Capability Statement
Optimisation of Passive Fire Protection

The optimisation of Passive Fire Protection (PFP) will reduce the amount of PFP applied to structures and plant installed on oil and gas facilities. This reduction of the amount of material has the benefits of:

- Reducing the costs of protecting the structure
- Reducing the weight of material that is applied
- Ensuring that the correct parts of the structure are adequately protected
- Speeding up, and reducing the complexity of, the fabrication procedure

Stages in the Optimisation Process

1. Fire Risk Analysis - Determine the threats to the facility
2. PFP Material Type Specification - Determine the appropriate type of material for the fire threats
3. Optimisation - Determine the optimum extent and amount of material to be applied to meet the fire threats

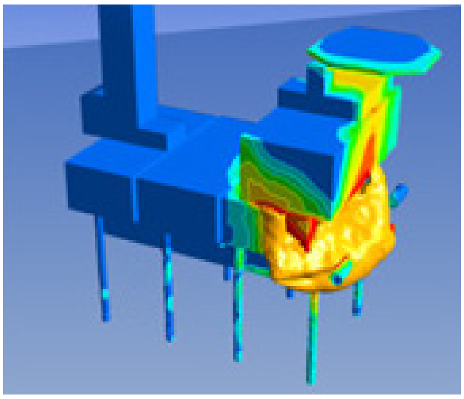
Use of all three stages sequentially will produce a PFP application that is fit for purpose and provides the required fire protection for the correct areas of the structure.

Stage 1 - Fire Risk Analysis (FRA)

The Fire Risk Analysis (FRA) identifies the fire threats posed by the operational activities on the installation. This assists in identifying which elements require protection and determine the fire loads that the elements will experience over time during a fire.

The identification involves:

- The identification of the type, size, and location of hydrocarbon inventories
- The likelihood of a release and ignition of the hydrocarbon
- The type of fire (jet or pool, confined or unconfined) produced
- The identification of the areas of the structure and plant that could be impinged upon by the various fire threats
- A criticality ranking of the required performance of the affected areas to determine the need, and required survival time, of the item
- The determination of the heat flux contours for each fire threat and the time variation of the contours
- The production of time-varying heat flux loadings on the critical elements, both fully engulfed or in close proximity to the fire



The criticality of a protected element may be defined on the basis of preventing the collapse of:

- Items which could compromise escape routes
- Structures supporting large vessels, and plant items, and piperacks
- Structures supporting control rooms, muster points, and lifeboat stations
- Failure of blast and fire walls segregating process areas containing large hydrocarbon inventories
- Firewalls protecting control rooms, riser manifolds, escape routes, etc.

Decisions on element criticality should take into account the facility safety case and the business requirements of installations Operator.

The study may also include specifying the material to limit the internal temperatures of enclosures.

The selection of appropriate acceptance criteria may also be defined at this stage, depending on the item to be protected. Criteria may be selected on the basis of an H or J rating (i.e. H120/J120 giving two hours of protection in a pool/jet fire). The rating defines limiting temperature criteria (i.e. for panels, a limitation of the temperature to 140 Celsius on the back face for a fixed time period as per SOLAS).

Stage 2 - PFP Material Type Specification

It is important that the material used to protect an item is appropriate for that item, and the fire threat it may experience. To ensure correct performance a system should be selected by giving consideration to:

- The functionality of the protected item
- The level of heat flux loading
- Mass momentum effects of jet fires and the fixity of PFP systems
- Geometry of the protected item
- Operation loadings and their effect on fixity and long-term durability
- Operational environment and its deleterious effect on long-term durability

A PFP strategy for an entire installation may involve a number of different systems, selected as appropriate for different situations such as:

- Sprayed intumescent material for steelwork
- Reinforced intumescent for major vessels
- Stainless steel box systems for riser ESD valves
- Half shell bolted systems for riser pipework
- Fire blanket systems for blowdown valves, etc.

Stage 3 - Optimising the Extent and Amount of PFP to be Applied

It is typical that major savings in material can be made in optimising the extent to which sprayed coatings are applied to structural steelwork and vessels. To achieve this, the FRA generates fire loads and survival durations at critical locations around the structure as a result of the various fire threats.

For discrete items of equipment such as valves and risers, a system can be selected using manufacturers information that has the required properties to provide the necessary fire protection.

The most efficient means of optimising the sprayed coatings is to undertake non-linear time-dependent finite element analysis of models of the structure with the critical fire loads and all operational loads applied. A code such as ABAQUS or USFOS is ideal for such a study. If significant portions of the structure involve the use of stiffened plate then ABAQUS is the preferred tool.