

SELECTED ELEMENTS OF TECHNICAL SECURITY SYSTEMS OF PUBLIC FACILITIES

Sławomir Bałuszyński^{*)}

ABSTRACT

Contemporary times where the priority is human life and health make that great emphasis is placed on the development and creation of new systems to ensure and the widest possible protection and safety of people. Buildings with a large volume such as shopping centers, cinemas, theaters, schools, hotels, restaurants in whose simultaneously live often a few hundred people can stand in the face of any threats. One of them which is a very dangerous is fire. Despite the high awareness of society about the element likelihood of a occur of a fire is always occurs. Just often that will do a roach of cigarette or a spark from a damaged electrical wiring or overheated engine. Damage resulting from a fire is mostly property damage and threat to human life. To prevent such threats are used modern systems.

The basic ones are:

- fire alarm system,
- sound warning system.

The use of these systems in buildings does not give 100% sure of safety but reduces to a minimum the threat may occur.

Key Words:

security, security systems, centrals of fire

ABSTRAKT

V súčasnej dobe je prioritou ľudský život a zdravie. Veľký dôraz je kladený na rozvoj a vytváranie nových systémov, ktoré zabezpečí vyšší stupeň ochrany a bezpečnosti osôb. Budovy s väčším zdvihovým objemom, ako sú nákupné centrá, kiná, divadlá, školy, hotely, reštaurácie, v ktorých sa často pohybuje súčasne niekoľko stoviek ľudí, môžu čeliť akejkol'vek hrozbe.

Jednou z veľmi nebezpečných hrozieb je požiar. Aj napriek vysokému povedomiu spoločnosti, nebezpečenstvo požiaru je vždy prítomné. Stačí často len ohorok cigariet alebo iskra z poškodeného elektrického vedenia alebo rozpálený motor. Následky

^{*)} Mgr. Ing. Sławomir Bałuszyński, Specialist fire safety, occupational health and safety, witness expert, an officer of fire, specslawek@wp.pl

vyplývajúce z výskytu požiaru sú predovšetkým škody na majetku a nebezpečenstvo pre ľudský život. Ak chceme zabrániť takejto hrozbe, mali by sa používať moderné systémy. Medzi tie základné patrí:

- systém požiarnej signalizácie,
- zvukový varovný systém.

Použitie týchto systémov v budovách nedáva 100% istotu bezpečnosti, ale zníži na minimum ohrozenie, ku ktorému môže dôjsť.

Kľúčové slová:

bezpečnosť, bezpečnostné systémy, požiarne ovládacie panely

1 GENERAL CHARACTERISTICS OF SAFETY SYSTEMS

1.1 THE FIRE ALARM SYSTEM

The fire detection system called briefly SSP is one of the most important safety systems in multi volume buildings. The effects of developing an uncontrolled fire in a way lead to very serious material damage can also cause loss of health or life of a large number of people. For this reason, in a certain class of buildings (commercial or exhibition buildings, theaters, cinemas, buildings used for the gastronomic purposes, entertainment and sports halls, hospitals, nursing homes and social rehabilitation centers, larger work factories, high-rise public buildings, collective residences, archives, museums, centers of electronic data processing, call centers, parking garages, subway stations, train stations, ports, banks, libraries) use SSP systems are mandatory [1]. It is governed by the laws of the acts and regulations. The most important element of each SSP system is control panel. It has a specific structure which allows you to connect the number of sensors to detect fires and signaling devices and controllers detect. It is a microprocessor device able to analyze the situation in the building covered in fire. It generates the appropriate decisions in the form of control signals triggering automatic media devices, smoke and heat extract flaps and signaling devices. The principle is to transmit an alarm signal to the local branch of Firefighters.

Great importance for the safety of persons in the affected area of the building has a smoke exhaust system. Specially designed controllers control the fans supply air and exhaust fans assuring adequate pressure in different areas of the building and also monitors and set smoke flaps during the exhaust action. Opening and closing of smoke flaps is according to the established procedure the program or manual [2].

1.2 AUDIBLE WARNING SYSTEM

Having regard to the safety of the people it seeks to create an effective method of warning of threats and provide information how to proceed in situations of threat. Until recently, warning people against fire or other threat was carried out in most of the objects using sounders (sirens). But notifications by sirens but was carrying a number of drawbacks. The most important of them are:

- Possible cause panic;
- No possibility of transmission the other informations besides the alarm;

- No possibilities of appeal alarm;
- No possibilities to determine the type of threat;
- No method of transmission possibilities proceedings in the case of threat;
- No possibilities to provide information about the way of escape;
- Small effectiveness of the transmission of informations.

These defects are deprived the voice alarm systems DSO in whose transfer of informations is done using speakers. In addition, besides the message-forwarding feature of danger these systems can be used to transmit advertising, broadcasting music which is especially useful in some types of objects.

2 PRINCIPLES OF PLANNING THE FIRE ALARM SYSTEMS

At the very beginning, it should be noted that the guides not covering every incident that may happen are the recommendations of whose derogation is permitted provided that will be discussed and agreed by interested parties [3].

The first step in the implementation of the fire alarm system (SSP) is to determine what requirements must meet building in the field of fire detection and alarm systems. This analysis we can make through:

- Determining how much of the building will be under the protection so-called the scope of protection.
- *Ranges of protection can be defined as follows:*
 - a) total protection (all parts of the building);
 - b) zone protection (one or more fire zones in the building)
 - c) protection ways of escape (to ensure the safe use of the exists roads before their will be blocked by fire and smoke);
 - d) local protection (protection of selected devices or functions constituting not necessarily an all fire zone)

Develop a plan to be followed during a fire alarm. Key issues to be considered are:

- a) anticipated evacuation plan and its dependence from the place of fire;
- b) nature of the use of the building in terms of the time of day, and to determine the effect on the plan of conduct in the event of an alarm;
- c) time-frame for notification fire brigade and the way its call
- d) duties and responsibilities of personnel during managing of extinguishing and evacuation action;
- e) way of information people about the fire in the building;
- f) identifying the location of the fire;
- g) whether there is a necessity of the use of hierarchical system;
- h) whether the building has emergency power
- i) procedures when false alarms are damages;
- j) specify the time at which the installation is to fulfill its function after the detect of fire.

The second stage involves the planning and design of the installation. Its reach of covers:

- Selection of system components (detectors and manual call points)
- Division the building on the surveillance and alarm zones.

Surveillance zones based on indications of signaling devices should allow in a rapid determine the location of the alarm. In order to avoid ambiguity indications you must foresee measures to identify signals of manual call points.

- Arrangement of elements of the system at the facility.
- Designation the way how to oversight the installation and display its indications.

The third step are assemble and switching works.

Fourth last step is to start and check the proper operation of installation.

2.1 DIVISION OF FACILITY ON MONITORING AREAS

The most important thing during the division of multi-storey building on surveillance zones is the purpose of the object and the way the alarm and control equipments of security and fire in the building as well as the functional properties of used system of fire alarm. The basic principle is to perform all steps in the notification in terms of alerts and control appliances in an unambiguous way within the selected zone of fire in object and then associating actions protected area with adjacent zones.

Significant impact on the size of supervise zone has a kind of used supervision lines [4].

Types of supervised lines (characterization):

1. Supervised line not addressable and addressable open:

- one detection line to fire zone;
- maximum surface of supervised area by one detection line 1600m²;
- one detection line to the fire zone;
- when is not addressable supervise line one room to 1600m² to 5 adjacent rooms when their total area is not more than 400m² to 10 of rooms with an area of 1000m² with external alarm indicators;
- when is an addressable supervise line to 32 rooms with surface up to 1600m²;
- on the one supervise line you can install up to 10 manual call points (ROP), is allowed to conduct ROP on stairwells of not more than 3 storeys;

2. The addressable loop supervise line:

- one detection line for several fire zones;
- the necessity of the use of short-circuit isolators between fire zones;
- maximum number of detectors in the coverage line is 128 pieces;
- maximum use of short-circuit isolator every 32 linear elements;
- to 128 of rooms with a total area of 6000 m²;
- maximum up to 10 manual call points (ROP), we can install in dedicated zones using short-circuit isolators, allows conducting ROP in the stairwells of no more than three floors.

Please note that in a single detector line we can to install no more than 10 manual call points apply to both addressable and not addressable zones.

2.2 SELECTION AND TYPES OF DETECTORS

Properly selected fire sensors may for the job as possible early and reliably alert

for originating fire risk in a protected area or object.

For their proper selection please allow the influence of following factors:

- Legal requirements;
- Materials which are in the zone and their way of behavior during combustion;
- Effect of ventilation and heating;
- The environmental conditions inside the monitored room;
- The possibility of false alarms;
- Founded fire scenario:

a) a flame fire

b) a smoldering fire

- Ambient conditions:
 - a) height of temperature (smoke and flame detectors can be used at temperatures from -20 ° C provided that they will not be the subject of icing to the 50 C unless another value is not specified in the certificate. Heat detectors can not be used in areas where there are large fluctuations of temperature.
 - b) speed of air flow (ionization smoke detectors may be used to speed 5m / s., heat and flame detectors are not subject to any restrictions in that respect)
 - c) moisture (detectors can be operated with relative humidity not more than 95%)
- Height of room:
 - a) limited height of the installation of heat detectors
 - b) limited height to install the smoke detectors
- The impact of the environment:
 - a) air humidity
 - b) fumes
 - c) dust (in the case of use of smoke detectors incidence of powder, dust, smoke and small aerosols may cause false tripping while the flame detectors can have significantly reduced sensitivity)
 - d) temperature changes

Layout and placement of detectors

Table 1. Guidelines for the use of fire detectors in terms of the height of the assembly.

Type detector of fire	Height of room (m)					
	< 4,5-	< 6->4,5	<8->6	<11->8	<25->11	>25
	Radius of actions (m)					
Heat EN 54-5 Class 1	5	5	5	NN	NS	NS
Smoke spot EN 54-7	7,5	7,5	7,5	7,5	NN	NS
Smoke linear EN 54-12	7,5	7,5	7,5	7,5	7,5	NS

NS - unsuitable for use at a given height.
 NN - normally useless but can be used in special applications.

In rooms of below 3 m width, the distance between the detectors should not exceed:

- for smoke detectors – 15 m,
- for heat detectors – 10m

The distance between the detector and the wall must not exceed respectively 7,5 and 5 m. In no case, however, should not exceed a maximum area of surveillance. The spacing of detectors from walls may not be less than 0.5 m. In the case of corridors, channels and similar parts of buildings with a width less than 1 m smoke detectors should be put in the middle of the ceiling. If in room are substrings, beams or running under the ceiling ventilation channels at a distance of less than 15 cm from the ceiling the distance from the detectors to these elements should not be less than 0.5 m. Horizontal and vertical distance between detectors and devices or materials being stored can not be less than 0.5 m.

Do not place the detector in a stream of air or supply air conditioning installations or local exhaust ventilation. Minimum distance of the detectors from the intake grilles is 1.5 m.

Perforated ceilings through which air is supplied to the premise should be covered within a radius of 0.5 around the detector.

3 DESIGN OF DSO SYSTEMS

The basic function of sonic alarm systems is to give comprehensible information about the means which have been entered into in a specific area, a number of specific areas or throughout the all facility in order to protect the lives and health at risk [5].

The system has to provide the following functional modes:

- The delegation of the alarm message "live" to selected regions,
- Transfer recorded before an alarm message to the selected regions both started manually or automatically via the SSP system (for example evacuation messages, alarm and encrypted messages, warning for the operators),
- The system will be able to broadcast within 10 seconds after you turn on the primary or backup power source,
- Within 3 seconds from the occurrence of risk system will be able to broadcast a warning signal transmitted automatically or by the operator,
- In the event of an alarm system becomes unable to perform the functions not concernet with a warning about the danger,
- Damage of a single amplifier or circuit should not cause a total loss of coverage of activities of speaker action because the system provides a refund of speaker lines.

3.1 PRIORITIES

To each event should be assigned the appropriate priority level.
The main priority levels are:

- a) evacuation - potentially life-threatening situation requiring immediate evacuation;
- b) alarm - the situation of the direct proximity of danger requiring warning during evacuation;
- c) no threats - operating messages (system check).

With message-section is necessary to establish an order of priority based on:

- a) actions programmed automatically;
- b) expected risk at a busy system which may require the manual control of programed action.

During the manual intervention a facility to bypass programmed automatic features a manual control should allow for:

- a) start or stop the saved before alarm messages
- b) to carry out the selection of previously saved alarm messages;
- c) enables or disables the selected zones of speaker systems,
- d) the messages broadcast in live by the emergency microphone.

3.2 A TECHNICAL REQUIREMENTS POSED TO SOUND WARNING SYSTEMS

- Speech intelligibility throughout the area of operation of the DSO. Intelligibility of speech should be greater than 0.7 on a scale of intelligibility CIS.
- Automatic status indication - indication should be obtained automatically in the control panel and show the ready of the system and the power and the state of damage.
- While in the system we have many speaker zones, it should provide adequate signaling what message is given in the zone;
- Checking whether a warning signal in accordance with BS EN 60849:2001 meets the requirements throughout the coverage area contained in the table

Minimum beep level	General room	65 dBA
	Sleeping rooms near the head of the sleeping person	75 dBA
The maximum level of beep	General room	120 dBA
	Sleeping rooms	85 dBA
Difference between beep level and noise level	Minimum	6 dBA
	Maximum	20 dBA

4 INTEGRATION OF THE FIRE SYSTEMS IN OBJECTS

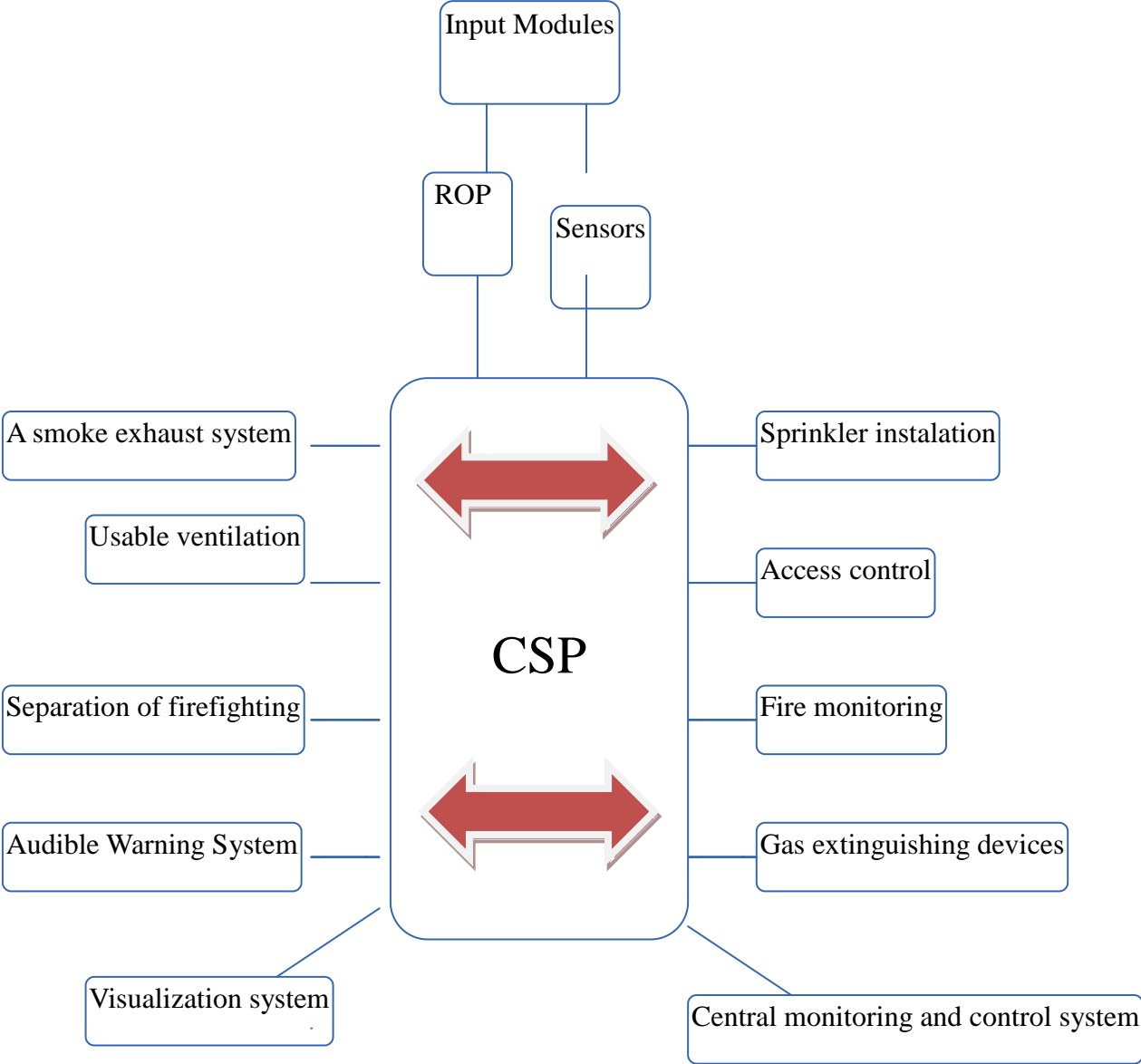
Protection of the objects of large volume from the point of view of systems of fire protection requires the use virtually all available fire equipment specified in

Regulation of the Minister of Internal Affairs and Administration (OJ no. 109 item 719) of 2010 on fire protection of buildings and other construction objects. According to the decree as the device of firefighting means a permanently or semi-actuated devices run manually or automatically aimed at combating and detecting fire and limit its effects.

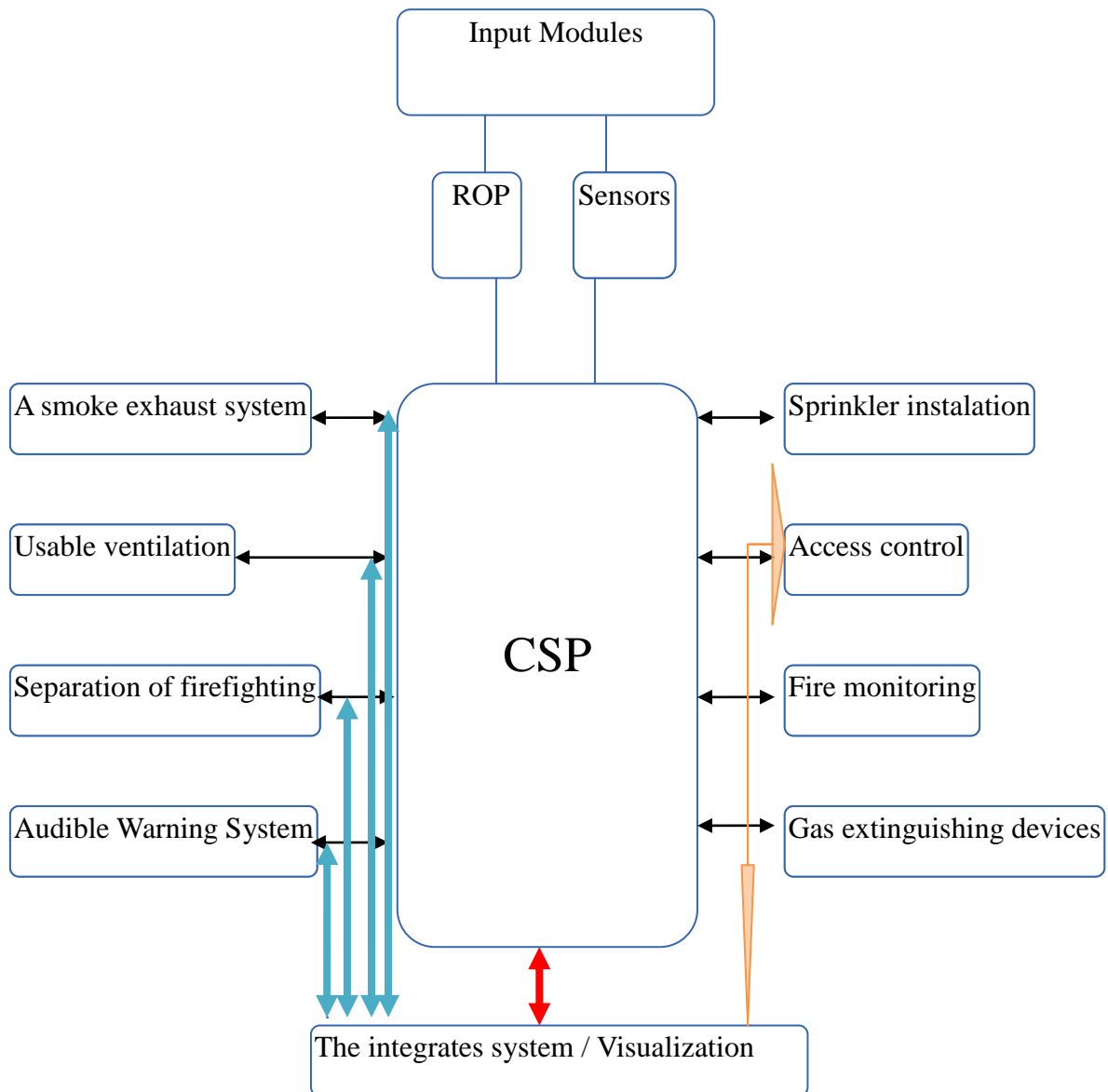
In order to ensure the effectiveness of actions of subsequent test systems in carrying out their functions all the art security system must have a joint program of the security of object so-called fire scenario on whose based the controlled boards are arised.

There are two types of implementation of control procedures security of facility through the use of [6]:

a) Fire alarm control which initiates and implements the control procedures



Schematic diagram of a conventional system of control security of facility
 The initiator of an integrates system is CSP while it carries out by the integrates system.



Schematic diagram of integrates system to control the fire protection equipments

The integrates system aims to create a network of liaisons procedures in which you one element of the system will result in tripping elements in other systems. An example of such integration may be the element of system of signaling fire - Manual Call Point (ROP). When you run this element will following fast verification of the address and location in the facility and then automatically on the screen is exposed image from the camera in which a field of view you find the ROP of the given address.

4.1 CONSTRUCTION OF INTEGRATES SYSTEM

The integrates system may consist of:

- fire alarm control CSP;
- DSO audible warning system
- KD access control;
- Alarm system of burglary and robbery SSWiN
- supervise television CCTV;
- emergency lighting control system;
- sprinkler system
- smoke exhaust control system

Connection to the integrating system can be implemented by:

- relay outputs of integrating system connected to the inputs of supervised controlled devices and integrated systems;
- relay outputs of devices and integrated systems connected to supervised exits of integrates system;
- digital links between integrating system and integrating appliances.
-

Please note that triggering commands issued by an authorized operator has a higher priority than commands generated by integrates system [7]

In order to ensure the correct operation of the elements of integrates system it should be created the fire scenario for the protected object with the table of logic control.

The scope of informations to be included in controlled table is as follows:

- control of voice alarm system,
- fire alarm system control,
- control of sprinkler installation,
- smoke system control,
- control the automatic locked of fire partitions,
- ontological vantilation control,
- control access control system.
-

In the event of fire, fire alarm installation performs the corresponding algorithms in accordance with the concept of fire safety of facility.

The implementation of the above mentioned purposes provide between other the following elements of the fire protection:

- Installation of fire alarm - fire detection, control and monitoring of other devices.
- Constantly Fighting Interiors - Rapid extinguishing action.
- Audible Warning System - a quick alert people to evacuate.
- The smoke systems are responsible for lead off heat and smoke – systems of

mechanical ventilation and smoke exhaust by channel or streaming process, installations gravitational smoke exhaust of staircases, controlled holes supply fresh air.

- Controlled elements of fire partitions separating a leak-fire zones in the event of a fire - the firefighting doors and gates, aqua stop valves in the canals of ventilation systems.

4.2 CONFIGURATIONS OF FIRE ALARM SYSTEMS

Use the correct configuration of fire alarm system in a very significant manner impact on security against the effects of a failure in the system.

It is often so that the protected object is consists of several adjacent smaller buildings. The system then must allow the joining of the headquarters many zones in the form of a loop with a capacity up to 128 addressable elements in each. If such a system is deposited with a one fire panel then it is often disappoints. It is often associated with distances between buildings and acting on their voltage drops caused by the loop resistance.

Long lines of surveillance are exposed to various kinds of electromagnetic interference for whereby panels must possess adequate safeguards and filters to work outside of the building. This applies especially resistance to interference from atmospheric discharges which may affect on the lines directly or indirectly in the form of induced surge[8].

4.3 CONFIGURATION OF CONTROL SYSTEM

1. Non-dedicated control systems - characteristics:

- Implementation of the simplest two-state controls the on-off type, derive information about the status of the device;
- Applied in small places in whose are not required to run complex devices
- No operating status of the whole system of protection;
- No automatic periodic actuation of devices to designet them to test;
- No possibilities to restore the devices to normal operation;
- If the alarm condition no extra possibilities of administration of additional informations that could give help in identifying the level of threat by operator.

2. Dedicated control systems – characteristics:

- Used in large buildings in whose due to the large number of security systems demanding of varying service start of varying devices is complicated;
- No connection to the priming device (detectors, manual call points) does not limit the operation of the system and perform the required procedures;
- Correctly matched drivers allow you to perform any sequences of control;
- Possibility of simultaneous coupling to the control panel several devices such as a few shafts of vents of smoke ventilation.

5 SUMMARY

In the above material the author presented some elements of the security systems which, according to assumptions may have an effect on the speed, effectiveness and efficiency of carried by the hotel staff rescue actions. Another issue is the cost of installation and failure of the system resulting from improper maintenance, mechanical defects of device, third-person action, etc. Imagine for example an activation of sound system or DSO in the time of night in the hotel building as a result of the tamper operation (malignant) of hotel guests for so-called fun or a joke and hence the necessity of evacuation of the whole object.

Without a doubt systems can improve the state of security, support the decision of personnel.

However, be aware that any studies concerning the speed of evacuation, the degree of potential difficulties may only hypothetical assumptions unsupported by specific studies in the case of an imminent danger. Conducted by the author talks with employees, customers of hotels indicate that society often does not understand the information provided by the devices or does not respond to them in a proper way. Even the most modern technologies and the introduction of more costly alarm systems of fires without developing high quality of training modules will not bring the expected results. Specialists in the field of fire protection confirmed that extremely important is to train employees of hotel who in the first seconds of events collide with the threat [9]. They take part of the tasks associated with the evacuation of the object, attempts to elimination of danger. It is therefore necessary to develop and introduce prevention in the field of fire protection so that the receptionists, the hotel staff and security personnel of facility have learned to not only cooperation with the emergency services in providing information about the number of people on the floors and in the rooms but also cooperation among themselves on different receiver divisions of competence and perform actions. At the same time staff of the hotel should be trained at an angle of activity that must be performed in the first place in the event of fire. The most important part of training in the fire protection with a big emphasis should therefore be to conduct a trial evacuation. This type of regular exercises gives the opportunity to verify in practice the skills of individual employees, make possible to check the correctness of the proceedings of the hotel staff cooperating with the emergency services and gives a picture of the operation of systems, their use and perception by the staff and potential persons in the face of threat.

REFERENCES

- [1] Ordinance of the Minister of Internal Affairs and Administration of 7 June 2010 regarding the fire protection of buildings, other construction objects and lands (Journal of Laws of 2010, No.109, poz.793)
- [2] Fire Protection 2/2010 ISSN 1644-6038 index 10906
- [3] Protection of assets and information 6/2011 (97) nr.ident. 381756

- [4] Ordinance of the Minister of Infrastructure dated 12 April 2002 on the terms of technical requirements for buildings and their situate(Journal of Laws of2002, No. 75 poz.690)
- [5] www.almamer.pl / ... / *TiR technological equipment of businesses*
- [6] Z.T. Nowicki, safe hotel "Hotelier" No. 6.7 of the 1997
- [7] www.almamer.pl/.../TiR_Hotelarstwo_dr%20Piotr%20Dominik.pdf
- [8] www.horeca.pl/vademecum_branzy/zarzadzanie/art27.html
- [9] <http://piomed.pl/2009/10/22/psychologiczne-skutki-sytuacji-kryzysowych/>

Článok recenzovali dvaja nezávislí recenzenti.

