

# RESEARCH ON FACTORS INFLUENCING PROFESSIONAL SELECTION OF MINE RESCUERS

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**Abstract.** High variation of efforts in the rescue activity entails very difficult demands in nature or intensity, but however limited they may be in the work process, they have an impact on the whole body. The predominance of body functions that are engaged in a professional activity, imprints the characteristics of work capacity. Thus, in the work capacity of underground personnel, whose activity requires a predominant physical effort, a main role is played by the locomotor apparatus and the kinaesthetic analyser and only secondarily by the visual and optical analysers. In the activity of rescue in toxic/explosive/flammable environments, physical and neuro-psychological demands intertwine and combine in an infinite number of variants. The paper will present the work capacity of the rescuers which is determined by a large number of factors: physiological factors, psychological factors, work environment and socio-economic factors.

Key words: intervention and rescue personnel, work capacity, physical effort, physiological factors, psychological factors.

## Introduction

Considering the great variability of individual skills regarding the possibility of performing a job, work capacity should be understood as the total of individual possibilities to perform a maximum amount of work. Usually [1, 2], in the professional activity, only a part of the work capacity is consumed, embodied in results of the work process.

The total work capacity also includes an important body reserve that is used only in extreme cases [1]. Work capacity can be defined as the performance that man can achieve with maximum possibilities. Performance means the activity performed in the unit of time and it can be physical or intellectual.

Knowledge of performance variation limits [2], mean to measure them represents one of the most important problems in the rescue activity.

Knowledge of work capacity is one of the basic factors for management of rescuers' activity and [2], knowing the factors that determine work capacity, appropriate measures can

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be taken to prevent overstraining the body, by adapting the body to conditions specific to accidents, within the trainings carried out.

## **1 Physiological factors that influence work capacity**

### **1.1 Health**

For a healthy person, under the influence of daily performance [2, 3], the body's functional capacity and systems involved in work activity remain at high levels.

Acute diseases, that cause transient disturbances, may affect work capacity to its complete annihilation; instead, chronic diseases, may, in some cases, cause a lower functional level and consequently reduced work capacity [3].

### **1.2 Type of food**

When performing work that requires higher energy consumption, it is absolutely necessary to equivalently increase the food ration value [3]. Differentiated influence of nutritional principles on health and on body performance under special work conditions, such as those in which rescuers often carry out their work (high temperature [4], high humidity, strong air currents) was demonstrated. When measuring work capacity [4, 5], in addition to physical development of the individual, also the functional structure of its body intervenes.

### **1.3 Exercise and training**

Represent factors of maintenance and enhancement of work capacity. Repetition of certain actions and systematic exercise lead to adaptational changes in the body [1, 3]. Only increased effort strains can strengthen work capacity at a high level and make it a habit for the body.

Training for professional activities predominantly based on physical effort includes an increase in muscle strength, better neuro-muscular coordination, which reduces energy consumption; a more effective cardiovascular activity [4], which provides a better supply of oxygen; a more efficient thermolysis, better pulmonary ventilation allowing adequate respiration. The final result of muscle training varies by type of work performed, number of repetitions, speed, duration and activity intensity of performing apparatus [6].

Training also contributes to improved static and dynamic activity, progressively eliminating interference of muscles less interested in performing a specific motor act. It also contributes to better relaxation of antagonist muscles [2]. When training is performed at a moderate activity level, it can be interrupted for several days (7-10 days), with no decreased of work capacity. On the contrary, when training refers to an activity accompanied by heavy muscular effort [4], its disruption over 4-6 days is followed by a decrease in performance.

Duration of stable, high level work capacity is dependent on the type of work and the worker's psychological state [7]. This can be longer for moderate intensity work and shorter for work accompanied by a high tension of organic systems. Whatever type of work, sooner or later, the period of decreased work capacity occurs and it is reflected in lower productivity, because of fatigue. This state should not be considered the result of a depletion of the functional potential, but primarily as a consequence of nervous control disorders, of various physiological processes caused by work and work environment [8].

Knowledge of work capacity in different periods of life has health, economic and social importance. In social and economic terms, two issues are of particular importance:

- Knowledge of the human body burden potential in young ages;
- Knowledge of work capacity at advanced ages.

Research on physical development showed that some parameters (vital capacity, chest perimeter) [9], reach maximum development at the age of 18. By that age the heart volume keeps increasing, heart weight recording the largest increase between the ages of 17 and 18. Because of these discrepancies in the development of the circulatory system and of other systems, it is understood that by the age of 20, heart and overall human body has a hard time adapting to considerable strains.

A well-known fact is that maximum development of work capacity is reached at the age of 25 to 30 years, and men labour economics increases with age [4, 5].

Consequently, it can be concluded that exercise and training improve effort performance of cardiovascular system and increases maximum aerobic power ( $V O_2max$ ) for a given level of effort, leading to increased extraction of oxygen at muscular level, increased volume of systolic ejection and to reduced blood pressure and heart rate.

So, the well-trained rescuer has a more important cardiovascular reserve when exposed to heat.



**Fig. 1.** Training of rescuers in the confined spaces polygon

## 2 Psychological factors

Work skills are personality qualities which determine success in certain forms of activity. They include a highly developed sense of observation, the ability to accurately assess proportions of objects [2], to visually establish correlations of dimensions, especially for certain professions.

Success in any activity depends on interfering general and special skills. Psychological characteristics, such as sense of observation, memory or intelligence are applicable in a broad framework of activities [4]. In addition to these general skills, also special skills are required, such as managerial skills, pedagogical tact, etc. especially for those in leadership positions. Individual skills make sense only when related to concrete forms of employment. They depend on the nature of activities, the socio-economic importance and requirements for such activity.

Technical progress called for and developed new skills and previous ones have taken on new content [5]. Specialization and division of labour leads to specialization of human

skills. An increased work capacity can be provided by systematically cultivating people's skills.

Interest or motivations are most often - especially in the current economic situation of our country - a powerful and active stimulant for people [6, 7], to acquire new knowledge or new skills.

Interest intensity manifests as persistence in a range of activities.

Psychology has shown that interest facets are very varied in relation to social and economic aspects of work management: promotion opportunities, job safety, and opportunity to perform useful work, to perfect profession [8], to surpass oneself, to face risk and be well paid.

Preference order of motivation factors denotes a very high professional level [9], but often the essential motivation is high remuneration followed by social consciousness motivations.

Strong beliefs, well-defined conceptions of life represent the fundamental condition to overcome difficulties related to the act of will. Man, having clear principles of conduct and belief of their correctness, can quickly decide on how to act properly, not hesitating to carry out the actions they have to perform [3]. That is why the cultural and professional training, commitment to profession and financial perspective, become stimuli in the act of will, and thus promote working capacity.



**Fig. 2.** Training of rescuers in the confined spaces polygon

### **3 Work environment and social economic factors**

Work is the main factor of human body's strain [4, 6]. Appropriate work management, avoiding idle hours and stray movements, using appropriate tools and less strenuous work positions as well as judicious use of pauses, maintain work capacity at high levels.

Working conditions, expressed as the ratio of actual working hours and breaks, represents a parameter to characterize industrial work. For hard work, such a rescue activity, this ratio is known and can reach 1: 1 or higher, and for light activities the ratio is 11: 1. Exaggerations of this parameter imply either a deficiency of work management or an exaggerated strain on the body caused by work and microclimate condition in the area.

Maintaining and respectively increasing the body's functional possibilities are conditioned by the breaks during work. The combination of effort and rest should be seen as a law of maintaining and promoting work capacity. A proper break after a cycle of activities has great efficiency in restoring work capacity. For cyclic activities, strengthening acquired functional changes occurs only if the new cycle of work is performed prior to the collapse caused by previous activity. If repeating a cycle occurs when the impression left after previous effort is completely cleared, then work capacity isn't strengthened, contrarily, it weakens.

Besides breaks during work, which are integrated into productive activity and represent opportunities for workers to pause and restore the functional capacity of the body, the work activity can often be interrupted by unwanted breaks, independent from workers. These breaks can be caused by shortfalls in work management, occurrence of unexpected events or failure of machinery or equipment used during work.

Most often, they are not an occasion for rest, on the contrary, interrupting the chain of conditioned reflexes of labour, they appear as foreign pathogens accompanied by inadequate overreacting, disturbing the achieved dynamic stereotype, negatively influencing work capacity.

Work environment conditions have a particularly important influence on work capacity. Unfavourable microclimate conditions, inadequate lighting, intense noise and vibrations, elevated levels of toxic and explosive substances, dusts as well as permanent hazards of work environment threatening the safety of rescuers in action, represent limiting factors for work capacity.

The presence of these pollutants in the work environment, wearing protective breathing equipment as well as stress causes overloading of physiological functions leading to a competition of functional adaptation requests during labour and thus diminishing work capacity.

Socio-cultural conditions, professional and cultural levels have a decisive action on labour productivity, maintenance and advancement of work capacity. By carrying out work in an organized manner, at well-established intervals of time, outside office hours people boast energy potential and significant leisure time. The way one uses this time has decisive influence on work capacity. A study carried out by Vaida and Pafnate shows that the level of professional training and the use of free time outside working hours have a considerable influence on work capacity.

The potential work capacity is conditioned by its reserves and by certain psychological moments, among which the factor of will and the disposition to work, which have a predominant role. These factors depend on the permanent state of the body, determined in general by the central nervous system, the nervous transmission organs, hormones, and the level of the social consciousness of the person. The willingness to work varies in conditions of a feeling of full development of physical and intellectual forces, pathological conditions are usually accompanied by a decrease in the willingness to work.

The feeling of psychological-physical fullness largely depends on a number of external factors to which inner life relationships are added. Thus, professional, moral or material success leads to the increase of the availability of work capacity. Individual sensitivity to such influences varies from person to person and it is difficult to assess.

The study of professional pathology is of highest importance in assessing working conditions. Knowledge of professional pathology provides a solid foundation in establishing effective measures of prevention and work force recruitment, especially for mine rescuers whose activities are carried out in extremely difficult conditions and requires a lot of physical and mental effort.



**Fig. 3.** Training of rescuers by simulating climbing a well

## Conclusions

While working with the insulating device, there are a number of factors that contribute to work becoming stressful. As a rule, those who work under the protection of the isolation device, in addition to the fact that they wear breathing protection devices, they also have to carry out actions of great difficulty, as for example: ensuring their own safety, saving human lives, performing urgent and highly qualified works (isolation of damaged areas, work in areas with water, transport of materials or injured people through works with low profiles, etc) quickly and under severe microclimate conditions (high heat and humidity), toxic environment, smoke, etc.

Thus, it follows that the physical effort put in by rescuers is intense due to conditions mentioned above.

We define as normal activity the performance of a rescuer with average performance capacity, trained, accustomed to his work, working at a moderate pace, taking his rest periods according to his needs.

Response and rescue activity in toxic / explosive / flammable environments, whether in response to incidents, simulated emergency situations or training activities, all of which are faced with dangerous situations. These hazards are an integral part.

It is obvious that the acceptability of a risk depends on how important is the outcome of the operation that involves that risk. Where people's lives are at risk, more dangerous operations can be allowed, ensuring that the risks are recognized and measured. This represents a practical use of hazard identification and control activity.

Certainly, the challenging conditions described can indeed lead to intense physical effort for rescuers. When faced with demanding situations such as natural disasters, accidents, or other emergencies, rescuers often find themselves in physically demanding environments that can greatly increase the strain on their bodies. Here are a few reasons why the physical effort of rescuers can be intense under such conditions: rescuers frequently operate in harsh environments, such as extreme temperatures, rugged terrains, or areas with poor visibility, these conditions can require extra physical exertion to navigate and perform their tasks

effectively, rescuers may need to carry heavy equipment, tools, and gear to access and aid those in need, this additional weight can add to the physical demands of their work.

Considering these factors, it is essential for economic agents to provide appropriate training, support, and resources to ensure the well-being of rescuers. Furthermore, implementing strategies for managing physical and emotional stress can help mitigate the intense physical effort that rescuers may experience in challenging conditions.

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