International Labour Organization

Fire Risk Management
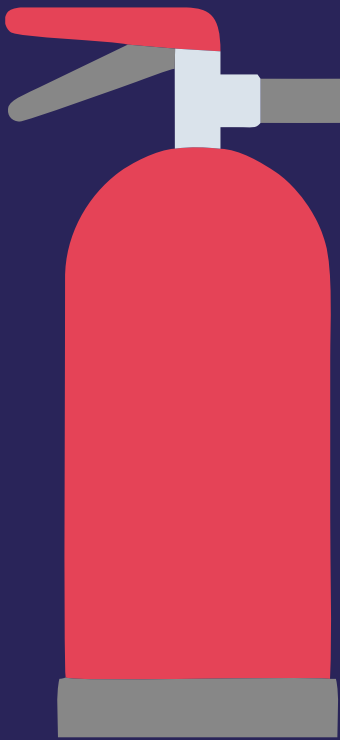
Second revised edition

▶ Fire Risk Management

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Contents

1. Introduction

This "Fire Risk Management" booklet is designed to provide employers, managers, workers and governmental organizations with information on the very severe risks that fires pose in the workplace, as well as on their prevention and control.

2. History of fires in the workplace

In the global record of severe Occupational Safety and Health (OSH) accidents, fatalities in factory fires rank almost immediately behind natural disasters such as earthquakes and tsunamis.

In the history of OSH single accidents, perhaps only the chemical release in Bhopal and major underground coal mine accidents, building collapses and bursting dams have resulted in more fatalities than the fires that have occurred in workplaces around the world.

Some examples of these disasters are listed below. This is by no means an exhaustive list and unfortunately there have been many more fires resulting in loss of life.

1911	New York USA	146 killed in a fire in a garment factory
1988	Piper Alpha UK, North Sea	167 killed by a fire on an oil platform
1993	Nakhon Pathom Thailand	188 killed in a fire in a toy factory
2003	Station Nightclub Rhode Island, USA	100 killed in nightclub fire
2012	Karachi Pakistan	289 killed in a fire in a garment factory
2012	Ashulia District Dhaka, Bangladesh	117 killed and more than 200 injured in a garment factory fire
2013	Mishazi China	119 killed and more than 60 injured in a food-processing fire
2014	Shouguang China	18 killed and 13 injured in a carrot packaging factory
2015	Valenzuela City Philippines	74 killed in a slipper factory fire
2019	Delhi's Anaj Mandi area, India	43 killed in a garment factory fire
2020	Beirut port explosion Lebanon	At least 207 deaths, 7,500 injured, fire caused ammonium nitrate to explode
2021	Rupganj Dhaka, Bangladesh	At least 52 killed in a fire in a food and beverage factory

In addition to these, almost every type of building and every country in the world has experienced a history of catastrophic fires, be they in hotels, nightclubs, farm hostels, shops or fuel depots.

The question we should ask ourselves is "Why do these tragedies repeatedly occur and what have we learnt from them over the last 100 years to reinforce prevention measures globally?"

3. Common causes of major fire disasters in the workplace

The sequence of events that leads from the outbreak of a fire through to a major disaster with multiple fatalities is a simple one.

There are three basic requirements for a fire to be created and sustained:

a. The presence of fuel or combustible materials;

b. The presence of a source of ignition, including heat;

c. The presence of oxygen in the air to support the combustion or oxidizing agents.[1]

The ability to manage and reduce the risks associated with these three factors will considerably reduce the likelihood of a serious fire.

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1.   Materials that support the combustion process

The sequence of events leading to a major fire may include the following:

▶ The storage and use of combustible materials in the workplace;
▶ The presence of a source of ignition;
▶ Failure to quickly detect the presence of fire or smoke;
▶ Failure to control the fire and extinguish it.

The inability of an employer or controller of the premises concerned to manage the risk of fire can lead to numerous human fatalities. The most common reason for a fire becoming a major human disaster is the inability of persons trapped within a building to escape in time. The problem is often compounded by the potential "domino effect" of the fire setting off an explosion or the building collapsing, which further reduces the chances of effective evacuation.

Many more people are killed in fires by the inhalation of smoke and toxic gases than by the heat of the fire itself. Toxic gases may cause loss of consciousness within minutes, so it is imperative that people be able to evacuate the building[2] and reach a place of safety or protected zone as quickly as possible.

The reasons for failure to make a timely escape from the building may include the following unsafe conditions or practices:

3.1 Poor building design

The lack of provision of suitable escape routes in the design of a building can result in dead ends. If a fire occurs between these areas and the only exit, the persons involved will have no means of escape.

Often fire escape routes are constructed only on the ground floor of a multi-storey building. If a fire develops on a lower floor and staircases are not sufficiently protected, workers on higher floors may be trapped by rising smoke.

3.2 Obstruction of fire escape routes

Warehouses and storage facilities often suffer from poor housekeeping or inadequate storage space, resulting in the obstruction of fire escape routes and exit doors.

The locking of exit doors as a security measure may make it impossible to open up exit routes and cause people to become trapped in a dead end within the burning building.

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2. Local building codes may specify a timeframe for building evacuation.

Fire escape routes that are too narrow for the number of people in the building may prevent them from escaping from the building in a timely manner.

3.3 The lack of an early warning system in the event of a fire

Early warning systems such as smoke detectors, heat detectors or flame detectors provide an effective way of detecting fires rapidly and applying timely control measures. Detectors should be connected to an evacuation alarm system with a signal loud enough to be heard by all workers in the event of an emergency. The lack or malfunctioning of systems and equipment for detecting the presence of fire and sounding the alarm can lead to a significant delay in the evacuation of a building. The system should also be appropriate for people with hearing impairments or other disabilities, for example by including flashing lights.

3.4 A lack of emergency procedures

A lack of emergency procedures, a lack of training in the procedures that exist and a lack of routine practices of such procedures are all factors that can lead to a delay in the evacuation of a building.

4. Fire risk reduction and control

For an employer or person in control of a building, the first requirement in the process of effective risk reduction is the appointment of a manager to be responsible for fire risk management issues; this person is designated as the "Fire Manager".

The appointed Fire Manager should produce a "Fire Plan",[3] after liaising closely with worker representatives during implementation of the employer's policies and procedures for fire risk reduction.

The employer should consider appointing a Fire Warden for each area of the building.

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3. Often referred to or contained in an Emergency Plan that also covers other events that require emergency evacuation of the building

Fire Wardens should be responsible for:

▶ assisting the Fire Manager in the development and implementation of the Fire Plan;

▶ carrying out daily or weekly checks of the workplace fire safety arrangements, to include:
  - monitoring the fire escape routes to ensure that they are unlocked and free of obstructions,
  - monitoring the storage of combustible materials, where this is allowed by national laws and regulation
  - monitoring the control and minimization of sources of ignition,
  - checking the availability of and access to firefighting equipment;

▶ ensuring that all persons within their area are able to evacuate should an emergency arise; special arrangements may be required for workers with disabilities or children in childcare facilities, where these are provided by the employer;

▶ ensuring that all persons have evacuated from their work area in an emergency;

▶ ensuring that only trained workers use the firefighting equipment.

The fire-risk-reduction policy and plan should take into account the following critical elements:

4.1 Controlling combustible materials

All workers should receive information, instruction and training in working safely when handling/storing/using combustible materials, and should be urged to follow them. Employers, managers and supervisors must ensure that these safe systems of work are followed.

Combustible materials need to be restricted to appropriate areas within the building and suitably stored. The amounts of stored materials should be kept to a minimum.

Flammable or highly flammable[4] liquids and gas bottles should be securely stored in external storage buildings unless in use, in which case the amount inside the building should be the minimum required,[5] and should be kept in labelled, fire-resistant containers.

Combustible materials such as paper, fabrics, wood, plastics, packaging materials, chemicals and so on should not be stored beneath staircases or in stairwells, or in close proximity to sources of ignition, such as:

▶ heating equipment;

▶ electrical cabinets or equipment;

▶ places where hot work, such as welding and grinding, is performed;

▶ cookers or smoking areas.

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4. Liquids with a flashpoint below 21°C
5. Local codes may restrict the amounts permitted within the workplace, e.g. the United Kingdom limit is 50L.

All flammable materials and liquids should be adequately labelled as such and stored in suitable fire-resistant containers. With regard to the storage of chemicals, the warning signs stipulated by the Globally Harmonized System of Classification and Labelling of Chemicals[6,7] should be used, particularly those warning of the following risks:

Explosives

Flammable gases, liquids and aerosols

Oxidizing liquids and solids

Compressed gases

The implementation of good housekeeping practices and regular workplace inspections will ensure the effective control of combustible materials in the workplace.

It is important to provide an adequate number of waste receptacles for each workstation, to avoid the accumulation of waste and scraps on the workplace floor and to facilitate housekeeping. Receptacles for contaminated fabrics and rags should have a tight-fitting cover to reduce the risk of vapours being released into the workplace.

The outside of the building should be kept clear of any material that might become combustible in hotter weather (e.g. dry vegetation).

Where places are allocated for workers to smoke, these must be kept free of combustible materials.

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6. About the GHS | UNECE
7. Microsoft Word - ST-SG-AC10-30-Rev8e.docx (unece.org)

4.2 Reducing the potential for ignition

The presence of sources of heat or ignition needs to be taken into account in relation to the location of combustible or flammable materials.

The following control measures should be included in the Fire Plan:

▶ No smoking in the workplace, except where controlled smoking areas are provided;
▶ Controlled access to minimize the potential for arson;
▶ Good housekeeping in areas where hot work (welding/grinding) is carried out and, once such work is completed, regular checks of the work area to ensure material has not ignited;
▶ Safe procedures for the burning of waste materials, where this is allowed by national laws and regulation;
▶ Continuous supervision of heat sources during kitchen work;
▶ Effective electrical maintenance and inspection.

Poor electrical maintenance can lead to sparking, overheating or arcing, thus causing ignition. The following special precautions should therefore be observed:

▶ Electrical equipment should be earthed to minimize the potential for static electricity creating sparks or arcing.
▶ Each electrical circuit should have an adequate fuse or circuit breaker located in a fire-resistant cabinet.
▶ Hard-wired circuits should be used, not extension cables, to minimize the potential for damage to the wiring insulation and to prevent the practice of "ganging" multiple plugs and overloading circuits.
▶ Isolators should be arranged and properly identified so that all electrical equipment can be swiftly isolated in an emergency.

4.3 Rapid identification and notification of the presence of fire or smoke

The provision of detectors connected to an automatic alarm and warning systems is important for rapid identification and early warning of the presence of fire or smoke.

Fires can be detected using a variety of electrically powered equipment that may identify the presence of smoke, heat (or rapid heat rise) or flickering light.

These devices need to be routinely inspected and tested in accordance with national legislation and manufacturers' instructions. Their location and distribution are critical. Their presence is vital, especially in areas of a building where combustible materials or flammable liquids are stored.
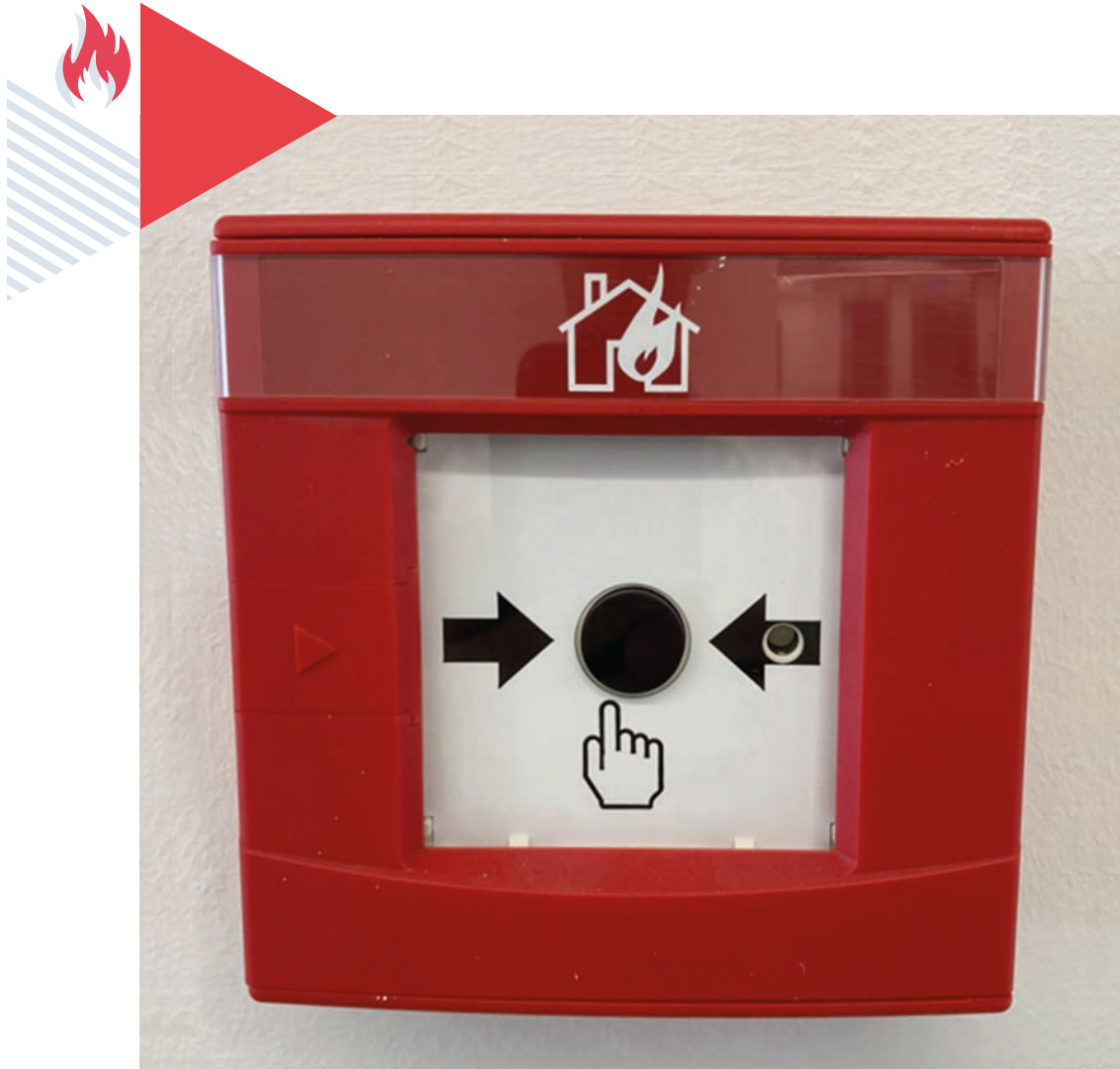
4.4 Effective emergency provision and procedures

Ensuring that everyone can evacuate the building in a timely fashion is a vital risk control measure.

A workplace should normally have at least two exit routes to permit the prompt evacuation of workers and other building occupants during an emergency. More than two exits may be required if the number of workers, size of building or arrangement of the workplace does not allow workers to evacuate swiftly. Exit routes should be located as far away from one other as possible, but within the maximum distances prescribed by national fire safety codes in case one is blocked by fire or smoke. Additional emergency escape routes may be needed, depending on distances, numbers of people and internal floor distribution.

Closed rooms (such as offices) may have one exit, so long as the door opens onto an exit route.

If the number of occupants or local arrangements allow for all occupants to safely evacuate in an emergency, then one exit route may be acceptable.[8]

All fire escape routes must be visibly marked, wide enough for the maximum number or occupants to pass through in minimal time, and free of obstruction. Most codes stipulate that the determination of exit requirements for a building should be based on the type of use or occupancy of the building, the occupant load, the floor area, the distance to an exit and the capacity of the exits themselves. Examples are given in the ILO Fire Risk Management Course.[9]

Higher floors in buildings should be constructed with at least two separate escape routes, preferably at different ends of the building. These escape routes should be protected to delay the ingress of fire/smoke for a sufficient time to allow safe evacuation.

Fire escape routes should be well lit with emergency lighting. All escape routes must lead to a safe place outside the building.

All fire escape routes should be checked on a daily basis to ensure that the routes are unobstructed and that the escape doors can be opened easily.

If the employer feels the need to lock the final exit doors for security reasons, they must open outwards and be fitted with push-bar releases or locked with mechanisms that can be easily opened from the inside without the need for a key.

All workers should be instructed and trained in the fire escape procedure, which should be the primary OSH element in a worker's induction training.

All workers should take part in a fire escape practice at least annually, whenever layouts change, or in accordance with local codes. This exercise should be observed by the Fire Manager and any improvements or corrective actions subsequently implemented.

4.5 Control of the fire

Firefighting equipment for use by occupants and fire service personnel must be selected and positioned to be as accessible as possible. The Fire Manager must ensure that the following factors are considered in the firefighting plan:

▶ Fire extinguishers must be matched to the potential type of fire (fires are classed according to type, from combustible solid materials through flammable liquids and

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8.   Emergency Exit Routes (osha.gov)
9.   Fire Safety Management Course (ilo.org)

gases/aerosols to metal and electrical fires). The markings and colours of extinguishers may vary with local codes.[10]

▶ Fire extinguishers must be located throughout the floor area, within a specified distance of any point[11] and, where necessary adjacent, to a particular hazard area.

▶ The firefighting equipment for use by the fire services (such as hose reels and hydrant connections) must be positioned at the exits from the building, so that they can be accessed from a safe position.

▶ The firefighting equipment must be properly mounted, in an unobstructed and marked position.

▶ A sufficient number of workers must be selected and trained in the use of the extinguishers.

▶ The Fire Manager must be notified of any use of the extinguishers for any purpose.

▶ The fire extinguishers must be inspected at least weekly, to ensure that they are correctly positioned and fully charged for use.

All relevant workers must be instructed and trained in the proper use of the firefighting equipment (including which equipment is for use only by adequately trained and equipped firefighters), and in how to fight a fire in a safe manner.

Prompt reporting to supervisors and to the firefighting department is critical for the control of a fire and for the rescue of trapped workers. The telephone numbers of emergency contacts should be clearly indicated in workplaces, and means of making such contact should be available.

The spread of a fire should be limited by installing fire-rated compartment walls between the different areas of a building, with fire doors at openings and in corridors. Fire doors slow the rate of spread of a fire, allowing workers more time to evacuate the building.

The specification of fire doors may be dictated by local codes, but will generally be in line with internationally recognized standards.

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10. For example, red (water), cream (foam), blue (dry powder), black (CO2) April-2018-Types-of-fire-extinguisher-in-Australia.pdf (cct.org.au)

11. Local fire codes may specify maximum distances; if not, 15–20 metres is suggested as an appropriate distance.

4.6 Management of fire risk

The numbers of workers and visitors within a building must be known to the Fire Manager or their appointed deputy.

Workers, contractors and visitors must be instructed in the evacuation procedure: when the alarm is given, evacuate without delay, avoiding the use of lifts/elevators. The only exception is if a person is assigned to a specific task by the fire/emergency plan. Doors on escape routes should be self-closing so as not to hinder evacuation.

Fire wardens should be trained to check that their areas are cleared of people before exiting themselves, then should report to the Fire Manager or his/her deputy.

Having evacuated the building, people must remain in a designated safe area until the Fire Manager has accounted for them. Under no circumstances must they be allowed to re-enter the building until instructed by the Fire Manager.

Any vehicles carrying flammable liquids or gas bottles should, if possible without increasing the risk to those involved, be moved to a safe distance from the building.

Approach routes must be clear at all times to allow the emergency services easy access to the site.

4.7 Information, training and education

Workers should be given formal training in the emergency procedures and fire management processes as part of their induction.

Workers should be given refresher training on a regular basis.

On arrival in the building, all visitors should be given instructions and information concerning the fire alarm warning system, evacuation routes and fire assembly points. This information may be provided on cards.

5. Fire management systems

Risk-reduction plans should be drawn up following consultation with the workers and consideration of all the factors and information contained in the guidance.

Employers should consider the use of checklists as a means of conducting simple risk assessments or as a tool for the conduct of routine inspections of the workplace. Annex 1 is an example of a weekly inspection sheet for Fire Wardens.

How to use the Weekly Inspection sheet

Once the management checklist has been implemented and the recommended actions taken, a system of weekly checks can be introduced, to be carried out by the department representative or appointed Fire Warden.

1. The employer, or person in charge of the building should consider appointing a Fire Warden for each department or each building.

2. The Fire Warden should receive training and be aware of the enterprise's standards and policies with respect to fire risk management.

3. The Fire Warden's inspections should be carried out once a week, or more frequently if issues are found.

4. The Inspection form should be discussed with the relevant manager and the workplace occupational safety and health committee, and any necessary remedial actions implemented.

5. The inspection form should be retained in a way that allows for ease of reference.

6. Conclusion

The management of fire risks is a fundamental responsibility of every employer or person in control of a building. For many employers, it is possibly their primary occupational safety and health requirement.

As well as destroying a business, a fire could result in the death or injury of many innocent people.

Effective fire management is a staged process. The stages are logical and small steps can effectively reduce the risks.

Close cooperation between workers, employers and governments is essential for the successful prevention and control of fires in the workplace.

Annex 1.
Fire Warden's Weekly Inspection Sheet

Fire Warden's name:	Date of inspection:
Area of inspection:	Fire Manager sign off:

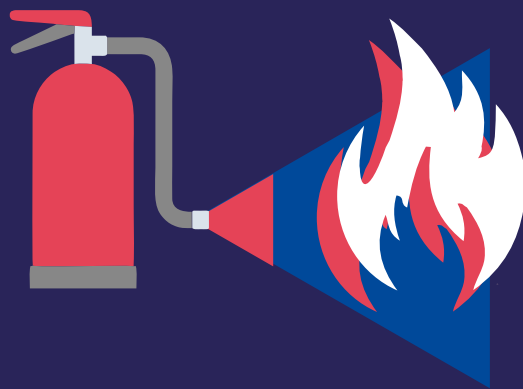|		
Have all new workers received fire induction training?	YES	NO
Are all sources of ignition effectively controlled or managed?	YES	NO
Are safe working practices being followed with respect to ignition sources?	YES	NO
Are housekeeping standards satisfactory?	YES	NO
Are all combustible materials properly stored?	YES	NO
Are all flammable liquids properly stored?	YES	NO
Are the fire escape routes unobstructed?	YES	NO
Are the external doors easily opened from the inside?	YES	NO
Are the smoke / fire detectors all working satisfactorily?	YES	NO
Are the fire extinguishers properly positioned, marked and accessible?	YES	NO
Are the fire extinguishers in a fully functional condition?	YES	NO
Is the company smoking policy being observed properly?	YES	NO
Are the fire assembly points identified and accessible?	YES	NO

Together with this publication LABADMIN/OSH has also revised the **Fire Safety Action Checklist**.

This is a management tool to improve fire safety.

The checklist comprises three parts:

▶ Measures to minimize fire risks;

▶ Preparing for fire emergencies;

▶ Training.