



Document No.	GP 24-40
Applicability	Group
Date	27 July 2006

Guidance on Practice for Fire Protection of Atmospheric Storage Tanks

GP 24-40

**BP GROUP
ENGINEERING TECHNICAL PRACTICES**

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 24-40. This Guidance on Practice (GP) is based on incident investigation reports and parts of heritage documents from the merged BP companies as follows:

British Petroleum

RP 58-1 Non Refrigerated Petroleum and Petrochemical Storage

Amoco

A PS-FES-00-G Process Safety - Fire Extinguishing Systems - Guide.
A PS-FES-00-E Process Safety - Fire Extinguishing Systems - Engineering Specification.
A FE-TK-00-G Fabricated Equipment - Tanks - Guide.
A FE-TK-00-E Fabricated Equipment - Tanks - Engineering Specification.

ARCO

900-97 Welded Oil Storage Tanks.

Copyright © 2006, 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 organisation. None of the information contained in this document shall be disclosed outside the recipient's own organisation without the prior written permission of Director of Engineering, BP Group, unless the terms of such agreement or contract expressly allow.



Table of Contents

	Page
1. Scope	6
2. Normative references.....	6
3. Terms and definitions.....	7
4. Symbols and abbreviations	9
5. Fire hazard management philosophy	9
5.1. Tank firefighting philosophies.....	9
5.2. Firefighting resources	10
6. Tank spacing, bunding, and road access	13
6.1. Minimum requirements.....	13
6.2. Bunding	13
7. Firewater main	14
8. Requirements for all type of tanks.....	15
8.1. Tank equipment not specific to firefighting	15
8.2. Incident prevention and detection equipment.....	17
8.3. Firefighting equipment	17
9. Fixed roof tanks	20
9.1. Limitations of use.....	20
9.2. Tank equipment not specific to firefighting	20
9.3. Fire detection equipment.....	20
9.4. Firefighting equipment	20
10. External floating roof tanks.....	20
10.1. Limitations of use.....	20
10.2. Tank equipment not specific to firefighting	21
10.3. Fire detection equipment.....	23
10.4. Firefighting equipment	23
11. Emergency plan for tank farms	24
12. Fire system testing.....	24
Annex A (Informative) Typical emergency response plan.....	25
Bibliography	27

List of Tables

Table 1 - Minimum design requirements for fire protection of atmospheric storage tanks.....	10
Table 2 - Water needed for foam production only for a full surface tank fire (fresh water; add 20% in case of sea water use) (add cooling of exposures if needed)	11
Table 3 - Foam application rates for most common foam destructive liquids.....	12



List of Figures

Figure 1 – Tank Full Surface Fire.....	25
--	----

Uncontrolled Copy



Introduction

This Guidance on Practice (GP) will clarify policy with respect to firefighting and fire detection design for new or retrofitted atmospheric storage tanks. The intent of this GP is not to examine all possible situations but rather to aid fire risk assessors and fire protection engineers in settling on a hazard management design that is fit for purpose for the most common tank types on sites.

Recent mergers and reorganisations have resulted in some confusion within BP Business Units as to what the policy is with respect to tank fire protection design as regional and heritage practices are different and what are preferred options. In addition, due to the proliferation of suppression/detection system existing on sites and that have materialised in the industry over the past few years, those responsible for facility fire protection are often faced with a confusing array of alternatives.

Application

This document may refer to certain local, national, or international regulations, but responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Feedback and Further Information

Users are invited to feedback any comments and to detail experiences in the application of BP ETPs, to assist in the process of their continuous improvement. Please use the ETP Library comment feature to provide feedback regarding issues with this document. Use the Shared Learning System to enter shared learnings related to this document. You may access both systems through this link http://technical_practices.bpweb.bp.com/. The ETP Library comment feature allows you to ask questions to the subject matter experts and owners of the document content.



1. Scope

This GP provides guidance for selection of fire detection and firefighting systems for new or retrofitted vertical atmospheric storage tank fires containing Class I, II or III hydrocarbons. This GP applies to all facilities with atmospheric storage tanks.

BP suffered three major full surface tank fires in the past 20 years. In all cases, what started as a minor emergency (roof stuck, rim seal fire, etc.) escalated to a major incident that lasted for days, with involvement of authorities and severe legal and reputation issues. On the other hand, response to some other serious emergencies (rim seal fires, sunken roof, etc.) has demonstrated the value of good design and adequate emergency response preparedness.

The challenge for the fire protection engineer is to select or develop a risk based and cost effective fire hazard management strategy for the protection of life, the environment, and assets that also complies with societal expectations. Confronted by often confusing claims and selective reporting of fire test results, it is crucial for those responsible for fire protection to recognise that all the systems currently available represent a compromise. As such, an appropriate balance must be struck between efficient detection, extinguishing efficiency, environmental impact of extinguishing agents and of the incident, damage to protected assets, the costs of installation, changeout or maintenance, and the potential risk. Reference the BP Fire Booklet Series and LASTFIRE Study 1996 and 2005 revision.

It is also recognised that, in some areas, there may be prescriptive legislative requirements that will have to be applied. However, every time the requirements of this GP are greater than local rules, this GP shall take precedence.

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.

BP

GP 04-20	Guidance on Practice for Civil Engineering.
GP 24-10	Guidance on Practice for Fire Protection - Onshore.
GP 44-10	Guidance on Practice for Plant Layout.
GP 44-60	Guidance on Practice for API RP 500 Area Classification.
GP 44-65	Guidance on Practice for IP 15 Area Classification.
GIS 58-101	Guidance on Industry Standard for Welded Steel Atmospheric Tanks for Oil Storage.
GN 24-001	Safety Gates and Bar for Vertical Ladders (BP Std Dwg S-1969)
LASTFIRE Foam Tests 2002	LASTFIRE Live Fire Tests and Environmental Assessment of Fire Fighting Foam Concentrates Used or Being Considered by BP or Joint Venture Companies, September 2002, Resource Protection International.
LASTFIRE Foam Tests 2003	LASTFIRE live fire tests and environmental assessment of fire fighting foam concentrates used or being considered by BP or



JV companies: June/July 2003 test series, October 2003,
Resource Protection International.

BP Group HSSE [Position Paper: Halocarbons and the Environment.](#)
[BP Fire Response Workbook](#)

Energy Institute (EI) – Formerly the Institute of Petroleum (IP)

IP-MCSP-P19 Model Code of Safe Practice for the Petroleum Industry - Part 19 - Fire
Precautions at Petroleum Refineries & Bulk Storage Installations.

National Fire Protection Association (NFPA)

NFPA 11 Standard for Low-, Medium-, and High-Expansion Foam.

Oil and Gas Producers Association (OGP)

OGP – Fire Systems Integrity Assurance (available at www.ogp.org.uk).

Process Industry Practices (PIP)

PIP STF05501 Fixed Ladders and Cages.

3. Terms and definitions

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

Active fire protection or active systems

Equipment, systems, and methods required for detection, alarming, control, and extinguishing of fires using water, steam, dry powder (also called “dry chemical”), or gaseous extinguishing agents. An example of such system would consist of detection equipment for fire, smoke, gas, or heat that activates fixed extinguishing or control systems.

Application rate

Volume of foam solution (premix water + foam) to be applied on a unit of surface per unit of time (i.e., l/min/m² or gpm/ft²).

Bund (also called “dike”)

Wall, usually made of concrete or earth, designed to provide secondary containment around tanks: refer to GP 44-10 for bund design.

Expansion ratio

Volume of finished foam compared to volume of foam solution: for example, expansion ratio of 6:1 means that one volume of solution will produce six volumes of finished foam once air has been injected.

Fixed water/foam systems

Fixed systems are those consisting of permanently installed foam or water distribution equipment and foam making equipment. These may be initiated automatically or manually with remote or local control.

[Important note: For the purpose of this document, unless specifically indicated, any mention of “fixed” systems refers to both “fixed” and “semi fixed” systems.]



Foam concentrate

Pure foam compound, usually used at 1%, 3%, or 6% concentration, to create foam solution. Once air is added to solution, this is finished foam. In some areas, foam concentrate is referred to as “foam liquid”.

Foam (finished)

Foam solution mixed with air.

Foam solution

Water with 1%, 3%, or 6% foam concentrate. Foam solution may be referred to as premix, but this is normally only used if fluid is mixed before actual usage (e.g., foam extinguishers contain premix).

Full surface foam system

Designed to place foam on surface of liquid through pipework accessed from outside bund. Can be used on fixed (cone) roof, floating roof, and internal floating roof tanks. Can be over top (top foam pourers [also called “top foam chambers”]) or subsurface.

Grounding (also referred to as “earthing”)

Electrical connection of equipment to main body of earth to ensure that it is at earth potential.

Lower explosive (or flammable) limit

Concentration of a hydrocarbon gas in air below which there is insufficient hydrocarbon to support and propagate combustion.

Passive fire protection or passive system

Provision of non combustible materials that, in a fire, for a defined period of time, protect equipment, prevent collapse of structural supports, or limit spread of fire. In addition, passive systems embrace basic requirements for area separation and classification.

Petroleum liquids or liquids

Class 0: Ethane, ethylene, propylene, LPG, and LNG. Class I: Liquids that have flashpoint below 21°C (70°F). Class II: Liquids that have flashpoint from 21°C to 55°C (70°F to 131°F) inclusive. Class III: Liquids that have flashpoint above 55°C (131°F) up to and including 100°C (212°F). Class II or III liquids can be further subdivided. Class II (1) or III (1) liquids are those that are handled below their flashpoints. Class II (2) or III (2) liquids are those that are handled at or above their flashpoints.

Pyrophoric iron sulphide

Iron sulphide capable of a rapid exothermic oxidation causing incandescence if exposed to air and potential ignition of flammable hydrocarbon gas/air mixtures.

Retrofitted tanks

Tanks that:

- will be subject to maintenance or modification work, including full cleaning and gas freeing of tank and performing repair or modification work that involves hot work; OR
- will be containing Class I, II or III liquids, when their previous service was products with a flashpoint above 100°C (212°F).

As a guidance for application of this document, major maintenance or modification can be considered to take place when the costs of the work is exceeding 15% of the price of building a new tank.



Rim seal foam system

System designed to place foam in area of rim seal of floating roof tanks. Foam/water solution is injected into pipework system from outside bund area. It is aerated and allowed to fall into dam constructed around seal. There are a number of variations of this system.

Semi fixed water/foam systems

Semi fixed systems are those that consist of permanently installed water or foam distribution equipment but requiring manual intervention to connect up to water/foam supply. See important note in "Fixed systems" definition.

Subsurface foam injection system (also called "base injection")

Designed to discharge foam into base of tank, either through product lines or separate specific pipe work. Foam floats to surface of liquid.

True vapour pressure

True vapour pressure of liquid is absolute pressure exerted by gas produced by evaporation from liquid if gas and liquid are in equilibrium at prevailing temperature and gas/liquid ratio is effectively zero.

Unmanned location

Site where no operator will tour tanks during 12 consecutive hr or more.

4. Symbols and abbreviations

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

CCTV	Closed circuit television.
ETBE	Ethyl tertiary butyl ether.
GRE	Glass reinforced epoxy.
HDPE	High density polyethylene.
LEL	Lower explosive limit.
LFL	Lower flammable limit.
MTBE	Methyl tertiary butyl ether.
TVP	True vapour pressure.
VRU	Vapour recovery unit.

5. Fire hazard management philosophy**5.1. Tank firefighting philosophies**

- a. In case of full surface tank fires, options available are:
 1. Extinguishment.
 2. Controlled burndown.
- b. Controlled burndown option is not possible for products susceptible to boilover due to relatively unpredictable nature of boilover.

