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HAZARDS RELATED TO ACTIVITIES OF FIRE-RESCUE DEPARTMENT MEMBERS DURING THE COVID-19 PANDEMIC

Summary. Today, being a member of the Fire-Rescue Department (FRD) is challenging as it is a risky and professionally demanding job, which often requires an individual schedule both in terms of physical condition and psychological knowledge as well as safety and health protection at work. Apart from the standard services provided by the FRD and the integrated rescue system, their members also participated in hundreds of interventions during emergencies and crisis situations to mitigate the impacts of the pandemic on society.

Keywords: pandemic, Fire-Rescue Department member, hazard, safety

1. INTRODUCTION

COVID-19, an emerging infectious disease caused by the SARS-CoV-2 virus, was first reported in Wuhan, Hubei Province, China, in December 2019 [8-16]. The Fire-Rescue Department (FRD) is responsible for protecting against fires, and their extermination, carrying out rescue activities related to emergency incidents, avoiding unwanted accidents, and

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providing different types of assistance. Apart from these tasks, starting from March 2020, the FRD had to fulfil tasks related to the COVID-19 pandemic. All rescue units were called upon to respond to the emergency in the country. During the first wave of the pandemic, members of the FRD participated in the direct operation of 12 state quarantine facilities, the testing of 60 quarantine facilities, and a support call centre to answer repatriation questions in the town of Gabčíkovo. They also built and provided maintenance and service of 44 emergency tents and 18 administrative containers at border crossings, on the grounds of hospitals, regional health authorities and quarantined communities.

The priority of the Ministry of Interior is to provide good conditions and facilities for all units of government departments to function effectively, including material and technical equipment of the FRD with the necessary technology and personal protective equipment for the department members, which was especially important during the disease pandemic [7].

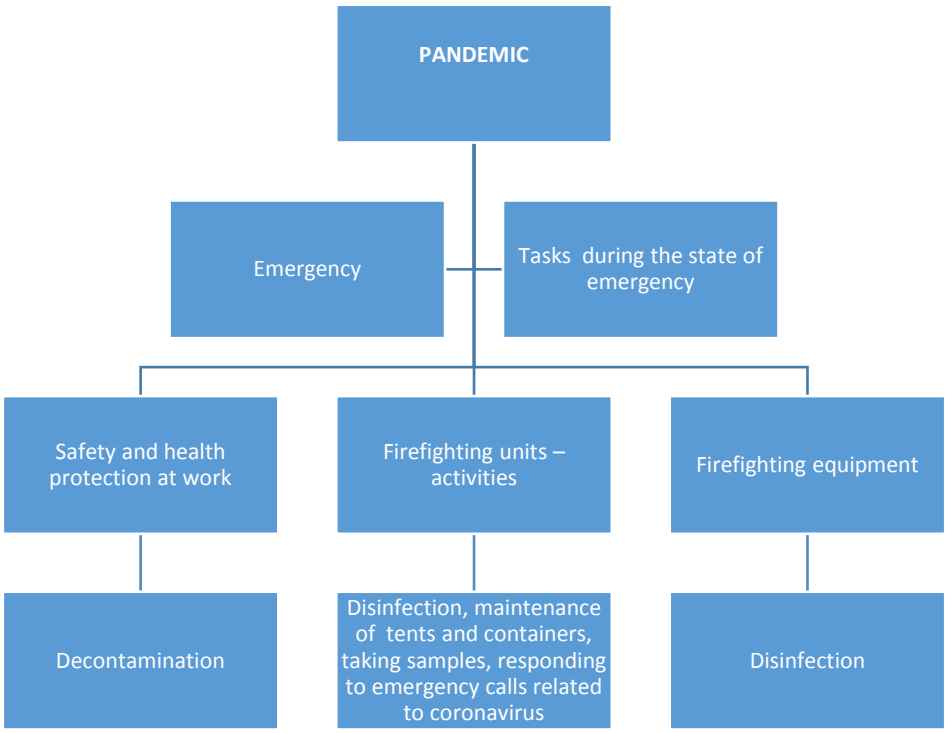

Fig. 1. Basic terms related to activities during the coronavirus pandemic

1.1. Activities performed by firefighters during the pandemic

The activities performed by HAZZ (Fire and Rescue Service of the Slovak Republic) members regarding the COVID-19 disease are risky and quite psychologically demanding (Figure 1). The Fire-Rescue Department participated in tasks listed in Figure 2.

Fig. 2. Tasks of the Fire-Rescue Department

Tab. 1

Activities of the FRD over three years spanning before and during the pandemic

	2019	**2020**	**2021**
Total number of emergency calls	31 993	34 913	30 795
Number of fires	9 602	8 704	8 107
Number of technical interventions	11 330	13 911	11 439
Number of emergency calls to road accidents	8 185	7 235	6 951
Number of emergency calls to ecological events	899	3 149	2 298
Number of training	1 330	1 217	1 400
Number of false alarms	647	652	600
Number of interventions related to the pandemic	**0**	**6 893**	**4 585**
Number of people rescued in rescue events	14 269	16 540	13 481
Value of rescued properties	170 681 323 Eur	233 930 939 Eur	210 612 911 Eur
Fire protection inspections	8 283	5 201	4 701
Faults found during fire protection inspections	41 638	25 171	16 164
Number of emergency calls and activities of the volunteer Fire Department	4 029	5 393	6 805

Table 1 compares the year 2019, before the COVID-19 pandemic, to the years 2020 and 2021, which witnessed the COVID-19 pandemic. These two years, 2020 and 2021, saw an increase in the total number of emergency calls. The number of interventions by the on-call members of communal fire brigades that assisted the FRD increased several-fold. In 2020, members of the FRD saved property worth 233 930 939 €, which is 63 249 616 € more than in the year 2019. The number of inspections of fire protection systems in 2021 decreased in comparison with the year 2019 by 3 582 inspections.

1.2. Activities of firefighters' units related to the coronavirus pandemic

- **Operation of state quarantine facilities**

During the first wave, the FRD provided the operation of 12 state quarantine facilities. Thirty firefighting commanders operated in these facilities. The first quarantine facility for COVID-19 was opened in Gabčíkovo and operated continuously for 89 days; the last returnees left this quarantine facility on 12 June 2020. Over a period of three months, 3 678 returnees stayed in Gabčíkovo, out of which 58 tested positive for coronavirus. Firefighters disinfected premises and furniture, supervised the facility and conducted regular testing of the returnees.

- **Took samples for COVID-19 testing**

Firefighting units also participated in taking samples in more than 60 quarantine facilities and 12 state facilities (Figure 3). From March to August 2020, more than 25 000 samples were taken by members of the FRD all over the Slovak Republic, with the largest number of 11 308 samples taken in May.

Firefighting units carried out long-term regular testing of employees of the Ministry of Interior of Slovak Republic, members of the Fire-Rescue Department, the Police Force, and the Mountain Rescue Service.

Furthermore, they were involved in the mass testing at Orava in October 2020, specifically in the districts of Námestovo, Tvrdošín and Dolný Kubín. The Fire-Rescue Department of the Slovak Republic sent 50 testing teams and 50 firefighters enrolled in different positions from all regions of Slovakia. During the mass testing, the FRD provided 19 firefighting vehicles to the Slovak Armed Forces, which travelled 14 884 kilometres [3].

Fig. 3. Taking samples for COVID-19 testing
in the state quarantine facility in Gabčíkovo [3]

- **Transportation of samples for COVID-19 testing**

At the request of the integrated rescue system, firefighting units transported biological samples to the Regional Health Authority for subsequent analysis for the COVID-19 disease [6].

- **Operation of call centre for returnees**

The centre for returnees opened in Gabčíkovo was the only facility of its type in Slovakia that offered psychological help, emergency assistance and a general question service for returnees via information lines operated by well-trained firefighters. The average phone call lasted 3–20 minutes, firefighters were available daily from 9:00–20:00 hours, and each phone call was handled courteously to help as much as possible [1].

- **Setting up triage tents and emergency containers**

Another activity carried out by the firefighting units was the setting up of 44 triage tents and 18 administrative containers. Triage tents were set up on hospital grounds for more effective sorting of patients right on the spot by antigen testing, based on the urgency of their need for care as well as checking their personal or travel history. These tents were also set up on the grounds of the regional Public Health Administrations, in quarantine communities, next to high-capacity testing facilities and at border crossing points of the Slovak Republic or before boarding a bus to the state quarantine.

- Setting up and putting into operation of such a tent takes 2 hours.
- Administrative containers were first installed and put into full operation by members of the Fire-Rescue Department at border crossing points for the needs of the security forces (Figure 4) [6].

Fig. 4. Installation of an administrative container at the border crossing point of Jarovce - Kittsee [1]

- **Operation of mobile antigen testing facilities**

Firefighters-operated testing facilities offered access to antigen screening of the population. Testing was performed by trained personnel of the Fire-Rescue Department who had experience with testing. Testing facilities, in most cases, were set up on the grounds of fire stations of the regional headquarters of the FRD [6].

- **Setting up drive-through testing facilities on the grounds of fire stations**

Drive-through testing facilities were set up temporarily on the grounds of fire stations to increase testing capacity for COVID-19. Teams of firefighters took samples directly from individuals in their cars (Figure 5). Drive-through testing facilities helped firefighters to make testing more efficient and thus help much more people [6].

- **Logistic support**

From the onset of the coronavirus pandemic, firefighters provided logistics support by creating more favourable conditions for other rescue units and medical personnel involved in the fight against it.

Fig. 5. Drive-through testing for COVID-19 on the grounds of the fire station in the town of Nitra

2. IMPORTANCE OF DECONTAMINATION DURING THE COVID-19 PANDEMIC

Decontamination is the effective removal of contaminants and reduction or elimination of the effects of hazardous materials to a determined safety level. A decontamination process is essential for the removal of contaminants such as radioactive, chemical, or biological materials from a contaminated surface and its immediate surroundings. The Fire-Rescue Department is gradually being equipped with modern technology to assist firefighters in the decontamination of more individuals and equipment. The Internal Regulations of the FRD define and regulate the decontamination procedure

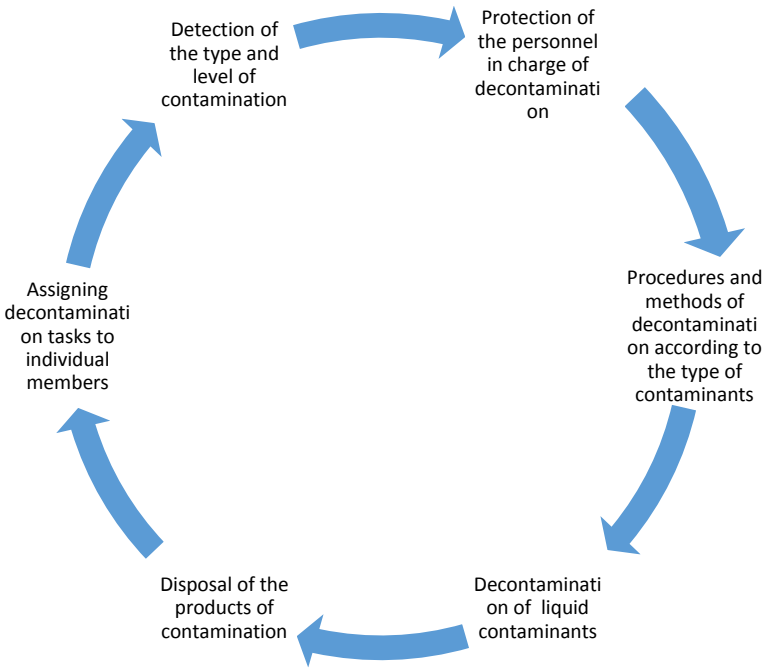

Fig. 6. Importance of decontamination during the pandemic

According to the type of contaminants, decontamination is divided into:
- decontamination (detoxication) – chemical contaminants,
- deactivation – radioactive contaminants,
- disinfection - biological contaminants [2].

According to the type of agents being removed, decontamination is divided into:
- detoxication – process of removal, neutralizing, or decomposition of toxic or other hazardous chemical substances and mixtures,
- deactivation – process of removal of radioactive contamination,
- disinfection – process of eliminating B-agents by destroying harmful microorganisms.

Methods of decontamination include dry, semi-dry and wet decontamination techniques. The general principles of decontamination are given in Figure 6.

2.1. Safety precautions in a decontamination area

The decontamination area is divided into two parts: clean and dirty [17]. The clean part is set up on the windward side. It is essential to prevent any contamination of the clean part by leakage or sprinkling of contaminated waste materials from the dirty part to the clean part. Personnel operating the decontamination area must be equipped with personal protective equipment before launching a decontamination work [1].

The following rules apply in the dirty area:
- personal protective equipment must be worn by the staff involved in work activities,
- protection of individuals present there,

- protective equipment must be used following the manufacturer's instructions to protect the body, respiratory system, hands, and eyes when preparing the decontamination mixtures,
- decontamination mixtures must be handled carefully; personal equipment must not touch contaminated objects or surfaces,
- chemical and dosimetric control of decontamination,
- regular inspection of the whole workplace and accessory equipment used for detection of contamination, and if necessary, decontaminate and constantly monitor activities, movement and behaviour of the staff and other individuals in the dirty area.

2.2. Decontamination tents and showers

An inflatable tent with a shower is used for mass decontamination in case of direct danger, emergency or outbreak of chemical hazards or other accidents where it is necessary to quickly decontaminate more individuals, both professional rescue workers and people in the affected or endangered areas.

Inside the deflated tent, showers, water dispensers and bathtubs are installed. This means that during an intervention, all it takes is to inflate the tent and connect the water supply line. The tent is smartly designed, easy and quick to set up and is ideal to use for large-scale decontamination. The tent can be divided by partitions into several areas designated for changing clothes, showering, and dressing (Figure 7).

Individual components can be easily attached to the structure using a Velcro fastener. Conveyors are used for transporting immobile people (Figure 8). In the shower area, the water distribution pipes are divided into two separate parts – one of them with a decontamination agent for decontamination and the other for rinsing with clean water [1].

Benefits:

- detachable shower equipment attached to the structure with a Velcro fastener,
- areas for undressing, showering, and dressing separated by transverse partitions,
- longitudinal partitions dividing the area into separate corridors,
- corridor with a conveyor for transporting immobile people placed in the centre.

Description:

- inflatable tent with a shower,
- bathtub and water distribution piping,
- flow device for heating with a decontamination agent mixer,
- grates used on the floor in decontamination showers and pools,
- uncovered accessible separate water tank,
- inaccessible tank for contaminated water,
- lockable containers for contaminated clothing,
- water supply - self-priming pump,
- water drainpipe - sewage pump,
- diesel heating unit,
- electric blower,
- conveyor - roller scissor track,
- lighting [1].

Fig. 7. Decontamination tent with longitudinal partition

Fig. 8. Decontamination tent with roller scissor track for immobile people

In the event of an incident that requires immediate decontamination of the staff or equipment, the speed of response to the emergency and location of the decontamination showers are decisive. (Figure 9) [2].

Fig. 9. Decontamination shower

Fig. 10. Service gloves of transparent material installed in the window

Portable decontamination showers can be deployed at locations of incidents. It takes just a few minutes to charge the compressor, and once connected to a water supply, the showers are ready for decontamination. Thanks to the partitions and the shower cabin, all the water goes into the sump, from where it can be subsequently pumped into enclosed sacks for potential liquidation. In case of contamination, it is sufficient to replace only the contaminated part. Water supply pipes can be either plastic or stainless steel. The side panels of the shower are fitted with a window with a glove box to avoid direct contact with contaminated individuals or liquid in case the assistance of another person is required while washing (Figure 10). There is no need to worry about privacy, as the material used for side panels only allows one to see the silhouette of the person inside. A decontamination shower kit comes in one practical storage bag.

2.3. Personal protective equipment for work with infectious materials

Personal protective equipment (PPE) of the members of the FRD includes the following:

Protective clothing (suit, coverall, overall) of the members of the FRD is a critical part of their personal protective equipment, especially when performing activities related to the COVID-19 pandemic.

In the first half of the year 2020, there was a shortage of disposable protective clothing; however, it later became more available and was widely used in the second half of 2020, especially when taking samples for Covid, decontamination, disinfection of premises, dealing with situations where there was suspicion of COVID-19.

Respirators have become an integral part not only during interventions of the FRD. Given that coronavirus is transmitted through the respiratory tract, the respirator is one of the basic PPE. Microfibers absorb aerosols inhaled from the air and infectious particles. Respirator type FFP2 (lower protection level) and FFP3 (higher protection level), which meet EN 149:2001 +A1 standard, are used to protect against coronavirus. In 2021, the FRD used 154 080 pieces of FFP3 respirators. However, it is important to realize that every product has its own lifespan. [8].

Protective shields and goggles

Protective face shields and goggles prevent coronavirus from entering tear ducts, nasal mucous membranes and, eventually, the lungs. These, combined with a face mask or respirator, provide full protection for members of the firefighting units when in contact with other individuals, and were mostly used for Covid testing and disinfection.

Panoramic full-face mask

Full-face masks protect the respiratory tract and eyes against hazardous chemical substances, particles and biological or radioactive hazards.

The most essential personal protective equipment for members of the testing team are:

- protective full-face mask with filter,
- respirator FFP3, for administrators FFP2,
- protective eye and face shield or protective goggles,
- disposable protective clothing,
- protective shoe covers,
- disposable rubber gloves - at least 2 pairs,
- silver adhesive tape.

3. PHYSIOLOGICAL STRESS WHEN WEARING PERSONAL PROTECTIVE EQUIPMENT WORKING IN A CONTAMINATED ENVIRONMENT

The human body has mechanisms that, to some extent, allow it to keep body temperature in thermal balance, but sometimes a person gets into a situation where the required external conditions or necessary activities exceed the capabilities of the human body and, thus, pose an increased risk. Thermal stress is an issue of concern in every field of human activity. Climatic conditions of an environment affect performance, the ability to carry out required activities, and especially health if the external conditions are not comfortable.

Factors affecting adaptation to heat (Figure 11).

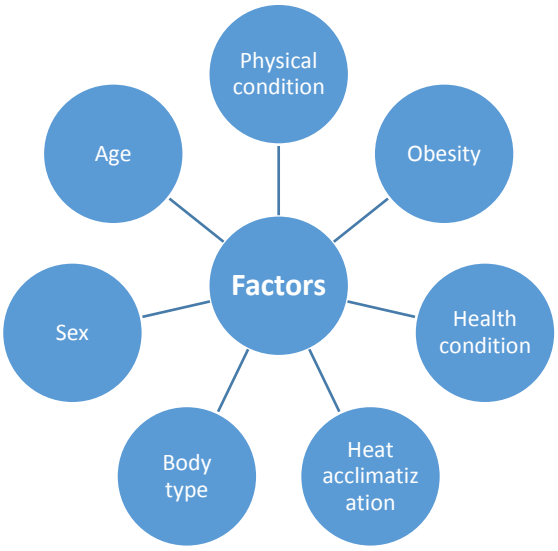

Fig. 11. Factors affecting adaptation to heat

Working in a contaminated environment wearing protective equipment is more stressful than working in common work clothes and environment. Anti-chemical protective equipment usually provides a much higher level of isolation compared to common work clothes. Activities carried out in anti-chemical protective clothing are performed under situations where it is impossible to replenish fluids or take measures against overheating, as was also in the case of activities conducted by members of the FRD under high-temperatures conditions during the pandemic.

Tab. 2

Risk categories affecting HAZZ members during the COVID-19 pandemic

Risk category	**Description of the risk category**
K1	Interventions with individuals positive for COVID-19
K2	Testing (of immobile people in state quarantine facilities and assistance at mobile testing facilities)
K3	Concentration of positively tested members in quarantine
K4	Distribution of material equipment in contaminated environments (mobile beds, tents for setting up testing facilities, tents at checking points, mask filters for railway units, vaccines, testing kits)
K5	Decontamination and disinfection of FRD members and facilities
K6	Increased psychological burden of FRD members in emergencies during the pandemic
K7	Tracking of individuals (infected people or people who were in contact with infected individuals)
K8	Checks at border crossing points during the pandemic

Tab. 3

Assessment of selected risk categories using a risk matrix

Consequence: Low / Moderate / High / Critical		Likelihood of occurrence																Risk
		Low				Moderate				High				Critical				
		Likelihood				Likelihood				Likelihood				Likelihood				
		low	moderate	high	critical	low	moderate	high	critical	low	moderate	high	critical	low	moderate	high	critical	
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
K1	2					2												4
K2	4													3				12
K3	2									3								6
K4	3									4								12
K5	4									4								16
K6	3									2								6
K7	3					2												6
K8	4									4								16

Levels of risk	Description	Risk rating
Low	Acceptable risk	1-4
Moderate	Reduced risk	6-16
High	Long-term intolerable risk	18-27
Critical	Unacceptable risk	32-64

The problem of thermal stress requires particular attention not only during interventions when dealing with real situations in an environment contaminated with contagious infections but also in practical exercises focused on this issue.

The impact of the coronavirus crisis on individuals differs depending on the job type. The two key aspects of employment include the ability to work from home and the amount of contact they make with other people at the workplace. Jobs that cannot be done from home and involve close contact with people were at the highest risk during the coronavirus crisis. The riskiest occupations are jobs in healthcare, the police, and fire protection, as well as construction, mining and the food processing industry.

4. CONCLUSION

Although the whole world is endeavouring to contain COVID-19 and several countries have successfully controlled the pandemic, this novel norovirus is still spreading rapidly in many countries. Since late May 2020, daily confirmed cases have been more than 100 000, and there has been an increasing trend worldwide, which indicates that the COVID-19 threat is still serious. Additionally, studies have reported the characteristics of SARS-CoV-2 as being different from other coronaviruses [15].

Since the beginning of the pandemic, firefighters have provided logistical support, creating more favourable conditions for the deployed members of other rescue services and medical personnel.

Risk assessment of activities involving FRD members during the COVID-19 pandemic include:
• interventions in the presence of people positive for COVID-19:
• transportation of patients and returnees,
• assistance to health rescue services,
• testing - people who could not visit a testing site, people in state quarantine facilities, assistance at mobile testing sites, with testing of employees of the Ministry of Interior,
• concentration of positively tested members in quarantine,
• specific activities like unloading aircraft with PPE,
• subsequent distribution to regions and central government administration bodies,
• distribution of other material equipment in contaminated environments.

Distribution of:
• mobile beds in hospitals,
• tents for setting up testing sites,
• tents for checking border crossing points,
• masks and filters for Railway units of the FRD.
• disinfectants.

The evaluation of the selected criteria in Table 2, elaborated in the risk matrix in Table 3, showed that the serious risks that affect HAZZ members are risks K5 and K8.

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