



Document No.	GP 24-23
Applicability	Group
Date	August 31, 2005

Guidance on Practice for Active Fire Protection - Offshore

GP 24-23

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 24-23. 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



Copyright © 2005, BP Group. All rights reserved. The information contained in this document is subject to the terms and conditions of the agreement or contract under which the document was supplied to the recipient's organization. None of the information contained in this document shall be disclosed outside the recipient's own organization without the prior written permission of Director of Engineering, BP Group Technology, unless the terms of such agreement or contract expressly allow.



Documents

Document Sharing Hub

Table of Contents

	Page
Foreword	2
Introduction	4
1. Scope	5
2. Normative references.....	5
3. Terms and definitions.....	6
4. Symbols and abbreviations.....	9
5. Requirements for Active Fire Protection:.....	10
5.1. Roles of Active Fire Protection:.....	10
5.2. Active Fire Suppression System Effectiveness	11
5.3. System Performance Standards	12
5.4. System Inspection, Maintenance and Repair	13
5.5. Adverse Effects.....	13
5.6. Regulatory and Code Compliance	14
6. The Role of Fire Teams	14
7. Firewater Infrastructure:.....	15
7.1. Performance standards.....	15
7.2. Fire pumps.....	19
7.3. Firewater distribution.....	23
8. Fixed Protection fire water Systems.....	26
8.1. Deluge protection systems including water curtains	26
8.2. Fixed Monitors	35
8.3. Fixed foam systems – helideck monitors.....	38
8.4. Hydrants and manual firefighting equipment	41
8.5. Sprinkler systems	42
8.6. Hose Reels	43
9. Fixed Extinguishing Systems	43
9.1. Fixed fire extinguishing system performance standards.....	44
9.2. Fine waterspray systems	44
9.3. Gaseous Extinguishing Systems.....	45
9.4. Galley systems	46
10. Portable firefighting equipment	46
Annex A: List of possible routes to escalation	48
Bibliography	49



Introduction

This GP provides guidance on how to implement the hazard management decisions relating to the provision of active fire protection arising from the hazard management process described in GP 24-20. This process and the supporting analyses described in GP 24-21 should have provided the designer with a full understanding of the fire hazards, a definition of the design events, both frequent and infrequent, which may occur on the installation. This process should already have 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, and the role of these systems in counteracting the identified hazards.

This GP turns those high level standards into detailed specifications which would form the basis of design of the systems. It provides guidance on how to provide reliable, effective and cost effective systems and on the infrastructure to support these systems, e.g. fire pumps and ring mains.

Complimentary Guidance on passive fire protection GP 24-24 describes 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 has been provided. This applies to the design of deluge systems for pressurised fires within enclosures; GIS 24-231 Deluge System Design and for the design of fine water mist systems; GIS 24-071 Fine Waterspray Specification, and others.



1. Scope

This GP provides guidance for the selection, design, and installation of active fire protection for offshore exploration and production installations. It does not define the need for active fire protection or the standard for fire protection. These result 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 active systems including fixed fire protection, portable equipment, extinguishers and the arrangements for manual firefighting.

This GP covers the protection of 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, process hydrocarbon hazards, fuel, utilities and accommodations. The GP guidance covers only drilling and blowout hazards and equipment on production installations or wellhead towers where the drilling rig is an integral part of the facility. The GP 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.

The GP does not cover use of active systems to reduce the overpressure of explosions but it does cover the protection from fires which may occur following plant or structural damage caused by the explosion.

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

GP 04-10	Guidance on Practice for Drainage Systems and Sewers
GP 24-07	Guidance on Practice for Fire Fighting Suppressants – Alternatives to Halon
GP 24-20	Guidance on Practice for Fire and Explosion Hazard Management - Offshore
GP 24-21	Guidance on Practice for Fire Hazard Analysis – Offshore/Onshore
GP 24-24	Guidance on Practice for Passive Fire Protection – Offshore
GIS 24-231	Guidance on Industry Standards for Deluge System Design – Offshore
GIS 24-071	Guidance on Industry Standards for Fine Waterspray Active Fire Protection
GP 30-85	Guidance on Practice for Fire & Gas Detection
GP 34-00	Guidance on Practice for Machinery
GIS 34-305	Guidance on Industry Standard for Diesel Engines



GP 36-10	Guidance on Practice for Metallic Materials Selection
GP 42-10	Guidance on Practice for Metallic Piping Systems ASME B31.3
GP 48-50	Guidance on Practice for Major Accident Risk Process

European Standards

ICAO CAP 437	International Civil Aviation Organisation CAP 437 Offshore Helicopter Landing Areas: Guidance on Standards
ICAO B CAP 160	International Civil Aviation Organisation CAP 160 AFFF type
UKOOA	Guidelines for Fire and Explosion Hazard Management Rev 2 October 20

National Fire Protection Association (NFPA)

NFPA 11	Foam extinguishing systems.
NFPA 13	Installation of sprinkler systems
NFPA 15	National Fire Protection Association Standard for Water Spray Fixed Systems for Fire Protection
NFPA 16	Deluge foam-water sprinkler and spray systems
NFPA 17	National Fire Protection Association Standard for Sprinkler Systems
NFPA 20	National Fire Protection Association Standard for the installation of Centrifugal Fire Pumps

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 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 to 3600 litres/minute (475 to 950 gpm).

Fixed System: 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, riser utilities and accommodation.

Jet Fire: 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: Turbulent diffusion fire which burns 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, 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. For specific systems, a large reliability may be required.



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 standard will require the severity and duration of the event or the survival time to be specified. The survival time specified will then be the requirement for a piece of equipment to remain operable during and/or after a specific hazardous event.

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
ATK	Aircraft turbine kerosene
BLEVE	Boiling liquid expanding vapour explosion
BS	British Standard
CCR	Central control room
CO ₂	Carbon dioxide
ESD	Emergency shutdown
FEHM	Fire and Explosion Hazard Management program or process
FPSO	Floating Production Storage and Offloading facility built from a oil tanker
GRP	Glass reinforced plastic
Gpm	Gallons (US) per minute
ICAO	International Civil Aviation Organisation
ISO	International Organisation for Standardisation
LP	Liquid Petroleum
NFPA	National Fire Protection Association



NGLs	Natural gas liquids
NPS	Nominal pipe size (inches)
NPSHA	Net positive suction head available
SCDM	Safety Critical Design Measures
SOLAS	Safety of Life at Sea
TR	Temporary refuge
UKOOA	United Kingdom Offshore Operators Association
UL	Underwriter's Laboratory

5. Requirements for Active Fire Protection:

The following requirements shall guide the selection and specification of active fire protection systems.

Annex “A” of GP 24-20 gives default provisions for control and mitigation measures including active and passive fire protection for a range of fire hazards. Sections 6 and 7 of this GP describe the role of fire teams and firewater infrastructure, respectively. Sections 8 and 9 of this GP describe each type of system in common use, the roles that they can fulfil, the hazards in which they will be effective, and a listing any limitations and drawbacks.

5.1. Roles of Active Fire Protection:

Safety Critical Design Measures (SCDM) shall have clearly defined roles as designated by the FEHM process and the categorisation of the hazards. Any conflict between fires and explosions shall be identified during the FEHM process.

The overall aim for the fire protection in each hazard category shall be:

- **Controllable hazards:** To suppress the hazard effects, protect personnel in the muster area, 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

These roles shall be in relation to specific hazards and their quantified effects. Systems shall fulfil one or more of the roles identified in the following sections.

5.1.1. Extinguishment

The primary means of fire extinguishment shall be the isolation of the fuel supply. Extinguishment of ongoing releases and liquid accumulations shall only be applied where the source and containment characteristics can be precisely defined so that rapid extinguishment can be achieved and post extinguishment security can be assured, thereby minimising the threat of escalation or a risk to life beyond the fire location.



5.1.2. Suppression of combustion or ignition

Combustion or ignition suppression:

1. May be applied where it is not practical to extinguish the fire in the short term
2. May be used to minimise the effects of heat, smoke and flame beyond the source area so that escalation into other areas or impairment of escape routes and muster areas is prevented.
3. May be applied to confined space or compartment fires in order to reduce the overall heat fluxes thereby preventing the failure of roof support structures and high level pipe work.
4. May be used to reduce the severity of a fire hazard, so that the fire hazard may be categorised a controllable rather than an evacuation event.
5. May be required for large unignited liquid or gaseous releases
6. May be required in cases where a fire has been extinguished suppression is used to prevent re-ignition.

5.1.3. Prevention of structural failure, escalation, or the loss of safety systems

The FEHM process and its supporting fire analysis shall:

1. Identify those hazardous events which can cause escalation, its timing and the severity.
A brief list of possible routes to escalation is included in Annex "A" of this GP. A comprehensive list of routes to escalation is given in GP 24-20
2. Determine whether protection is necessary.
This may include the further significant release of hydrocarbons, structural failures or damage to safety systems. The methods to assess whether the fire exposure is likely to lead to a failure are given in GP 24-21.

5.1.4. Shielding of muster points, escape and evacuation routes

In cases where it has not been possible to locate the muster points and evacuation systems such that they are not affected by fire hazards, one or more of the following may be used:

- a. Manually operated fixed monitors to provide a water shield to divert flames and smoke
- b. Spray systems or radiation protection may also be used to shield escape routes back to the muster points and routes leading from there to the means of evacuation.

5.2. Active Fire Suppression System Effectiveness

Active fire suppression systems shall be effective in counteracting the hazards as characterised by the fire analysis. Systems shall fulfil three requirements:

1. Suitability for the fire type
Descriptions of the fire types and their characteristics are given in GP 24-21. The suitability of a system is discussed in the sections where that system is discussed.
 - a. Most fire suppression systems will be suitable for suppressing pool fires.
 - b. The velocities and heat intensities of gas jet and high pressure liquid spray fires are such that conventional deluge design standards and application rates in NFPA 15 may not be sufficient to either protect against or suppress these fires.



Passive fire protection can be designed to match these high pressure fires but only materials which have been tested and certified under these conditions shall be used.

- c. Systems shall also be suitable for the environmental conditions including the effects of wind and the saline atmosphere
2. Sufficiency
 - a) The extent of the active fire protection coverage shall be sufficient to match the dimensions of the damaging events. External flaming from confined modules and the radiation and smoke effects from large fires shall be taken into account.
 - b) The extent of the active fire protection coverage shall account for reasonable variations in the location of the coverage area due to wind strength and direction.
 - c) The duration of the fire protection shall be sufficient to; match the duration of the fire, ensure the operation or survival of the protected plant, or to allow controlled evacuation, whichever is appropriate according to the categorisation and consequences.
3. Effectiveness

The type of system and the functional performance standards shall be sufficient to and shall ensure that the system performs its role effectively against the designated hazards for which it has been designed.

5.3. System Performance Standards

The system design engineer shall utilize GP 24-20 to determine the requirements for setting system performance standards. The system design engineer shall ensure:

1. The fire protection systems meet the clearly defined minimum requirements in GP 24-20 for the working life of the facility.
2. Higher design performance standards set to take account of performance deterioration of the system.
3. Sufficient reserve performance allowing prolonged intervals between refurbishment and repair

Sections 6 and 7 give a list of the performance standards which shall be set for each type of active fire protection system.

5.3.2. Functionality

Systems shall have clearly defined minimum functional performance standards which shall be achievable throughout the life of the facility. These standards shall be measurable so that the design criteria can be assessed to verify that the system is effective.

5.3.3. Availability and Reliability

The FEHM process shall determine the minimum probability that a system will fulfil its role as defined by the functional performance standards. This probability is comprised of two parts; reliability and availability.

- a. Each system shall have a predetermined reliability.
- b. The reliability shall be verified by regular testing of the components or the complete system.
- c. This reliability should cover the whole system including any supporting infrastructure such as fire detection and firewater supplies.



- d. Each system shall have a predetermined availability which shall be expressed as a downtime limit per annum.
- e. Availability shall be monitored during operation.

For example; an availability of 95% gives a downtime limit of 18 days per annum allowing the equipment to be refurbished or replaced.

- f. Reliability and availability targets shall be achieved initially by the inherent design of the facility or plant, design allowances, and the quality of the equipment.
- g. Duplication of systems should only be considered where it is not possible to achieve the targets and results in the possibility of production loss.
- h. Where the availability targets cannot be achieved in operation, additional risk reduction measures shall be employed such as the suspension of hazardous activities or reduction in manning.
- i. Production shutdown shall be considered if the absence of the active fire protection system increases the overall platform risk to levels unacceptable as defined in the Major Accident Risk Process, GP 48-50.
- j. System availability following explosions shall not be provided by duplicating the systems unless they are totally independent and it is impossible to protect them.

Damage to the interconnecting infrastructure of control systems or firewater supplies is likely to impair the overall system function. It is unlikely to be safe or practical to identify and repair damaged systems during a major fire following an explosion.

5.3.4. Survivability

Fire protection systems shall be designed to remain operable during the fire hazards. This shall be achieved by location, shielding, protection or by the rapid operation of the system itself.

Systems shall be designed to remain operable following explosions where this has been specified by the FEHM process. This shall be achieved by location, shielding or strengthening of the equipment.

5.4. System Inspection, Maintenance and Repair

- a. Systems shall be maintained for the life of the facility with the minimum reasonable amount of inspection, maintenance, repair and refurbishment.
- b. Systems shall be provided with access and equipment to measure the functional parameters either by component or full function test.
- c. Repeated full function tests shall be minimised where its effects cause major disruption to the facility or it may adversely affect the plant, for example by water ingress or corrosion.
- d. Systems may be taken off line for short periods to be tested within the allowances set in the availability standards.
- e. Systems which require long term disablement for inspection or testing shall not be used.

5.5. Adverse Effects

Systems shall be selected and designed to minimise adverse effects on the facility or plant during future operations.

The system design engineer shall be aware of the list of challenges below arising from the use of active systems, mainly due to the use of seawater. Where active systems are chosen, each of these



problems shall be examined and, when necessary, actions taken to manage them. These shall be fully documented for project handover.

- a. Corrosion as a result of water deluge including corrosion under insulation.
- b. The vulnerability of electrical and control equipment to water ingress.
- c. Poor historical reliability and availability of active systems.
- d. Corrosion and biological growth within the system piping causing nozzle blockage.
- e. Damage to piping due to normal operations.
- f. Damage to the plant due to the discharge of the agent (e.g. rapid cooling and contraction of hot plant).
- g. Vulnerability to explosions.
- h. Survivability and operability of the supporting infrastructure (e.g.; power supplies, control systems, pumps, and mains) during a very large incident
- i. The need to dispose of large quantities of firewater safely when it may contain hydrocarbon liquids.
- j. Disruption to operations during active system testing.
- k. Additional congestion caused by deluge piping in areas which may have an explosion risk.
- l. Personnel exposure to operate or reinstate a system in an emergency.

5.6. Regulatory and Code Compliance

Systems shall comply with any local country statutory requirements and regulations.

Compliance with local regulations, class rules or default prescriptive codes and standards shall not be used in place of a formal assessment of the fire hazards to determine the need for fire protection. Prescription of fire protection requirements without hazard assessment shall not be used to provide assurance that the systems are either sufficient or effective

6. The Role of Fire Teams

Fire teams shall not be used as the primary means of fire fighting to control process, well, or riser hazardous events. Fire teams shall only be used for small or incipient fires.

In roofed modules or congested process areas, it is impractical for individuals to approach close enough to the source of the fire to be effective. In addition, it is dangerous to take such actions. They may augment protection using fixed monitors where the monitors are positioned at the safe end of the facility; (e.g. by directing water towards the drilling rig).

The primary roles of the fire team shall be:

- a. To assess the incident and the effectiveness of the fixed systems, and report back to the CCR.
- b. To search for missing persons.
- c. To man helideck fire fighting monitors and equipment.



- d. To fight minor fires where fixed systems are not provided, such as in the utilities, accommodation, workshops, waste skips and open decks.
- e. Each facility should clearly identify those fire scenarios that will be fought by the fire team and those that will not.
- f. To augment fixed protection from a safe location.

The fire teams should not be a core part of the hazard management philosophy for fighting any major fire hazard. Where the layout permits, they may augment protection using fixed monitors from a safe location, (such as on the deck of an FPSO or remote from the drilling rig on a fixed platform).

- g. To secure an area post incident or following an unignited oil release

In cases where there is an unignited oil spill or a residue of unburnt hydrocarbon liquid, fire teams may be required to apply aspirated foam to prevent ignition. This should only be carried out following a risk assessment to confirm that personnel are not exposed to a flash fire or explosion caused by the vapours.

- h. To protect and guide personnel during evacuation

A well trained fire team can make the difference between a controlled, orderly evacuation and an evacuation with confusion and panic. They can provide the confidence for personnel to make their way through smoke and heat to the embarkation points. They may also use fixed or portable monitors to divert smoke or flames or to provide radiation shielding during lifeboat embarkation.

The size and capability of the fire team and other individuals on the facility should be assessed, or agreed with the Operator on a new project, before placing reliance on them to fulfil any of these roles. Suitable and sufficient portable equipment shall be provided to fulfil the identified roles. Personnel shall be trained in its use.

7. Firewater Infrastructure:

The fire water infrastructure covers the firepump, drivers, power supplies and the distribution system of ring and deluge main headers. It extends as far as the inlets to deluge skids, foam systems, monitors and hydrants. These items are covered in later sections.

The main design principles for the infrastructure are simplicity, robustness and suitable layout (to avoid exposure to damaging fires or explosions). These are developed in section 7.2 onwards.

The performance standards that will need to be set for the whole infrastructure are as follows:

7.1. Performance standards

7.1.1. Functional Performance standards

7.1.1.1. Firewater demand and system capacity

- a. The minimum fire water capacity shall be defined in two ways;

