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# Guidance on Practice for Offshore Passive Fire Protection

**GP 24-24**

**BP GROUP**  
**ENGINEERING TECHNICAL PRACTICES**

## Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 24-24. This Guidance on Practice (GP) is based on parts of heritage documents from the merged BP companies as follows:

### British Petroleum

RP 24-02

Fire Protection - Offshore



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## Introduction

This GP provides guidance on implementation of hazard management decisions relating to the provision of passive fire protection. The fire and explosion hazard management process described in GP 24-20 should have already been conducted. The fire and explosion hazard management process and the supporting analyses on fire hazards described in GP 24-21, should have provided the designer with a full understanding of the fire hazards and a definition of the fire events (through the use of hazard categorisation) that may occur at a facility. This process should have already defined where protection is required, the fire hazard characteristics, the type of protection (active or passive), and the type of systems, e.g. deluge, intumescent coatings. It shall also define the role of these systems in counteracting the identified hazards.

This GP turns those high level objectives into detailed specifications that form the basis of design of the passive fire protection systems. It provides guidance on how to provide reliable, effective and cost effective systems.

Complementary Guidance on active protection (GP 24-23) describes the role of active fire protection and how those systems should be specified.

Where the detailed design of protection systems is not adequately described in international codes, further Guidelines on Industry Standards have been provided.



## 1. Scope

This GP provides guidance for the selection, design, and installation of Passive Fire Protection (PFP) for offshore exploration and production installations. It does not define the need for fire protection or the standard. The need results from the analysis of the fire hazards as described in GP 24-21 and the hazard management decision making process as described in GP 24-20.

This guidance covers the specification of passive systems including

- structural protection
- firewall, doors and penetrations
- protection of process plant and pipelines
- protection of safety systems
- protection of accommodation and muster points

This GP covers the protection against all offshore fire hazards that may constitute a direct risk to life through their immediate effects or through escalation including all well, well service, riser and process hydrocarbon hazards. It covers fuel, utilities and accommodation fires through reference to default international standards. It only covers drilling and blow out hazards and equipment on production installations or wellhead towers where the drilling rig is an integral part of the facility. It does not cover mobile drilling rigs or the fire protection of “knock down” drilling rigs which are owned by others and assembled as required on the facility.

## 2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

This Guidance on Practice does not rely upon international codes and standards as primary normative references. These are not considered to provide a fully integrated hazard management process and therefore cannot be relied upon to ensure that systems match the events that could realistically occur or their particular fire characteristics. They are also not considered to be sufficiently up to date with current research on fire hazards or protection effectiveness. They are also not considered to be sufficiently precise to clearly define either the need for systems or the detailed performance standards that they should meet.

### BP Engineering Technical Practices (ETPs)

|          |                                                                          |
|----------|--------------------------------------------------------------------------|
| GP 24-20 | Guidance on Practice for Fire and Explosion Hazard Management - Offshore |
| GP 24-21 | Guidance on Practice for Fire Hazard Analysis                            |
| GP 24-23 | Guidance on Practice for Offshore Active Fire Protection                 |
| GP 24-24 | Guidance on Practice for Passive Fire Protection – Offshore              |



|          |                                                                        |
|----------|------------------------------------------------------------------------|
| GP 44-80 | Guidance on Practice for Design Guidelines for Relief Disposal Systems |
| GP 48-50 | Guidance on Practice for Major Accident Risk Process                   |

### British Petroleum (old BP) RPSEs

|         |                          |
|---------|--------------------------|
| RP 43-3 | Subsea Isolation Systems |
|---------|--------------------------|

### International Standards

|     |                                                                                                                                                      |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------|
| IMO | International Convention for the Safety of Life at Sea (SOLAS) 1974 Chapter II-2, Construction – Fire Protection, Fire Detection and Fire Extinction |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------|

### European Standards

|              |                                                                                                                                                                                 |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EN ISO 13702 | Petroleum and natural gas industries – Control and mitigation of fires and explosions on offshore production installations – Requirements and guidelines; First issue June 1999 |
| EN ISO 834   | Fire resistance tests – Elements of building construction 1975                                                                                                                  |

### Industry Standards

|            |                                                                                                                              |
|------------|------------------------------------------------------------------------------------------------------------------------------|
| API RP 14G | Recommended Practice for Fire Prevention and Control on Open Type Offshore Production Platforms; Third edition December 1993 |
| UKOOA      | Guidelines for Fire and Explosion Hazard Management Rev 2 October 2003                                                       |

## 3. Terms and definitions

For the purposes of this GP, the following terms and definitions apply:

**Active Fire Protection:** A system for fire prevention and control requiring moving parts and mechanical system that may or may not require human intervention to initiate. These include water deluge and foam systems, monitors, systems, fire extinguishers etc.

**Availability (Performance Standard):** Target availability is a performance criterion for repairable systems that accounts for both the downtime limits for a system while awaiting or undergoing repair. If these are exceeded, further risk reduction measures may be required, possibly including the shutdown of hazardous operations or processing. It is combined with the reliability to give the overall probability that the system operates successfully and effectively when required.

**Catastrophic Event:** An event which would overwhelm an offshore installation such that; orderly emergency response could not be achieved; the infrastructure of safety systems is impaired to such an extent that they cannot counteract the effects of the event; or that controlled evacuation cannot be achieved.

**Catastrophic Escalation:** Escalation which could lead to the destruction of the facility before safe evacuation can be achieved.

**Compartment Fire:** A fire originating in the modular compartments of an offshore installation such that there is limited ventilation.



**Confined Fire:** A fire within an area such that the shape of the flames is severely disrupted by the presence of walls or ceilings but the ventilation may not be restricted to the extent that it is ventilation controlled.

**Control Systems:** (In the context of control measures for hazards rather than instrumented control systems). Measures systems, procedures or processes which limit the severity of hazards.

**Controllable Event:** A fire or explosion event where the effects and potential escalation can be controlled such that evacuation is not essential to preserve life.

**Deluge Header:** Piping arrangement which distributes firewater from the fire pumps to the inlets to deluge systems and monitors which are needed to protect against the effects of process and well fires. It is of the minimum practical length, located in a safe area and does not provide double feeds though a “ring” type arrangement.

**Deluge System:** A system designed to distribute water spray onto specific targets either to suppress fires or to protect equipment and structure from the effects.

**Escape Route:** A route whereby persons can remove themselves from any point in a dangerous location to a place of safety.

**Escape System:** A secondary means for escape from an installation in which the individuals must depend upon their own resources for survival; e.g. life rafts or decent devices.

**Evacuation Event:** A fire or explosion event that would require the controlled evacuation of personnel from the offshore location.

**Evacuation Route:** A path of minimum size from each work station that is accessible at all times for employees to reach the evacuation system.

**Evacuation System:** A system consisting of boats, helicopters or other means to evacuate the offshore installation.

**Exposure Protection:** The fire protection offered from a suppression system for a specific type of fire event, e.g.; jet fire, pool fire, etc.

**External Flaming:** External flames projected from modules due either to the size of the fire or ventilation-controlled conditions fires (fires in modules that are controlled by the amount of ventilation in the module).

**Fixed Monitor:** Part of the active fire protection system. This device is fixed in a permanent location, connected to the firewater supply, and is capable of directing a straight or diffuse jet of water through a variable horizontal trajectory and elevation towards a potential fire location. Typical monitors shall have a capacity from 1800 – 3600 litres / minute.

**Fixed System:** A permanently installed system that either extinguishes or controls a fire at the location of the system.

**Functional (Performance Standard):** The minimum measurable criteria which define whether a system is achieving its high level performance standard. These may be criteria such as a response time, duration, flow or application rate.



**Hazard:** The potential to cause harm (including ill health or injury), damage to property, plant, products, the environment, or production.

**Helideck Reference Area:** The helideck reference area is the landing area for the helicopter as defined by  $0.75D^2$  where the D value given in chapter 1.2 of CAP 437 is that for the largest aircraft for which the helideck is certified.

**High Level Performance Standard:** A statement of the overall role or intent of a system with respect to specific hazardous event; for example, to prevent the catastrophic rupture of a pressure vessel when exposed to a jet fire.

**Integrated Platform:** An integrated or facility platform has all of the facilities upon one supporting structure or floating hull. This may include processing, wells, drilling facilities, risers utilities and accommodation.

**Intumescent PFP:** Intumescent PFP products are those which expand (or intumesce) to several times their original size when activated by high temperatures. This action prevents the spread of flames and smoke to other parts of a building. Passive fire seals and pipe clamps contain intumescent compounds.

**Jet Fire:** A fire caused by the release and ignition of a pressurized gas

**Manual Fire Fighting:** Manual fire fighting involves personnel using portable or fixed fire fighting equipment to extinguish a fire.

**Muster Area:** A location on the installation that is located and protected from the effects of anticipated incidents and to which people are instructed to go in the event of an emergency.

**Natural Gas Liquids:** Those portions of reservoir gas which are liquefied at the surface in lease separators, field facilities, or gas processing plants. Natural gas liquids include but are not limited to the following: ethane, propane, butanes, pentanes, natural gasoline, and condensate.

**Passive Fire Protection:** Fire protection which does not require power sources or initiation in order to achieve its aim. This is generally applied to firewalls and systems which protect the plant and structures by preventing the transfer of heat and temperature fires for a defined period. It may include systems which react to the fire; e.g. intumescent paints.

**Pool Fire:** A turbulent diffusion fire burning above a horizontal pool of vaporising hydrocarbon fuel where the fuel has zero or low initial momentum.

**Pool/Spray Transition Pressure:** This is the pressure at which 90% of a liquid release burns as a spray. This is classified as 7 bar for oil and 4 bar for condensate. In the presence of medium velocity deluge in roofed modules, these pressures will rise to 15 and 10 bar respectively.

**Portable Fire fighting Equipment:** Fire fighting equipment that is not fixed and is intended to be moved to location in the event of a fire.

**Probability of Failure on Demand:** Generally used to define overall success rate for a safety system. The probability of failure on demand is the inverse of the probability that the system will operate successfully when demanded due to an emergency situation, such as a fire. This includes events causing the system to be unavailable, including unexpected failures, breakdowns, un-revealed failures faults, repair time, scheduled and unscheduled maintenance.



**Radiative Heat Flux:** Heat from impinging fire on plant structures or people either within or beyond the flames. The absorbed heat flux will be less and will be determined by the reflectivity of the surface.

**Reliability (Performance Standard):** Reliability represents the probability of components, parts and systems to perform their required functions for a desired period of time without failure in specified environments with a desired confidence. A high reliability may be required for specific systems.

**Ring main:** A ring main is a method of distributing firewater around a platform such that any point can be supplied from at least two different directions. In this Guidance on Practice, it is only used for hydrants in process and well bay areas and for supplies to non hazardous areas. Deluge systems should be supplied through a deluge header.

**Risk:** The product of the frequency of a specific undesired event and the consequences of that event.

**Spray Fire:** The fire characteristics resulting from the release of pressurized liquid such that the droplet generation and heat feed back cause the liquid to burn as a spray rather than dropping out to form a pool fire. A spray fire is normally defined by the pool/spray transition point.

**Survivability (Performance Standard):** Refers to a piece of equipment or system remaining operational after an event such as a fire or explosion. The requirement for a piece of equipment to remain operable during and/or after a specific hazardous event such as a fire or explosion. The standard will require the severity and duration of the event or the survival time to be specified.

#### 4. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

|                 |                                            |
|-----------------|--------------------------------------------|
| AFFF            | Aqueous film forming foam                  |
| ANSI            | American National Standards Institute      |
| API             | American Petroleum Institute               |
| ASTM            | American Society for Testing and Materials |
| ATK             | Aircraft turbine kerosene                  |
| BLEVE           | Boiling liquid expanding vapour explosion  |
| BOP             | Blow out preventer                         |
| BS              | British Standard                           |
| CAA             | Civil Aviation Authority                   |
| CCR             | Central control room                       |
| CO <sub>2</sub> | Carbon dioxide                             |
| CUI             | Corrosion under insulation                 |



|       |                                                |
|-------|------------------------------------------------|
| COSHH | Control of substances hazardous to health      |
| CSE   | Concept Safety Evaluation                      |
| DAE   | Design accidental event                        |
| DHSV  | Down hole safety valve                         |
| ESD   | Emergency shutdown                             |
| F & E | Fire and Explosion                             |
| FEHR  | Fire and explosion hazard register             |
| FHA   | Fire Hazard Analysis                           |
| GRP   | Glass reinforced plastic                       |
| HAZID | Hazard identification                          |
| HSE   | Health and Safety Executive (UK)               |
| HVAC  | Heating, ventilating and air conditioning      |
| IMO   | International Maritime Organisation            |
| IP    | Institute of Petroleum                         |
| ISO   | International Organisation for Standardisation |
| LNG   | Liquefied natural gas                          |
| LPG   | Liquefied petroleum gas                        |
| MOL   | Main oil line                                  |
| NDT   | Non destructive testing                        |
| NFPA  | National Fire Protection Association           |
| NGLs  | Natural gas liquids                            |
| PFP   | Passive fire protection                        |
| SGI   | Smoke and gas ingress assessment               |
| SOLAS | Safety of Life at Sea                          |
| SSIV  | Sub-sea intervention valve                     |
| SWG   | Standard wire gauge                            |
| TR    | Temporary refuge                               |



UKOOA United Kingdom Offshore Operators Association

UL Underwriter's Laboratory

## 5. Requirements for Passive Fire Protection:

The following requirements shall guide the selection and specification of passive fire protection systems hereinafter referred to as PFP. Appendix 3 of GP 24-20 gives default provisions for control and mitigation measures including active and passive fire protection for a range of fire hazards. If these default systems are specified rather than following the FEHM process, then retrospective analysis and assessment of the fire hazards shall be used to confirm their selection and specification.

The provision of PFP to protect against non process hydrocarbon hazards should follow established international standards for buildings on marine facilities. The FEHM process should be used to confirm the suitability of these standards wherever there are major inventories of fuel which, if ignited, might overwhelm the installation.

Sections 5, 6 and 7 of this document describe each type of system in common use, the roles that they can fulfil, the hazards in which they will be effective. They also list any limitations and drawbacks. These shall be taken into account during their selection and specification.

### 5.1. PFP Fire Protection System Roles:

- a. PFP fire protection systems shall have clearly defined roles as designated by the FEHM process and the categorisation of the hazards.

*The overall aim for fire protection in each category is:*

**Controllable hazards:** *To protect personnel in the muster area, limit fire spread and its effects, and prevent escalation to an evacuation or catastrophic event*

**Evacuation hazards:** *To protect muster and evacuation areas and to prevent catastrophic escalation until controlled evacuation has been completed*

**Catastrophic hazards:** *To prevent the occurrence of catastrophic events through fire exposure*

- b. The use of PFP shall be considered after all practical ways to minimise the exposure of critical equipment and structures by their relocation has been considered. These roles shall be defined in relation to specific hazards and their quantified effects.
- c. PFP shall be used in preference to active systems for the protection of structures, walls, accommodation, muster areas and safety systems.
- d. PFP shall be used where practical to prevent the premature catastrophic escalation of evacuation events before all personnel can be mustered and leave the installation.
- e. PFP systems shall fulfil one or more of the following roles:

#### 5.1.2. Prevention of structural failure or collapse

PFP may be applied to structures where their failure can lead to;

- Further loss of containment of process hydrocarbons
- Loss of support for the muster area or safety systems
- Collapse of firewalls



- Collapse of tall structures
- The progressive collapse of the topsides structures and jacket

### 5.1.3. Prevention of catastrophic process or riser failure

- a. PFP may be used to protect risers and large process inventories where their failure may lead to major escalation.

*This would include catastrophic rupture of vessels or result in fires which would either require evacuation or could be catastrophic.*

- b. PFP shall only be used where it does not increase the chance of leakage due to corrosion or seriously hinder essential inspection of the equipment.
- c. If this requires regular removal of the PFP, it shall only be used if it is practical to dismantle and replace it such that it continues to maintain its effectiveness.

### 5.1.4. Limitation of fire spread

Firewalls, decks and ceilings may be used to separate different hazardous areas within the facility or to segregate non hazardous areas from those hazards. They shall prevent the passage of gas, smoke, heat and flame. They may also serve a dual role of blast walls.

*The need for and extent of fire barriers shall be defined by the FEHM process in GP 24-20. Their presence may limit ventilation, increasing the size of gas clouds, with a consequent increase in ignition probability and explosion overpressure.*

### 5.1.5. Protection of essential safety systems

PFP may be used to protect safety systems, or their components which are required to function at the beginning of a fire or throughout the whole event. This may include;

- Critical shutdown or depressurisation valve, their actuators and power sources
- Control and power cables
- Piping supports for firewater, flare and drains systems
- Fire pumps and emergency power supplies
- Protection of the main, and any emergency, control rooms

Protection is only required if the system is both exposed to the fire and needed to control that incident.

*Well control equipment should not require protection against process incidents. This is double jeopardy. If it may be exposed to process events, this should be highlighted and operation control placed on hazardous process activities during those periods when the well control equipment may be required.*

*ESD valves and their control systems should only be protected if they are in the same area as the source of the fire for which they are required.*

### 5.1.6. Protection of personnel

PFP may be used to protect personnel in the following ways:

- Protection of escape routes allowing personnel safe passage back to the primary muster points or to other safe locations such as bridge linked installations

