reporting requirements. We are completely comfortable in these scenarios, thanks to our experience with a range of FHA methods, including:

- Computer-Based Fire Modeling
- Structural Response Modeling
- Fire Protection System Response Modeling
- Explosion Hazard Assessment (Gases and Dust)
- Preliminary Hazard Assessment (PHA)
- Hazard and Operability Studies (HAZOP)
- Failure Modes and Effects Analysis (FMEA)
- Event Tree Analysis

Beyond modelling, simulation, and assessment software, PLC has also developed specific tools to assist with efficiently and effectively coordinating hazard data and protection information for larger industrial sites.



5-Year Hazard Assessment Program for Nuclear Facilities

N293- and N393-compliant plants and facilities are required to revise and reaffirm their fire protection assessments (FPAs) at least once every five years. This process includes updating the Fire Hazard Assessments (FHAs) and Fire Safe Shutdown Analyses (FSSA).

These assessments often demand a substantial investment in finances, time, and resources.

PLC's innovative approach to maintaining FPAs allows for early schedule planning, reduced financial commitments, and optimal resource utilization.

Our approach ensures that changes in facility conditions are confirmed on-site, reviewed, and evaluated soon after implementation throughout the update cycle. This process allows for maintaining the FPA technical content in keeping with regulatory standard requirements.

Plus, our proprietary nuclear industry hazard assessment software—Performance-Based Fire Assessment for Nuclear Safety (PB Fans) —also allows our clients real-time access to current plant information and the impacts of ongoing changes in facility conditions.

For nuclear power plants, PLC has also developed a System Interdependency Model (SIM) to assess the consequences of fire on nuclear safety-related systems.

Closer to the end of the update cycle, our team inspects the facility to confirm the latest conditions and completes necessary updates to the assessments, ready for delivery to our clients.

5-Year Program

Highlights

- Ongoing confirmation of plant modifications
- Ongoing evaluation of changes
- Ongoing documentation of findings
- Up-do-date software database and impact analysis
- Ongoing report updates
- Final site inspection
- Final reports

PLC's staff have completed fire hazard assessments for most of Canada's nuclear power generating stations, research reactors, nuclear laboratories, uranium mines, waste management, and other types of nuclear facilities



Assist owners, architects, developers, and authorities to plan and implement designs that meet safety objectives, codes, and standards

PLC engineers actively contribute to many of the codes and standards governing fire protection, so we understand specific requirements and their intent

Code Compliance Reviews

Because our engineering staff actively participates on codes and standards committees, we intricately understand the requirements and are uniquely qualified to resolve complex fire and life safety issues with innovative solutions and cutting-edge designs.

PLC engineers participate on the following committees:

- National Building Code of Canada (NBCC) – Standing Committee on Use and Egress
- National Fire Protection Association (NFPA), Technical Committee on Sprinkler System Discharge Criteria (NFPA 13)
- NFPA, Technical Committee on Sprinkler System Installation Criteria (NFPA 13)
- NFPA, Technical Committee on the Standard for the Installation of Private Fire Service Mains and Their Appurtenances (NFPA 24)
- NFPA, Technical Committee on the Inspection, Testing, and Maintenance of Water-Based Fire Protection System (NFPA 25)
- NFPA, Technical Committee on Explosion Protection Systems (NFPA 67, 68, and 69)
- Underwriters Laboratories of Canada (ULC), Committee on Fire Tests

Informed by a thorough understanding of code requirements and their intentions, our engineers can mitigate code issues by developing alternative performance-based solutions that provide the requisite level of fire safety while remaining cost-effective.

We provide a range of code compliance services, including:

- Building and Fire Code Consulting
- Code Issues Resolution
- Code Compliance Audits
- Accessibility and Means of Egress Evaluation
- Plan Reviews
- Performance-Based Design
- Regulatory Compliance
- Fire System Design Reviews
- Alternate Code Approaches
- Life Safety Studies



Accessibility Assessments

Many countries, regions, and cities have legislation to establish, improve, and protect accessibility standards for people with physical and mental disabilities. One prominent example is the Accessibility for Ontarians with Disabilities Act, 2005 (AODA), the purpose of which is to improve accessibility for public establishments by 2025.

Accessibility regulations typically require buildings and facilities to adhere to established standards, like the Canadian Standards Association's CSA B651-18 - Accessible Design for the Built Environment.

PLC has the expertise and experience to assess the current accessibility and barrier-free design of your buildings and leased spaces—we have inspected parking, passenger pick-up areas, entrances, washrooms, and accessible routes including ramps and lifts. We can also provide guidance on cost-effective approaches to complying with regulations.

Inspections to assess compliance of buildings and leased facilities with accessibility regulations and standards, including AODA and CSA B651-18



Commissioning Services

Proper commissioning ensures fire and life safety solutions satisfy operational needs. Over decades of trusted work, our fire safety engineers, and technicians have earned a sterling reputation for providing quality commissioning services to our clients, general contractors, Authorities Having Jurisdiction, and end users.

Relying on PLC's experienced commissioning team helps ensure the timely delivery of a quality project while providing the project owner with a strong safety-minded advocate intent on seeing the project through to completion. Involving our experts as early as possible in a project substantially increases the likelihood that a project will be completed on-time and on-budget, as it helps to avoid rework and other inefficiencies that can result from finding safety issues in later stages.

Third-Party Reviews

Facilities with regulatory requirements, or with high fire or explosion risk exposure, generally require an independent review of modifications and new designs to confirm that hazards are identified, and protection is effective.

These reviews assess the correctness, completeness, and appropriateness of a design package and confirm the system meets applicable standards. Moreover, even when independent reviews aren't mandated, they offer a very cost-effective means of enhancing designs and preventing costly fixes later on.

PLC offers independent third-party reviews by professionals who understand specific industries, conditions of use, and applicable safety standards. Our staff are members of CSA, NFPA, and building and fire code committees; because of our involvement in the development of national and international codes and standards, our engineers are extremely adept at interpreting and applying these requirements.

Reviews are conducted to address one or more of the following:

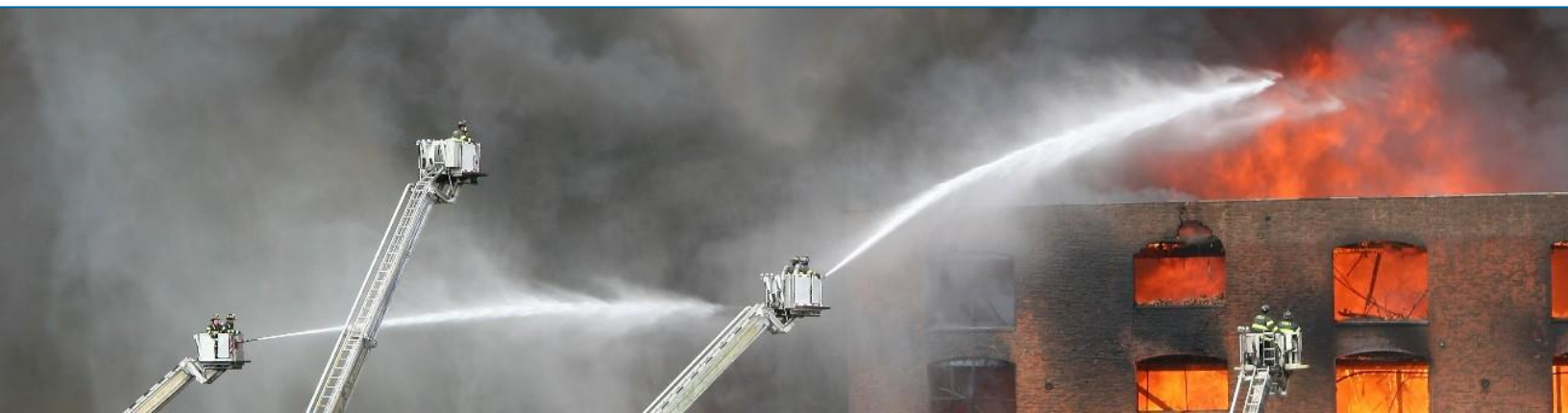
- Identify hazards associated with a modification or design
- Confirm that modifications meet industry standards
- Confirm that protection features are adequate
- Confirm that protection features satisfy conditions of use
- Confirm that regulatory requirements are met
- Ensure that alternate compliance features are adequate and properly documented

PLC's reviews are documented and provided to the client in a letter or report.

Planning, documenting, scheduling, testing, verifying, and training to ensure fire and life safety systems operate as required

Independent reviews by professionals who understand specific industries, conditions of use, and the applicable safety standards

Our staff are members of CSA, NFPA, and building and fire code committees; because of our involvement in the development of national and international codes and standards, our engineers are extremely adept at interpreting and applying requirements



A range of services, from developing system design criteria and producing detailed designs, to supervising construction and commissioning systems

“A fire detection and alarm system is a key element among the fire protection features of any building. Because most fire deaths result from building fires, the use of fire detection and alarm systems in buildings can help significantly reduce the loss of life from fire. Also, if properly specified, designed, manufactured, installed, maintained, tested and used, a fire the alarm system can help limit property fire losses in buildings regardless of occupancy.”

—NFPA Handbook, 20th ed.

Fire Alarm Systems Design

Whether as part of a larger design team or as an individual design service, PLC provides building owners with an expertise in fire alarm system design and related activities— including developing system design criteria, producing detailed or performance designs, to supervising construction and commissioning systems. Our design packages include schematic designs, detailed designs, construction drawings, submission packages for building permit applications and Technical Standards and Safety Authority (TSSA) approvals.

Like all our fire protection and life safety services, our alarm system designs take into consideration the unique and specialized needs of different occupancies and clients; our staff have the necessary knowledge and skill to develop prescriptive or performance-based designs for fire alarm and detection systems in a diverse range of sectors, including complex industrial, commercial, institutional, and nuclear facilities.

Because PLC is an industry leader—participating on committees for the development of the National Building Code and CAN/ULC standards for fire alarms, and with active involvement in the Canadian Fire Alarm Association—our engineers stay current with new and emerging technologies. Informed with up-to-date knowledge, our team designs cost-effective and code-compliant fire alarms that meet or exceed safety goals by incorporating advanced features, including improved detection, intelligible notification, central monitoring stations, wireless alarm systems, releasing systems, addressable systems, and system designs that are easily maintained.

PLC staff provide expertise in the following detection types:

Heat

- Spot
- Rate Compensated
- Hazardous Environment
- Linear

Smoke

- Spot
- Beam
- Air Aspirating
- Very Early Warning

Flame

- UV
- IR
- UV/IR
- IR with Frequency Discrimination
- Video



Sprinkler Systems Design

Water-based fire protection systems are the most common form of fire suppression overall, and even in many specialized sectors—including industrial and commercial.

Water is a versatile, effective fire suppressant; in practice, water-based sprinklers come in a wide variety of systems, including (but not limited to):

- Automatic Sprinkler Systems
- Standpipe and Hose Systems
- Water Supply Systems/Private Fire Service Mains
- Fire Pumps
- Water Spray Fixed Systems
- Foam-Water Sprinkler Systems/Foam-Water Spray Systems
- Low-, Medium-, and High-Expansion Foam Systems
- Water Mist Systems

PLC's specialized expertise and an array of services make us an ideal partner for clients who need assistance with water-based systems; our technical staff is involved on NFPA committees related to fire protection system design and are always up-to-date on the latest and most effective approaches to fire suppression.

We can provide cost-effective designs—including the preparation of specifications and design drawings—for water-based extinguishing systems (and their associated fire detection/actuation systems) that match hazards with the appropriate level of protection.

Our design packages include schematic designs, detailed designs, construction drawings, and submission packages for building permit applications and TSSA approvals.

From an operational perspective, we can also help clients with inspection, testing, and maintenance (ITM) of water-based systems and with developing and improving upon their ITM programs.

Additionally, we can prepare tender documents for systems installation, and we're able to provide project management and contract administration.

Design, project management, and contract administration for cost-effective water-based fire protection systems that match hazards with appropriate protection

Our design packages include schematic designs, detailed designs, construction drawings, and submission packages for building permit applications and TSSA approvals



Design effective smoke management systems that meet a range of design and life safety objectives

“Smoke is inherent in all fires and contains dangerous products of combustion that have critical influences on life safety, property protection and operations by firefighters in buildings.”

—NFPA Handbook, 20th ed.

Smoke Management Systems Design

PLC staff has the specialized knowledge about smoke properties and movement characteristics necessary to design effective smoke management systems.

Our team has developed system design criteria, carried out detailed or performance designs, supervised construction, commissioned, and tested smoke management and control systems for a range of facility types, including:

- High Buildings
- Hospitals
- Telecommunications Facilities
- Control Rooms and Control Equipment Rooms
- Large Industrial Production Buildings
- Underground Powerhouses

Crucially, our technicians and engineers appreciate the special needs of different occupancies and clients, so we’re able to produce cost-effective designs without compromising on project objectives.



Special Extinguishing Systems Design

Particular hazards may contribute to situations in which water either may not be an effective extinguishing medium or where automatic sprinklers may need to be supplemented with other types of fire suppression systems.

Under these circumstances, special extinguishing systems are needed, potentially including:

- Gaseous Fire Extinguishing Systems
- Dry Chemical Systems
- Condensed Aerosol Fire Extinguishing Systems

PLC's specialized expertise and an array of services make us an ideal partner for institutions and facilities that need such systems; our technical staff is involved on NFPA committees related to fire protection system design and are always up-to-date on the latest and most effective approaches to fire suppression.

We can provide cost-effective designs—including the preparation of specifications and design drawings—for special extinguishing systems (and their associated fire detection/actuation systems) that match hazards with the appropriate level of protection.

Our design packages include schematic designs, detailed designs, construction drawings, and submission packages for building permit applications and TSSA approvals.

From an operational perspective, we can also help clients with inspection, testing, and maintenance (ITM) of special extinguishing systems and with developing and improving upon their ITM programs.

Additionally, we can prepare tender documents for systems installation, and we're able to provide project management and contract administration.

Design, project management, and contract administration for cost-effective special extinguishing systems that match hazards with appropriate protection

PLC's technical staff are involved on NFPA committees and are always up-to-date on the latest and most effective approaches to fire suppression



A range of audit services to assist clients in improving fire protection and overall life safety programs while satisfying regulatory commitments

Regular audits are an effective means of proactively improving fire and life safety programs and can identify potential problems before they arise to the level of regulatory concern

Fire Protection Audits

Building owners and operators typically have responsibility for sustaining compliance to protect life, property, and the environment in the event of a fire.

An audit measures a safety program against regional (e.g., provincial, state), national, and international codes and standards, and can be completed as part of a periodic or ongoing effort.

In most cases, audits are initiated by a facility owner or manager to satisfy regulatory commitments, mandated by the Authority Having Jurisdiction (AHJ); however, regular audits are an effective means of proactively improving fire and life safety programs and can identify potential problems before they arise to the level of regulatory concern.

PLC offers a range of client-oriented, timely, and cost-effective audits, including:

- Fire protection program audits
- Fire safety system inspection, testing, and maintenance program audits
- Facility condition inspections
- Life safety audits
- Emergency response audits

Our certified lead auditors are experienced with the following standards:

- International Standards Organization (ISO)
- Canadian Standards Association (CSA)
- American Society of Mechanical Engineers (ASME)



Emergency Management

We are an industry leader in developing, assessing, and evaluating Emergency Response Teams and Emergency Preparedness plans and programs.

Needs assessment and hazard analyses are important planning documents for Fire Departments and Emergency Response Teams (ERTs), as these resources help to inform resourcing decisions and operational planning activities.

PLC's staff possesses the expertise necessary to assist clients in identifying and detailing fire hazards and outlining the most effective means to control these hazards safely. We maintain an extensive, up-to-date library of reference texts and training programs designed to meet the specific and varying needs of our diverse client base.

Moreover, our emergency response specialists have extensive first-hand experience as emergency responders, including as Senior Fire Officers; these specialists have the training and expertise to conduct ERT evaluation and training as per the requirements of applicable standards (e.g., CSA N293 and CSA N393).

Our emergency management planning services include:

- Emergency Response Needs Assessment
- Hazard Assessment
- Emergency Planning and Egress Models
- Pre-Incident Planning
- Fire Safety Plans
- Emergency Response Team Audits and Leadership Training
- Emergency Response Training Program Development and Evaluation

Needs assessment and hazards analysis to assist clients in defining the hazards present and to determine the most effective safety controls

Our emergency response specialists have extensive first-hand experience as emergency responders, including as Senior Fire Officers



Investigate fire and explosion events to determine the cause, identify contributing factors, and—ultimately—to prevent similar incidents

Fires and explosions often destroy the evidence of their origin, which makes determining the cause of the event, and the reasons for the extent of damage, a difficult undertaking requiring specialized expertise

PLC's specialists apply scientific methodologies to reach supportable and defensible conclusions which consider all factors and views of a particular loss

Loss Investigations

Establishing the cause of a loss and identifying factors contributing to the extent of the loss is necessary to prevent similar incidents and to correctly assign liability.

However, fires and explosions often destroy the evidence of their origin, which makes determining the cause of the event, and the reasons for the extent of damage, a difficult undertaking requiring specialized expertise.

Our loss investigation and forensic engineering services range from file/report review to complete investigation and reporting and are carried out by experts with the knowledge and experience to assist in explaining fire and explosion events.

To every investigation, PLC's team brings expertise in important subjects including:

- Fire cause determination
- Fire growth and spread
- Fire and explosion dynamics
- Modeling of fire events
- Identification of factors contributing to the loss
- Material flammability
- Fire protection system operation/contribution
- Role of emergency response in controlling losses
- Fire safety codes and standards

Our specialists apply scientific methodologies to reach supportable and defensible conclusions which consider all factors and views of a particular loss. This approach involves collecting facts, gathering evidence, and forming and testing hypotheses, before reaching conclusions regarding the loss event. Findings are discussed with the client and, where appropriate, documented in a report; prior to finalizing a report, all investigations are subject to an internal, formal quality review, to ensure technical accuracy.



Explosion Protection

Explosion hazards are an ever-present reality in industries that handle, process, or store flammable liquids, flammable gasses, and combustible solids that produce dust.

Explosions present a significant life safety risk and can result in extensive damage to buildings and specialized industrial equipment.

The factors that contribute to the risk and severity of an explosion can be complex, and the measures required to mitigate the risks and protect facilities and personnel demand specialized knowledge.

PLC has been an active member of the National Fire Protection Association (NFPA) Technical Committee on Explosion Prevention Systems since 1988 and has spent decades developing an understanding of hazard and protection requirements from additional organizations including:

- Factory Mutual (FM) Global
- International Standards Organization (ISO)
- The Association of German Engineers (VDI)
- European Directives (ATEX)

As a result, we have the know-how and the experience to minimize the risk and consequences of an explosion.

Identify where hazards are present, help quantify loss potential, and develop cost-effective protection solutions

PLC has been an active member of the NFPA Technical Committee on Explosion Prevention Systems since 1988





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please visit
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