



Safety distances between waste containers and buildings

CFPA-E Guideline No 7:2022 F





The CFPA Europe develops and publishes common guidelines about fire safety, security, and natural hazards with the aim to achieve similar interpretation and to give examples of acceptable solutions, concepts, and models. The aim is to facilitate and support fire protection, security, and protection against natural hazards across Europe, and the whole world.

Today fire safety, security and protection against natural hazards form an integral part of a modern strategy for survival, sustainability, and competitiveness. Therefore, the market imposes new demands for quality.

These Guidelines are intended for all interested parties and the public. Interested parties includes plant owners, insurers, rescue services, consultants, safety companies and the like so that, in the course of their work, they may be able to help manage risk in society.

The Guidelines reflect best practice developed by the national members of CFPA Europe. Where these Guidelines and national requirements conflict, national requirements shall apply.

This Guideline has been compiled by the Guidelines Commission and is adopted by the members of CFPA Europe.

More information: www.cfpa-e.eu



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Contents

1	Introduction	4
2	The safety distance defined	4
3	Example of fire objects.....	5
4	Rate of heat release.....	5
5	Quick estimation of the safety distance.....	5
5.1	Horizontal safety distances.....	5
5.2	Minimum horizontal safety distance	6
5.3	The 4m safety distance group	6
5.4	The 6m safety distance group	6
5.5	The 8m safety distance group	6
6	The alternative to the safety distance	6
7	Conclusion	6
	Annex 1: Essentials of the calculations	7
	Annex 1.1: The temperature and height of the flame	7
	Annex 2: Heat radiation calculations	10
	Annex 2.1: Calculations	10
	Annex 2.2: The Acceptance Criteria of Heat Radiation Calculations.....	12
	Annex 2.3: Horizontal safety distances.....	12
	Annex 3: References.....	12
	European guidelines	14

Key words:

1 Introduction

Many arson attacks target waste containers and other combustible objects located outside buildings. These relatively innocuous fires too often develop into fires, which can cause significant personal injuries or property damage when they spread into buildings. For this reason, it is necessary to give the owners and occupiers of premises some basic advice about ways to prevent these.

This guidance is based upon methods of calculation, which have developed from an analysis of fire investigations and empirical knowledge gained in such investigations.

In the prevention of arson, however, particular attention must also be paid to practical measures to thwart the arsonist, i.e. the fencing of the yard, the locking of areas and the removal of all combustible materials from the yard.

This guideline is primarily intended for those responsible for safety in companies and organisations. It is also addressed to the rescue services, consultants, safety companies etc so that, in the course of their work, they may be able to help companies and organisations to increase the levels of fire safety.

2 The safety distance defined

A fire can spread from its place of ignition:

- by conduction through structures
- through heat radiation from a flame (D)
- through the hot gases and sparks the fire has created (E)

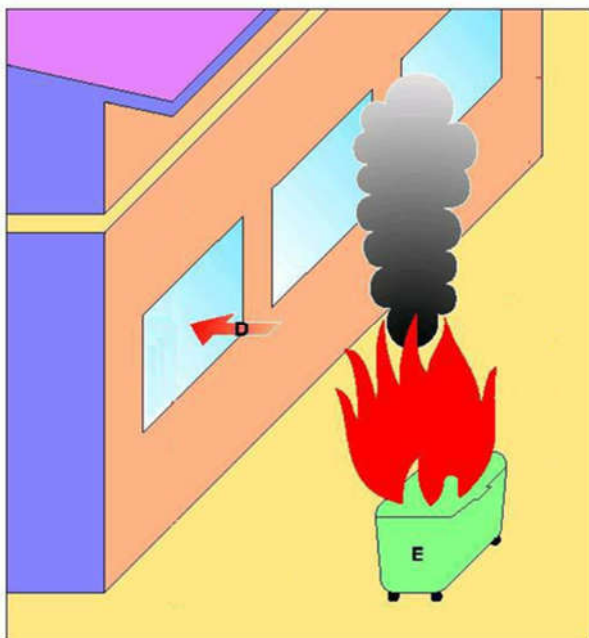


Figure 1: A fire can spread from its place of ignition through heat radiation from a flame (D) or through the hot gases and sparks the fire has created (E)

In outside areas, the heat of a fire is transferred from combustible objects primarily through the last two methods mentioned above. That is why from the fire technical point of view, it is vital that

the horizontal safety distance between the burning object and the building's weakest point, will be determined.

The potential spread of fire along the eaves caused by the heat energy of a smoke column, has also been addressed by the application of and reference to horizontal safety distances.

3 Example of fire objects

For the purposes of calculation, three fire objects have been taken as examples:

- (a) a 600 litre waste container made of glass fibre or plastic;
- (b) a group of three such waste containers, burning simultaneously;
- (c) a 2m x 6m skip, loaded with combustible material.

Using these three examples, it is possible to estimate fire safety distances for other objects or structures in the yard.

4 Rate of heat release

The material (garbage) stored in waste containers is mostly like household waste, comprising paper, wood, cardboard and plastics. In what follows, heat release rates are based on this kind of fuel. For example the value of heat release of the single waste container (2MW) is comparable the peak value of the heat release of wood pallet stacks, when the pile height is about 1m. The heat release of a burning petrol barrel is about 1MW.

The Rate of Heat Release (RHR) of a fire is needed to determine the height and temperature of the flame. This can be calculated as described in source (3). The test results of source (2) can also be used. On the basis of these results, the following values of RHR of the chosen fire objects were determined:

- | | | |
|-----|----------------------|-------------|
| (a) | waste container | RHR = 2 MW |
| (b) | 3 waste containers | RHR = 6 MW |
| (c) | demountable platform | RHR = 10 MW |

5 Quick estimation of the safety distance

It is possible to use the results of the fire technical calculations to determine the horizontal safety distances of objects and structures from buildings.

Equation provides a quick approximation of the horizontal safety distance:

Safety distance \approx width of object to be estimated + 2,5 m

This equation provides a valid result if the height of the fire object is not bigger than its width.

5.1 Horizontal safety distances

A range of horizontal safety distances can be established for different categories of fire objects and structures outside buildings.

5.2 Minimum horizontal safety distance

The minimum horizontal safety distance between combustible objects and buildings is 2,5m. This is the horizontal safety distance for, for example, point sources of flames.

5.3 The 4m safety distance group

These objects should be located at least 4m away from buildings:

- a single 600 litre waste container made of glass fibre or plastic;
- a waste container made of steel;
- other combustible objects, structures and piles which are less than 1,5m high and wide.

5.4 The 6m safety distance group

These objects should be located at least 6m away from buildings:

- a group of waste containers made of glass fibre or plastic;
- a trolley for pasteboard packages;
- other combustible objects, structures and piles which are less than 4m high and wide.

5.5 The 8m safety distance group

These objects should be located at least 8m away from buildings:

- an interchangeable platform full of combustible material (dumpsters);
- a rubbish shelter;
- a wooden shed, a small building and similar combustible structures;
- a car shelter;
- a caravan and other mobile homes;
- pallet piles;
- other combustible objects, structures and piles which are less than 6m high and wide

6 The alternative to the safety distance

If it is not possible to achieve any of the safety distances cited, then it is necessary that the adjacent structure is fire resistant. It must have fire resistance in the EI 30 – EI 120 class (2000/367/EC) according to national building regulations. The abbreviation EI 30 refers to a wall, which has a resistance to fire of 30 minutes in terms of both, integrity (E) and insulation (I).

The class requirements for fire separating building elements can be compensated by automatic fire extinguishing system, for example according to CEA 4001 (last issue).

7 Conclusion

In addition to the safety distances included in the guidebook (1), it describes different methods for preventing the spread of fire from structures in a yard into a building.

It is worth repeating that, to thwart the arsonist, it is vital to implement practical measures to secure the perimeter of a yard and to reduce the accumulation of combustible materials in yards.

Annex 1: Essentials of the calculations

Annex 1.1: The temperature and height of the flame

The temperature of the persistent flame was presumed, in each fire object, to be 800 0 C and (see Figs 2-4). The temperature of the intermittent flame was presumed to be 600 0 C and. These values have been checked using calculation method, which is based on RHR.

The height of the flame and the temperature of the smoke column were calculated according to Drysdale by using McCaffrey's smoke column model. The flame was assumed to be an orthogonal radiator, radial plate. The largest possible width of the flame was taken to be the width of the flame, i.e. in the case of the skip, the longest side of the platform faces the building.

The results of the calculations are shown in Figs 2-4.

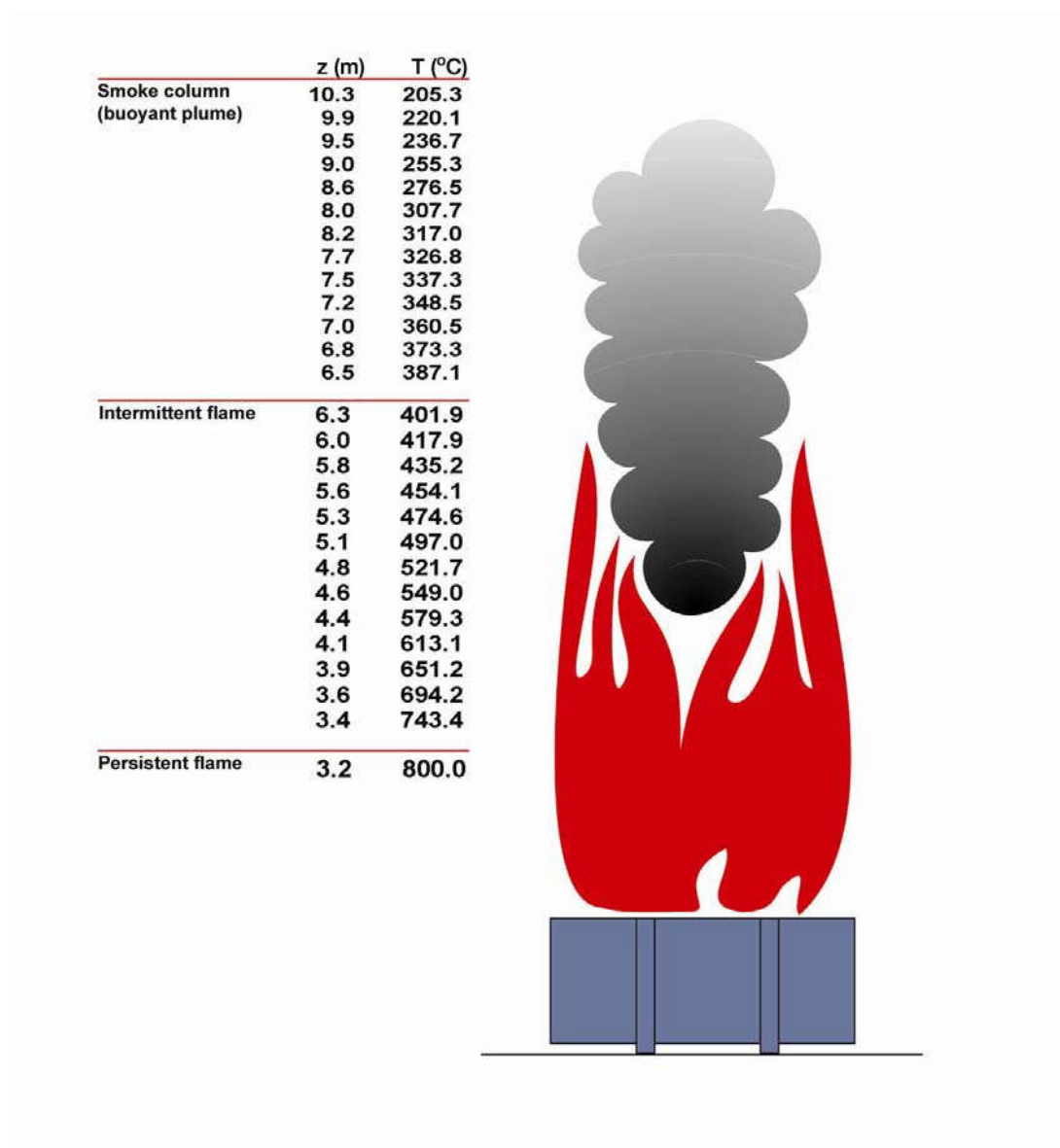


Figure 2. The values of height and temperature of the fire plume on the skip.

	z (m)	T (°C)
Smoke column (buoyant plume)	8.8	172.4
	8.2	190.0
	7.7	210.7
	7.2	235.2
	6.7	264.7
	6.2	307.7
	6.0	317.0
	5.9	326.8
	5.7	337.3
	5.5	348.5
	5.3	360.5
Intermittent flame	4.8	401.9
	4.6	417.9
	4.4	435.2
	4.0	474.6
	3.8	497.0
	3.7	521.7
	3.5	549.0
	3.3	579.3
	3.1	613.1
	2.9	651.2
	2.8	694.2
Persistent flame	2.4	800.0
	0.0	800.0

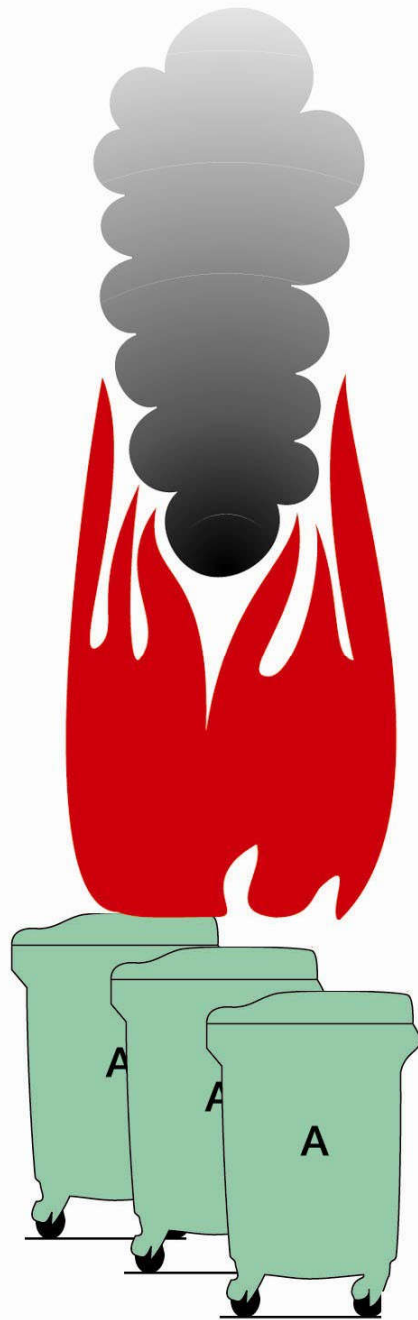


Figure 3. The values of height and temperature of the fire plume when three waste containers are burning.

	z (m)	T (°C)
Smoke column (buoyant plume)	6.0	199.0
	5.4	229.0
	4.8	270.0
	4.3	307.7
	4.2	317.0
	4.1	326.8
	3.9	337.3
	3.8	348.5
	3.7	360.5
	3.6	373.3
3.4	387.1	
Intermittent flame	3.3	401.9
	3.2	417.9
	3.0	435.2
	2.9	454.1
	2.8	474.6
	2.7	497.0
	2.5	521.7
	2.4	549.0
	2.3	579.3
	2.2	613.1
2.0	651.2	
1.9	694.2	
1.8	743.4	
Persistent flame	1.7	800.0
	0.0	800.0



Figure 4. The values of height and temperature of the fire plume when a single waste container is burning.

Annex 2: Heat radiation calculations

Annex 2.1: Calculations

The energy of the heat radiation transmitted by the fire plume was calculated from the temperature of the flame, i.e. a persistent flame has an energy of 75kW/m² and a intermittent flame has 33kW/m². The calculation was carried out according to Stefan-Boltzmann's radiation heat estimation theory and was checked using calculation method in Drysdale, which is based on fire energy.

The energy of heat radiation, which can impinge on different external elements of a building, can be examined by adding a visibility coefficient to the values of the heat radiation transmitted by the fire plume. See, for example, sourer for information about visibility coefficients. Figure 5 shows the variables which are involved in the heat radiation calculations.

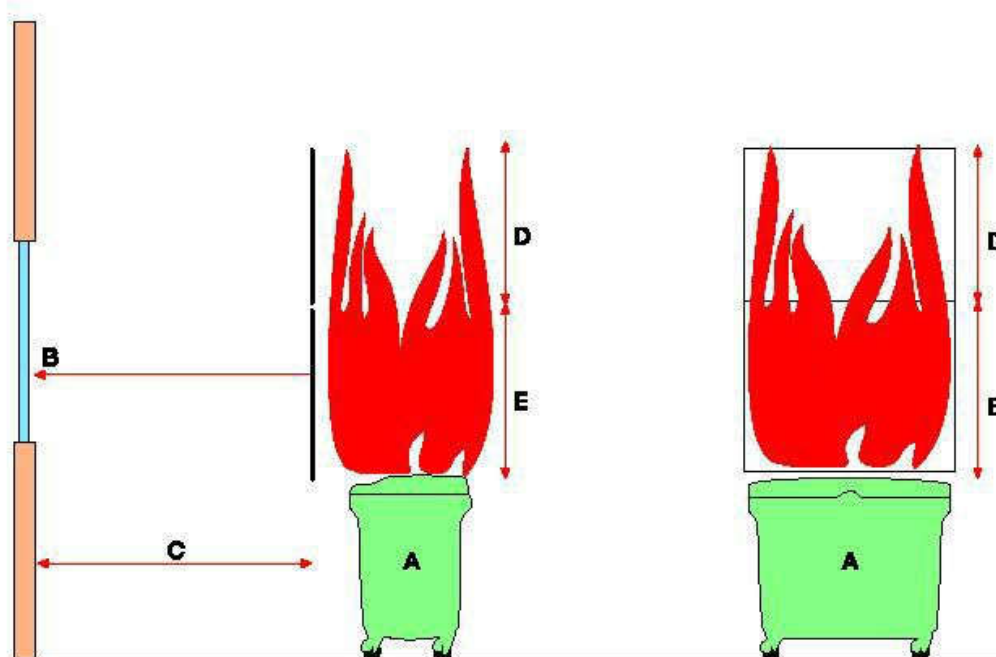


Figure 5. The variables in the heat radiation calculations. B is the heat radiation to the facade of the building and C is the horizontal distance between the fire plume and the facade. Their values are shown in Figs 6-8. (D is the intermittent flame and E is the persistent flame.)

Figures 6-8 are graphs, which show the relationship between heat radiation and distance from the building for the three chosen fires.

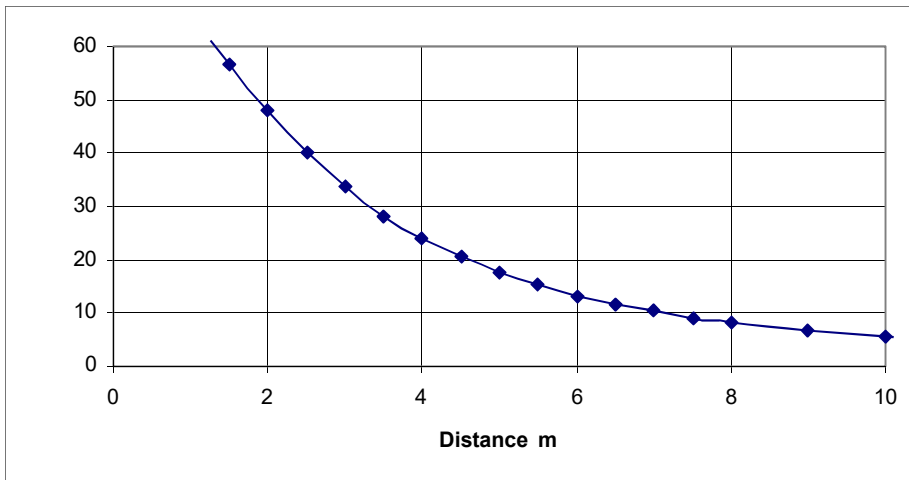


Figure 6: Heat radiation v. distance when the demountable platform is burning

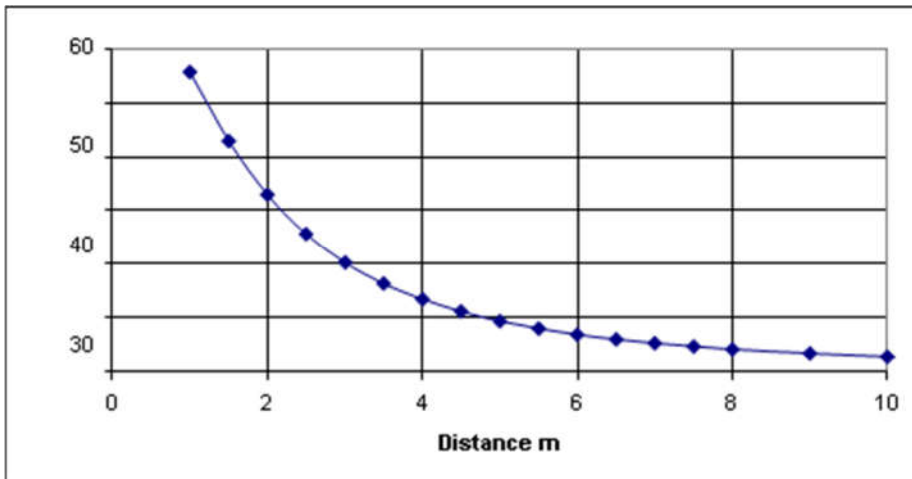


Figure 7: Heat radiation v. distance when the three waste containers are burning.

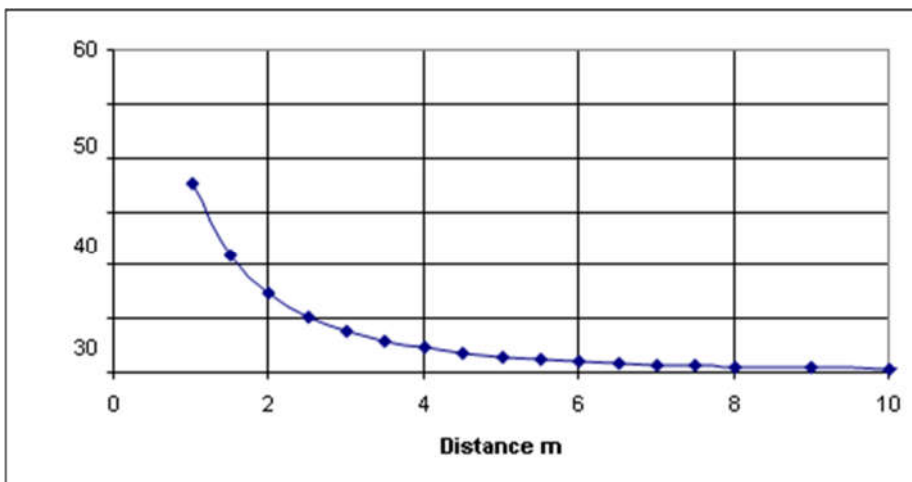


Figure 8: Heat radiation v. distance when the one waste container is burning

Annex 2.2: The Acceptance Criteria of Heat Radiation Calculations

The results of the radiation calculations can be used to estimate the safety distances if it is possible to determine the acceptance criteria for the maximum values of the heat radiation onto the facade of the building at risk. It is possible to determine the building elements from the external wall. The heat radiation resistance of the elements is critical when examining the spread of fire into a building from outside. Such elements include the wooden and plastic parts and the windows of the facades. In addition, features inside the windows, such as curtains, must be taken into consideration.

In sources (3) and (4), the experimental and theoretical value of the heat radiation resistance of glass is presented. Based on these values it is possible to estimate that the critical long-term radiation flow for normal window glass is about 10 kW/m².

It can be presumed that when this value is exceeded the glass panes will break one by one and then the heat radiation will strike with full force the movable property, which is located inside and the plume gases could flow in through the window openings. The critical heat radiation flow value for wooden materials is about 12.5kW/m² and for plastic materials about 10kW/m², see source (2) and (3).

When the critical heat radiation flow value onto the external facade is exceeded for a long period the material in question will ignite, at which time the fire will spread into the building itself. The critical heat radiation flow value of wooden material is the same as will ignite thin, cellulose-based curtain material, which in fact will occur at this heat radiation flow level faster than the ignition of a wooden structure.

Thus a value of 10kW/m² is used in the calculations as the largest acceptable heat radiation flow into the external wall surface of the building at risk.

Annex 2.3: Horizontal safety distances

After a safety examination has been carried out, it is possible to use the results of the foregoing calculations to determine the horizontal safety distances of objects and structures, which are located outside buildings. The values, which have been obtained from the calculations, must take into account the inclination of the fire plume towards the building, caused by wind. This is done by carrying out an inclination examination of the fire plume, based on which it is possible to estimate the actual safety distances by adding 1m to the safety distances which have been obtained from the calculations. In respect of the fire objects, which have been presented in the calculations, the following values for the safety distance in the horizontal places were obtained:

(a)	waste container	safety distance 4m
(b)	3 waste containers	safety distance 6m
(c)	skip	safety distance 8m

The spread of fire into and along the eaves, caused by the heat energy of a smoke column, has also been addressed by the application of and reference to horizontal safety distances.

Annex 3: References

- (1) Pihan jäteastiat ja tuhopolttojen torjunta Tekniikka opastaa 17 Suomen Palastusalan Keskusjärjestö 2002 (The Finnish National Rescue Association)
- (2) Drysdale, Dougal. An Introduction to Fire Dynamics, John Wiley, 1985.

- (3) Buchanan, A.H. (ed). Fire Engineering Design Guide, Centre of Advanced Engineering, Christchurch NZ, 1994.
- (4) Keski-Rahkonen Olavi. Ikkunoitten rikkoutuminen tulipalossa Palontorjuntateknikka-lehti 3/1990.

European guidelines*Fire*

- Guideline No 1 F - Internal fire protection control
- Guideline No 2 F - Panic & emergency exit devices
- Guideline No 3 F - Certification of thermographers
- Guideline No 4 F - Introduction to qualitative fire risk assessment
- Guideline No 5 F - Guidance signs, emergency lighting and general lighting
- Guideline No 6 F - Fire safety in care homes
- Guideline No 7 F - Safety distance between waste containers and buildings
- Guideline No 8 F - Preventing arson – information to young people
- Guideline No 9 F - Fire safety in restaurants
- Guideline No 10 F - Smoke alarms in the home
- Guideline No 11 F - Recommended numbers of fire protection trained staff
- Guideline No 12 F - Fire safety basics for hot work operatives
- Guideline No 13 F - Fire protection documentation
- Guideline No 14 F - Fire protection in information technology facilities
- Guideline No 15 F - Fire safety in guest harbours and marinas
- Guideline No 16 F - Fire protection in offices
- Guideline No 17 F - Fire safety in farm buildings
- Guideline No 18 F - Fire protection on chemical manufacturing sites
- Guideline No 19 F - Fire safety engineering concerning evacuation from buildings
- Guideline No 20 F - Fire safety in camping sites
- Guideline No 21 F - Fire prevention on construction sites
- Guideline No 22 F - Wind turbines – Fire protection guideline
- Guideline No 23 F - Securing the operational readiness of fire control system
- Guideline No 24 F - Fire safe homes
- Guideline No 25 F - Emergency plan
- Guideline No 26 F - withdrawn*
- Guideline No 27 F - Fire safety in apartment buildings
- Guideline No 28 F - Fire safety in laboratories
- Guideline No 29 F - Protection of paintings: transports, exhibition and storage
- Guideline No 30 F - Managing fire safety in historic buildings
- Guideline No 31 F - Protection against self-ignition and explosions in handling and storage of silage and fodder in farms
- Guideline No 32 F - Treatment and storage of waste and combustible secondary raw materials
- Guideline No 33 F - Evacuation of people with disabilities
- Guideline No 34 F - Fire safety measures with emergency power supply
- Guideline No 35 F - Fire safety in warehouses
- Guideline No 36 F - Fire prevention in large tents
- Guideline No 37 F - Photovoltaic systems: recommendations on loss prevention
- Guideline No 38 F - Fire safety recommendations for short-term rental accommodations
- Guideline No 39 F - Fire protection in schools

Natural hazards

- Guideline No 1 N - Protection against flood
- Guideline No 2 N - Business resilience – An introduction to protecting your business
- Guideline No 3 N - Protection of buildings against wind damage
- Guideline No 4 N - Lighting protection

- Guideline No 5 N - Managing heavy snow loads on roofs
- Guideline No 6 N - Forest fires
- Guideline No 7 N - Demountable / Mobile flood protection systems

Security

- Guideline No 1 S - Arson document
- Guideline No 2 S - Protection of empty buildings
- Guideline No 3 S - Security systems for empty buildings
- Guideline No 4 S - Guidance on keyholder selections and duties
- Guideline No 5 S - Security guidelines for museums and showrooms
- Guideline No 6 S - Security guidelines emergency exit doors in non-residential premises
- Guideline No 7 S - Developing evacuation and salvage plans for works of art and heritage buildings
- Guideline No 8 S - Security in schools
- Guideline No 9 S - Recommendation for the control of metal theft
- Guideline No 10 S - Protection of business intelligence
- Guideline No 11 S - Cyber security for small and medium-sized enterprises



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