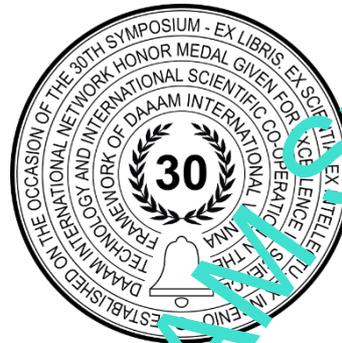


PREVENTIVE AND REPRESSIVE MEASURES FOR FIRE SAFETY

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Abstract

Fire safety, as one of the basic safety categories, has developed throughout history. The article focuses on determining preventive and repressive measures related to fire protection. The preventive and repressive model of ensuring safety is first described as a theoretical basis. Subsequently, an analysis of fire protection measures is defined, describing specific preventive and repressive fire protection measures. Based on these measures, individual phases of fire protection activities are described, followed by a description of proactive fire protection measures. The article's result is the proposal and application of fire prevention measures. These measures are proposed for a soft target - a shopping centre.

Keywords: Fire Protection; Measures; Fire Safety; Safety

1. Introduction

Fire protection is a primary type or category of security and a sense of security in society. It began to develop in ancient times and was transformed several times throughout history to its current form. Among the first major threats related to fire protection was the massive fire in Rome in CE 64. [1] The region's largest recorded fire in history was the Siberian Taiga fire in Russia in 2003, which spread over an area of up to 55 million acres (about 5,500 square kilometres). [2]

Fire safety is a highly resolved issue regarding security breaches. Primary fire threats include fire, explosion and leakage of hazardous substances. Of these fire threats, there are many other fire threats associated with them. The article deals with individual fire protection measures. In the first part, he describes the security model, which from the point of view of security can be divided into preventive, repressive and combination. The next chapter describes individual preventive and punitive fire protection measures. In the next part, the individual phases of the fire protection activity process are defined and arranged chronologically. The following chapter describes specific proactive fire protection methods belonging to the second phase of the fire protection activity. The same results of the article are the design and application of proactive methods for fire protection. It is the creation of new or modification of current measures. As part of future research could be about creating and applying proactive fire protection measures intended for schools, hospitals, restaurants, stadiums and various cultural and social events.

2. Security model

The model expresses the main aspects of reality. It is a specific type of abstract understanding of the actual situation. It can be represented graphically, on a map, numerically (quantitatively), descriptively (qualitatively), programmatically or in other ways. The subjects and objects found in the given model are linked logically, hierarchically and structurally according to the given situation.

The security model describes an actual situation oriented toward a possible security breach. This description and representation can also be done graphically, on a map, quantitatively, qualitatively, by a program or in other ways. It is distinguished between 3 basic security breach models: preventive, repressive, and combination.

The preventive security assurance model expresses knowledge, prevention methods and preparation for future possible security breaches. Performs individual activities before a security breach occurs.

The repressive model of ensuring security expresses a set of knowledge, methods of repression and their implementation in already created states of security violation. Performs individual activities after the occurrence of a security breach.

The combination of preventive and repressive models expresses a set of knowledge, methods of prevention and repression and their implementation from the period of preparation for the state of security assurance to the solution of the state of a security violation. [3]

3. Analysis of fire protection measures

This chapter analyses fire protection measures, describing preventive and repressive activities. Preventive and repressive activities are described together within fire protection units - state (professional) and simultaneously voluntary fire protection units, legal entities and natural persons - entrepreneurs and state authorities.

3.1 Prevention of fire protection

As part of the prevention of fire protection, the following activities are carried out:

Prevention of fires or explosions - repair and maintenance of equipment working with dangerous substances, creation of maps in case of fire, conducting preventive fire inspections and building evacuation drills in the event of a fire.

Fire protection technician - determining places with increased fire risk, carrying out fire protection training, activities regarding fire protection documentation and practising fire alarms.

Fire protection specialist - development of fire safety solutions in project documentation of buildings, assessment of conformity of products, placement of technological equipment and analysis of the risk of fire.

Preparation of documents - fire identification card, workplace fire regulations, fire alarm directives, fire evacuation plan, fire book, fire risk analysis, documents on the control of fire equipment according to a special regulation, documentation on the training of fire patrol employees, documentation on the training of fire patrols, documentation on the activities of the fire department, fire protection documentation for apartment buildings, municipality documentation on fire protection and the municipality's fire regulations.

Educational activities - educational training within primary schools, secondary schools and universities, information leaflets, radio, videos and other ways of presenting fire protection activities to the population, teaching the subject of fire protection in schools and vocational secondary or higher education focused on fire protection.

Training - training of fire patrols, conducting basic training for members of voluntary fire protection units, conducting professional training for members of the fire and rescue service (professional firefighters), training of a preventive officer, technician and fire protection specialist.

State fire supervision - carrying out comprehensive, thematic or follow-up inspection, assessment of building documentation, zoning proceedings, building proceedings, approval proceedings and ascertaining the causes of fires.

Fire patrol - creation and performance of fire patrol at the workplace, creation and performance of fire assistance patrol.

Control activities - conducting preventive fire inspections and a safety audit within the fire safety framework.

Employee training - employee training regarding fire protection and regular implementation of safety at work.

Fire evacuation plan - drawing up a fire evacuation plan for objects with text, graphics and a legend.

Exercises - regular performance of screening (not prepared in advance) and tactical (prepared in advance) exercises.

Prevention officer - prevention officer of the village within the voluntary fire protection unit, proper heating of households, proper placement of fire extinguishers in households, control of burning places during the ban.

Other activities - promotion of fire protection, recruitment of new fire protection members, implementation of various actions for children and adults aimed at fire protection. [4] [5]

3.2 Repression of fire protection

As part of the repression of fire protection, the following activities are carried out:

Firefighting - firefighting in a family house, apartment or cottage, firefighting in an industrial building, at the airport, firefighting in a vehicle, firefighting in the natural environment, and other types of firefighting.

Water transport - long-distance transport of water by shuttle or chain method.

Water removal - water removal in the natural environment, residential environment, water removal or industrial environment.

Liquidation activities - objects, animals, persons, dangerous substances, and other liquidation activities.

Activities within the framework of crisis management - the evacuation of people, animals and objects, hiding of people, animals and objects, emergency survival of people and animals and provision of life needs to people and animals.

Traffic accident: traffic accident in a natural environment, on a road, expressway or highway, traffic accident in another environment, traffic control on the road, removal of trees or objects from roads and public spaces.

Providing first aid and rescue - providing first aid to a person or an animal, rescuing people or animals from heights or depths, rescuing people or animals from inaccessible places.

Control activities - control of an emergency after intervention in a natural, residential or industrial environment.

Documents: report on the intervention of firefighters, annual report on the activities of the fire and rescue service, creation of statistics for the past periods.

Other activities: explosives, preparation for suicide, removal of stinging insects, removal of other animal species, the performance of other activities related to an emergency event, and performance of other activities related to a crisis event. [6] [7]

4. Phases of fire protection

When determining proactive fire protection methods, it is essential first to characterize the phase of proactive fire protection activity. The phases of fire protection activities can be divided into four parts: passive prevention of fire protection, active prevention of fire protection, active repression of fire protection and passive repression of fire protection.

4.1 *Passive prevention of fire protection*

The first phase of fire protection activities prepares for possible future security breaches. The most common categories of activities include the preparation of documents, educational activities, professional training, state fire supervision, training, prevention officer, fire protection technician, and fire protection specialists.

4.2 *Active prevention of fire protection*

The second phase of fire protection activities involves active and up-to-date preparation for future security breaches. It is also a proactive activity. The most common categories of activities include fire patrol, electric fire alarm, preventive-tactical exercises, and preparation for typical activities.

4.3 *Active repression of fire protection*

The third phase of fire protection activities is intended for active repression after a security breach. The most common categories include firefighting, hazardous substances, water transportation, water removal, liquidation, crisis management, traffic accidents, first aid and rescue, and other activities.

4.4 *Passive repression of fire protection*

The fourth phase of fire protection activities is characterized as passive repression after a security breach. It is also called an evaluation activity. The most common categories of activities include evaluation documents, control after the intervention, evaluation of the procedure, and creation of statistics.

Individual phases follow each other. In the last fourth phase, the first phase of the process of fire protection activities is again transferred.

5. Proactive methods of fire protection

Proactive methods of fire protection belong to the group of active prevention. As part of the proactive activity, it must not be passive prevention but an active and timely reaction to the current situation of a possible security breach within a specific object.

The main general proactive fire protection methods include fire patrol, fire alarm systems and other systems, preventive-tactical exercises, and preparation for typical and other activities.

5.1 Fire patrols

Fire patrols are divided into workplace fire patrol and fire assistance patrol.

5.1.1 Workplace fire patrol

The workplace fire patrol is established at workplaces with an increased fire risk. If it is only an occasional workplace (the employee stays here only for the occasional inspection, delivery of material, etc.), the establishment of a workplace fire patrol is not required.

Its primary tasks include monitoring compliance with regulations at the workplace and immediately reporting detected deficiencies to the workplace manager, and implementing measures in the event of a fire, especially for rescuing people, calling for help, fighting the fire, closing fire dampers and combustible material inlets, and turning off the electricity.

The members of the fire patrol at the workplace ensure that after the end of working hours the workplace is in impeccable condition from the point of view of fire safety, that the fire shutters, the supply of flammable substances and all appliances are turned off. Their task is also to check the workplace's equipment with firefighting equipment, fire extinguishers and connecting means, and they also check their completeness and access them. [8]

5.1.2 Fire assistance patrol

This type of patrol is established for activities with an increased risk of fire or events attended by many people.

Among its primary tasks is the supervision of compliance with measures designed to prevent the occurrence of fire and the implementation of measures in the event of a fire, mainly for rescuing people, fighting a fire, closing fire valves and supplies of flammable substances and turning off the electric current.

The members of the fire assistance patrol familiarise themselves with the nature of the activities, the nature of the secured event or the object related to the measures to ensure protection against fires. Before starting an activity or event, members of the patrol check whether the measures to ensure protection against fires have been met. The members also check compliance with the fire safety regulations of the building. Another of their activities is the inspection of the given premises before the event's start, during the course, and after the end for a specified period. In imminent danger, the patrol members immediately alert the head of the workplace or the event organiser. [9]

5.2 Fire alarm system

The fire alarm system is a security system designed for the fire protection of a given object. Nowadays, various institutions and other objects are necessary and needed in addition to workplaces, and it is also starting to be used in households.

The fire alarm system is an essential safety system, as it can perform several functions. When a fire detector detects a fire through the central electrical fire alarm system, it can perform signalling, whether acoustic or optical, automatically contacts the Fire and Rescue Service operation centre and can also perform object control (for example, start sprinklers, open fire doors, open windows, activate safety gate and so on. [10]

5.3 Fire protection control panel

The fire protection control panel is an element and part of the electrical fire alarm system. It is a device connected to the electrical fire alarm system through a remote transmission device for fire protection units. The advantage of this device is the essential operation of the electrical fire alarm control panel remotely. The fire protection control panel also indicates the operational state of the electrical fire alarm system and enables the fire department to control the electric fire alarm system remotely and reliably. The fire protection control panel is usually placed at the entrances to buildings for easy accessibility. [11]

5.4 Review exercises

Review exercises are carried out by all fire protection units, whether professional, corporate or voluntary. Screening exercises are not pre-arranged. The individual components are not ready for the given type of intervention. In this exercise, the corps' ability to act, their interrelationship and cooperation during the given exercise are mainly tested. At the end of the exercise, the leader evaluates the progress of the given review exercise.

5.5 Tactical exercises

Tactical exercises are also carried out by all fire protection units, whether professional, corporate or volunteer firefighters. Tactical exercises are pre-planned exercises. The individual components of fire protection are informed about the place, time and date. Information is also provided on the type of intervention and what firefighting equipment will be used. At the end of the exercise, the leader will also evaluate the progress of the given tactical exercise.

5.6 Preparation for typical activities

It is a simulation of the course of a given event related to fire protection. As part of the process simulation, the components of the fire and rescue service, the medical rescue service and the police are most informed. All these emergency services perform their tasks within a simulated event. The most frequently simulated events include car, bus or train traffic accidents, plane crashes, the explosion of a dangerous substance, forest fire, flooding of an area, leakage of a dangerous substance into a river or lake, managing the evacuation of the population, simulating the process of solving an explosive device, preparing for a suicide attempt and others events.

5.7 Other activities

Other proactive fire protection methods activities may include new evaluation systems that actively respond to the occurrence of fire or the imminent danger of explosion caused by dangerous substances. Other activities may include software programs designed for fire protection.

6. Proposal and application of proactive methods of ensuring fire protection

Proposed proactive methods include fire patrol, private security service, software, tactical exercises, evacuation, typical activities and control activities.

6.1 Fire patrol

In this case, it would be the type of workplace fire patrol because this type of patrol is constantly at the workplace, unlike the fire assistance patrol, which carries out supervision within the framework of fire protection only in the case of shorter periods, such as social-cultural events or events and the like. In table 1 and 2, there is a proposal for the number of fire patrols with a specific number of members and their working hours. The range of tables is divided into 6 degrees (0 to 5) according to the shop area. As the level increases, so do the number of fire patrols and the number of members for individual units. Table 1 shows these suggestions for the case when the shop is not in non-stop operation, and Table 2 shows these suggestions for shops in non-stop operation. A detailed breakdown of the degrees can be found in the following two tables.

Degree	Shop area [m ²]	Non-stop operation	Working hours of fire patrols	Number of fire patrols	Number of members in one fire patrol
0	until 10 000	no	x*	0*	0*
1	10 001 – 30 000	no	4 hours/day	1	1
2	30 001 – 50 000	no	8 hours/day	1	2
3	50 001 – 70 000	no	12 hours/day	1	3
4	70 001 – 100 000	no	8 hours/day	2**	2
5	over 100 000	no	8 hours/day	2**	3

Table 1. Fire patrol without non-stop operation

* At fire patrol degree 0, it is not necessary to create a fire patrol if there is without non-stop operation

** With two patrols, there is a regular change (morning and afternoon shifts) - that is, the working time of both patrols is a total of 16 hours per day

Degree	Shop area [m ²]	Non-stop operation	Working hours of fire patrols	Number of fire patrols	Number of members in one fire patrol
0	until 10 000	yes	2 hours/day	1	1
1	10 001 – 30 000	yes	4 hours/day	1	2
2	30 001 – 50 000	yes	8 hours/day	1	3
3	50 001 – 70 000	yes	12 hours/day	1	2
4	70 001 – 100 000	yes	12 hours/day	2*	3
5	over 100 000	yes	12 hours/day	2*	4

Table 2. Fire patrol for non-stop operation

* With two patrols, there is a regular exchange (day and night shifts) - that is, the working hours of both fire patrols are a total of 24 hours a day.

6.2 Private security service

The performance of a private security service is also significant for the proper operation of the shopping centre. The activities of the private security service are mainly focused on the physical security of the shopping centre. As part of fire protection, members of the private security service would ensure that there is no intentional fire and coordination of groups of people in case of evacuation.

6.3 Software

Another proactive method of fire protection would be the creation of software that would focus on specific criteria of individual operations in the shopping centre and, based on the established criteria, would evaluate the resulting degree based on which fire protection measures would be proposed. The evaluation process would refer to the following criteria: number of persons, shop area, type of shop, time mode of shop, working hours, holiday, number of floors, presence of fire alarm system and security alarm system, emergency exit, presence of fire patrol and statistics.

6.4 Tactical exercises

Tactical exercises are pre-planned exercises conducted by fire protection units. The main task of this type of exercise is excellent preparation, coordination and efficiency. In the case of a proactive method, it would be the performance of tactical exercises in the event of a fire or dangerous smoke in periods when there are more people in shopping centres (for example, Christmas and Easter) or in periods when there is a risk of fire occurring more frequently (for example, during the summer season).

6.5 Evacuation

The evacuation process is mainly carried out by the units of the integrated rescue system of the employer. In the case of a practice evacuation process within the shopping centre, the fire patrol would carry out the evacuation process in cooperation with the private security service. In a practice evacuation, persons would be moved to a gathering place outside the shopping centre. It would be ideal for carrying out practice evacuations at least two times a year.

6.6 Typical activities

This section covers different events that can occur in the shopping centre. It is about creating a simulation of the event with an immediate reaction. Among the most common types of events in the framework of fire protection in a shopping centre can be fire, generation of dangerous smoke, presence of gas or other dangerous substance, the explosion of gas or other dangerous substance, failure of electric fire alarm, malfunction of fire equipment, blocking off escape exit, process evacuations, the process of evacuation, in case the fire is located at the entrance. There is no other escape exit or other emergency activities.

6.7 Control activities

These are random inspections of compliance with fire regulations in the shopping centre. The check would be done randomly. The employer would not be informed about the inspection in advance. The control of compliance with fire regulations would be carried out by a member of the state fire supervision, a fire protection technician, or an authorized preventive officer (a member of the prevention department of the Fire and Rescue Service or voluntary fire protection).

7. Conclusion

Safety is one of the basic needs of human society. One of the basic categories of safety is fire safety. The article dealt with the analysis and proposal of new or modified methods. The first chapter described the security model. According to individual characteristics, the security model is generally divided into preventive, repressive and combined from the point of view of safety. Fire protection primarily deals with the repressive part, and the preventive part is not addressed to such an extent. Therefore, it is advisable to deal more with combined security models. The following part dealt with analysing individual preventive and repressive fire protection measures, which are also individually characterised. The next chapter describes the individual phases of the fire protection process. These four phases of the process were timed and logically arranged. Typical activities and fire protection activities were defined for each phase. This chapter was followed by a section on proactive fire protection methods, which were dealt with in the second phase of the fire protection process. Proactive fire protection methods included fire patrols, fire alarm systems, fire protection control panels, review exercises, tactical exercises, and preparation for typical and other activities. The last chapter deals with the proposal and application of new or modified proactive methods intended for fire protection. The proposed methods included fire patrol modified by number and time requirement, private security service, software, tactical exercises, evacuation, typical activities and control activities. All these proposed methods are intended for a shopping centre object.

The disadvantage and limit of this proposal may be the time or cost required for the shopping centre.

As part of future research, proactive methods could also be proposed for other objects such as schools, hospitals, restaurants, stadiums and various cultural and social events where many people are present.

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