

# Recommended Practice for Fire Prevention and Control on Fixed Open-type Offshore Production Platforms

API RECOMMENDED PRACTICE 14G  
FOURTH EDITION, APRIL 2007

REAFFIRMED, SEPTEMBER 2019



AMERICAN PETROLEUM INSTITUTE



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**Upstream Segment**

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This Recommended Practice (RP) is under the jurisdiction of the American Petroleum Institute (API) Executive Committee on Drilling and Production Operations. It has been prepared with guidance from API and the Offshore Operators Committee (OOC). It is essential that operations on offshore production platforms are conducted in a manner providing for the safety of personnel and property and the protection of the environment. Process systems and operating practices are designed to prevent the unintentional release of hydrocarbons to the atmosphere and their subsequent ignition. However, the possibility of such an occurrence must be considered and methods employed not only to prevent fires but, where practical, to control a fire that may occur.

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# Recommended Practice for Fire Prevention and Control on Fixed Open-type Offshore Production Platforms

## 1 General

### 1.1 INTRODUCTION

For many years, the petroleum industry has prepared documents representing the knowledge and experience of industry on various phases of oil and gas producing operations. In a continuation of this effort, this RP presents guidance for minimizing the possibility of accidental fires and for designing, inspecting, and maintaining the fire control systems on open type offshore platforms. Application of these practices, combined with proper design, operation, and maintenance of the entire production facility can provide adequate protection from the threat of fire.

### 1.2 SCOPE

This publication presents recommendations for minimizing the likelihood of having an accidental fire, and for designing, inspecting, and maintaining fire control systems. It emphasizes the need to train personnel in fire fighting, to conduct routine drills, and to establish methods and procedures for safe evacuation. The fire control systems discussed in this publication are intended to provide an early response to incipient fires to prevent their growth. However, this discussion is not intended to preclude the application of more extensive practices to meet special situations or the substitution of other systems which will provide an equivalent or greater level of protection.

This publication is applicable to fixed open-type offshore production platforms which are generally installed in moderate climates and which have sufficient natural ventilation to minimize the accumulation of vapors. Enclosed areas, such as quarters buildings and equipment enclosures, normally installed on this type platform, are addressed. Totally enclosed platforms installed for extreme weather conditions or other reasons are beyond the scope of this RP.

### 1.3 INDUSTRY CODES, STANDARDS, AND RECOMMENDED PRACTICES

Various organizations have developed standards, codes, specifications, and recommended practices which have substantial acceptance by government and industry. Listed below are publications that may be useful to persons designing, installing, and operating fire control systems on offshore production platforms. The latest edition of these publications should be consulted. It should be recognized that portions of some of these publications are not applicable to offshore operations:

#### API

|           |                                                                                                                                                                              |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| RP 14C    | <i>Analysis, Design, Installation and Testing of Basic Surface Safety Systems on Offshore Production Platforms</i>                                                           |
| RP 14E    | <i>Design and Installation of Offshore Production Platform Piping Systems</i>                                                                                                |
| RP 14F    | <i>Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Division 1, and Division 2 Locations</i> |
| RP 14FZ   | <i>Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1 and Zone 2 Locations</i>  |
| RP 14J    | <i>Design and Hazards Analysis for Offshore Production Facilities</i>                                                                                                        |
| RP 75     | <i>Development of a Safety and Environmental Management Program for Offshore Operations and Facilities</i>                                                                   |
| RP 500    | <i>Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2</i>            |
| RP 505    | <i>Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1 and Zone 2</i>            |
| RP 520    | <i>Sizing, Selection, and Installation of Pressure-relieving Devices in Refineries</i>                                                                                       |
| RP 521    | <i>Guide for Pressure-relieving and Depressurizing Systems</i>                                                                                                               |
| RP 2003   | <i>Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents</i>                                                                                     |
| Publ 2030 | <i>Application of Fixed Water Spray Systems for Fire Protection in the Petroleum and Petrochemical Industries</i>                                                            |
| Publ 2218 | <i>Fireproofing Practices in Petroleum and Petrochemical Processing Plants</i>                                                                                               |
| RP T-1    | <i>Orientation Programs for Personnel Going Offshore for the First Time</i>                                                                                                  |

NFPA<sup>1</sup>

*National Fire Codes  
Fire Protection Handbook*

ASTM<sup>2</sup>

B 163      *Standard Methods of Fire Tests of Window Assemblies*  
 D 2996      *Standard Specifications for Filament Wound Reinforced Thermosetting Resin Pipe*  
 D 4024      *Standard Specification for Reinforced Thermosetting Resin (RTR) Flanges*  
 E 84      *Standard Methods of Test for Surface Burning Characteristics of Building Materials*  
 E 119      *Standard Test Methods for Fire Tests of Building Construction and Materials*  
 E 152      *Standard Methods of Fire Tests of Door Assemblies*  
 E 814      *Standard Methods of Through Penetration Fire Stops*

UL<sup>3</sup>

UL 711      *Classification, Rating, and Fire Testing of Class A B, and C Fire Extinguishers and for Class D Extinguishers or Agents for Use on Combustible Metals*  
 UL 1709      *Rapid Rise Fire Tests of Protection Materials for Structural Steel*

**1.4 CONVERSIONS**

Conversions of English units to International System (SI) metric units are provided throughout the text of this Recommended Practice in parenthesis; e.g., 6 in. (152.4 mm). English units are in all cases preferential and shall be the standard in this Recommended Practice. Products are to be marked in the units in which ordered unless there is an agreement to the contrary between the purchaser and the manufacturer. The factors used for conversion of English units to SI units were taken from API Publ 2564 and are listed as follows:

**Length**

1 inch (in.) = 25.4 millimeters (mm)  
 1 foot (ft) = 0.3048 meters (m)

**Pressure**

1 pound per square inch (psi) = 0.06894757 bar

Note: 1 bar = 100 kilopascals (kPa)

**Temperature**

The following formula is used to convert degrees Fahrenheit (F) to degrees Celsius (C):

$$C = \frac{5}{9} (F - 32)$$

**Flow Rate**

1 gallon per minute per square foot (gpm/ft<sup>2</sup>) = 40.746 liters per minute per meters squared (liters/min per m<sup>2</sup>)  
 1 gallon per minute (gpm) = 0.06309020 cubic decimeters per second (dm<sup>3</sup>/s)

**Area**

1 square foot (ft<sup>2</sup>) = 0.0929304 square meters (m<sup>2</sup>)

**Mass**

1 pound (lb) = 0.4535924 kilograms (kg)

<sup>1</sup>National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, Massachusetts 02269-9101, [www.nfpa.org](http://www.nfpa.org).

<sup>2</sup>ASTM International, 100 Bar Harbor Drive, West Conshohocken, Pennsylvania 19428, [www.astm.org](http://www.astm.org).

<sup>3</sup>Underwriters Laboratories, 333 Pfingsten Road, Northbrook, Illinois 60062, [www.ul.com](http://www.ul.com).

**Power (Electric)**

1 horsepower (HP) = 0.746 kilowatts (kW)

**Volume**

1 gallon = 3.785412 liters

**1.5 DEFINITIONS**

**1.5.1 combustible:** Capable of burning.

**1.5.2 combustible liquid (Class II, IIIA, and IIIB liquids):** A liquid having a flash point at or above 100°F (37.8°C).

Combustible liquids are subdivided as follows:

Class II liquids, those having flash points at or above 100°F (37.8°C) and below 140°F (60°C).

Class IIA liquids, those having flash points at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB liquids, those having flash points at or above 200°F (93°C). (See NFPA 30.)

**1.5.3 combustion:** The oxidation of materials accompanied by the development of heat and usually the production of flame.

**1.5.4 enclosed area:** A three-dimensional space enclosed by more than two thirds ( $\frac{2}{3}$ ) of the possible protected plane surface area and of sufficient size to allow the entry of personnel. For a typical building, this would require that  $\frac{2}{3}$  or more of the walls, ceiling, and/or floor are present.

**1.5.5 fire:** The phenomenon of combustion manifested in light, flame, and heat.

**1.5.6 fire protection, active:** Any fire protection system or component which requires the manual or automatic detection of a fire and which initiates a consequential response.

**1.5.7 fire protection, passive:** Any fire protection system or component, which, by its inherent nature, plays an inactive role in the protection of personnel and property from damage by fire. Passive fire protection functions independently of a requirement for human, mechanical, or other intervention to initiate a consequential response.

**1.5.8 flammable:** Capable of igniting easily, burning intensely, or spreading flame rapidly.

**1.5.9 flammable (explosive) limits:** The lower and upper percentages by volume of concentration of gas in a gas-air mixture that will form an ignitable mixture. (See NFPA 325M.)

**1.5.10 flammable liquid (Class M III, and Class IC liquids):** A liquid having a flash point below 100°F (37.8°C) and having a vapor pressure not exceeding 40 lb per sq. in. absolute (276 kilopascals) at 100°F (37.8°C). Flammable (Class 1) liquids are subdivided into Classes IA, IB, and IC. (See NFPA 30.)

**1.5.11 flash point:** The lowest temperature at which the vapor pressure of the liquid is just sufficient to produce a flammable mixture at the lower limit of flammability.

**1.5.12 fuel:** Any material which will burn.

**1.5.13 ignite:** To cause to burn.

**1.5.14 ignitable (flammable) mixture:** A gas-air mixture that is capable of being ignited by an open flame, electric arc or spark, or device operating at or above the ignition temperature of the gas-air mixture. See **flammable (explosive) limits**.

**1.5.15 ignition source:** A source of temperature and energy sufficient to initiate combustion.

**1.5.16 incipient stage fire** is a fire which is in the initial or beginning stage and which can be controlled or extinguished by portable fire extinguishers or small hose systems without the need for protective clothing or breathing apparatus.

**1.5.17 manned platform:** A platform on which at least one person occupies an accommodation space (living quarters).

**1.5.18 open-type platform:** A platform that has sufficient natural ventilation to minimize the accumulation of vapors.

**1.5.19 primary means of escape:** Fixed stairways or fixed ladders of non-combustible construction.

**1.5.20 secondary means of escape:** Fixed stairways or fixed ladders of non-combustible construction or portable flexible ladders, knotted manropes, or other devices, approved by the regulatory agency.

**1.5.21 station bill:** A posted list, which sets forth the special duties and duty stations of each member of the personnel of a manned platform for emergencies, including a fire.

**1.5.22 ventilation, adequate:** Ventilation (natural or artificial) that is sufficient to prevent the accumulation of significant quantities of vapor-air mixtures in concentrations above 25% of their lower flammable (explosive) limit (LFL).

**1.5.23 ventilation, inadequate:** Ventilation that is less than adequate.

## 1.6 ABBREVIATIONS

|      |                                            |
|------|--------------------------------------------|
| ANSI | American National Standards Institute      |
| API  | American Petroleum Institute               |
| ASTM | American Society for Testing and Materials |
| CFR  | <i>Code of Federal Regulations</i>         |
| DOT  | Department of Transportation               |
| ESD  | Emergency Shutdown                         |
| IR   | Infrared                                   |
| LFL  | Lower Flammable Limit                      |
| MCC  | Motor Control Center                       |
| MODU | Mobile Offshore Drilling Unit              |
| NEC  | <i>National Electric Code</i>              |
| NFC  | <i>National Fire Code</i>                  |
| NFPA | National Fire Protection Association       |
| NRTL | Nationally Recognized Testing Laboratory   |
| NVIC | Navigation and Vessel Inspection Circular  |
| OOC  | Offshore Operators Committee               |
| P&ID | Process and Instrument Diagram             |
| PFD  | Process Flow Diagram                       |
| RP   | Recommended Practice                       |
| SI   | International System                       |
| Std  | Standard                                   |
| TLP  | Tension Leg Platform                       |
| TSE  | Temperature Safety Element                 |
| UL   | Underwriters Laboratories                  |
| USCG | United States Coast Guard                  |
| UV   | Ultraviolet                                |

## 2 Fuels and Ignition Sources

### 2.1 GENERAL

The three essentials that must be present for the occurrence of fire are fuel, air (oxygen), and a source of ignition. Fire prevention procedures mainly involve identification and elimination or separation of these three essentials.

### 2.2 FUELS

Fuels may conveniently be grouped as to the type of fire they create on the basis of the materials burning or which have the potential to burn. To facilitate the proper use of extinguishers on different types of fires, the National Fire Protection Association (NFPA) has classified fires as follows:

a. *Class A Fires.* Class A fires are fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics. Examples of such materials commonly found on offshore platforms are the following:

- Construction Materials and Supplies—wood decking, framework, and skids; shipping containers and fiber ropes.
- Operational Materials and Supplies—cleaning rags and tarpaulins.
- Waste Materials—used paper and rags.

b. *Class B Fires.* Class B fires are fires in flammable liquids, gases, and greases. Examples of such materials commonly found on offshore platforms are the following:

- Produced Fluids—oil and condensate, gas and vapors, residue from produced or stored hydrocarbons.
- Construction Materials and Supplies—paints, welding and cutting gases.
- Operational Materials and Supplies—heat transfer fluids, glycols, hydraulic fluids, lubricants, and fuels.
- Miscellaneous—Cleaning compounds and cooking oils and greases.

c. *Class C Fires.* Class C fires are fires that involve energized electrical equipment. In this situation, electrical non-conductivity of the extinguishing agent is of importance. When electrical equipment is de-energized, the fire becomes a Class A or B fire.

d. *Class D Fires.* Class D fires are fires of combustible metals, such as magnesium, zirconium, sodium, and potassium.

## 2.3 IGNITION SOURCES

Ignition occurs when sufficient heat is produced to cause combustion. Factors influencing resultant combustion from a given ignition source are temperature, exposure time, and energy. Ignition sources that may be present in offshore production operations include:

a. *Chemical Reactions.* Chemical reactions may produce heat. This heat can ignite the substances reacting, products of the chemical reaction, or nearby materials. A chemical reaction that might occur on an offshore platform is spontaneous combustion.

Offshore facilities producing hydrogen sulfide may develop iron sulfide as a product of corrosion. Iron sulfide may be a source of heat and ignition due to spontaneous combustion when exposed to air.

b. *Electric Sparks and Arcs.* An electric spark is the discharge of electric current across a gap between two dissimilarly charged objects. Although static electricity and lightning are forms of electric spark, they are listed as separate ignition sources to emphasize their importance. Electric sparks from most electric supply installations will usually ignite a flammable mixture because the spark intensity and duration create enough heat for combustion. An electric arc occurs when an electric circuit carrying current is interrupted, either intentionally as by a switch or accidentally as when a contact or terminal becomes loosened or a current-carrying conductor is broken. The arc can be considered electric momentum. Electric current that is flowing through a contact will try to keep flowing when the contact is broken. The same charge will travel across a wider gap as an arc than as a spark. For this reason, the opening of switches is a potentially greater ignition source than the closing of switches. Sources of electric sparks and arcs could include but are not limited to the following:

- Electric motors and generators.
- Switches, relays, and other arcing components of electric circuits under normal operating conditions.
- Electric wiring and equipment malfunctions.
- Electric arc welding.
- Storage batteries.
- Fired vessel ignition devices.
- Internal combustion engine ignition systems.
- Lighting fixtures.
- Electric powered hand tools.

c. *Lightning.* Lightning is the discharge of an electric charge on a cloud to an opposite charge on another cloud or on the earth. Lightning can develop very high temperatures in any material of high resistance in its path. Lightning tends to discharge to high points such as antennae and flare stacks. See API RP 521 and NFPA 78 for additional information that may be useful to the designer.

d. *Static Electrical Sparks.* If two objects are in physical contact and then separated, the objects sometimes collect an electric charge through friction or induction. Similar electric charges can be generated by rapid flow of gases or liquids. If the objects are not bonded or grounded, they may accumulate sufficient electric charges that a spark discharge may occur. The terms bonding and grounding are sometimes used interchangeably; however, the terms have different meanings. Bonding is done to eliminate a difference in potential between objects. Grounding is done to eliminate a difference in potential between an object and ground. API RP 2003 *Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents* can be referenced for additional information.

Static electrical sparks are normally of very short duration and do not produce sufficient heat to ignite ordinary combustible materials, such as paper. Some, however, are capable of igniting flammable vapors and gases. This situation is more common in a dry atmosphere. Static electrical sparks may be a problem in situations such as the following:

1. Fueling operations.
2. Filling containers, tanks, and pressure vessels.

3. High exit fluid velocities.
  4. Drawing samples.
  5. Drive belt operation.
  6. Abrasive blasting.
  7. Steam cleaning.
- e. *Flame*. When common fuels are burned, energy is released in the form of heat. The burning is generally accompanied by a luminosity called flame. Examples of situations where flames may be present on a platform are the following:
1. Hydrocarbon flaring.
  2. Fired production equipment burner operation.
  3. Gas welding and cutting.
  4. Engine operation (backfires and hot exhaust gases).
  5. Heating, cooking, and other appliances operation.
- f. *Hot Surfaces*. Hot surfaces can be a source of ignition. These sources may include the following:
1. Welding slag.
  2. Fired vessel stacks.
  3. Hot process piping and equipment.
  4. Engine exhaust systems.
  5. High-temperature electrical devices such as incandescent lighting fixtures.
  6. Frictional heat such as a slipping belt against a pulley, unlubricated bearings, etc.
  7. Heating and cooking appliances.
  8. Hot metal particles from grinding.
  9. Clothes dryers and exhaust systems.
- g. *Heat of Compression*. If a flammable mixture is compressed rapidly, it will be ignited when the heat generated by the compressing action is sufficient to raise the temperature of the vapor to its ignition point. Combustion as a result of heat of compression may occur when hydrocarbon vapors or gases are mixed with air under situations such as the following:
1. Improper purging of pressure vessels and other equipment when introducing hydrocarbons.
  2. Packing or seal failure that allows supply air to mix with supply or process hydrocarbons.
  3. Lubricating system failure in air compressors.
  4. Admission of air into the suction of hydrocarbon gas compressors.

### 3 Fire Prevention Practices

#### 3.1 GENERAL

The best protection against the occurrence of fire will be realized through the provision of well-designed facilities and the training of personnel to employ safe operating practices. The facility should be designed and operated to account for all phases of the producing operations, including temporary situations such as drilling, workover, construction, etc. Facilities and operating practices should be capable of isolating fuel sources should a fire occur.

#### 3.2 FACILITY DESIGN

The facility should be designed to contain hydrocarbons, prevent ignition of those that do escape, and provide mitigation should a fire occur. Some specific items that should be considered are the following:

- a. *Platform Safety System*. Platform safety systems play an important role in preventing fires and minimizing their effect. The primary purpose of a safety system is to detect abnormal conditions and initiate appropriate action to prevent situations that could result in an accidental fire. The primary action normally initiated by the safety system is to shut off process flow, thus eliminating the major fuel source on a platform. The safety system may also shut down potential ignition sources such as engines, compressors, and heaters. The proper design, operation, and maintenance of these safety systems are addressed by API RP 14C.
- b. *Equipment Arrangement*. Within the limits of practicality, equipment should be arranged on a platform to provide maximum separation of fuel sources and ignition sources and paths of access and egress for personnel. Guidelines for the arrangement of production equipment are presented in API RP 14J. Particular consideration should be given to the location of fired process vessels and the placement of temporary equipment during workover, completion, and construction activities.

- c. *Ignition Prevention Devices.* Natural draft components should be equipped with spark and flame arrestors to prevent spark emission. Recommended safety systems for fired components are presented in API RP 14C.
- d. *Hot Surface Protection.* Surfaces with a temperature in excess of 400°F (204°C) should be protected from liquid hydrocarbon spillage and mist, and surfaces in excess of 900°F (482°C) should be protected from combustible/flammable gases and vapors. API RP 14C and API RP 14E should be consulted for guidance.
- e. *Fire Barriers.* Barriers constructed from fire resistant materials may be helpful in special situations to prevent the spreading of forces and to provide a heat shield. Locations of fire barriers should be reviewed carefully due to the possibility that the fire barriers may impede natural ventilation to such an extent that hydrocarbon vapors and gases may accumulate. Further information on ventilation can be found in API RP 500. Further information on fire barrier arrangement can be found in API RP 14J. A discussion of fire barrier ratings and construction is included in Section 9 of this document.
- f. *Electrical Protection.* Protection from ignition by electrical sources should be provided by designing and installing electrical equipment in accordance with API RP 14F or API RP 14FZ using the area classification as designed by API RP 500 or API RP 505.
- g. *Combustible Gas Detectors.* The concentration of a combustible gas can be determined by detection devices that may initiate alarms or shutdowns. The usual practice is to activate an alarm at a low gas concentration and to initiate action to shut off the gas source and/or ignition source if the concentration reaches a preset limit below the Lower Flammable Limit (LFL). API RP 14C, API RP 14F, API RP 14FZ, API RP 500 and API RP 505 contain guidelines for the installation and operation of combustible gas detectors.
- h. *Bulk Storage.* The inventories of flammable/combustible fluids should be consistent with operational needs and should be minimized to the greatest extent practical. Recommended practices for permanent bulk storage (crude oil, condensate, methanol, jet fuel, diesel, etc.) include the following:
1. Tanks should be installed as far as practical from ignition sources and protected from damage (lifting operations, etc.).
  2. Tanks should be enclosed by curbs, drip pans, or deck drains, to prevent liquid accumulation. The drain system should be designed with provisions to prevent vapor return.
  3. Tanks should be adequately vented or equipped with a pressure or pressure/vacuum relief valve and should be electrically grounded (see API RP 14F or API RP 14FZ).
  4. Fire detection devices should be installed in the storage area.
- i. *Helicopter Fueling Facilities.* Recommended practices for helicopter fueling facilities include the following:
1. Fire extinguishing equipment should be readily accessible to the helicopter fueling area.
  2. Helicopter landing areas with fueling facilities located above living quarters should be constructed so as not to retain flammable liquids and to preclude these liquids from spreading to, or falling on, other parts of the platform unless this has been considered in the heliport fire management design. Confined drainage is not practical for timber decks. Special precautions should be taken to minimize the risk of fire to the area beneath wooden decks.
  3. The helicopter fuel hose should be of a type recommended for aircraft fuel service and should be equipped with a static grounding device and a “deadman” type nozzle. The helicopter should be bonded with self-releasing or spring-clamp bond cables (same potential as hose).
  4. Suitable storage should be provided for the fueling hose. The fuel transfer pump should be equipped so that it can be shut down from the fueling station.

NFPA 418 *Standard for Heliports* should be consulted for additional information.

### 3.3 OPERATING PROCEDURE

Safe operating practices will reduce the probability of an accidental fire on a platform. Personnel should be trained in their duties and responsibilities and be attentive to conditions that might lead to a fire. On observation of such conditions, personnel should correct the conditions and/or report them to the proper supervisor so corrective action can be taken. Additional operating procedures may be desirable. See API RP 75 and API RP 14J for guidance. As a minimum, practices should be established for the following:

- a. *Housekeeping.* Provisions should be made for the safe handling and storage of materials such as dirty rags, trash, waste oil and chemicals. Flammable liquids and chemicals spilled on the platform should be immediately cleaned up. Particular care should be taken to provide proper storage for paint, chemicals, hydrocarbon samples, welding and cutting gases, and other flammable substances. Access to means of escape and to firefighting equipment should not be blocked.
- b. *Cutting and Welding.* Cutting and welding operations should be conducted in accordance with safety procedures established by the operator. NFPA 51B *Standard for Fire Prevention in Use of Cutting and Welding Processes* should be consulted when developing cutting and welding practices.