

International  
Labour  
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# FIRE RISK MANAGEMENT



 SafeWork



# **FIRE RISK MANAGEMENT**

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## 1. INTRODUCTION

This 'Fire safety at work' booklet is designed to provide Employers, Managers, Workers and Governmental Organizations with key 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

Amongst the world's record of the most severe Occupational Safety and Health accidents, fatalities in factory fires rank almost immediately behind natural disasters such as earthquakes and tsunamis.

In the history of Occupational Safety and Health single accidents, perhaps only the chemical release in Bhopal and major underground coal mine accidents have resulted in more fatalities than the fires that have occurred in factories around the world.



Examples of these disasters include the following (see also Annex 1):

<b>1911</b>	New York USA	146 killed in a fire in a garment factory
<b>1988</b>	Piper Alpha UK North Sea	167 killed by a fire on an oil platform
<b>1993</b>	Nakhon Pathom Thailand	188 killed in a fire in a toy factory
<b>2012</b>	Karachi Pakistan	289 killed in a fire in a garments factory

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

The question we should ask ourselves is 'why do these tragedies occur repeatedly 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 initiation of a fire through to a major disaster with multiple fatalities is a simple path.

There are 3 basic requirements for a fire to be created and sustained:

- a. The presence of fuel or flammable materials;
- b. The presence of a source of ignition;
- c. The presence of oxygen in the air to support the combustion.

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



The sequence of events that can lead to a major fire may include the following:

- the build-up of flammable materials in the workplace;
- the unintentional provision of a source of ignition;
- the failure to quickly detect the presence of the fire;
- the failure to control the fire and extinguish it.

The inability of the employer or controller of the premises to manage the fire can lead to human fatalities. The most common cause of a major fire becoming a major human disaster is the inability of persons trapped within the building to exit the building in a timely and safe manner.

Many more people are killed in fires by the inhalation of smoke and toxic gases than by the heat of the fire. The toxic gases may also cause loss of consciousness within minutes, so timely evacuation is imperative. The exact time for this to happen depends on many factors, but it is recommended that everyone within a building should reach either a place of safety or a protected zone within 2 to 3 minutes of becoming aware of an uncontrolled fire.

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

### **3.1 Poor building design**

The lack of provision of fire escape routes within the design of the building.

This can result in long dead ends within the building where if a fire occurs between that area and the only exit, the persons involved will have no means of escape.

Often fire escape routes are only available on the ground floor of a building, and if a fire develops beneath the only descent route from higher floors, workers may be trapped by the rising fire.



The presence of fire escape routes that may be insufficient for the numbers of employees and visitors in the building, leads to an inability to effectively escape from the building.

### **3.2 Obstruction of fire escape routes**

Warehouses and storage facilities are often overfilled or with poorly distributed materials, leading to an obstruction of the fire escape routes.

The locking of exit doors as a measure to improve security can result in the inability to open the exit routes and lead people to become trapped in a dead end within the burning building.

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

Fire early warning systems such as smoke detectors, heat detectors or flame detectors provide an effective way to detect fires rapidly in order to apply timely control measures. Where possible, they should be connected to an independent evacuation alarm system loud enough so that all workers can hear the signal in case of emergency. The lack or malfunctioning of systems and equipment to detect the presence of a fire and to provide an early warning can lead to a significant delay in the escape and evacuation of a building.

### **3.4 The lack of Emergency Procedures**

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





## 4. FIRE RISK REDUCTION AND CONTROL

The first requirement within the process of effective risk reduction for an employer is the appointment of a Manager to be responsible for the Fire Management issues.

The appointed person should produce a 'Fire Plan' after liaising closely with employee representatives during the implementation of the employer's policies and procedures for fire risk reduction.

The employer should consider the appointment of a Fire Warden within each area of the building.

The Fire Warden could be responsible for the following:

- assisting the Fire Manager in the implementation of the Fire Plan;
- carrying out weekly check-ups of the workplace;



- ensuring that all persons have escaped from their area in an emergency;
- monitoring the control and minimisation of sources of ignition;
- the use of the fire fighting equipment.

The policy and plan should consider the following critical elements in the fire risk reduction programme:

#### **4.1 Controlling flammable materials**

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

Flammable liquids and gas bottles should be stored in external storage buildings.

Flammable materials such as paper, fabrics, wood, plastics, packaging materials etc. should not be stored:

- beneath stair cases or in stair wells;
- up against heating equipment;
- close to electrical cabinets or equipment;
- near to sources of hot work such as welding and grinding;
- close to heat sources such as cooking or smoking.

These flammable materials and liquids should be adequately labelled as such and stored in suitable and fire resistant containers.

Chemical or toxic smoke can be generated through the burning of specific materials. The required preventive measure is the selection of 'fire retardant materials' for accommodation units. However, factories where the production of materials can produce toxic smoke during thermal decomposition, should consider the potential increase in the risks and therefore increase the levels of control for all factors described in this guidance.



The implementation of good housekeeping practices and regular workplace inspections can assist in the reduction of flammable materials in the workplace.

The outside of the building should be kept clean from any material that may become flammable in the summer.

Where locations are established for employees to smoke, these must be kept free from flammable materials.

## **4.2 Reducing the potential for ignition**

The positioning of any sources of heat or ignition need to be considered in relation to the location of flammable materials.

The following control factors should be considered within the Fire Plan:

- no smoking in the work place;
- controlled access to minimize the potential for arson;
- good housekeeping in areas where hot work is carried out;
- the use of fire watchers following the conduct of hot work;
- safe procedures for the burning of waste materials;
- continuous supervision of heat sources during kitchen work;
- effective electrical maintenance and inspection.

Poor electrical maintenance is one of the main ignition factors, and special precautions should be observed:

- electrical equipment should be earthed to minimize the potential for static electricity creating a source of ignition;
- each electrical circuit should have an adequate fuse or circuit breaker located in a well-constructed box in close proximity to the work station;
- hard wired circuits should be used instead of extension cords to minimize the potential for damage to the wiring; insulation and to remove the practice of ganging multiple plugs and possibly overloading of circuits;



- isolators should be arranged so that all electrical equipment has the potential to be isolated in an emergency.

### 4.3 Rapid identification of the presence of the fire

The provision of detectors connected to alarm and warning systems are important in the rapid identification of the presence of a fire.

Fire detection can be achieved using a variety of battery or mains electrical powered equipment that may identify the presence of smoke, heat or flickering light.

These equipment and devices need to be routinely inspected and tested. Their locations and distribution are critical. Their presence is vital especially in all areas of the building where flammable materials are being stored.



## 4.4 Effective emergency provision and procedures

The ability for all persons to timely evacuate the building is a vital control requirement.

There needs to be a fire escape route established in two opposite directions from every workstation and rest area. Closed rooms may have one exit (such as an office) as long as the door opens onto an exit route.

All fire escape routes must be marked out, preferably with yellow floor paint and they must be a minimum of 70cms in width and free of obstruction.

Higher floors in buildings should be built with two separate staircases, preferably at different ends of the building. Where possible, these staircases should be enclosed in a protected structure to delay the ingress of the fire.

Where possible the fire escape route should be well lit with emergency lighting. All escape routes must exit the building to a safe place.

All fire escape routes must be checked on a weekly 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 escape doors for security reasons, then they must be fitted with break glass locks, push bar releases, or locked with locks where the key or mechanism is easily accessible on the inside of the door.

All employees should be instructed and trained in the Fire Escape procedure.

The fire escape procedure should be the primary OSH element in an employee's induction training.

On a regular basis all employees should take part in a fire escape practice. This exercise should be observed by the Fire Manager and any improvement or corrective actions subsequently implemented.

Employees should be given instructions and information on any alternative methods for evacuating a building should the escape routes be inaccessible. This may involve the use of axes to break down walls or barriers. Employees should also be instructed on the practice of crawling should the building become smoke filled.





## 4.5 Control of the fire

Fire fighting equipment must be selected and positioned to be as effective as possible. The Fire Manager must ensure that the following factors are considered in the fire fighting plan:

- the correct fire fighting equipment is matched to the type of fire;
- the fire fighting equipment is positioned at the exits to the building. Such that they can be accessed from a safe position;
- the fire fighting equipment is properly mounted in an unobstructed and marked position;
- employees are selected and trained in the use of the extinguishers;
- the use of the extinguishers, for any purpose, results in a notification to the Fire Manager;
- the fire extinguishers are inspected on a weekly basis, to ensure that they are correctly positioned and fully charged for use.

All relevant employees must be instructed and trained on the proper use of the fire fighting equipment and on the correct ways to fight a fire in a safe manner.

Prompt reporting to supervisors and to the fire fighting department is critical for the control of fire and rescue of fire trapped workers. Numbers of emergency contact should be clearly indicated at the workplaces and means for such a contact should be available!

The spread of the fire should be limited by the installation of 'Fire Doors' in corridors and between large areas of the building. The fire doors will slow the rate of spread of the fire allowing employees more time to evacuate the building.



## 4.6 Management of the fire risk

The numbers of employees and visitors within the building must be known to the Fire Manager or their appointed Deputy.

The employees, contractors and visitors must be instructed in the evacuation procedure. This procedure must include the requirement to avoid the use of elevators and to close the fire doors on exit.

When the persons have evacuated the building, the Fire Manager must be confident that all persons can be accounted for.

The evacuated persons must remain in a safe location until the Fire Manager has accounted for them and under no circumstances must they be allowed to re-enter the building.

Any vehicles with flammable liquids, or gas bottles, must be moved to a safe distance from the building.

Approach routes must be cleared to allow the Emergency Services easy access to the site.





#### 4.7 Information, training and education

Employees should be provided with formal training on the emergency procedures and fire management processes as part of their induction training.

Employees should be provided with refresher training on a regular basis.

All visitors should be provided with instructions and information on arrival to the building on the fire alarm warning system, the evacuation routes and the fire assembly points. This information may be provided on cards for visitors.

## 5. FIRE MANAGEMENT SYSTEMS

Plans for the reduction of risks should be drawn up following consultations with the employees and the consideration of all the factors and information contained in the guidance.

The employer 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 2 is an example of a weekly inspection sheet for Fire Wardens. The following steps should be taken for the use of this sheet.

### How to use the Weekly Inspection sheet

Following the conduct of the Management Checklist and the implementation of the actions that have been recommended, then a system of weekly checks can be introduced for conduct by the department representative or appointed Fire Warden.

1. The enterprise should consider appointing a Fire Warden for each department or each building.
2. The Fire Warden should receive training and also be aware of the standards and policies of the enterprise with respect to Fire Management.
3. The Fire Warden's inspection should be carried out once a week. It is anticipated that this may take 15 minutes, depending on the size of the building.
4. The Inspection form should be discussed with the relevant Manager and the resulting actions implemented.
5. The Inspection form should be stored in a folder with all the previous inspection reports.





## 6. CONCLUSION

The management of fire risks is a fundamental responsibility for every employer. For many employers it is possibly their primary Occupational Safety and Health requirement.

A serious fire could destroy a business, but it could also result in the deaths 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 successful prevention and control of fire at the workplace.



# Annex 1 MAJOR FACTORY FIRES<sup>1</sup>

## 1. Fire accidents in garment factories

Date	City/Country	Type of accident	Number of deaths
11 Sep 2012	Yegoryevsk, Russia	Fire	14
11 Sep 2012	Karachi, Pakistan	Fire	289
17 Jan 2011	Wuhan, China	Fire	14 (4 injured)
14 Dec 2010	Dhaka, Bangladesh	Fire	31
21 Jan 2007	Shenzhen, China	Fire	7
23 Feb 2006	Chittagong, Dhaka, Bangladesh	Fire	54 (100 injured)
05 Jan 2005	Narayanganj, Bangladesh	Fire	23
13 Dec 1993	Gaofu, Fuzhou, Fujian, China	Fire	61
27 Dec 1990	Saraka, Bangladesh	Fire	32
31 Oct 1941	Huddersfield, England	Fire	49
25 Mar 1911	New York, USA*	Fire	146

\* Triangle shirtwaist factory in New York City caused the death of more than 146 garment workers. This major industrial disaster led to national legislation reinforcing workplace measures for fire prevention and improving working conditions for garment industry workers.

## 2. List of fire accidents in factories other than garment factories

Date	City/Country	Type of Factory	Type of accident	Number of deaths
03 Oct 2012	Qadian, Punjab, India	Firecracker	Explosion	1 (4 injured)
11 Sep 2012	Lahore, Pakistan	Shoe	Fire	25
05 Sep 2012	Sivakasi, India	Firework	Explosion	37 (60 injured)
25 Aug 2012	Paraguana, Venezuela	Refinery	Explosion	48 (151 injured)

1 Please note these are non-exhaustive lists gathered from a web-based search performed on 9 October 2012 and may include unconfirmed information.

Date	City/Country	Type of Factory	Type of accident	Number of deaths
06 May 2012	Map Ta Phut, Rayong, Thailand	Synthetic rubber	Explosion	12 (100 injured)
20 Nov 2011	Xintai, Shandong, China	Chemical plant	Explosion	14
17 Oct 2011	Raidighi, India	Firework	Fire	42 (11 injured)
03 Oct 2011	Sattur, Tamil Nadu, India	Firework	Explosion	2
06 Aug 2011	Sivakasi, India	Firework	Explosion	6
16 Aug 2010	Yichun, Heilongjiang, China	Firework	Explosion	19 (153 injured)
07 Jul 2009	Tamil Nadu, India	Firecracker	Fire	17
21 Jun 2009	Anhui, China	Quartz sand processing	Explosion	16 (43 injured)
25 Apr 2008	Lissafa, Casablanca, Morocco	Furniture	Fire	55
21 Oct 2007	Putian, Fujian province, China	Shoe	Fire	37
22 Nov 2006	Kolkata, India	Leather	Fire	9
26 Jun 2002	Agra, Uttar Pradesh, India	Footwear	Fire	42
30 Jun 2000	Guangdong, China	Fireworks	Fire	36
22 Apr 2000	Qingzhou, Shandong, China	Chicken processing	Fire	38
21 Sep 1997	Jinjiang, Fujian, China	Shoe	Fire	32
20 Nov 1993	Zhili, Kuyi, Shenzhen, China	Toy	Fire	81
03 May 1993	Kader, Thailand	Toy	Fire	188
03 Sep 1991	Hamlet, North Carolina, USA	Chicken processing	Fire	25
26 Jun 1971	Czechowice-Dziedzice, Poland	Refinery	Fire	37 (105 injured)
18 Nov 1968	Glasgow, United Kingdom	Upholstery	Fire	24
02 Mar 1960	Busan, South Korea	Rubber manufacturing	Fire	68 (44 injured)

# Annex 2 FIRE WARDEN'S – WEEKLY INSPECTION SHEET



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

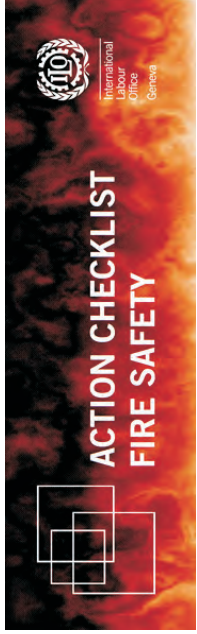
Have all new employees received Fire induction training?	YES	NO
Are all the sources of ignition effectively controlled or managed?	YES	NO
Are safe working practices being followed with respect to ignition sources?	YES	NO
Are the housekeeping standards satisfactory?	YES	NO
Are all the flammable materials 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?	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





<b>Actions required</b>	<b>By whom</b>	<b>By when</b>
a.		
b.		
c.		
d.		





Together with this publication, the ILO SafeWork programme has also published a fire safety action checklist. This is a management tool to improve fire safety.

The checklist includes three parts:

- Measures to minimize fire risks;
- Preparing for fire emergencies;
- Training.

For further information please contact:

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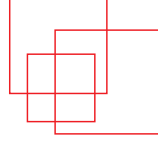
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