

## Psychological aspects of workplace safety in the infrastructure projects of underground

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### Abstract

The relationship of work safety psychology and occupational injuries was studied and analyzed; the reasons for causing injuries in the workplaces in the structural divisions of underground were stated. The measures to improve the labor safety management systems in enterprises of underground were proposed.

Key words: WORK SAFETY PSYCHOLOGY, OCCUPATIONAL INJURIES, SOCIAL SECURITY, ISO STATE STANDARD, UNDERGROUND, PROJECT, INFRASTRUCTURE, PRODUCTION PROCESS, MEASUREMENT TOOLS

Work safety psychology is a branch of psychology that studies the psychological causes of accidents occurring in the course of work and other activities and develops psychological methods to improve safety. The

objects of research are mental processes (perception, attention, memory, etc.), which are generated by human activities and affect the mental state of a person, personality characteristics and its safe behavior during

the work.

The properties and characteristics of psyche and consciousness play an important role. The factors determining the nature of human work activity are physical activity, the amount of nervous and emotional stress, rhythm, pace of work, its monotony, the volume of perception and processing of information, etc. The mental condition namely the existence of conflicts, weariness, exhaustion, illness, dependence on drugs, alcohol, nicotine, particularly of the human psyche have a special influence on the person labor safety.

Analysis of occupational injuries shows that the main cause of injuries and death of people in the workplace is a bad mental state of workers while performing work duties.

The activities for the prevention of occupational injuries are important to ensure reliable and uninterrupted production process. Stop of production for various reasons is now frequently encountered and leads not only to a sharp decrease in labor productivity, production losses, but also to a sharp deterioration in the physical and psychological health of the staff, it gives rise to various kinds of errors in the work, stress state, increases the risk of accidents and injuries. Such production is accompanied by significant mental stress, disruption of the normal work rhythm, disputes of workers with their colleagues and the leadership of the enterprise [1].

On this basis, in conditions of instability of production, along with safety condition of equipment, working environment and measuring devices, considerable attention from the leadership of the enterprises structural divisions should be given to improve the reliability of the human factor in “man - machine - environment” system [2, 3]. It is necessary not only to improve the quality of staff training and briefing on the labor safety and first of all to carry out the proper psychological work in order to bring up the psychology of safe work in workers conscience, when they will be able to evaluate every step and every action from the point of view of its safe performance in compliance with state standards.

Before the accident, usually some kind of dangerous situation occurs when the person can understand the approach of such a case and can take necessary measures to prevent it. The inability of man to realize the dangerous situation in time and to take adequate measures leads to accidents and crashes. A person should envisage the development of the manufacturing process and his behavior, to realize in time the dangerous situation and prevent accidents. Sometimes these cases are considered as a consequence of inadequate

behavior of the person in a dangerous situation.

The safety human behavior on the production depends on the following factors:

- state of unconditioned reflexes, which people unconsciously use respond to various dangers that threaten his organism (e.g., automatic hand moving away from a hot object);
- psycho-physiological qualities of man, which appear in its sensitivity to the signals of danger, its high-speed response capability to these signals, in the emotional reactions of danger when determining a dangerous situation and responding to it. The emotional, mental and physical condition effects on the human behavior. Thus, the state of anxiety sharpens the sense of danger and the state of weariness reduces the human ability to identify and counteract the danger;
- professional qualities and experience of the person, i.e. knowledge of the profession and safety rules, life experience;
- motivation to safe work, compliance of technological processes performance.

Sometimes the motives of some benefits (time savings, increased production) exceed the safety performance motives. The workers should be morally and materially encouraged to comply with the requirements of work safety and state standards to increase their motivation. The costs of such encouragement justify the prevention of accidents. This will make safe work financially profitable. A worker will earn more not only due to the productivity of labor, but also due to the fact that he works safe according to the instructions. And it is important that every violation of normative documents on labor safety should not be unnoticed, all employees should be aware that any violation of the instructions will be punished.

Motivation of the worker to safe labor increases when they notice that there is a strict control over the compliance with safety regulations in the company. The employees are financially and morally encouraged for the high safety conditions. The condition for bonus payments should be work without injuries and accidents. The executives of the enterprise units from the material incentive fund can be paid a reward only under the condition that at the sites and services, which they head, there are no injuries and violations of labor safety requirements and the means of individual and collective protection, equipped with medical kits, etc are available.

Management of the enterprises should abandon the principle of “production and safety separately”, and move on to the principle of “production in safety conditions”, when safety becomes a means of achieving

efficiency. The labor safety policy should be directed to the collective search for ways to prevent accidents. Each in its place should make proposals in this direction. The mental attitude aimed at safety should be created in the staff.

Psychological processes of human labor activity and work safety are characterized by a number of basic types of mental activity (sensation, perception, attention, etc.). The worker receives information from several sources of irritation simultaneously by different senses. This is a perception process. Time of perception by different senses reaches the second and more. It is important for the worker to know which objects he should watch over very carefully during the production process [4].

The concentration of attention can be caused by external factors (noise, light). This is unconscious concentration of attention. The conscious concentration, which is carried by the second signal system (speech, thinking, etc.), is of great importance. The unconscious concentration of attention may cause distraction from the main work and can lead to an emergency situation. At the same time, the person is able to divide the mental processes, for example, to do the work automatically and think about something else. However, work will be safe under condition that the worker at any time is able to connect a second signaling system for the adoption of urgent solutions. This is achieved by education and development of appropriate skills. Thus, the development of skills and the ability to consciously control mental activity is an important condition for work safety.

The human ability to keep the attention on one object determines the attention stability and the ability to transfer attention to other objects is the phenomenon of refocusing. Distraction factor can cause attention wander, which leads to errors. If a person simultaneously watches over the several objects, it causes the attention allocation. However, a person cannot simultaneously observe more than 4-5 objects. Studies show that the man can observe one object with the same degree of attention no more than 10-20 minutes. Weariness influence significantly the attention. It reduces the range of attention and decreases the time of its concentration. Therefore, it is necessary to provide a rest pause (15 min break after every 2 hours) for such work [4].

The labor collective is also an important moment in the formation of safety psychology. Each collective has formal and informal leaders, which determine the attitude of workers to performing the instructions on labor safety. Thus, it is necessary to form the right attitude of the collective to the safety by involving the

leaders to the activities as authorized for the labor protection. Safety measures coincide with the objectives of the collective and production process. The leader must regularly remind to the workers about this. The authority of leader is created if the instructions are not carried out due to administrative subordination, but due to a result of awareness by the subordinates of their correctness.

Thus, the physiological hazards factors directly affect the person, the physical and physiological processes, performance, mood, productivity and life in general.

First of all, the fight against weariness is improving the sanitary and hygienic conditions of the production environment (elimination of air pollution, noise, vibration, microclimate normalization, rational lighting, etc.). The professional selection, organization of workplace, the correct working position, the rhythm of work, rationalization of the labor process, the use of emotional stimuli, the introduction of rational modes of work and rest play a special role in the prevention of weariness of workers.

In addition, the specific methods such as the means of recovering the functional state of visual and musculoskeletal system, hypodynamia reducing, brain blood circulation increasing, mental performance optimizing are applied for the prevention of weariness of workers.

From the medical point of view, the exercises including psychotherapy, physical, water and air procedures, physiotherapy, massage, adequate nutrition, vitamins and minerals, relaxing music and exercise, meditation, autogenous training are recommended to use for the prophylaxis, prevention and rehabilitation of the consequences of emotional stress.

In the prevention of weariness and overwork of worker, a significant role also belongs to the rational organization of work and rest. Physiologists have substantiated five conditions for improving working efficiency that promote effective prevention of weariness:

- you need to enter slowly to any work;
- measured pace and rhythm are the condition of successful working efficiency;
- familiarity, sequence and planning;
- negligence and haste in the work are not permitted;
- physiologically reasonable alternation of work and rest, as well as changes in the forms of activities (the most effective relaxation is associated with the active state of the muzzle);
- favorable attitude of society to work (labor motivation and social conditions).

The negligence of the worker himself is one of the common causes of occupational injuries in the underground facilities. The worker actions can be considered as of negligence if he is inattentive at work, does not use personal protective equipment, and applies carelessly to the requirements of labor protection instructions. Sometimes workers with great experience of more than 10-15 years ignore the implementation of safety rules and regulations on labor protection.

The human factor is the cause of most accidents (75%), so the main focus of the preventive work should be improving the workers' health and preservation of it during working hours. An important direction of this work is the early diagnosis of occupational pathology and the disease condition of the nervous system. The accident is the result of failure taking into account the potential danger. The physical condition of the worker (good sight, hearing, etc.) plays an important role [5].

Perfect vision is an important condition for work safety. A large part of accidents occur as a shortcomings result of poor lighting of tunnels, mines, machinery spaces of escalators, transformer and traction step-down substations of workplaces, etc. Uneven lighting requires frequent readaptation of vision that takes up to 6 seconds while an accident can occur.

A high background noise and hearing losses lead to rapid weariness and delayed reactions to the sound signals. The more tired is the person, the longer it takes for the perception and reactions to a dangerous situation.

Reduction of incidence and preservation of health of workers are important social and economic problems. Radical measures in this direction are improving of working conditions, conducting therapeutic and preventive measures (health education, promotion of healthy lifestyles, industrial gymnastics, medical examination, etc.). This will reduce the level of injury and increase economic efficiency of production.

Workers should know and follow occupational safety instructions when working. However, the instructions cannot foresee everything. Vital activity is much more difficult than the detailed instruction. Therefore, it is very important to bring up at workers the ability to observe, to be cautious and careful.

The workers poll have shown that the majority of them consider the imperfect labor organization, bad mood, weariness, conflicts in collective with manager, inattention of managers to the subordinates, unsatisfactory psychological climate as the most common causes of injury.

The violation of work and rest rhythm has a signi-

ficant impact on the working efficiency. Therefore, in determining the working time mode, the shifts schedules should be set so that the duration of rest between workers shifts when taking into account intra-shifts breaks is not less than double length of working time of its previous shift. Working time established by legislation cannot be changed by the administration even with the employee's consent.

The requirements to his performance should be sufficiently high considering that the worker error during operation may endanger the health and life of both worker and other people. Most employees feel weariness at the end of shift, which increases probability of traumatic situation occurrence, therefore strict adherence to the established legislation and work and rest rules is very important.

The biorhythms have a huge impact on health, working efficiency and reliability of human. It is known that the human body has more than 100 different rhythmic processes. There are many publications on the effectiveness in regulating the workers operation regimes of work and rest taking into account the three sinusoids with periods of 23, 28 and 33 days characterizing the physical (working efficiency, energy), emotional (mood, reaction) and intellectual (intelligence, memory) state [6].

In order to prevent accidents and diseases, the safe working methods should be promoted. The following methods of mass agitation work are applied: briefings, lectures, films, radio programs on issues of work safety. The posters and memos are widely used. Posters promote to keep right and safe work practices in the minds of worker. Effective labor protection propaganda is a form of public reviews, which are conducted by the administration together with trade union activists. It is important to use such forms of propaganda, as exhibitions, stands, corners of safety information, etc.

However, formation of motives forcing worker to observe safety regulations is more effective than methods listed, not because the employer requires so, but because this is his personal desire to psychological setting on safe work. This setting is achieved by improving the psychological climate, attracting workers to the control of occupational safety, educational work, managers' personal example.

Thus, the social and psychological safety management methods are based on the use of a set of inter-related factors, such as knowledge of safety requirements, skills of safe work, motivation, professional performance, moral stimulation for compliance with safety regulations, the humanization of labor, respect for science-based work and rest, promotion of occu-

pational safety, therapeutic and preventive measures.

For this reason, the professional selection and professional orientation of employees for certain responsible professions are the important factors among the social-psychological methods of occupational safety management. Not only physiological, but also psychological data, i. e. a sense of responsibility, degree of confidence in their capabilities, volitional qualities (self-control, perseverance, determination) should be taken into account. The probability of accidents increases with the inclination of the worker to risk, adventurism, indiscipline, frivolity, social instability, aggressiveness and impulsivity.

Existing methods of economic motivation of labor protection at the enterprises in modern conditions of managing are complicated by the lack of funds to carry out appropriate administrative and technical measures and incentives for staff. Therefore, the solution of work problems on labor protection at the enterprises can be achieved by improving the efficiency of economic activity. The existing procedure for the centralized management of economic activity at the enterprise, when all of control levers are located at the first head, is out of date. This procedure suppresses initiative and productivity in the labor collectives. It is necessary to radically change the order of performance management.

Economic mechanism of occupational safety management should provide an incentives system for the employees who conscientiously comply with the requirements of occupational safety; do not allow violations and breaches of personal and collective safety; take the active and creative part at implementation of measures to improve the level of occupational safety at the enterprise. The collective agreement should fix the various kinds of moral and material incentives of the employees such as salaries, bonuses (including special incentive bonuses for the achievement of a high level of occupational safety), reward for inventions and rationalization proposals on labor safety issues. The bonuses to workers teams, sites, shops for a long work without violations of safety rules, without injuries and accidents bring the positive results. In case of dangerous and harmful production factors, which are constantly threaten the employee's health, it is recommended to pay a premium for extra caution. In addition to material incentives, the moral stimulation is also important, which one time has been used in our country and successfully applies in foreign firms. Forms of moral incentives can be very diverse: from the announcement of gratitude to the amusement evenings, picnics, cruises for collectives that have achieved the best results on a labor safety.

The unsatisfactory state of occupational safety at the enterprise leads to inhibition of the economic and social progress of the country in general. According to the experts of the International Labour Organization losses due to the accidents at work and occupational diseases accounted for 4% of global gross domestic product (GDP). Thus, the improvement of occupational safety system is one of the most urgent issues at the level of both the State and the individual enterprise.

The occupational safety and health management at the enterprise is a set actions of officials carried out on the basis of ongoing analysis of information on the state of occupational safety in all workplaces to improve and maintain it at a certain level in accordance with the laws and regulations. [7]

The attitude of workers to the labor duties depends not only on wages but also in many ways on their confidence in the permanent employment, respect, recognition, interest in the work. The manager task is to combine the strong leadership with the giving to the subordinates the opportunity to show their creativity, initiative and individuality. The head should inform his subordinates about the state of business. This increases the interest of people to work. Every employee must realize that his work is very important that the enterprise may stop without his participation. The favorable and safe working conditions in the workplaces are important factors in increasing labor productivity. Additional costs for the improvement of occupational safety are repaid many times. This is evidenced by the experience of developed countries.

Efficiency measures for labor protection activities in the structural divisions of underground:

1. The key to decrease in the level of workplace injuries and improve of occupational safety is the rise of the economy, which in the current economic conditions can only be achieved by production decentralizing.

2. Improving the state of labor protection in structural divisions of underground can be achieved by transition from carrying out the certain disconnected activities to the system of planned purposeful management of the activities with a clear definition for each of the structural division of the enterprise, the list and contents of the tasks and functions of management. Occupational safety work tasks are derived from the entire production of the enterprise departments and aimed at the implementation of Occupational safety requirements of public policy.

3. In order to meet plan and other tasks of labor protection work at the enterprises, the funds of occu-

occupational safety should be created paying 0.5% of the volume of sales of products (services).

4. In the structural subdivisions of underground the systematical engineering support of OSH management system should be carried out by bringing manufacturing equipment, processes, buildings and structures, timely verification of measuring instruments, sanitary and hygienic state, sanitary and domestic security, etc. in compliance with the requirements of normative acts on occupational safety with the use of modern methods of engineering and re-engineering in order to eliminate unacceptable risks and adherence with state standards.

5. For briefing and training of employees in occupational safety the modern methods of active studying, the training of workers in psychology and culture of safety should be used when someone's threatening action would have been impossible. Before each potential danger, operation its implementation plan is made, the work permit is written out and a detailed briefing is conducted. At the first violation of safety rules the violator is given a warning, at repeated one he acts under the Labor Code. The occupational safety management system is a daily serving functional management subsystem of enterprise, institutions and organizations [8].

According to the legislation current in Ukraine the certification of enterprises in compliance with state standards DSTU ISO 9001-2001 "Quality Management Systems. Requirements" and GOST ISO 14001-97 "Environmental Management System" is carried out. The occupational safety management system is also subjected to certification. According to international standards, the following points are checked: the presence of a safety certificate, the integration of this system with the systems of quality management and availability of environmental protection document "Work Safety Policy at the Enterprise" signed by the first head and the implementation of this policy. The availability of normative legal acts of occupational safety, carrying out the certification of workplaces and evaluation of occupational risk on them, the availability of personal protective equipment, staff training, safety during high-risk works, certification of sanitary condition and the availability of means of

occupational safety in the workshops, conducting audits of occupational safety state in the shops and at the enterprise in general are checked. [9]

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