



European Guideline

CFPA-E No 6:2015 N

Forest Fires



FOREWORD

The European fire protection associations have decided to produce common guidelines in order to achieve similar interpretation in European countries and to give examples of acceptable solutions, concepts and models. The Confederation of Fire Protection Associations in Europe (CFPA E) has the aim to facilitate and support fire protection work in European countries.

The market imposes new demands for quality and safety. Today, fire protection forms an integral part of a modern strategy for survival and competitiveness.

This guideline is primarily intended for those people living in the countryside and those who like to enjoy the woodlands and forests as areas of recreation, sport and relaxation.

The proposals within this guideline have been produced by the Spanish Fire Protection Association (CEPREVEN) and the author is Miguel Vidueira.

This Guideline has been compiled by Guidelines Commission and adopted by all fire protection associations in the Confederation of Fire Protection Associations Europe.

These guidelines reflect best practice developed by the countries of CFPA Europe. Where the guidelines and national requirement conflict, national requirements shall apply.

Copenhagen, 27 July 2015
CFPA Europe

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Keywords:

Forest, wildfire, forestry, clearing, firebreak



1 Scope

Forest fires involve the loss of a major forest area, especially during summer in the southern countries of Europe. In Spain in 2012, a very dry year, the burned area reached almost 200,000 hectares.

This forest loss is difficult to recover. But this loss has to be added to other consequences of fires: injuries and deaths; evacuation of villages; roads and rail cuts; electricity, telephone and water supply disruptions...

Most fires that occur are intentional. Some others are caused by carelessness, and a few of them arise from natural causes (i.e. lightning strike).

The purpose of this document is to establish good practice to prevent the occurrence of a forest fire, to describe the main mechanisms to combat it, and to give practical guidance to those living on the countryside or those who like to enjoy the woodlands as recreation places in order to limit the possibility that these activities can be source of a forest fire.

2 Theory of Forest Fire

In order that a fire can occur, three elements are needed: ignition source, oxygen and fuel. These three elements constitute the so-called fire triangle.

In natural fires, the ignition source comes from lightning, and under certain conditions, from solar radiation. In accidental fires, the ignition is caused by cigarette butts, abandoned glass, barbecue embers, house fires...

In a forest fire, the oxygen is provided by the air. It's on windy days when forest fires spread faster.

Fuel is vegetation consisting of scrub, woodland, small plants and the dead remains, found in the mountains. In order that this fuel can burn easily it needs to be dry, so large fires occur mostly in summer.



2.1 Types of Forest Fire

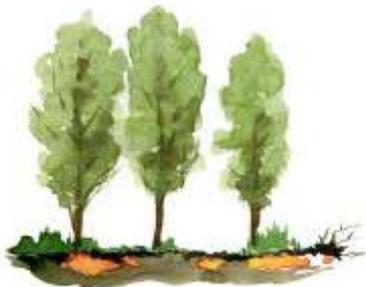
Not all the forest fires are the same. Depending on how the fire spreads it can be:



Soil or surface fire: This is the most common kind of forest fire. It spreads through the soil surface burning scrub and low vegetation and dried remains of trees and logs, fallen branches, leaves...



Treetops fires: They spread through the treetops. These fires are difficult to extinguish. Many of these fires start at the surface and spread to the treetops. Then they move from treetop to treetop pushed by the wind.



Subsurface fires: They spread by burning the organic matter existing below the soil surface. They are slow spreading fires and hardly emit smoke, so they are difficult to detect and extinguish. Such fires are hazardous because an apparently extinguished fire can reappear somewhere else due to the slow combustion running below the soil surface.

2.2 Process of burning wood

In the combustion process, the following phases can be distinguished:

- Preheating phase: The outside heat raises the temperature of the fuel just over 100 °C, resulting in the loss of water vapour. The temperature continues to rise to 200 °C, removing all water and distilling the resins.



- Gas combustion phase: This occurs when temperature is between 300 and 400°C. when flammable gases, which form the flames, are released. The temperature continues increasing to the 600-1000°C. In addition to the gases, heat is released, which contributes to sustain the combustion reaction. The wood burns with blue flame. Smoke is released, composed of unburned gases, carbon dioxide and water vapor.
- Coal Combustion phase: The wood burns, consuming the carbon content in the wood. Ashes are composed of mineral substances that do not burn.

2.3 Spread of Wildfire

There are a number of factors that influence the spread of forest fire. The most important are vegetation, topography and meteorology.

Vegetation influences the spread of the fire since it is the fuel that feeds the fire. This fuel can have different moisture content, calorific value and structure, so different types of vegetation will give rise to different types of fire development.

Topography can influence the spread of a fire especially in mountainous landscapes. The fire spreads very easily uphill, while a downward slope slows its rate of travel.

Finally the weather is a key factor. For example, low relative humidity, high temperature, and high wind speeds, are factors that combined can result in a very rapidly developing fire.

3 Forest Fire Prevention Techniques

The following formulas can be used in the prevention of forest fires.

3.1 Forestry

Traditionally, control of vegetation was done by fire and shepherding, as cattle limits the growth of scrub and favours the existence of grassland. Currently, techniques such as preventive forestry are substituting the traditional method.

Preventive silviculture is a widely used technique that aims to:

- Reduce the fire risk.
- Minimise damages, especially the affected surface in case of fire.
- Provide a safe intervention condition for the fire brigade.

This technique is essentially based on modifying the conditions of the forest through the removal of certain types of fuels and controlling fire spread.



The techniques applied are different depending on the type of forest structure. The main ones are briefly described below:

3.1.1 Clearings

This technique consists on reducing the vegetation at ground level:

- To cut off the fuel continuity,
- To slow down wind speed into the tree canopy;
- To maintain high relative humidity,
- To reduce or delay the invasion of scrub.

3.1.2 Pruning

This technique consists on removing the branches from the ground to half the average height of the tree mass (provided it exceeds 5m). In every case dead branches shall be removed. The technique called pruning penetration should be applied to all the lower levels of trees on the cleared zone up to 3 m high, It is recommended in all cases to reduce the combustibility and promote walkability.

3.1.3 Complete clearing

This technique involves the complete removal of vegetation at a soil level. It can be done manually (using brushcutter) or using a tractor. In the first case the clearing is more selective.

3.1.4 Clearing by Burning

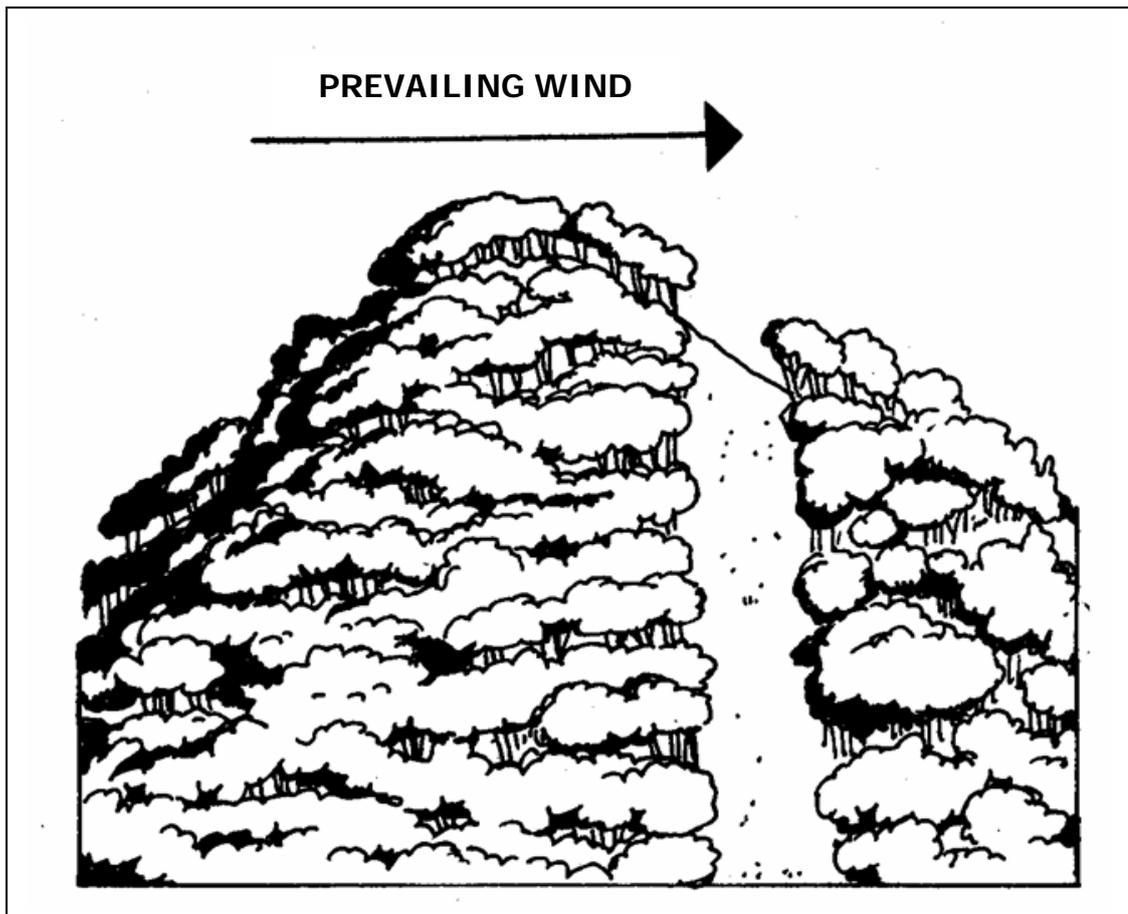
In this case vegetation at ground level is removed by controlled burning. It is not very selective but low cost. Its application is commonly restricted by local regulations, depending on the time of the year to perform the burning and the type of soil and forest mass, since this technique can cause damage to the wildlife and forest that it is intended to protect.

3.1.5 Firebreaks

Firebreaks are elongated spaces in forested areas with a width of 20-30 meters, in which all vegetation is removed, leaving bare mineral soil on the surface.

Its goal, well expressed by its name, is to increase the safety and efficiency of ground fighting manoeuvres, and enable the implementation of backfires (see 4.3).

The firebreaks are arranged on artificial lines, such as roads or boundaries of mountains; over natural lines coinciding with maximum gradient separation between stream channels; or close to the summit of a hill, although in this case it should not be disposed directly over the ridge line, but in a recessed area where the wind speed is relatively minor, like shown in the figure.



They are intended to facilitate the movement of terrestrial firefighting equipment, either walking or with off-road vehicles or heavy machinery, forming networks that can ease escape although the personnel from the fire brigade may not know the zone. They do not serve to stop the fire by themselves.

3.2 Surveillance

The purpose of surveillance is to find the fire as soon as possible to guarantee a quick reaction, coordinate the extinguishing works, and minimize the consequences of the fire.

Another main objective is to conduct a surveillance security check that everything is in order to prevent fires from occurring.



3.3 Awareness and Management

The best way to avoid a forest fire is to prevent its occurrence. Regarding this matter, it should be noted that only 20 % of fires arise from natural causes, the rest are caused by negligence or willful ignition. Reducing the number of forest fires is in the hands of those of us who make use of our forests, and mountains, either for work or leisure.

Education and awareness are the foundations of fire prevention. These can be achieved in different ways, for example:

- Conducting awareness sessions in schools from an early age.
- Prevention campaigns on television.
- Information leaflets.



These awareness campaigns should address issues such as:

- The role of forests for ecological balance.
- The long and difficult recovery of ecosystems after the occurrence of fire.
- The incalculable value of certain protected areas.

Responsibility of local authorities and managers of natural heritage should also be taken into account. These entities should consider the application of the use of fire management in the mountains with considerations such as:

- Providing recreation areas for the use of open fires.
- Regulating the use of fire in the forest outside these areas.
- Establishing periods of prohibition of any type of fire on the mountain, depending on the time of year or weather conditions.
- Applying sanctions to violators of the established rules.

4 Forest Fire Fighting

Forest fires can be extinguished as in the case of any other type of fire by removing any of the sides of the fire triangle described in a previous chapter: ignition source, fuel, and oxygen.

It is possible to limit the possible ignition sources for a forest fire, by avoiding throwing cigarette butts or pieces of glass onto the ground, and of course restricting the use of barbecues to the places provided for such purpose. During the fire itself, the heat generated acts as an ignition source over unburned areas. The attenuation of this heat is achieved by applying water onto the burning fuel. The smaller the droplet size, the higher is its capacity for heat absorption, so sprayed water is more effective than a jet. But in the woods water is not always available or easy to apply.

It is also possible to take action on the "fuel side" of the fire triangle, by limiting or controlling the amount and distribution of vegetation as explained in the section "forestry", as a means to prevent or slow-down the spread of fire.

Finally, the action over the oxygen can be implemented by the method of suffocation, which consists on throwing dirt over residual fires. There are also specific tools called beaters that may be provided to hit areas that burn with low rise flames. When hitting the zone oxygen moves from it, preventing combustion in that area. The most elementary tools to get this effect are the tree branches. Throwing water on the fuel has a smothering as well as cooling effect: the water evaporates, and the steam generated displaces oxygen in contact with the fuel.

Specialized brigades use the following fighting techniques in forest fires:



4.1 Direct Intervention

The direct method consists on directly attacking the fire, fighting the flames and taking action to limit available fuel. It involves:

- a. Cool the fuel with water, chemicals or dirt.
- b. Displace oxygen by covering the fuel with soil.
- c. Reduce fuel next to the flames by forming a firebreak.

Sometimes the burning fuel is forced into the burned area so it can not act as an ignition source in the unburned zone.

The direct attack is used primarily in emerging or superficial fires, and also in the case of small burning areas of a major fire in which smoke and fire heat is still limited. Suffocation, cutting and scraping tools are used.

4.2 Indirect Intervention

Indirect action consists of setting a Control Line at a safe distance from the edge of the fire and considers the use of fire to eliminate available fuel.

This method takes advantage of natural and artificial barriers with no or very little fuel present. Additional defence lines are built to complete the Control Line.

4.3 Backfire

Used in indirect combat, this method consists of creating a large-scale fire from an existing wall or defensive line of trees of a sufficient size, so that the artificially created fire progresses towards the main fire attracted by suction flows.

Intermediate fuel is burned and the fire is extinguished when the two fires met.

This method requires a careful assessment of the situation to determine its correct application, as it may cause a second uncontrolled fire and complicate the fire fighting operations.

5 Homes in the countryside

Homes in a country setting may be the source of a forest fire, but also can be affected by a fire declared in the woodlands.

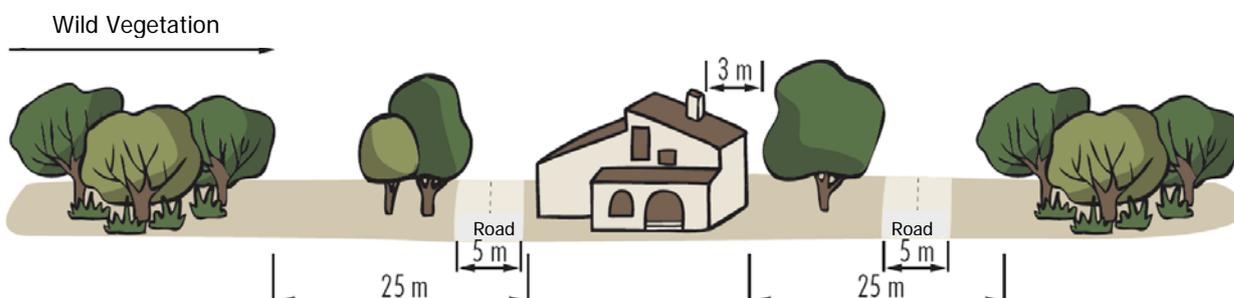
Urban-wildland interface is particularly troubling. In this zone it is usual to find wild vegetation coexisting with cultivated plants and gardens, plus combustible elements associated with gardens maintenance and care. Waste land with vegetation can also be found in these areas. All these factors can facilitate the spread of a fire from the urban area to the forest and vice versa.

5.1 Fire Prevention

To prevent a fire in the house or built-up area from spreading to the woodlands, the following measures can be taken. The measures described here are according to regulations and best practice in Spain. Local regulations at each country must always prevail.

- Establish an Emergency Plan for the urbanized area considering the specific measures to prevent a fire from spreading to the woods.
- Set a 25m distance separating the built-up area from the forest.
- Build a peripheral road with a 5m width around the constructed area, both to act as a firebreak, and to allow access for fire fighting vehicles.
- Keep a minimum distance of 3m between chimneys and trees.
- Prune trees up to 2/3 of their height.

Distances between buildings and woods or wild vegetation





- Install barbecues in kitchens with 3 walls and a roof, place spark arrestors of a non-combustible material in the chimney, and remove all vegetation within 3m.
- Waste land shall be kept free of vegetation and trees on them shall be pruned.
- Beware of machinery and tools which may produce sparks or electric shock.
- Electrical panels or gas meters on the outside of the housing must be installed over concrete or vegetation-free soil.
- Shield flammable substances or materials from direct sunlight.

To prevent a forest fire from spreading to the urbanized area:

- Use preferably noncombustible materials in the linings of the house.
- Install double glazed windows to better insulate the house from the heat of the fire.
- Keep the roof and gutters clean of litter.
- Do not let tree branches to grow over the roof of the house.

5.2 Protection against wildfire

Homes in the countryside are specially at threat from wildfires. When there exists the possibility that a wildfire can reach an urban area, three strategies can be adopted by the Authorities:

- Evacuation.
- Distancing.
- Confinement.

The choice of strategy will depend on the magnitude of the fire, its vicinity to the urban area, and its speed of fire spread.

Evacuation is the choice preferred when there is enough time to safely evacuate the inhabitants. When the evacuation order is given, it must be followed with maximum speed. Otherwise, the roads and paths can be affected by the fire making them unusable.

Distancing consists in the evacuation of people inside the urban area, from the houses that are more exposed to the fire (in the border between the urban and wildland area) to the remote area inside the village that is considered a "Safety zone". The absence or minor presence of combustible materials in the streets of the urban area makes fire spread more difficult. The flames will not be able to reach this "safety area", but the effects of the wind sweeping along smoke and embers must be considered.

Finally, in some occasions there is no time to evacuate the urban area, or it is so small that distancing is not effective. In this case, the only option is confinement, which means staying at home waiting for external help. To improve the options of survival under these conditions, it is important that:



- All the doors and windows must be tightly closed.
- All the shutters must be lowered.
- Remove the fuel elements from the vicinity of doors and windows, inside and outside the house.
- The remaining holes in walls, like ventilation ducts, are closed with wet towels.
- If there is an irrigation system in the garden, it must operate during the fire, since it can contribute to dissipate radiation heat from the fire and prevent the flames from reaching the walls.
- If there is a cellar in the house, stay in it until the fire outside has been extinguished.
- Keep with you your mobile phone, to be in touch with the emergency services.

6 Practical advice for conducting activities in the woodlands

6.1 Use of tools that produce heat

Mechanical tools use an engine that also produces heat. Besides, they need to consume flammable or combustible fuels to work, or are provided with electrical power that can produce discharges, sparks, etc. If these tools are used on a natural environment without any precaution, the risk of a wildfire increases.

Following advice must be fulfilled when using mechanical tools:

- In certain countries or regions the local authorities can state a level of preemergency. Check if the level of preemergency permits the work with mechanical tools.
- Be cautious with hot machinery. Leave it on an area without vegetation, such as a road or a rock, if it is hot after work.
- Be careful when refueling, avoid spills and physical contact between fuel and hot spots.
- The refueling area and the zone where the engine is started must be separated and clear of vegetation, since the fuels are volatile and flammable substances that are slow to evaporate.
- Install spark arrestors in the exhaust pipes of self-propelled machines.
- Never leave flammable or combustible materials in the sun.
- Check the operation, cleaning and maintenance of tools, and check there are no fuel leaks, shortcuts, or sparks, when the engine is working.
- All vehicles and freestanding machinery must be equipped with at least one 43A rated manual extinguisher and in every case, the appropriate number of the extinguishers according to the expected risk.
- Provide a 43A/188B manual extinguisher to extinguish any fire in the machinery itself.
- Locate the nearby water supply.



6.2 Use of vehicles

Many fires on roadsides and paths are associated with motor vehicle traffic. Sometimes fires are caused by a spark from the exhaust pipe, by parking in areas with dry vegetation, or in most cases, by throwing lighted cigarette butts out the window.

When driving a vehicle on forest roads, it is mandatory to:

- Use the roads and tracks, it is forbidden to drive cross country.
- Be respectful of the maximum speed limit. In forest tracks it is 30 km/h.
- Only emergency services are exempt from the above limitations.
- If the vehicle is used regularly to travel along forest tracks, it will require safety devices, such as spark arrestors in the exhaust, and protection of the radiator and other parts of the engine.
- When parking, check the exhaust system is not in direct contact with vegetation.
- If the car is parked in the track, check it does not impede the transit of emergency vehicles.
- Park the vehicle pointing towards the direction of the exit, so it makes escape easy in case of an emergency.

6.3 Recreation in the woods

Woodlands and forests are areas of recreation, sport and relaxation. The following advice should be considered to avoid these activities being a source of a wildfire:

- When accessing the forest with a vehicle, it must be parked in authorized places.
- Local regulations governing free camping must be followed. If you have to spend the night in the woodlands, choose a camp site clear of woody vegetation.
- Never hang a lamp with a flame on a branch. Place it on a rock surface free of vegetation. However, it is preferable to use battery lamps.
- Rubbish must be collected in bags and deposited in a waste container.
- Bottles and pieces of glass may be an ignition source for a fire. They should never be abandoned in the woods.
- Cold food or snacks are preferable to cooking. If necessary recreational areas fitted with the barbecues should be used paying special attention to the control of the heat and being aware that any incorrect use can be a direct cause of a forest fire.
- Smokers should ensure that butts are completely extinguished, never throw them to the ground.
- When hiking, behave safely and follow signed trails and paths.



7 Guidelines

Fire

- Guideline No. 1:2015 F - Fire protection management system
- Guideline No. 2:2013 F - Panic & emergency exit devices
- Guideline No. 3:2011 F - Certification of thermographers
- Guideline No. 4:2010 F - Introduction to qualitative fire risk assessment
- Guideline No. 5:2003 F - Guidance signs, emergency lighting and general lighting
- Guideline No. 6:2011 F - Fire safety in care homes for the elderly
- Guideline No. 7:2011 F - Safety distance between waste containers and buildings
- Guideline No. 8:2004 F - Preventing arson – information to young people
- Guideline No. 9:2012 F - Fire safety in restaurants
- Guideline No. 10:2008 F - Smoke alarms in the home
- Guideline No. 11:2015 F - Recommended numbers of fire protection trained staff
- Guideline No. 12:2012 F - Fire safety basics for hot work operatives
- Guideline No. 13:2015 F - Fire protection documentation
- Guideline No. 14:2007 F - Fire protection in information technology facilities
- Guideline No. 15:2012 F - Fire safety in guest harbours and marinas
- Guideline No. 16:2008 F - Fire protection in offices
- Guideline No. 17:2015 F - Fire safety in farm buildings
- Guideline No. 18:2013 F - Fire protection on chemical manufacturing sites
- Guideline No. 19:2009 F - Fire safety engineering concerning evacuation from buildings
- Guideline No. 20:2012 F - Fire safety in camping sites
- Guideline No. 21:2012 F - Fire prevention on construction sites
- Guideline No. 22:2012 F - Wind turbines – Fire protection guideline
- Guideline No. 23:2010 F - Securing the operational readiness of fire control system
- Guideline No. 24:2010 F - Fire safe homes
- Guideline No. 25:2010 F - Emergency plan
- Guideline No. 26:2010 F - Fire protection of temporary buildings on construction sites
- Guideline No. 27:2011 F - Fire safety in apartment buildings
- Guideline No. 28:2012 F - Fire safety in laboratories
- Guideline No. 29:2013 F - Protection of paintings: Transport, exhibition and storage
- Guideline No. 30:2013 F - Managing fire safety in historical buildings
- Guideline No. 31:2013 F - Protection against self-ignition and explosions in handling and storage of silage and fodder in farms
- Guideline No. 32:2014 F - Treatment and storage of waste and combustible secondary raw materials
- Guideline No. 33:2015 F - Evacuation of people with disabilities
- Guideline No. 34:2015 F - Fire safety measures with emergency power supplies
- Guideline No. 35:2015 F - Smoke and heat exhaust ventilation systems. Planning and design



Natural hazards

- Guideline No. 1:2012 N - Protection against flood
- Guideline No. 2:2013 N - Business Resilience – An introduction to protecting your business
- Guideline No. 3:2013 N - Protection of buildings against wind damage
- Guideline No. 4:2013 N - Lightning protection
- Guideline No. 5:2014 N - Managing heavy snow loads on roofs
- Guideline No. 6:2015 N - Forest fires

Security

- Guideline No. 1:2010 S - Arson document
- Guideline No. 2:2010 S - Protection of empty buildings
- Guideline No. 3:2010 S - Security system for empty buildings
- Guideline No. 4:2010 S - Guidance on key holder selections and duties
- Guideline No. 5:2012 S - Security guidelines for museums and showrooms
- Guideline No. 6:2014 S - Emergency exit doors in non-residential premises