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Guidance on Practice for Alternatives to Halon 1211, 1301 and 2402 Fire Fighting Suppressants

GP 24-07

**BP GROUP
ENGINEERING TECHNICAL PRACTICES**

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 24-07. This Guidance on Practice (GP) is based on parts of heritage documents from the merged BP companies as follows:

bp

Group HSSE

Alternatives to Halon 1211 and 1301- Fire Fighting Suppressants –
Guidance to the BPAmoco Group – Revision January 2000

British Petroleum

None

Amoco

None

ARCO

None

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Introduction

This Guidance on Practice (GP) will clarify the Group halocarbon policy with respect to fire fighting and explosion prevention, will outline the current status of fire and gas detection, and will discuss certain fire suppressing agents as preferred alternatives to replace Halon. The intent of this GP is not to examine all possible situations, but rather to aid the fire risk assessors and fire protection engineers in settling on a hazard management strategy that is fit for purpose.

Recent mergers and reorganisations have resulted in some confusion within the BP Business Units as to what the new BP Group policy is with respect to the phase out of halons, and what are the preferred alternatives. In addition, due to the proliferation of suppression agents that have materialised over the past few years, those responsible for facility fire protection are often faced with a confusing array of alternatives from sales people who all claim that they are a “drop-in” replacement for halon 1301. Let us be clear from the outset, none of the alternative agents currently commercialised is a “drop-in” replacement for halon 1301, and no such alternative agent is likely to be developed within the foreseeable future.

There are other Group Practices, HSSE guidance notes and GPs or GISs in the ETP structure, that the reader should refer to for more details on the applicability of technologies presented herein to their own situation.

Application

Text in blue italics is Commentary. Commentary provides background information that supports the requirements of the GP, and may discuss alternative options. It also gives guidance on the implementation of any ‘Specification’ or ‘Approval’ actions.

This document may refer to certain local, national or international regulations but the 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 GPs, to assist in the process of their continuous improvement. Please use the ETP Library comment feature or the ETP Shared Learning System to provide feedback regarding issues with this document. You may access both systems through this link <http://etp.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 the selection of fire fighting suppressants as alternatives to halon. The GP applies to both onshore and offshore plants and facilities.

The Montreal Protocol, the international treaty on substances that deplete the ozone layer, banned the production of halons in the developed nations effective January 1st, 1994. In addition, several nations have taken actions to restrict or ban halon use and, in particular, the European Union enacted legislation that, except for a narrow band of critical uses, required the decommissioning of halon systems and extinguishers by December 31st, 2003.

Also, with the greater focus on the potential impacts of gases on global warming, the Kyoto Climate Change Protocol requires reductions in emissions of greenhouse gases. These include some of the alternative gases that have been found to be effective for the purposes of fire fighting, including hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs). Enforcement and implementation issues are still to be developed; yet it is another factor to be considered when evaluating these gases. Thus today, as a general rule, it is advisable to consider man-made fire extinguishing gases that accumulate in the atmosphere only for applications required by law, or where they are the only practical, people-safe option.

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 conforms to 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 halon replacements and alternatives currently available represent a compromise. As such, an appropriate balance must be struck between extinguishing efficiency, agent (or thermal decomposition product) toxicity to exposed personnel, damage to protected assets, the costs of installation, change-out or maintenance, and environmental impact.

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 24-10	Guidance on Practice for Fire Protection – Onshore.
GP 24-23	Guidance on Practice for– Offshore Active Fire Protection
GP 24-03	Guidance on Practice for Inherently Safer Design.
GIS 24-071	Guidance on Industry Standard for Fine Water Spray Mist Systems
GIS 24-072	Guidance on Industry Standard for Carbon Dioxide Extinguishment Systems
GP 30-85	Guidance on Practice for Fire and Gas Detection
BP Group Fire Advisor	Last-fire live fire tests and environmental assessment of fire fighting foam concentrates, September 2002, Resource Protection International.



BP Group Fire Advisor 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 Fire booklet series; Liquid hydrocarbon storage tanks: prevention and fire fighting (2003) [Link to Booklet](#)

Group HSSE Position Paper: Halocarbons and the Environment

American Society for Testing and Materials (ASTM)

ASTM D5632-I or -II Standard Specification for Halon 1301, Bromotrifluoromethane (CF₃Br)

International Organization for Standardization (ISO)

ISO 7201 Fire Protection - Fire Extinguishing Media - Halogenated Hydrocarbons - Part 1: Specifications for Halon 1211 and Halon 1301 Second Edition; (CEN EN 27201-1: 1994)

BS ISO 14520 Gaseous Fire-Extinguishing Systems - Physical Properties and System Design - Part 1: General Requirements-CORR 13394: Together with BS ISO 14520-2, BS ISO 14520-3, BS ISO 14520-4, BS ISO 14520-6, BS ISO 14520-7, BS ISO 14520-8, BS ISO 14520-9, BS ISO 14520-10, BS ISO 14520-11, BS ISO 14520-12, BS ISO 14520-13, BS ISO 14520-14, BS ISO 14520-15, Also Supersedes DD 233:1996;

National Fire Protection Association (NFPA)

NFPA 11A Standard for Medium- and High-Expansion Foam Systems.

NFPA 12 Standard on Carbon Dioxide Extinguishing Systems

NFPA 13 Standard for the Installation of Sprinkler Systems

NFPA 14 Standard for the Installation of Standpipe and Hose Systems.

NFPA 15 Standard for Water Spray Fixed Systems for Fire Protection.

NFPA 16 Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems.

NFPA 750 Standard on Water Mist Fire Protection Systems.

NFPA 2001 Standard for Clean Agent Fire Extinguishing Systems.

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 the detection, alarming, control, and extinguishing of fires using water, steam, dry powder, or gaseous extinguishants. An example of this would comprise detection equipment for fire, smoke, gas, or heat that activates fixed extinguishing or control systems.

Fire Potential

This applies to plant and equipment (but excluding piping) that contain combustible fluids (See API 2218).

Fixed Systems or Total Flood Fixed Systems

Fixed systems are those comprising permanently installed fire suppressant distribution equipment and possibly suppressant mixing or making equipment. Fixed systems may be initiated automatically or manually with remote or local control.



Flammable Liquid

Any liquid having a flash point below 37.8°C (100°F) and a vapour pressure not exceeding 2,76 bar abs at 37,8°C (40 psia at 100°F).

Inherently Safe Design, Well-designed facilities

Incorporation of design safety features on an inter-disciplinary basis, encouraging a coordinated approach to safety in the overall design process.

Passive Fire Protection or Passive System

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

Petroleum Liquids or Liquids

Class 0: Ethane, ethylene, propylene, LPG, and LNG. Class I: Liquids that have a flashpoint below 21°C. Class II: Liquids that have a flashpoint from 21°C to 55°C (70°F to 131°F) inclusive. Class III: Liquids that have a 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.

4. Symbols and abbreviations

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

AFFF	Aqueous film forming foam.
CCTV	Closed Circuit Television
CO ₂	Carbon dioxide.
CVP	BP's five stage Capital Value Process for projects (Appraise, Select, Define, Execute, Operate)
FEHMP	Fire and explosion hazard management plan.
FICs	Fluoriodocarbons
FKs	Fluoroketones
FRA	Fire Risk Analysis.
HCFCs	Hydrochlorofluorocarbons
HF	Hydrogen fluoride
HFCs	Hydrofluorocarbons
HSSD	High Sensitivity Smoke Detection
IR	Infrared light waves
PFCs	Perfluorocarbons
P&ID	Piping and instrument diagram.
PCM	Prevention, control and mitigation.
UV	Ultraviolet light waves

5. BP halocarbon position**5.1. Policy**

The exact wording of BP's policy shall be found in the document "Position Paper: Halocarbons and the Environment" on the Halocarbon Network BP Intranet web page at:

<http://hse.bpweb.bp.com/halocarbons>



5.2. Position

BP plants and facilities shall follow the Group HSSE and Group Technology-Fire position on the use of halons and halocarbons that is to minimise, or where possible, prevent emissions of halocarbons, and to eliminate their use well ahead of international and national obligations. With respect to halons and the halocarbon alternative agents, the net effect of this position, which shall be followed, is included below:

5.2.1. Removal of Halon 1211 Portable Extinguishers

All halon 1211 portable fire extinguishers shall have been removed from all BP facilities by January 2000. If portable fire extinguishers are still necessary, the extinguishers shall be replaced with alternatives to halon. The only exceptions are those portable extinguishers used within aircraft, helicopters or required by regulation.

Even though aviation has an exception, any live training must not use halon but instead must use alternatives such as carbon dioxide portable extinguishers.

5.2.2. Decommissioning of existing Halon 1211, 1301, or 2402 fixed systems

BP Business Units shall have a program to decommission fixed halon systems within their existing facilities as alternative technologies become viable. For new offshore and onshore facilities, halon based fixed systems must not be used.

Based on experience to date, there are unlikely to be any on-shore facilities within the BP group where the continued use of fixed halon systems will be required for the foreseeable future. The only exception to date is the Alaskan Business Unit.

5.2.3. Responsible recovery and disposal of halon

- a. When halon systems or extinguishers are replaced, or reach the end of their useful life, Group policy requires that any remaining halon must be recovered for recycling or destruction through companies that are recognised (nationally or internationally) as being environmentally responsible. Only companies with equipment that reclaim halon to ASTM D 5632 Type I or Type II or ISO 7201 specifications shall be used for recycling halon. Losses of halon on equipment transfer must not exceed 0.5%.
- b. The discharge of halon to the atmosphere must not occur.

Discharge of halon systems or portable extinguishers prior to their decommissioning is an unacceptable practice, even for training purposes.

5.3. Halocarbon alternatives to halon

Man-made gaseous alternatives, e.g. hydrochlorocarbons (HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), fluoro ketones (FKs) etc., shall not be used as replacements for halon in new or existing fire extinguishers or fixed fire protection systems. Man-made gaseous alternatives for new fire extinguishers or fixed systems may only be used if required by regulation or if they are determined by a fire risk assessment to be the only practical, people-safe option.

The man-made chemical agents mentioned above are not considered sustainable in the long-term, are generally the most expensive option (either initial cost or future maintenance), and are always at risk of being subject to regulation, including phase out of use. In addition, BP Fire Protection engineers have determined that none of the man-made gaseous alternatives offers any significant benefit over conventional fire fighting agents and practices. However, in some rare and exceptional cases, a hazard analysis may determine that the use of such gaseous alternatives is the only people safe option. Contact Group Technology Fire or Group HSSE for further advice.



5.3.1. Halocarbons in Portable Fire Extinguishers

Halocarbon based portable extinguishers shall not be used unless the local country laws or regulations require their use or if they are determined by a fire risk assessment to be the only practical, people-safe option.

This rule is the current BP policy. BP Fire Protection Engineers have determined that these halocarbon based portable fire extinguishers offer no significant fire fighting benefit over traditional extinguishers of the same rating. These extinguishers are generally more expensive and, with the exception of Novec 1230, have environmental concerns that may restrict their use now or in the future. A future exception to this policy may occur for fire extinguishers on-board aircraft. The FAA/CAA/JAA and aircraft manufacturers may in the future certify them for use.

Halocarbon agents that come close to matching the desirable properties of halon 1211 have been developed. These include Halotron 1 (an HCFC blend) from American Pacific, available in Amerex, Badger, and Buckeye extinguishers; FE-36 (HFC-236fa) from DuPont, available in Ansul extinguishers; FM-200 (HFC-227ea) from Great Lakes Chemical Company, available in special purpose extinguishers from Metalcraft; FE-241 (HCFC-241) from Dupont available in fire extinguishers from Fireboy; and Novec1230 (FK-5-1-12) from 3M Corporation (not currently available in extinguishers). American Pacific is also investigating the commercialisation of a brominated propene (2-bromo-3,3,3-trifluoropropene), which has an environmental impact similar to Novec 1230.

5.3.2. Halocarbons in Total Fixed Flood Systems

Halocarbon based total fixed flood systems shall not be used in most BP applications. These agents shall only be considered for special applications required by law, or where they are the only practical people-safe option as identified by a fire risk assessment or FRA. Use of halocarbons in fixed total flood systems shall only be used in consultation with Group Technology-Fire and Group HSSE.

5.3.2.1. System Design of Halocarbons in special applications

For system design and use of made-man halocarbons in special approved applications, the fire protection engineer shall use the design requirements specified in ISO 14520 and NFPA 2001.

The NFPA 2001 standard incorporates the use of an EPA-sponsored, physiologically based pharmacokinetic (PBPK) model to determine exposure limits for halocarbon agents. The PBPK model allows inhalation exposures of halocarbon agents to be assessed in terms of the chemical concentrations in blood during exposure. It provides a more accurate assessment of the length of time that a person can be exposed before toxic effects could occur. The standard allows exposure to halocarbon agents in normally occupied areas at a design concentration up to the LOAEL (lowest observed adverse effect level) for a length of time determined using a PBPK model, or less than 60 seconds in the absence of PBPK information.

If a halocarbon alternative to halon is being considered, the fire protection engineer should take into account the high cost of the halocarbon agents and any future refill costs which would add significantly to ongoing maintenance costs.

The system shall be designed with the knowledge that all man-made halocarbons generate higher hydrogen fluoride (HF) values than halon 1301 when released under fire conditions. The system shall contain a pre-discharge alarm. Personnel in the protected area shall promptly evacuate at the sound of the pre-discharge alarm. Also, because of the higher HF generation, any electronic circuitry within the protected area should be protected from HF exposure.

HF has a corrosive effect against electronic circuitry similar to or worse than halon.

