# Chapter 7
# Civil Danger and Risk of Crisis Situation – Risk of Fire from Safety and Protection of Population as Possible Soft Targets


**Iveta Coneva**

**Abstract** The paper deals with security, fire protection and fire. The issue of security is wide, and its important part is, in particular, the protection of human life – so-called: soft targets in the military as well as in the civil sector, which can be components of critical infrastructure too. Anti-fire security is a matter of global concern, with its primary objective being to protect the health and lives of people, material values and the environment, with a focus on the civilian sector. Protection against fire is a system of prevention and repression, which is housed by the Fire and Rescue Service of the Ministry of the Interior of the Slovak Republic. Fires and blasts are unwanted, destructive phenomena, which cause significant economic losses in the national economy each year, as well as significant losses to the lives and health of the population – soft targets in the civilian sector. Examination of fires can be prevented, in the event of their occurrence they can be localized in time and then effectively eliminated by organized activity – by extinguishing.

**Keywords** Security · Fire protection · Protection of soft targets

## 7.1 Introduction

Security is explained as a state in which the subject (citizen, population) does not feel threatened in terms of its existence, interests and values. It is a sum of measures to ensure the internal security and state order, to safeguard the human rights and freedoms of citizens against crime, terrorism, organized violence etc., preserving the democratic foundations of the state, its sovereignty, territorial integrity and the inviolability of borders [1, 2]. The current interpretation of security is as follows [2, 3]: security is a state in which peace and security of the state are preserved, its democratic order and sovereignty, territorial integrity and the integrity of state

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borders, fundamental rights and freedoms, and in which lives and health are protected citizens, property and the environment [3]. The security risks on the territory of the SR that are currently occurring are divided [4]:

1. Military risks and threats.
2. Non-military risks and threats.

## 7.2 Military Risks and Threats

Military risks and threats to their size and extent represent a potential or direct threat to the security of the Slovak Republic by military forces and means. Involvement against them requires operational deployment of the armed forces, activation of the entire security system of the state or possible military assistance from abroad [2].

This group of risks and threats includes [2]:

- Extensive armed conflict with great impact on the state's vital interests. It has a low probability of occurrence and a long enough warning time before it may arise.
- Regional armed conflict with medium probability of occurrence. After the end of the Cold War, the security environment in Europe and in the world has a positive development, as the likelihood of the global war has declined. Security risks are regional conflicts in fragile regions and certain countries, states (e.g. Syria, North Korea and others).

## 7.3 Non-military Risks and Threats

Non-military risks and threats are activities directed against the interests of the Slovak Republic and not related to the use of military means. These risks can cause a significant threat to the interests of (security) of the population and the state due to the action of natural, technological, economic, internal and even international forces that are not capable of provoking an armed inter-state conflict. Non-military risks and threats can not only be targeted, managed and coordinated (e.g. organized crime, terrorism, etc.), but they may also have a spontaneous trigger mechanism and course (e.g.: natural disasters – floods, fires and others, environmental accidents, migration due to regional conflict, etc.).

The most important non-military risks and threats are [2]:

1. Uncontrollable migration.
2. International Organized Crime and Terrorism.
3. Criminalization of social relations.
4. Activities of foreign special services.

5. Failure or targeted disruption of information systems.
6. The excessive dependence of the Slovak Republic on the unstable sources of basic raw materials, energy and transport.
7. Negative demographic trends.
8. Environmental threats that are related to the environment. These may be industrial and technological accidents, natural crises (e.g. fires, explosions, etc.) that may cross the state border. They are often unpredictable, the nature and consequences of which are still threatening the lives of people (so-called soft targets) and property on a large scale.
9. Lowering the country's food security.

## 7.4 Fire

Every human activity has its security aspect, starting with state security, home security, security and protection of persons and property, fire protection and ending environmental protection. Natural and environmental crises may occur as a result of natural disasters (e.g. floods, fires, windstorms, tsunamis, etc.) and industrial, technological accidents (e.g. fires, explosions, leakage of hazardous substances and others).

They are accidental, unexpected, their course and consequences present a permanent risk to the health and life of humans (so-called soft targets in the civil sector), animals, tangible and intangible property and also cause environmental damage to soil, water and air protection. Fire is any unacceptable burning where the life or health of humans, animals, property, or the environment is endangered, resulting in damage to property, the environment, or the consequence of being an injured or killed person or animal [4].

Based on technical experience, specifically based on the nature and properties of flammable substances and materials, most European countries place fires in the relevant classes of fires. Fire classes are listed in Table 7.1 according to [5, 6].

The correct determination of fire class and type of combustible substance and material helps in the efficient selection of extinguishing agent suitable for firefighting by fire units. In the EU countries there is no classifying fire class of electrical equipment, it is not classified as a separate class with the appropriate designation. In the event of a fire of electrical equipment, the electrical current is switched off first and then it is possible to continue extinguishing according to the principles of other classes of fire, depending on the type of combustible substance. Pictograms in Table 7.1 – is a graphic depiction of fire extinguishers designed for extinguishing the relevant fire class [5, 6].

**Table 7.1** Fire classes

| Fire class | Fire characteristic | Flammable substance |
|---|---|---|
|   | Fires of flammable substances in solid state, which tend to melt or burn with flame. They are usually of organic origin, burning tends to burn. | Coal, wood, paper, hay, straw, textiles and others |
|   | Fires of flammable substances in the liquid state or liquefied solids that burn with flame. | Petroleum and petroleum products, tar, organic solvents, paints, lacquers, fats, resins, carbon disulphide and others |
|   | Fires of flammable substances in the gaseous state, which burn with flame. | Acetylene, hydrogen, methane, propane-butane, carbon monoxide, natural gas, coke oven gas, blast furnace gas and furnace gas and others |
|   | Fires of combustible metals and their alloys. | Magnesium, aluminum, sodium, potassium, uranium and thorium oxides, electron alloy and others |
|  | Fires of electrical equipment. | Flammable substances of all classes of fire in connection with an electric current |
|   | Fires of vegetable or animal oils and fats used in kitchen appliances and large capacity appliances. | Vegetable and animal oils and animal oils fats |

### *7.4.1 Zones of Fire*

The space in which the fire is including its basic and consequential phenomena can be divided into three interconnected zones. Fire zones characterize the development of a fire for a certain period of time and can be spatially overlapped. Figure 7.1 shows zones of fire.

As the fire progresses, the area on which the fire progresses increases and the rate of degradation of materials increases. Extremely expanding fires include fires in the open air (so-called "open fires") when the fire is not limited. The fire area can be divided into three zones [7, 8]:

1. Burning zone.
2. Preparation or thermal effect zone.
3. Smoke formation zone.

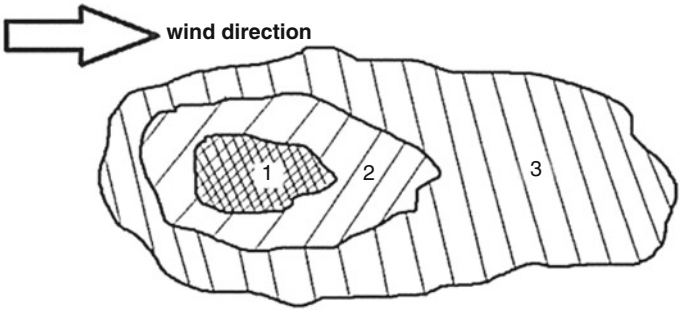


**Fig. 7.1** Zones of fire

#### 7.4.1.1 Burning Zone

This area is burning. The volume of space is filled and contains all gases and vapors that are bounded by the flame or the surface of the burning substance from which these gases and vapors are released. The burning zone is also delineated by building structures and tank walls. Burning volume and height are important when evaluating open fires. In this zone, the temperature is highest and the zone is characterized by a fire area. The generated and released heat from the burning zone is passed to the next zone, namely the preparation zone. Burning affects the type of combustible substance, the oxygen concentration and the amount of activation energy of the source.

Heat can be propagated in three ways [7, 8]: by conduction, by convection, and by radiation.

- Conduction – heat transfer is a result of interaction and movement of the basic particles of matter (atoms, molecules, free electrons). Higher temperature molecules (with higher kinetic energy) transmit some of their energy to neighboring molecules with lower temperatures [7, 8].
- Convection – (convection) heat dissipates in liquids (liquids and gases). The process of mass transfer of atoms and molecules of a substance while simultaneously transferring heat involves two phenomena: heat transfer by conduction at the contact of two particles (atoms or molecules) and heat transfer by flow when moving particles and volumes of matter that carry their internal energy. External fires transmit 60–70% of heat in this way. In fires, poisonous substances (so-called combustion products) are released and there are often poisoned and threatened persons [7, 8].
- Radiation – heat is transmitted in all directions evenly because of electromagnetic radiation. Electromagnetic radiation radiates from its surface any real body with a temperature greater than absolute zero. Of the total electromagnetic radiation that falls on the surface of the solid, part of the radiation is absorbed, the part bounces and then part passes through the solid. In this way, 30–40% of heat is released. It is typical of outdoor fires [7, 8].

#### 7.4.1.2 Preparation or Thermal Effect Zone

The preparation or thermal effect zone is directly adjacent to the combustion zone. There is a process of preparing the material for burning (heating, changing properties, etc.), which significantly affects the fire situation. Materials are heated under the influence of heat and create hazardous situations for persons located near the fire or in the area where they are burning. Due to the high temperature, the materials lose their properties and steel structures may collapse or damage to machinery and equipment. In the case of internal fires, the preparation zone is bounded by the structure of the building and the walls. Fire may, however, extend to the outside area outside the building. The thermal effect band is in practice referred to as a area where the temperature is higher than 55–60 ° C [7, 8].

#### 7.4.1.3 Smoke Formation Zone

Smoke formation zone is a part of the area near the burning zone, filled with smoke, in a concentration that threatens the health and lives of people, and makes it difficult for the fire brigade to work. In the smoke formation zone, tapping is usually a low air concentration (oxygen), reduced visibility, a large amount of fumes of combustion – smoke and often high ambient temperatures. The zone can be very extensive and the burning products with their toxicity can endanger life even at great distances. The smoke zone is characterized by a smoke area and smoke density [7, 8].

### *7.4.2 Phases of Fire*

Intensity of burning – changes occur during a fire. In the case of internal fires that are not extinguished by extinguishing agents, the duration of the fire is usually characterized by four phases of fire. The length of the individual phases is usually very different and depends mainly on the amount of combustible substance, its fire-technical characteristics and the conditions affecting the spread of fire.

Figure 7.2 shows the fire stages, depending on the temperature and from time [8–11].

**Ist Phase of Fire – Development of Fire** Phase I of the fire is a time period from the onset of fire to the beginning of intense burning. According to fire statistics, phase I usually takes 3–10 minutes. The time depends on the type of flammable substances and the conditions of fire development. Since the burning intensity is still relatively low – this is the most advantageous phase for starting firefighting, for extinguishing fire with extinguishing agents. Disposal is simple and damage is minimal [8–11].

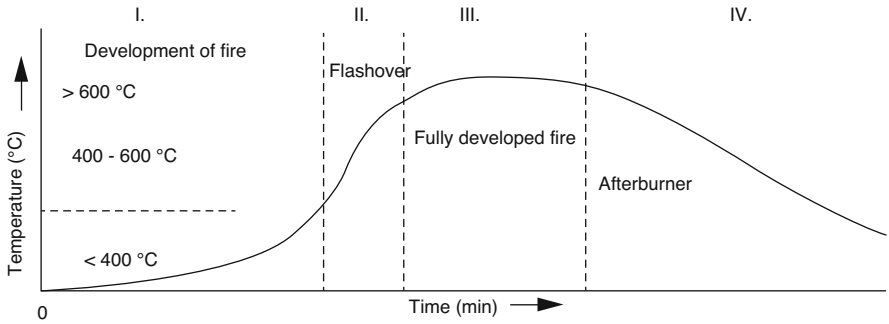


**Fig. 7.2** Phases of fire

**IInd Phase of Fire – Flashover** IInd the fire phase is the time from the beginning of intense burning until the burning of all combustible materials, the substances present in the object, and the construction of the burning object. Characteristic of this phase is the rapid increase in temperature and fire area, increase of gas flow rate and proportional increase in damage. The situation at the site of the fire is complicated and requires high demands on the organization of firefighting, especially when the fire is at the end of the phase [8–11].

**IIIrd Phase of Fire – Fully Developed Fire** IIIrd the fire phase is a time period from the end of the II phase, t. j. all combustible substances are burning in a given object, and the burning rate reaches the maximum until the burning rate decreases. At this stage, the other supporting elements are also disturbed and the ceiling, the truss and the like collapse. Fire brigade intervention focuses on cooling and protecting surrounding objects, and it is up to the commander to decide whether to take action or let the object burning. The actual intervention on the object is very demanding, usually costly and inefficient [8–11].

**IVth Phase of Fire – Afterburner** IVth the fire phase is the time period from the beginning of the decrease of the burning intensity until the complete burning of the combustibles. At this stage there is a risk of collapse of the internal and peripheral masonry, chimneys, staircases, etc. The activity of fire units is focused on finding and concealing fire and hidden fires of fire. The attack commander may decide that only the surveillance will be carried over the object until the object is completely burned [8–11].

## 7.5 Conclusion

Security is a state in which a citizen does not feel threatened in terms of his or her existence, interests, and values. At present, military risks and threats and non-military risks and threats are present in the world. The issue of safety, protection

of the so-called "soft targets" is currently up to date not only from a military point of view, but also from a civil point of view. Fire protection is concerned with the safety of persons, animals, property, but also with the protection of the environment [12]. Fire safety is aimed at preventing and subsequently resolving various crisis situations of natural, industrial and technological nature. One of the dominant crisis situations of a natural or industrial nature is the fire and the consequences associated with it [13]. To understand the origin, development, course and extinction of a fire, it is necessary to know the laws of the burning process. Fire is uncontrollable, unwanted burning that threatens the health and lives of people (so-called: soft targets), animals and causes significant economic and ecological losses in the economy, the state. Based on the types of flammable substances, the fires are divided into the appropriate classes of fire. External fires are divided into three zones and internal fires have four phases of fire. Knowledge of the theory and practice of burning processes helps us in time to prevent the occurrence of fires. The resulting fires must be localized in time and subsequently destroyed by the Fire and Rescue Corps of the Ministry of Interior of the Slovak Republic. The first responders play an important role of fire rescuing [14].

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