SECURITY DIMENSIONS
INTERNATIONAL & NATIONAL STUDIES
NO. 11; 2014 (43-51)

THE LOCAL THREATS SPECIFICATION IN THE CONTEXT OF ENVIRONMENT FACTORS HAVING AN INFLUENCE ON A RESCUE WORKER DURING RESCUE ACTIONS

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ABSTRACT

The main task of a professional firefighter's relief activities is interference with all sorts of events requiring intervention: fires, construction and chemical disasters, accidents and other situations which carry a risk for the health and life of humans. The basic duties of a firefighter are organizing, directing and conducting direct rescue efforts in order to protect the life, health and property, as well as liquidation the source of fire, natural disaster or other local danger (technical, chemical and environmental disaster, road traffic accidents, airline, etc.).

In the course of professional activities firefighters are exposed to all the possible risk factors from the environment resulting from the real potential occurrence of the event requiring rescue interventions (industry, infrastructure, traffic, transport). Moreover, they often do not realize the actual risk they are exposed to especially in situations that do not require putting out fire (traffic accidents, natural and industrial disasters). These emergency situations are not easy to predict or control, what means that firefighters put their lives on the line every time they attempt to do so. As a result they work under extremely stressful situations, day and night, including the responsibility for remaining calm and carrying out all duties with the recognition of the threat to life and property.

The special characteristics of service, including work shift system, continuous risk of danger and dealing with a lot of personal loss can make it an emotionally difficult job and may become a potential root of stress and personal problems. However, for some people this kind of work can be very rewarding, others may have a hard time dealing with the physical and emotional challenges that the occupation brings. That's why it is very important to examine and limit the influence of the hazardous environment factors on firefighters work.

ARTICLE INFO

Article history
Received: 04.05.2014 Accepted 30.06.2014
Keywords
separate ownership, premises, property, division

INTRODUCTION

Firefighters respond to emergency situations in dynamically changing conditions generally regarded as harmful. These harmful conditions lead to the exposure of various hazard factors that play a large role in firefighting duties. Some working conditions coming from firefighting operating environment include:

- collapsing constructions,
- falling ruble or construction elements,
- toxic gases,
- dust,
- biological factors,
- oxygen-poor atmosphere.

The hazard of work is escalated by the fact that firefighters often do not realize the

danger in many situations. It happens especially in emergency situations that are not fire e.g. motor vehicle accidents, industrial disasters, earthquakes, floods, ecological calamities. Firefighters within the service perform activities which include strenuous physical exercise (e.g. carrying and removing heavy things in high environmental temperature with protective gear and other equipment). It is one of potential reasons that causes prostration, overload injuries and cardiovascular diseases.

A huge influence on the extension of the participation of hazards, caused by firefighting operating environment factors, has lasting many hours, continuous risk of danger.

The characteristics of service i.e. work shift system, has also a contribution in this problem. It is a potential root of stress and personal problems. As a result, tragic events associated with rescue operations can trigger the traumatic stress disorder. The circumstances indicated above determine examinations and analyses for the counteraction and limiting the influence of the environment factors on firefighters work.

LOCAL THREATS

The local threat is defined as the event resulting from the development of civilization and natural laws of nature, not fire or natural disaster, posing a threat to life, health, property or the environment, and to prevent or remove effects that do not require the use of emergency measures [1].

THE CLASSIFICATION OF LOCAL THREATS

The local threats are classified mainly according to the measure generated by such hazards as:

1. construction risk - destabilization, destruction or damage of a building or an existing building structure, its part or individual items,
2. air, road, railway and water transport threats - destruction, damage, collision of the means of transport in the course of their movement or stopover, taking place on different communication routes: air (including airports), road, rail and water, the effects of which pose a threat to life and health or the environment, or property,
3. chemical hazard – a release of dangerous chemical substances into the environment, posing a threat to life and health or the environment, or property,
4. environmental risk – causing, as a result of human activity or nature forces, the contamination of the environment that poses a threat to life of animals and endangers their natural habitat,
5. radiological threat – related to the release of dangerous biological substances posing a threat to life and health or the environment, or property,
6. biological risk – connected with the release of dangerous life-threatening radioactive substances into the environment, damaging natural habitat,
7. infrastructural threats – damage or destruction of different kinds of devices or installation systems especially gas piping, water-supply systems, heat-pipe systems, power girds, telephone and network or lifting systems, that makes them unable to be used in a normal way and poses a threat to people,

Local threats generated by the forces of nature or natural disasters:

1. strong winds,
2. water rises – related to freshets, foods or water ice congestions,
3. snowfall,

4. rainfall,
5. water areas – related to events on water tanks that are not associated with freshets.

THE TYPES OF ACTIVITIES

In case of responding to local hazard events, fire protection units operate [1] with regard to the classification based on the criterion of carried out rescue operations:

1. release of people,
2. release of animals,
3. evacuation of people,
4. evacuation of animals,
5. evacuation of property,
6. transport victims out of the danger zone,
7. secure the place of the event,
8. secure the mass events,
9. cutting, bending of constructions, devices,
10. demolition of buildings,
11. raising of construction elements, machines, devices,
12. moving of structure elements, machinery parts,
13. rubble clearancing, digging out,
14. making excavations,
15. opening of rooms,
16. smoke exhaust, ventilation,
17. recognition of chemical substances,
18. identification of danger areas,
19. neutralization, sorption of chemical substances and others,
20. sealing tanks, cisterns, pipelines,
21. collecting, removing and washing chemical substances and others,
22. reducing spillages, leakages,
23. pumping petroleum and chemical substances,
24. pumping out water and other liquids from buildings,
25. production of protection belts, making firebreaks,
26. cutting, removing trees and other natural objects,
27. transport of water over long distances at fires,
28. water supplies at fires,
29. providing people with water,
30. providing people with material aid,
31. restoring and/or maintaining the patency of respiratory tract
32. executing external heart massage,
33. stemming external hemorrhages and dressing wounds,
34. oxygen therapy with 100% oxygen and/or artificial respiration,
35. fixing fractures and fracture suspicion,
36. cooling Burns,
37. protection against loss of heat,
38. anti -traumatic stress disorder actions,
39. care of the injured,
40. transport of aggressively and strange behaving insects or animals,
41. searching for missing persons.

The classification according to the criterion of activities with the use of specialized equipment for the relief operations for units of action are referred to as:

1. the cabin fire-fighting equipment,
2. fascinating equipment of cabin,
3. mud pumps,
4. typical fire pumps,
5. pumps to other media
6. oil separators,
7. skimmers,
8. firewalls,
9. chemical protective clothing,
10. fireproof protective clothing,
11. measuring devices,
12. respiratory protective equipment,
13. rescue kits, rescue hydraulic sets,
14. pneumatic assemblies, rescue sets,
15. rescue evacuation-equipment,
16. portable ladders,
17. special cars with mechanical ladders and hydraulic platform,
18. chain saw,
19. circular saw machines,
20. flame cutting units,

21. electric power generators,
22. lighting equipment,
23. water diving rescue kits,
24. high-altitude rescue,
25. medical emergency.

OVERVIEW OF EVENTS IN THE YEARS 2000-2013

Figures 1 to 4. show the list of rescue operations of the State Fire Service. Summarizes the operation of the rescue and fire local threats by a unit of administrative division and broken down by object code.

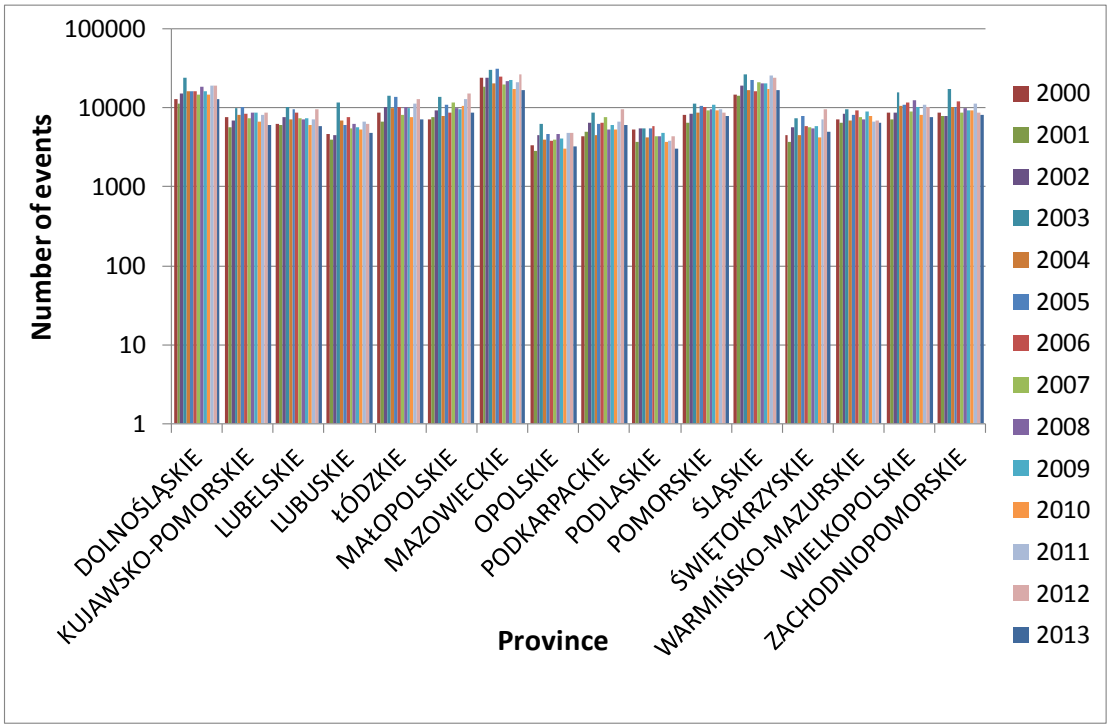

Fig. 1. Actions for rescue and fire on a unit of Administrative Division [2]

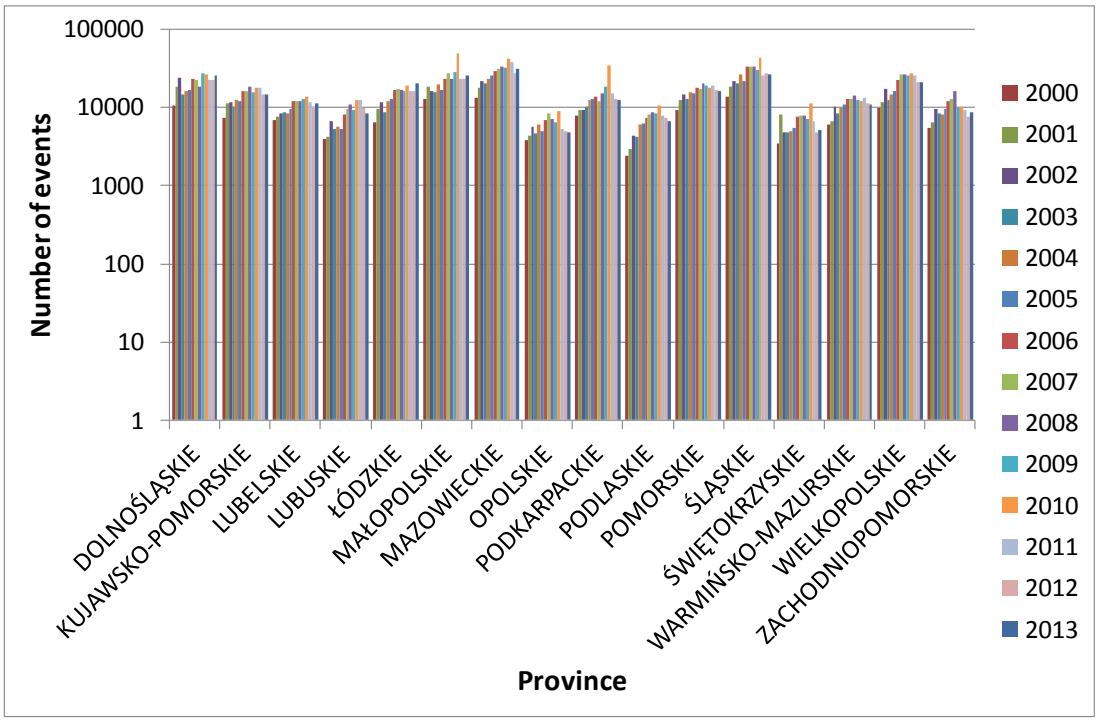

Fig. 2. Rescue Operations by local threats by a unit of Administrative Division [2]

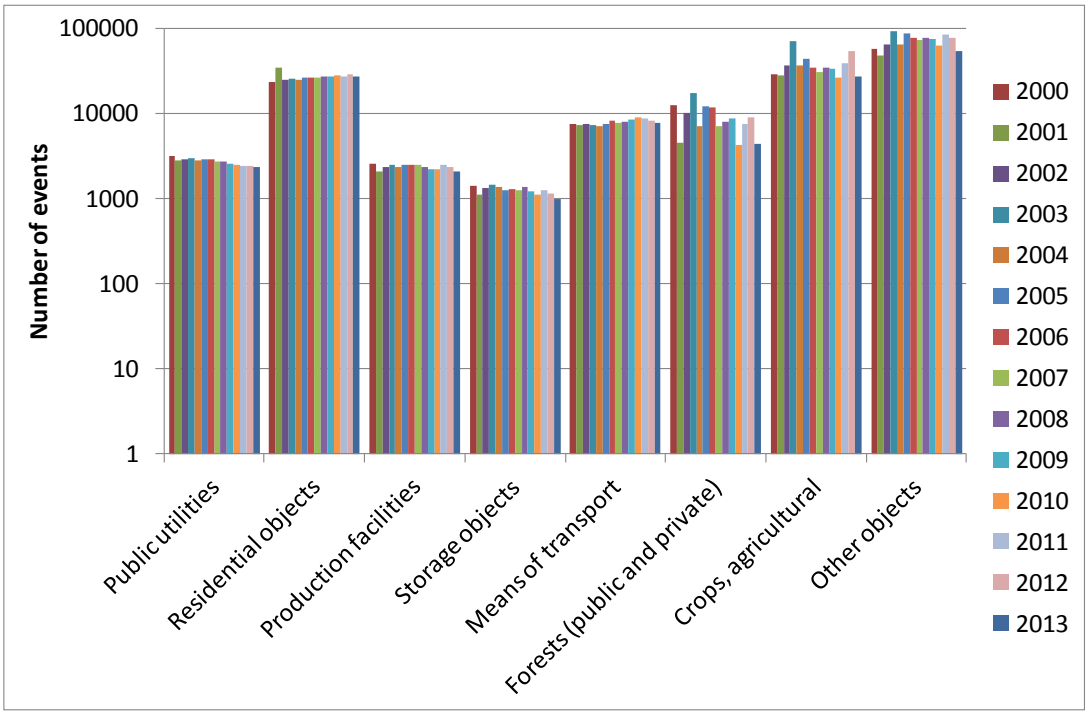

Fig. 3. The rescue fire broken down by object code [2]

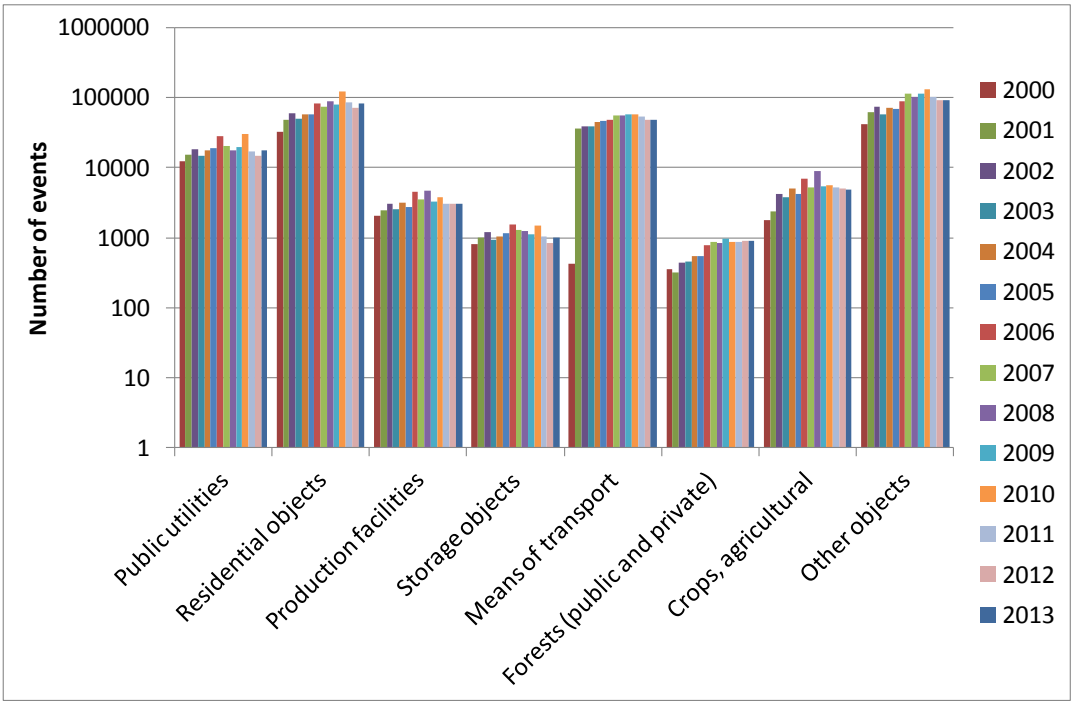

Fig. 4. Rescue Operations for local threats for object code [2]

The important point is visible progression of rescue firefighters rescue workers in so-called local events threats. This kind of trend determines the need for development a much more comprehensive development personal protective equipment. In particular taking into account during all stages of constructing a broad range of requirements for effective protection for every almost factors. Formal considerations requiring the need for universal personal protection affect their resistance. In figures 5. and 6. shows the use of the different types of sets of protective clothing. The growing trend of exposed on the side of the special clothing (PN-EN 469) [3] indicates the need to modify and systematic development of this group of individual measures. Chemical and fireproof clothes used in cases, especially extreme events (high chemical activity substance and in the second case, the high emission of thermal energy).

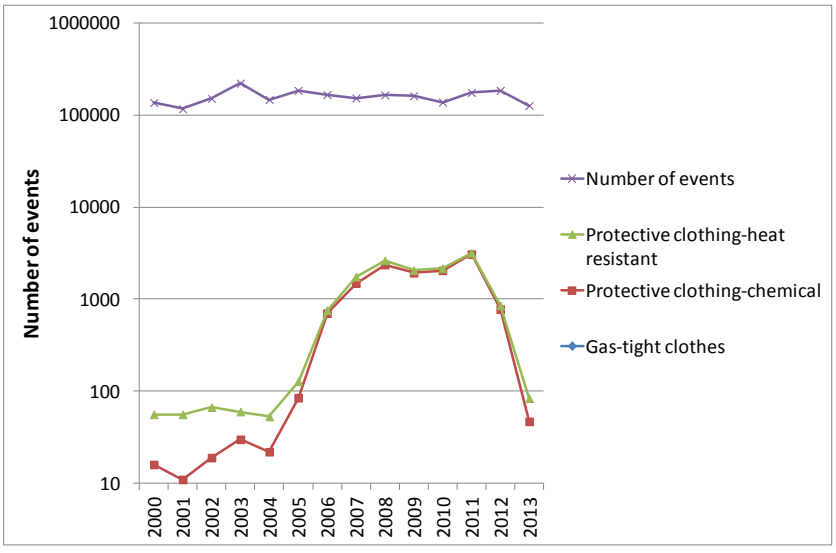

Fig. 5. Rescue Operations at the fire, used equipment (protective clothing) [2]

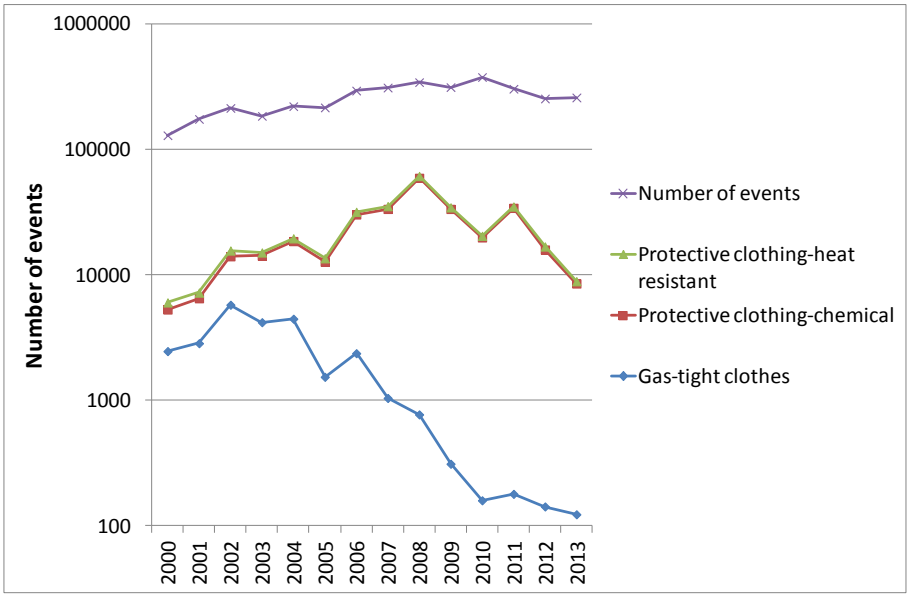

Fig. 6. Rescue Operations by local risks, used equipment (protective clothing) [2]

Figure 7. Shows the distribution of the events are eligible as local threats with regard to the specific characteristics of the space environment.

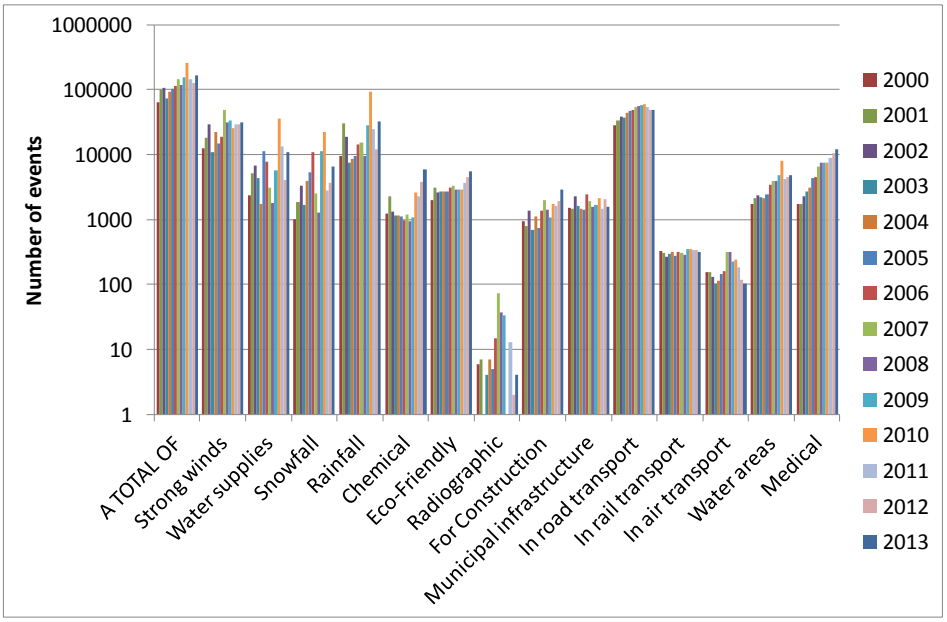

Fig. 7. Statistics relating to local threats in the years 2000-2013 [2]

ENVIRONMENTAL FACTORS IMPORTANT TO DISASTER-RISK-GENERATING SYSTEMS OPERATIONS

6.1. Factors determining the potential risks

- low oxygen concentration in the air-the possibility of strangulation,
- hot surfaces, air, gases,-the possibility of burns to the skin and respiratory tract,
- glass, metal and other sharp objects-the possibility of injuries as a result of the stings, cuts, punctures,
- falling construction elements (parts of ceilings, walls), debris-the possibility of injuries as a result of the impact, being crushed,
- immovable, protruding elements especially when poor visibility due to smoke-related injuries as a result of the impact,
- the possibility of injuries in traffic accidents while driving to disaster-action fire,
- electric current - electric shock for defectively functioning of electrical equipment,
- gas displacement from damaged gas installations the possibility of burns and injuries due to fire and explosion,
- chemical substances arising from the fire-the possibility of acute poisoning of carbon monoxide, hydrogen cyanide, oxides of nitrogen, sulphur dioxide, phosgene, hydrogen chloride, ammonia, formaldehyde, acrolein, ethanal, benzaldehyd, methyl ethyl ketone, phenol and its derivatives, acrylonitrile, carbon dioxide, hydrocarbons, aromatic-benzene, toluene, ethylbenzene, xylene, trimetylobenzen, tetrametylobenzen, styrene, kumen, dietylobenzeny, aliphatic hydrocarbons (ethane, octane, nonan, metylononan, tetradekan), halogenated (dichloroethane, dichloromethane, chloroform, chloroetan, tetrachloroethylene, dichlorofluorometan),
- slippery, uneven decking and ladders, stairs, collapsing roofs, the possibility of injuries as a result of tripping, slipping and falling.

6.2. Physical agents

- excessive noise during fire-fighting action-the possibility of hearing damage,
- high temperature prevailing during the fire-the possibility of thermal discomfort, overheating of the body and/or burns,
- low environment temperature while conducting rescue operations during the winter months, especially during the action of water rescue-the possibility of frostbite, hypothermia, bronchitis and pneumonia,
- mechanical impact on the human body-the possibility of mechanical injury.

6.3. Chemical agents and dust

- oxygen deficiency and the presence of carbon monoxide and other combustion products in the air breathed by a firefighter which may cause hypoxia and death due to asphyxiation,
- various chemical compounds that a firefighter can be exposed during chemical emergencies – acute poisonings, burns, inflammations of the skin,
- volatile gases from leaking tanks and technological installations covered by fire-the possibility of acute poisoning,
- forming (foaming) foam agents, and other materials (e. g.) disinfecting-the possibility of allergic cutaneous changes,
- dust characteristic for each branch of the economy.

6.4. Biological agents

- a biological factor (bacteria, micro-organisms) giving infectious disease

which source can be saved people or animals,
- blood and body fluids of victims and victims of events.

6.5. Psychosocial and ergonomic factors connected with the organisation of work

- responsibility for the safety and health of rescued people and associates,
- awareness of one's own risk life and health as well as events, which a firefighter the witnesses,
- the possibility of posttraumatic stress disorder,
- work performed in a duty mode (night shift) - the possibility of mental stress, biological rhythm disturbances, reduced potential for physical work,
- excessive exercise (lifting heavy things, including the victims, material goods, extinguishing equipment - as well as carrying the heavy protective clothing with the air respiratory protection equipment) - the possibility of pain arising from the overloading of the musculoskeletal system and the overall fatigue.

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