

# Fire Systems Engineering

Stopford Projects Ltd



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General fire safety in England and Wales is delivered through compliance with the Regulatory Reform (Fire Safety) Order 2005. By virtue of this Order, the responsible person should carry out a fire risk assessment on their premises, implement appropriate fire precautionary and protection measures, and maintain a fire management plan. The main purpose of the order is to prevent fire, minimise risk and to ensure the safety of everyone on the premises and in the near vicinity. The requirements of this Order are applicable to premises which are in operation.

Stopford has a high level of expertise in process design and safety consultancy for the chemical, petrochemical and renewable energy sectors. More specifically Stopford's trained and experienced engineers have the knowledge to conduct advanced fire risk assessment and fire protection studies. This enables companies to comply with the Regulatory Reform Order 2005 and also minimise economic losses by providing cost-effective and relevant Fire and Explosion Hazard Management Strategies.

Stopford can undertake the following activities:

- Fire Risk Assessments
- Design and Specification of Fire Detection and Protection Systems
- Fire Protection Reviews in Plant Buildings (e.g. means of escape, emergency lighting, etc.)
- Emergency Response Plans
- Quantitative Risk Assessments
- Heat Radiation Modelling
- Pressure Surge Analysis
- Calculation of water deluge and foam rates

Stopford work closely with the suppliers of specialist fire equipment to successfully deliver active fire fighting systems that comply with the appropriate codes and fully satisfies the client requirements.

Stopford Projects Ltd was formed in 1982 in the North West of England to provide cost effective detail design and Project management services to local industry. Stopford has developed over almost three decades to become the company we are today serving international clients from our offices in Cheshire, Lancaster and Luton. Stopford are now able to provide world class consultancy, multi-disciplined engineering design, project management and construction services in a variety of industrial sectors and to both UK and international clients. We offer a complete range of engineering services from concept design to complete engineering design through to total project implementation.

We pride ourselves on our flexibility to work with our clients in the most appropriate way to suit each individual project to achieve the best possible results for all parties. All our work is carried out in accordance with the Stopford Quality System and to our ISO 9001:2008 certification.



Stopford can provide the following services all specific to the needs of each installation:

- Fire Risk Assessments
- Design and Specification of Fire Detection and Protection Systems
- Fire Protection Reviews in Plant Buildings (e.g. means of escape, emergency lighting)
- Emergency Response Plans
- Quantitative Risk Assessments
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Standards and Guides are used to develop fire safety strategies for installations. Most of these guides, however, do not set prescriptive standards but instead provide recommendations and guidance for use when assessing the adequacy of fire precautions. Other fire safety arrangements which differ from the recommendations in these guides may be acceptable as long as it can be demonstrated that they meet an equivalent standard of fire safety.

The following list includes some of the most relevant standards used by Stopford; however, this is not an exhaustive list and other standards/guides may be used depending on the nature and location of the installation and the clients requirements.

#### NFPA Standards:

- NFPA 30: Flammable and Combustible Liquids Code
- NFPA 11: Standard for Low, Medium and High expansion foam
- NFPA 13: Standard for the Installation of Sprinkler Systems
- NFPA 16: Standard for the Installation of Foam Water Sprinkler & Spray Systems
- NFPA: 24 Standard for Private Fire Service Mains and their Appurtenances

#### BS Standards:

- BS EN 14339:Underground fire hydrants
- BS EN 13565:Fixed Fire Fighting Systems-Foam Systems
- BS EN 12845:Automatic Sprinkler Systems
- BS EN 9999:Code of Practice for Fire Safety in the Design, Management and Use of Buildings
- BS EN 5306-8 2000. Fire extinguishing installations and equipment on premises. Selection and installation of portable fire extinguishers. Code of practice.
- BS 9990: 2006. Code of practice for non automatic fire fighting systems in buildings.

#### Additional standards:

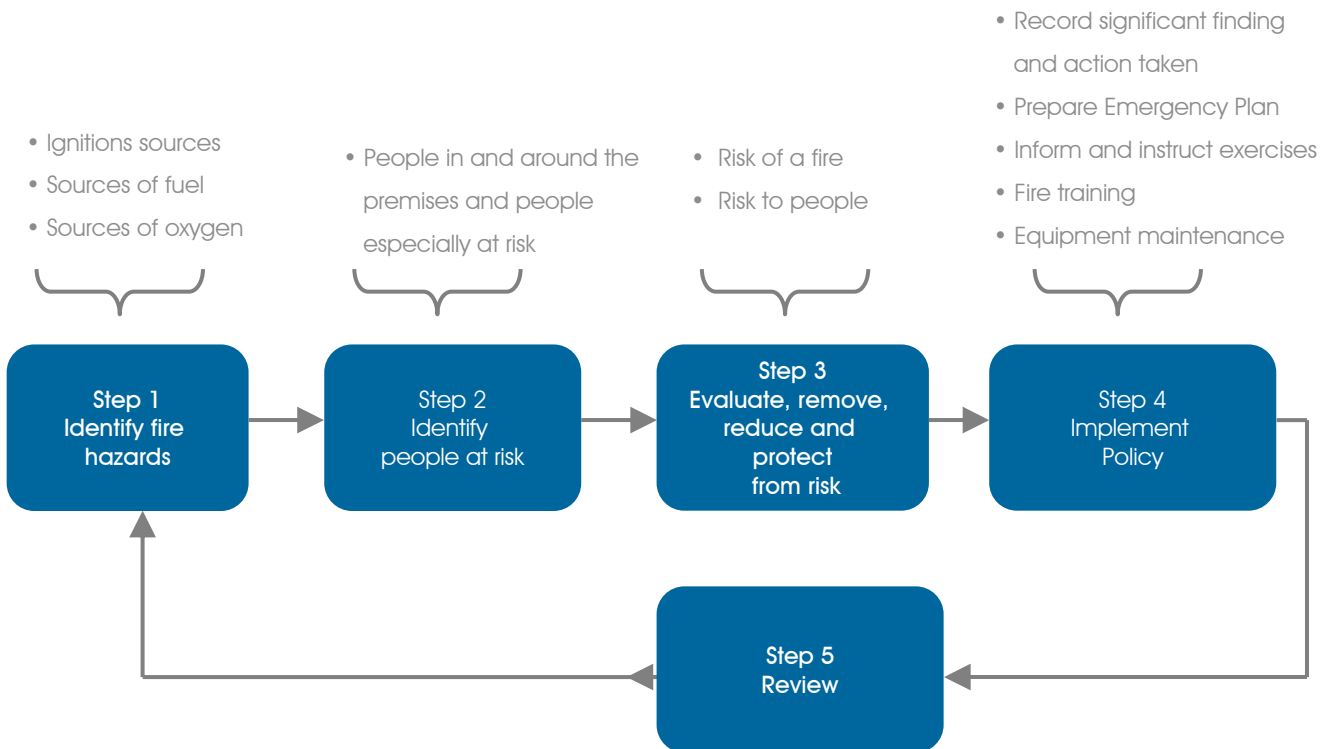
- Approved Document B. Volume 2- Buildings other than Dwellings/houses. Fire Safety The Building Regulations 2000. 2006 Ed Amended 2007.
- IP19 Fire Precautions at Petroleum Refineries and Bulk Storage Installations
- ICEL 1006:2008 Emergency Lighting Design Guide
- Relevant Company Standards or Engineering Guides

A fire risk assessment is carried out by following an organised and methodical study to:

- Identify fire hazards.
- Reduce the risk of those hazards causing harm to a level that is as low as reasonably practicable.
- Determine the physical fire precautions and management arrangements required to ensure the safety of people on the premises if a fire starts but also considering environmental and economical factors.

As part of the assessment, Stopford evaluate all the potential credible incidents, assesses the potential consequences of each incident and list the resources required to minimise the risk. A detailed quantitative assessment may be required for some scenarios to justify the implementation of some of the protection.

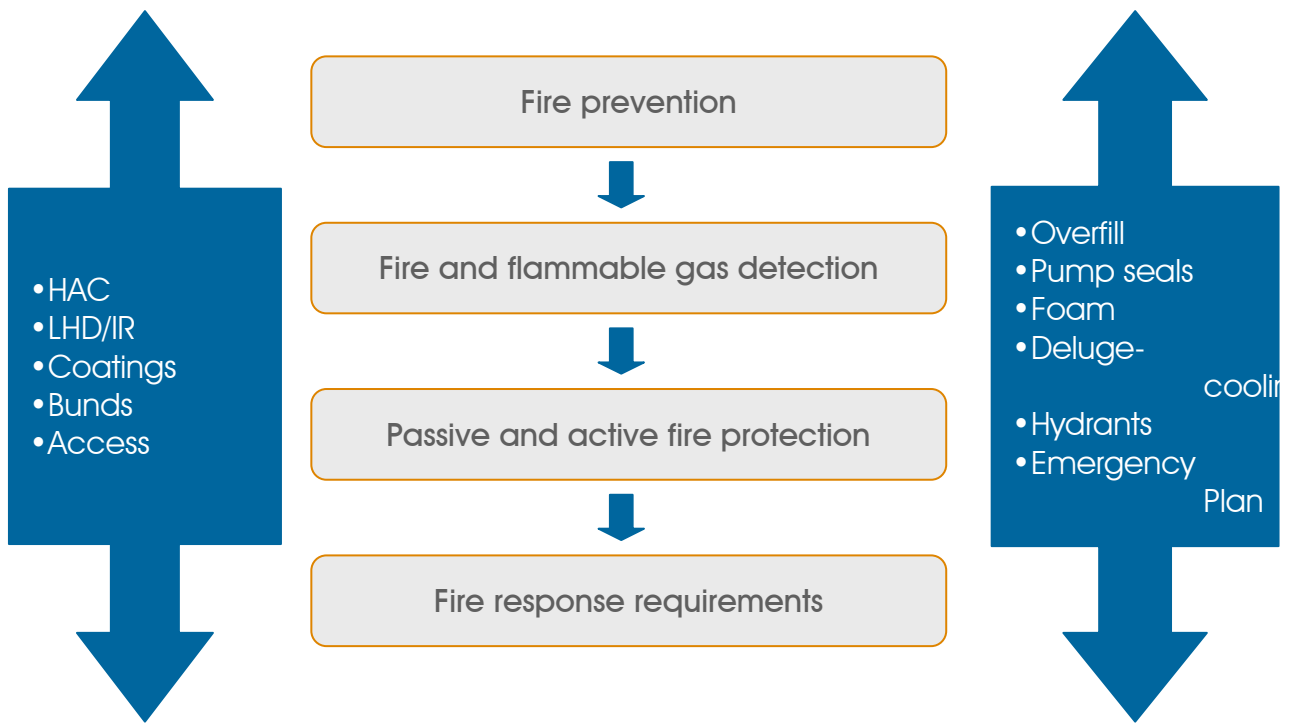
The five steps needed to carry out a fire risk assessment are shown diagrammatically below:



Flow diagram of the five steps required during a risk assessment.

The following diagram shows the different layers of protection for a fire event. Stopford put a big emphasis on minimising the requirements for fixed fire protection by fire prevention through process controls and plant procedures.

Following a preliminary fire risk assessment, liaison with the client and/or fire brigade is important when specifying the fire detection and protection to ensure the approach taken by Stopford fits with the clients policy and local fire brigade capabilities.

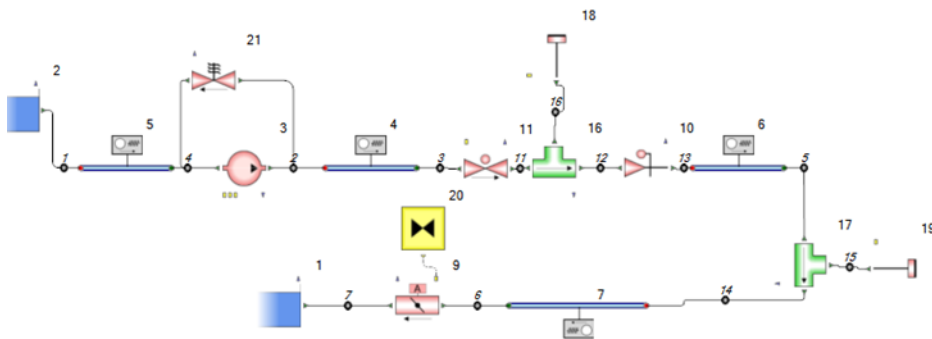


Layer of protection required in the event of a fire.

Surge is also known as “water hammer” and on fire hydrants can be caused by:

- Rapid closure of valves
  - Hydrant pump trips
- It can cause high pressure in the pipes and high forces on pipe supports, leading to loss of materials and equipment damage.
  - The biggest risk is long pipes with significant changes in elevation.
  - Good engineering design can minimise surge pressures.

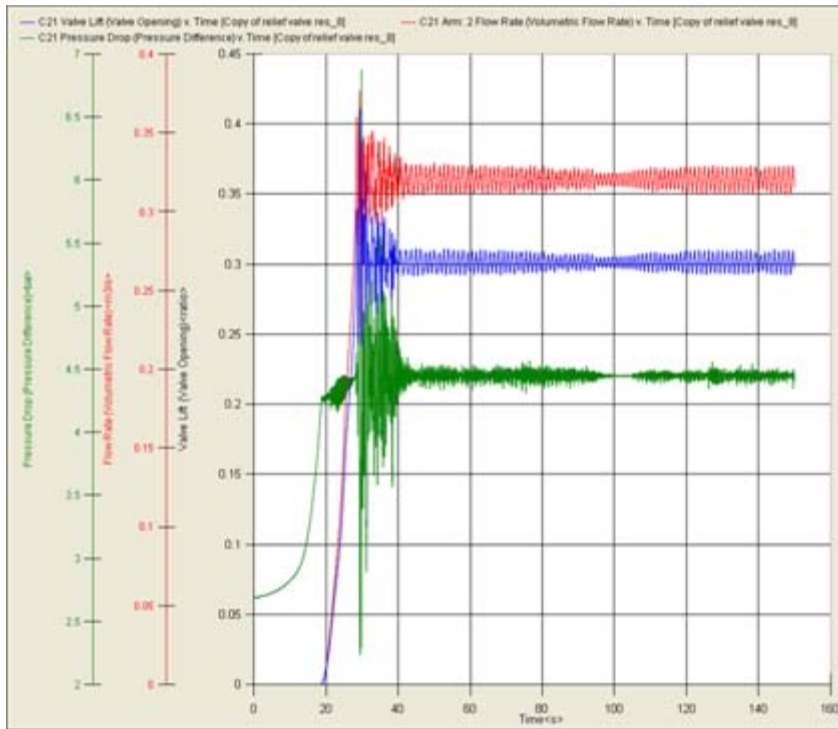
Initial assessment are conducted using Joukowski; should it be deemed necessary, Stopford would then perform detailed computer modelling using FLOWMASTER.



Systematic diagram of the system nodes for surge analysis.

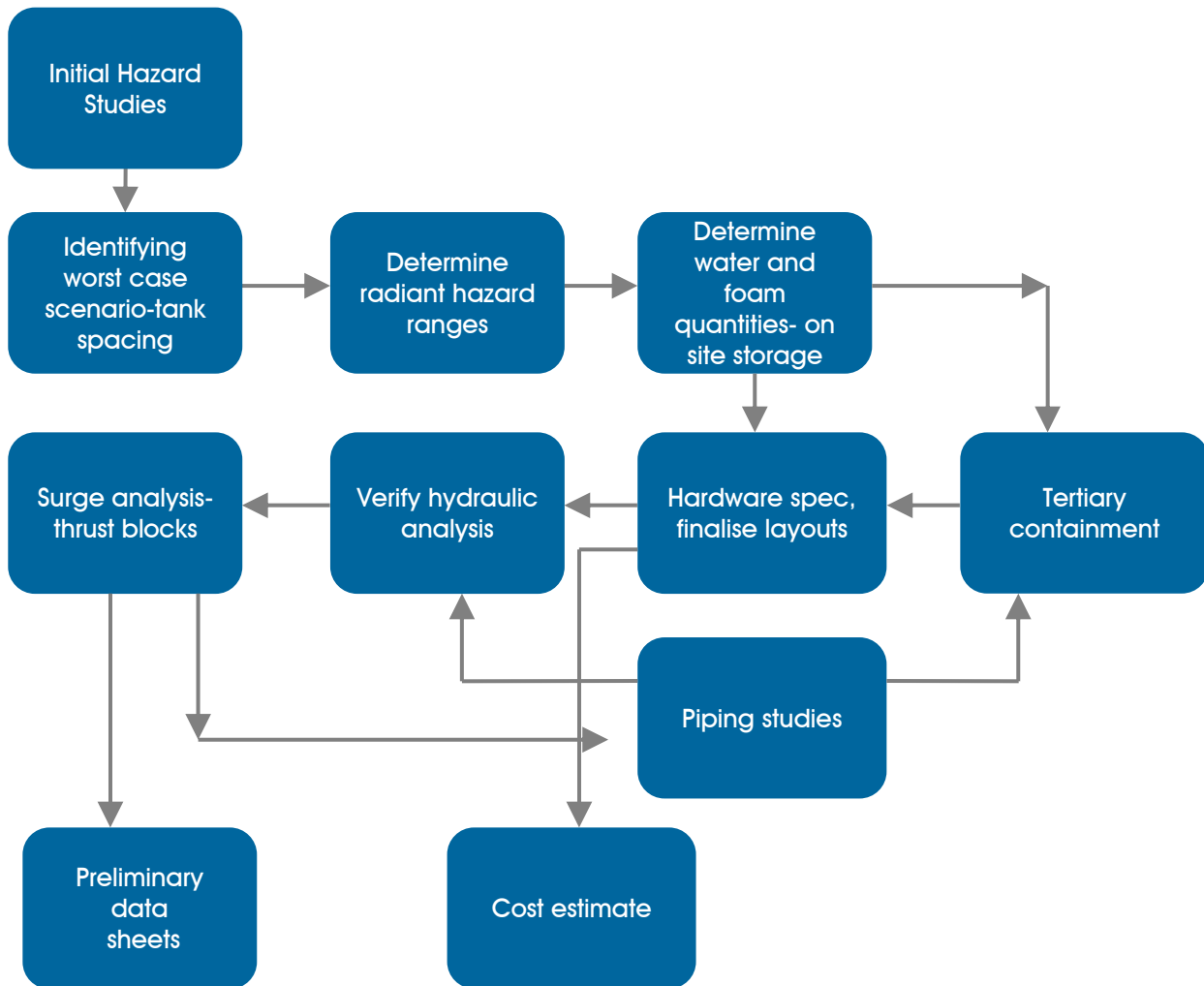
For underground pipework the use of thrust blocks can be specified to dissipate surge pressures. Stopford can design the thrust blocks taking into account the pressures and the properties of the ground/soil.

## Output from SURGE Analysis



Typical Pressure Profile

# Fire Safety in Flammable Storage Areas



Flow diagram of the elements consultancy required to apply fire safety in facilities that store flammable substances.

Stopford also has experience in reviewing and specifying the fire protection strategy and equipment for Industrial Buildings. Previous clients have included the Port of Tyne and Tarmac.

These studies included:

- Identification of potential scenarios with semi-quantification of event probability.
- Effect on life safety.
  - Assessment of means of escape, including
    - » Emergency lighting
    - » Signage
    - » Portable fire extinguishers
- Review of existing fire detection, alarms and active fire protection.
- Evaluation of hydrants, fire mains and water supply.
- Assessment of access for the fire service.
- Preliminary assessment of building structures.
- Potential for fire escalation to nearby buildings or structures.
- Review of management procedures.

Stopford have been involved recently in several projects in relation to Fire Safety. These have included:

- A review of fire protection for rail sidings in Nottingham for Total
- Fire risk assessment and production of fire system specifications for a \$220 million Waste to Energy Plant
- Fire risk assessment for fuel storage and into-hydrant depot facility at Bahrain Airport for Air BP.
- Fire risk assessments for several new ethanol facilities at fuel terminals for BP
  - Kingsbury
  - Northampton
  - Hamble
  - Hemel

The fire risk assessments included recommendations on equipment needed for active fire protection and water and foam requirements as well as preliminary design of the fire water main.

- Detailed design and installation of fire protection (detection and fixed fire fighting equipment) for ethanol facility at fuel terminal at Kingsbury for Chevron. This project is ongoing and includes the provision of a new foam line and hydrants to a new storage area and the extension of the existing foam line to serve a new loading area. An assessment has been carried out on the existing fire water main to check the size is adequate for the new duty.
- Conducted site wide fire risk assessments, specifying means of escape, active fire fighting measures and requirements for emergency lighting for Tarmac.