

# Introduction to qualitative fire risk assessment

**CFPA-E Guideline No 4:2010 F**





## 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 activities across Europe/work in European/work in the 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 an introduction to a qualitative method of assessing fire risks. There are many methods of carrying out a fire risk assessment and examples are Gardner, Meseri, Frame and the Fire Safety Concepts Tree. An analytical method enables a better fire risk assessment to be made and allows better control to be exercised over the fire hazards.

The proposals within this guideline have been produced by the AIAS - Associazione professionale Italiana Ambiente e Sicurezza and the author is Tiziano Zuccaro from Italy.

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 must apply.

Zürich, 18 November 2010  
CFPA Europe

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## Contents

1	Introduction .....	4
2	Scope.....	4
3	Reference Publications .....	4
4	Key terms.....	4
5	Summary .....	5
6	Fire Risk Assessment Procedure.....	6
6.1	Identify hazards.....	6
6.2	Identify people and property exposed to a hazard.....	7
6.3	Remove and reduce the fire hazards .....	7
6.4	Determine level of risk /Assign risk categories .....	8
6.5	Decide if the measures of risk reduction are reliable.....	8
6.6	Decide if the residual risk is tolerable .....	9
6.7	Review adequacy of the action plan .....	9
7	Reference list .....	9
8	Bibliography .....	10
9	European guidelines.....	10
10	Risk assessment form .....	11



## **1 Introduction**

Risk assessment is now implemented in much of the legislation affecting health and safety management in many countries around the world.

This guideline outlines an introduction to a qualitative way to assess fire risk for people and/or property.

When using this method caution is urged if the risk is high. More specific methods should be used for analysis if the risk is high (see "Reference List").

## **2 Scope**

The aim of this guide is to show the method for carrying out assessments for a robust and effective fire risk management in workplaces when the probability of occurrence of an accident is not easy to calculate. In fact not only for major disasters, where it is possible to know the probability of occurrence of an accident, but also for small fires or explosions causing serious consequences.

## **3 Reference Publications**

Other publications that provide information or guidance are listed in the Bibliography. Specifically, reference should be made to the following publications:

- BS 8800:1996, Guide to occupational health and safety management systems
- EC Directive 391/89
- EC Directive 106/89 and its Interpretative Document No.2

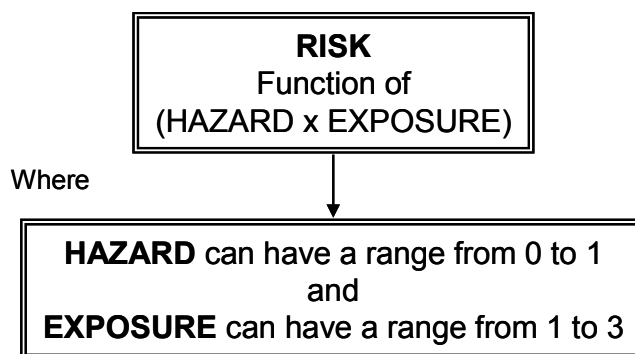
## **4 Key terms**

<b>Accident</b>	undesired event giving rise to death, ill health, injury, damage or other loss
<b>Exposure</b>	the possibility for the people and/or for the goods to be exposed to a particular hazard
<b>Fire Hazard</b>	the potential for loss of life (or injury) and /or damage to property by fire
<b>Hazard</b>	process of recognising that a hazard exists and defining its characteristics
<b>Hazard Identification</b>	
<b>Incident</b>	event that gave rise to an accident or had the potential to lead to an accident
<b>Risk Assessment</b>	overall process of estimating the magnitude of risk and deciding whether or not the risk is tolerable
<b>Risk</b>	the potential for realisation of an unwanted event, which is a function of the hazard and its exposure
<b>Safety</b>	freedom from unacceptable risk of harm
<b>Tolerable Risk</b>	risk that has been reduced to a level that can be endured by the organisation having regard to its legal obligations and its own Health and Safety Policy



## 5 Summary

Introducing the new definition of what a qualitative fire risk assessment consists of, we can say that Risk Assessment depends on two terms: the **HAZARD** and the **EXPOSURE** to it.



In other terms **HAZARD** can be present (1) or not (0)

And **EXPOSURE** levels may be considered as follows:

**Level 1:** property and goods can be damaged; people are not exposed directly to the hazard

**Level 2:** people can be harmed, but they can leave the place if necessary and property and goods can be seriously damaged

**Level 3:** possible deaths, people injured, goods destroyed, following accidents evolving in disasters.

In this way, this function determines 4 risk levels, as follows:

### No Risk

No action is required and no documentary records need to be kept.

### Low

Where there is hardly any risk from fire, few combustible materials, no highly flammable substances and virtually no sources of heat

### Normal

Where there are sufficient quantities of combustible materials and sources of heat to be of greater than low fire risk but where a fire would be likely to remain confined or to spread but slowly

### High

Where there is a serious risk to life from fire, there are substantial quantities of combustible materials, there are any highly flammable substances or there exists the likelihood of the rapid spread of fire, heat or smoke. High fire risk place are considered those where, apart from the presence of flammable substances and the probability for fire to spread, overcrowding of places, their condition and motor restrictions on people make the evacuation difficult in case of fire.

As a general rule, the existence of a hazard is a matter of fact, but its potential ability to cause harm depends on the level of exposure of the people and of the goods.

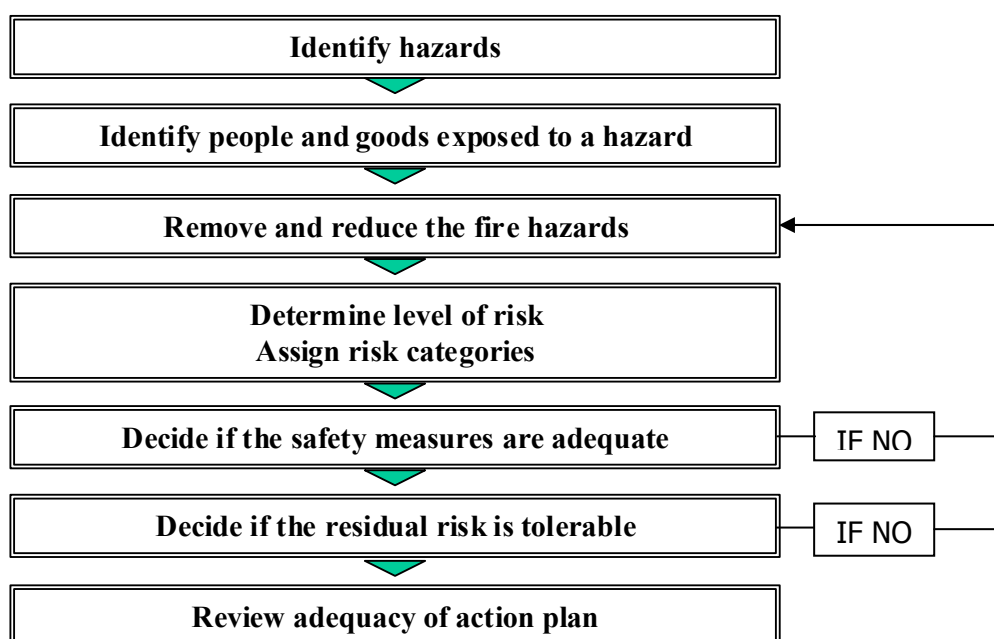


So the starting question will be: is there a hazard? What is its level of exposure?

Hazard		Exposure			Risk	
0	1	1	2	3		
x					0	No Risk
	x	x			1	Low
	x		x		2	Normal
	x			x	3	High

## 6 Fire Risk Assessment Procedure

The fire risk assessment procedure described in this code is intended to be used to classify the risk according to the scheme above. Below is shown the flow chart of the procedure:



### 6.1 Identify hazards

Instead of defining the probability of an event, an understanding of the character and intrinsic properties of the materials or equipment that have been identified, or the methodologies in which they are used, may lead to an understanding of the ways in which they could contribute to the initiation of a fire.



In other words an understanding of the fire dangers, like the presence of dangerous substances (combustible, flammable, etc.) and possible sources of ignition, allows a determination of the probability of a fire occurring.

To identify the fire Hazard you can follow the Table 1 points: D-E-F-G

## **6.2 Identify people and property exposed to a hazard**

The people exposed may be staff, contractors, visitors or members of the public. Consideration should be given to the numbers of people visiting or working in each area, to ensure that the means of escape are adequate.

Particular note should be made where:

- sleeping accommodation is provided
- large numbers of the public may be present
- people may be unfamiliar with the layout of the building and the location of the exit routes
- staff are working in areas where there is a specific risk, such as spray painting
- people may have lengthy or tortuous escape routes
- contractors are working up ladders or on scaffolding

Consideration must also be given to the weak points of the structure and to its contents.

To identify people and goods exposed to a hazard you can follow the Table 2 points: H- I

## **6.3 Remove and reduce the fire hazards**

For each of the hazards that have been identified in step 6.1, consider whether it could be removed, reduced, replaced, separated, protected, repaired or cleaned and if people in workplaces can be better informed or trained.

Be careful! Don't insert a hazard of a different kind trying to reduce the level of the previous hazard.

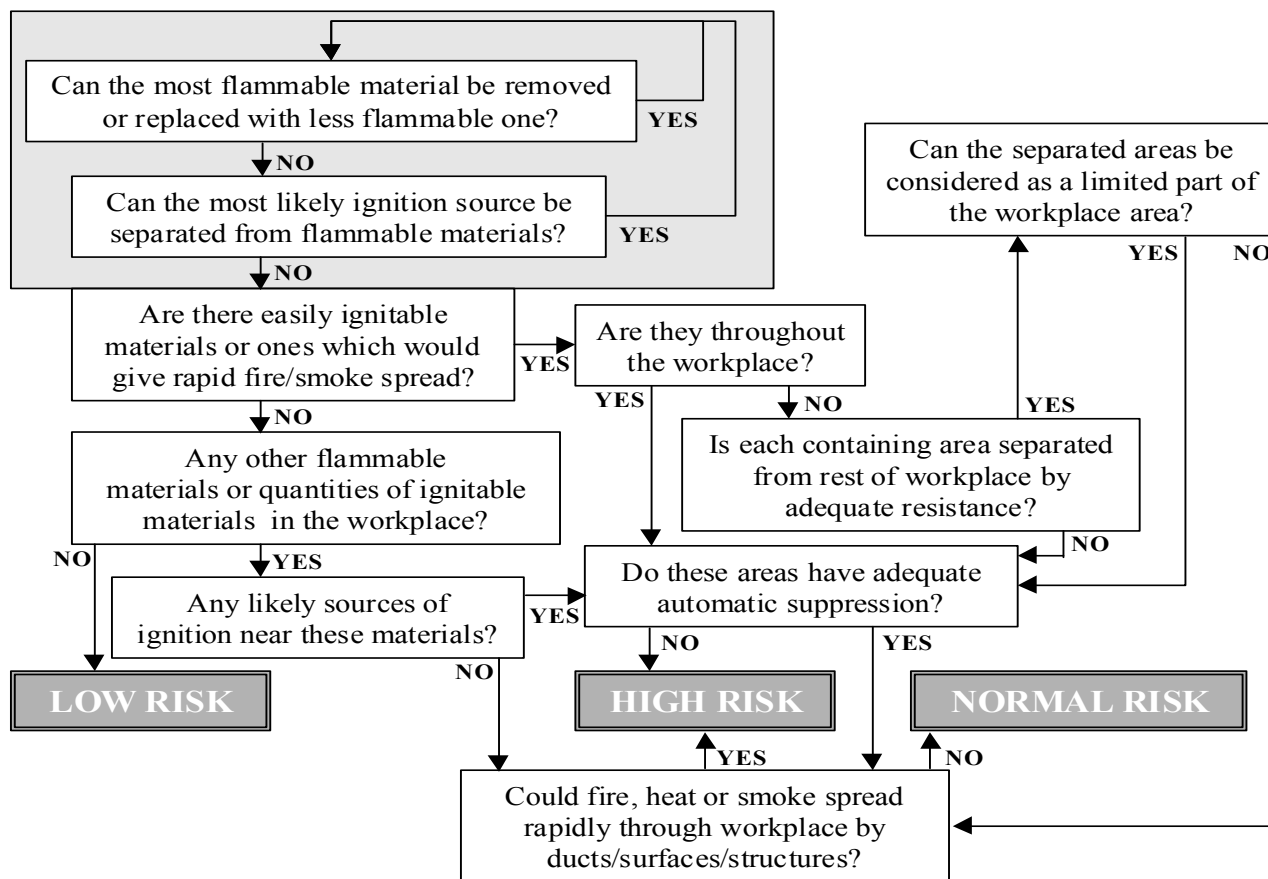
To identify the measures of risk reduction you can follow the Table 4 points: K-L-M-N (See Annex)

References to determine whether the residual risk is acceptable or not should be:

1. national laws and regulations,
2. accepted European/International technical standards (e.g. Eurocodes for structural fire design)
3. accepted fire protection principles (both national and European/International)



To determine the level of risk we could use different types of algorithm. The following example is one of these for risks relating to the use of flammable materials:



An application of the outlined methodology can be made through the use of the table 3 point: J  
(See Annex)

The risk analysis demands the total appraisal of the reliability of all the present measures for the management of the risk.

To decide if the measures of risk reduction are reliable you can follow the Table 5 point: P





## **6.6 Decide if the residual risk is tolerable**

To this point of the analysis, by estimating the outcomes which have been reached from the application of the tables introduced previously, it is possible to estimate the acceptability of the residual risk and verify if the previewed safety objectives from European Directive 106/89/CE are met.

- the load bearing capacity of the building for a specific period of time
- the generation and spread of fire and smoke within the works are limited
- the spread of the fire in the neighbouring construction works is limited
- occupants can leave the works or be rescued by other means
- the safety of the rescue team is taken into consideration

To decide if the measures of risk reduction are reliable you can follow the Table 5 point: O (See Annex)

Where the primary safety (i.e. human life) can be considered adequate and the residual risk is tolerable, decide if it is more convenient to improve cost/effective measures and/or transfer the risk for goods to an insurance company.

Possible improvements would include such steps as:

- The reduction of evacuation times/escape route lengths
- The provision of additional escape routes
- The installation of more fire alarm call points
- The provision of more fire safety signs
- The installation of a sprinkler system
- The institution of better programmes of fire safety training
- The appointment of fire wardens
- Etc.

## **6.7 Review adequacy of the action plan**

Reassess risks checking the implementation of the plan and planning the corrective action required to demonstrate that the precautions are sufficient to keep the hazard under control and meet legal requirements.

## **7 Reference list**

The most common methods of risk assessment are:

- The methods included in the legislation of each country
- Gretener
- Meseri
- Frame
- Fire Safety Concepts Tree
- Dow Index
- Etc.



## 8 Bibliography

- Adair Lewis, William Dailey, *Fire Risk Management in the Workplace. A Guide for Employers*, The Fire Protection Association, Borehamwood, Hertfordshire 1997
- F. Arruzzoli, P. Belardinelli, D. Poggiali, T. Zuccaro, *Analisi del rischio incendio nei luoghi di lavoro. Guida applicativa alla valutazione del rischio in conformità al D.M. 10.03.98*, Epc Libri, Roma 1999

## 9 European guidelines

- Guideline No 1:2002 F - Internal fire protection control
- Guideline No 2:2007 F - Panic & emergency exit devices
- Guideline No 3:2003 F - Certification of thermographers
- Guideline No 4:2003 F - Introduction to qualitative fire risk assessment
- Guideline No 5:2003 F - Guidance signs, emergency lighting and general lighting
- Guideline No 6:2004 F - Fire safety in residential homes for the elderly
- Guideline No 7:2005 F - Safety distance between waste containers and buildings
- Guideline No 8:2004 F - Preventing arson – information to young people
- Guideline No 9:2005 F - Fire safety in restaurants
- Guideline No 10:2008 F - Smoke alarms in the home
- Guideline No 11:2005 F - Recommended numbers of fire protection trained staff
- Guideline No 12:2006 F - Fire safety basics for hot work operatives
- Guideline No 13:2006 F - Fire protection documentation
- Guideline No 14:2007 F - Fire protection in information technology facilities
- Guideline No 15:2010 F - Fire safety in guest harbours and marinas
- Guideline No 16:2008 F - Fire protection in offices
- Guideline No 17:2008 F - Fire safety in farm buildings
- Guideline No 18:2008 F - Fire protection on chemical manufacturing sites
- Guideline No 19:2008 F - Fire safety engineering concerning evacuation from buildings
- Guideline No 20:2009 F - Fire safety in camping sites
- Guideline No 21:2010 F - Fire prevention on construction sites
- Guideline No 22:2010 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

## Appendix

### 10 Risk assessment form

A	Area identification	
	Activity description:	

B	Area features description (structural tipology, etc.)	

C	Specific risk area	YES <input type="checkbox"/>	NO <input type="checkbox"/>	Descript. ....
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#### 1. Hazards identification

				Yes	No	N.A.
D	Materials and substances	1	Are combustible materials/substances present?			
		2	Are comburent materials/substances present?			
		3	Are flammable materials/substances present?			
		4	Are explosive materials/substances present?			
		5	Are toxic materials/substances present?			
		6	Are wastes present?			
		7	Other			
E	Sources of ignition	1	Natural external sources (lightning, forest fires, etc.)			
		2	Mechanical sources (friction, etc)			
		3	Electrical sources			
		4	Cigarettes			
		5	Heat sources (stoves, oven, etc.)			
		6	Self combustion			
		7	Hot works			
		8	Other			
F	Structural or facilities lacks	1	Inadequate activity location			
		2	Secluded place			
		3	Inadequate area use			
		4	Manifest inadequate fire load or load bearing			
		5	Specific risk area lacks			
		6	System compliance lacks			

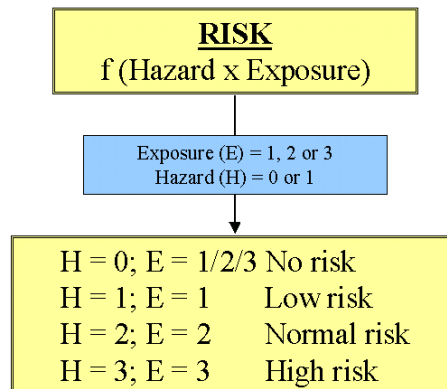
		7	Signage and prohibition lacks			
		8	Ventilation/aeration lacks			
		9	Inadequate safety distances			
		10	Inadequate or incomplete fire divisions			
		11	One way escape route presence			
		12	Inadequate escape ways/exits			
		13	Surveying and/or alarm systems lacks			
		14	Emergency lights lacks			
		15	Unwanted smoke and heat transmission			
		16	Extinguishing system lacks (hydrants, extinguishers, etc.)			
		17	Communication system lacks (phones, radio, etc.)			
		18	Other			

G	Organisational aspects lacks	1	Lacking in information, formation or training			
		2	Lacking in safety measures control			
		3	Lacking in systems and equipment maintenance			
		4	Lacking in emergency management/safety regulations			
		5	Prohibition and use limitation non-control			
		6	Inadequate cleaning			
		7	Other			

## 2. Exposed people and/or goods identification

				Yes	No	N.A.
H	Exposed people	1	Wide place with workers presence			
		2	Secluded workers			
		3	Large staff			
		4	Sleeping people			
		5	Customers/guests crowding			
		6	Workers presence during day hours			
		7	Workers presence during night hours			
		8	Presence of disabled			
		9	Workers exposed to specific risks			
		10	External company workers			
		11	Other			
I	Exposed goods	1	Buildings/area			
		2	External construction			
		3	Valuable goods			
		4	Other			

### 3. Risk assessment



J	Hazard	See points D - E - F - G HAZARD 0: no combustible materials or in very poor amount, no sources of ignition, no hot works  HAZARD 1: presence of combustible materials, presence of sources of ignition regardless of preventive measures adopted	
	Exposure level	See points H – I Exposure level 1: damages to goods are possible; people not exposed  Exposure level 2: accidents to people and damages to goods are possible;  Exposure level 3: deaths are possible; accidents to people and damages to goods	
	Risk level	LOW/NORMAL/HIGH  Risk 1: Low  Risk 2: Normal  Risk 3: High	

### 4. Risks reduction

				Yes	No	N.A.
K	Prevention	1	Correct area use			
		2	Fire load limitation			
		3	Facilities, machinery and equipment compliant			
		4	Correct systems and equipment maintenance			
		5	Correct emergency systems and equipment maintenance			
		6	Presence of ventilation systems			
		7	Prohibition and use limitation respect			
		8	Instruction for correct fire prevention behaviour			

L	Active protection	1	Extinguishers correctly maintained			
		2	Fixed operative extinguishing systems			
		3	Operative surveying system			
		4	Operative alarm/communication system			
		5	Operative emergency lights system			
		6	Operative smoke control systems			
		7	Emergency management procedures			
		8	Evacuation and emergency plans			
		9	Explicit tasks and responsibilities			
		10	Other			

M	Passive protection	1	Correct activity location			
		2	Suitable safety distances			
		3	Load bearing suitable to fire load			
		4	Correct ventilation/aeration			
		6	Surfaces with lesser resistance			
		7	Correct materials fire reaction			
		8	Suitable escape ways			

## 5. Fire safety and evacuation administrators

N	During day hours	YES		NO		Number:	
	during night hours	YES		NO		Number:	
	other	YES		NO		Number:	

NOTES

[illegible]

## 6. Safety measures adequacy

		Yes	No	N.A.	
O	Residual risk management procedures reliability	Fire revelation and alarm reliable (automatic and visual)			
		During day hours			
		During night hours			
		Other			
		Immediate fire suppression reliable (with fire extinguishers and other similar)			
		During day hours			
		During night hours			
		Other			
		Fire separation reliable (compartmentation)			

		During day hours			
		During night hours			
		Other			
		Emergency management reliable (evacuation plan)			
		During day hours			
		During night hours			
		Other			
		Delayed fire suppression reliable (professional fire fighters)			
		During day hours			
		During night hours			
		Other			

P	Achievement of the safety objectives of the interpretative document no. 2 "Safety in case of fire" Directive 106/89/CE	Reduction of fire opportunities			
		During day hours			
		During night hours			
		Other			
		Occupant can leave the work or be rescued by other means			
		During day hours			
		During night hours			
		Other			
		Suitable safety for the rescue teams			
		During day hours			
		During night hours			
		Other			
		Limitation of smoke and fire spreading within the work			
		During day hours			
		During night hours			
		Other			
		Limitation of the spread of fire to neighbouring construction			
		During day hours			
		During night hours			
		Other			
		Load bearing capacity assumed for a period of time			
		During day hours			
		During night hours			
		Other			

## 7. Conclusions

Q	Residual risk	The residual risk, considering all the above informations, is:	
		ACCEPTABLE/UNACCEPTABLE	
		Notes:	