

Influence of safety culture on the safety level in chosen enterprise

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ABSTRACT

Purpose: In this paper was carried out the analysis of influence of safety culture, connected with implementation Occupational Health and Safety Management System, on safety level in chosen enterprise. The organizational practices necessary for the effective formulation and maintenance of high safety culture were characterized.

Design/methodology/approach: The concept of health and safety at work legislation was defined and the idea of safety culture was discussed. Moreover, the necessity of continuous improvement according to PN-N-18001 standard was showed. In this paper was talked over the problem of accidents and occupational diseases among coal miners, who work in a huge and rich in dangers area.

Findings: According to continuous improvement principles is the necessity of monitoring work conditions, conducting regular audits and organizing training courses, which lead to developing high safety culture.

Practical implications: Developing of the safety culture brings some profits as reducing numbers of heavy and fatal accidents, increasing the number of detect occupational diseases. The enterprise, which developing high safety culture can expect from employees greater caution and respect for rules and instructions bench.

Originality/value: The article indicated that the coal mines needs effective actions which should be directed on increase supervision in workplaces and reducing threats causing industrial accidents. The essence of safety culture was presented.

Keywords: Safety culture; Safety and Health Management; PN-N-18001 Standard; Industrial Management and Organisation; Coal-Mining; Hazardous events; Causes of hazardous events

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1. Introduction

The occupational health and safety management is a component of management system in the enterprise. According to the idea of continuous improvement, contain in the PN-N-18001 standard, the company is required to satisfy the basic legal requirements and also systematic preventive measures and correction discrepancy.

Every action taken under the OSH management system must be understood and accepted by the staff of higher and lower level.

Hence forming a high safety culture is very important. The training courses, promotional activities for the safety and health, safety contests and audits are a mainly safety management tools. The active participation of workers improve health and safety management system and to contributes to safety growth in the enterprise. The workers are oblige to take particular care at the workplace and to behave safely. Safety culture is associated with the high value of applied health and human life, and maintaining the boundary between the necessary risk and the protection against risks.

2. The essence of industrial safety

Occupational Health and Safety is a set of legal norms and the organizational and technical actions which are designed to provide safe working conditions. One of the OSH objectives is to reduce the occupational risk, control of working conditions and protect workers against accidents, occupational diseases or excessive physical and psychological loads [1,2].

In recent years increase interest in safety management. It was understood that safe work is a greater profit for the company. Employers more and more often specify - as a reason for improving the working conditions (besides of existing legislation): to strive for reduce the number of accidents, occupational diseases and connected with them financial losses. Safe environment and safe behavior at work do not arise spontaneously, but first must be formed according to a well thought-out program. It is necessary to take actions aimed at sustaining and further improving working conditions, equipment and procedure employed [1,3].

3. Striving for continuous improvement

The occupational health and safety management system is part of the entire management system of the organization. Striving for continuous improvement is achieved by others by conducting corrective and preventive actions. It should be carried out with the active involvement of employees, the organization should establish and maintain proceedings procedures with nonconformities [4,5,6]. The model of occupational health and safety management system, based on the concept of continuous improvement - consistent with the norm PN-N-18001 is shown in Figure 1.

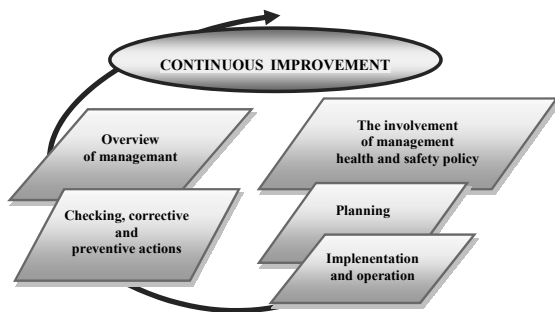


Fig. 1. The model of Occupational health and safety management system adopted in PN-N-18001 standard [4,7]

It is important to make the workers realize dangers in the enterprise or at work stations and associated occupational risks and in addition benefits of improving the health and safety and the potential consequences of failure to comply with established procedures. The organization should implement and use appropriate methods to motivate their employees to engage in actions to improve occupational health and safety [1,4,8,9].

In the same section of the PN-N-18001 standard, in which was formulated the requirements for the competence and training, is pointing to need to make employees aware of safety issues. Relationship between all the demands are shown in Figure 2 [10].



Fig. 2. Forming awareness of the members in organization in the range of OSH

4. Developing a safety culture

In recent years increase interest in safety management. Every organization is a social system. Performance and company's condition depend on employees and managers. It was understood that safe work is a greater profit for the company. A management system helps an organizations to achieve some goals e.g. achieve an optimal level of safety. Employers more and more often specify - as a reason for improving the working conditions (besides of existing legislation): to strive for reduce the number of accidents, occupational diseases and connected with them financial losses. Safe environment and safe behavior at work do not arise spontaneously, but first must be formed according to a well thought-out program. It is necessary to take actions aimed at sustaining and further improving working conditions, equipment and procedure employed [1,3,11,12,13].

In reference to organizations are using the definition of D. Cooper. He stated that safety culture is the result of individual and group values, attitudes, competencies and patterns of behavior which determine the involvement in activities to the benefit of the health and safety management and to influence the style and effectiveness of management. A newly hired employee meets the corporate culture and finds among other things which behavior are thought as an acceptable and appropriate - with the two main sources. The first of them is the formal training, regulations, or talk with a supervisor, while the other - collaborators behavior [1,7].

It is assumed that one of the fundamental objectives of occupational health and safety management is to develop safety culture in the enterprise. However, the level of safety culture isn't only a result of the quality of health and safety management at the workplace, but also determines the quality. This relationship is therefore bidirectional [7], which was presented in Figure 3.

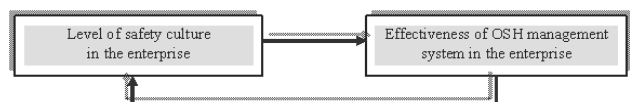


Fig. 3 Interdependence between the level of safety culture and the effectiveness of OSH management system in the enterprise [7]

The level of safety culture in the enterprise has a direct impact on the employees attitudes in safety and health protection. This was confirmed in numerous studies of the formation of accidents, conducted in the past few years. It has been found in them that cultural mechanisms play a crucial role in the occurrence of major industrial accidents such as e.g. Chernobyl in 1986. So we could risk to say that the accident are the result of the absence or insufficient level of safety culture, and the number of accidents or occupational diseases - can be measure of the culture in the organization, professional group or community [1,7].

5. Some ways of shaping a safety culture in the enterprise

Open and honest communication, associated with systematic and reliable informing employees about the risks, for staff at all levels of the organizational structure, is one of the essential elements of high culture [1,7].

In Table 1 are presented the organizational practices, which are indicated by experts, as necessary for the efficient development and maintenance high safety culture in the company.

6. Promoting a safety culture in the chosen enterprise

In the chosen coal mine was implemented, maintained and confirmed by certificates Integrated Quality, Environmental (compliant with ISO 9001:2000 and ISO 14001:2004) and Occupational Health and Safety Management (compatible with the PN-N-18001 standard). Stages of implementation and system integration process is shown in Figure 4.

Chosen coal mine is a huge area in which they are spread a variety of workplaces. An extensive infrastructure of this company, which include:

- three levels of extraction,
- walls and sidewalks,
- underground and on the surface transport roads,
- locomotive depots,
- shafts,
- betting processing, workshops,
- social and administrative buildings,

is a potential site of a dangerous event. Activating the mine workers in efforts to improve safety in the workplace, certainly brings many benefits. Increase awareness of safety sensitive employees somehow forces the potential danger, because they understand the rules, regulations and possible threats to their workstations. There are caused limits the number of moves to dangerous behavior.

One of the main points of a project to improve the security situation in the enterprise is the Job Training audit, conducted in cooperation with staff representatives. Also organized a contest to promote health and safety topics in the workplace. The nature of competition, rivalry, and high rewards for the winners mobilize workers to greater respect and absorb messages of health and safety and labor law [14].

Table 1. Organizational practices necessary for the effective formulation and maintenance of high safety culture

No	Area of operations	Explanation
1.	Management commitment	expression monitoring by managers and personal interest and concern about the safety of workers
		establish security and hygiene policy declaration, and appropriate procedures and standards
		consideration OHS during the planning and implementing organizational, technological, personnel changes
2.	Employee participation	consistent efforts to eliminate occupational accidents, occupational diseases an accident potential events
		an example of participation of employees may be involved in the development of internal standards and health and safety documents,actions and decisions taken in the company encouraging employees to present their views and suggestions on health and safety
3.	Education OSH	training and courses (including the exercise of practical skills), adapted to current needs of work and workers
4.	Analysis of accidents	reporting and analysis of any event of accident and potential accidents that have occurred in the workplace
		identify causes and take preventive action
5.	Motivating	quick response of problems regarding security
		expressing approval and recognition of employees who behave safe and engage in activities aimed at improving safety in the workplace
6.	Collaboration between employees	organization of competitions related to the health and safety in the enterprise promoting safe behaviors outside work too (e.g. on the road, at home, during the holidays)
		the atmosphere of understanding and trust between management , employees and between employees from different departments and organizational levels
7.	Strengthening a sense of belonging	developing a sense of pride connected with the work in the company
		the opportunity for professional development and execution of one's own professional ambitions in the company

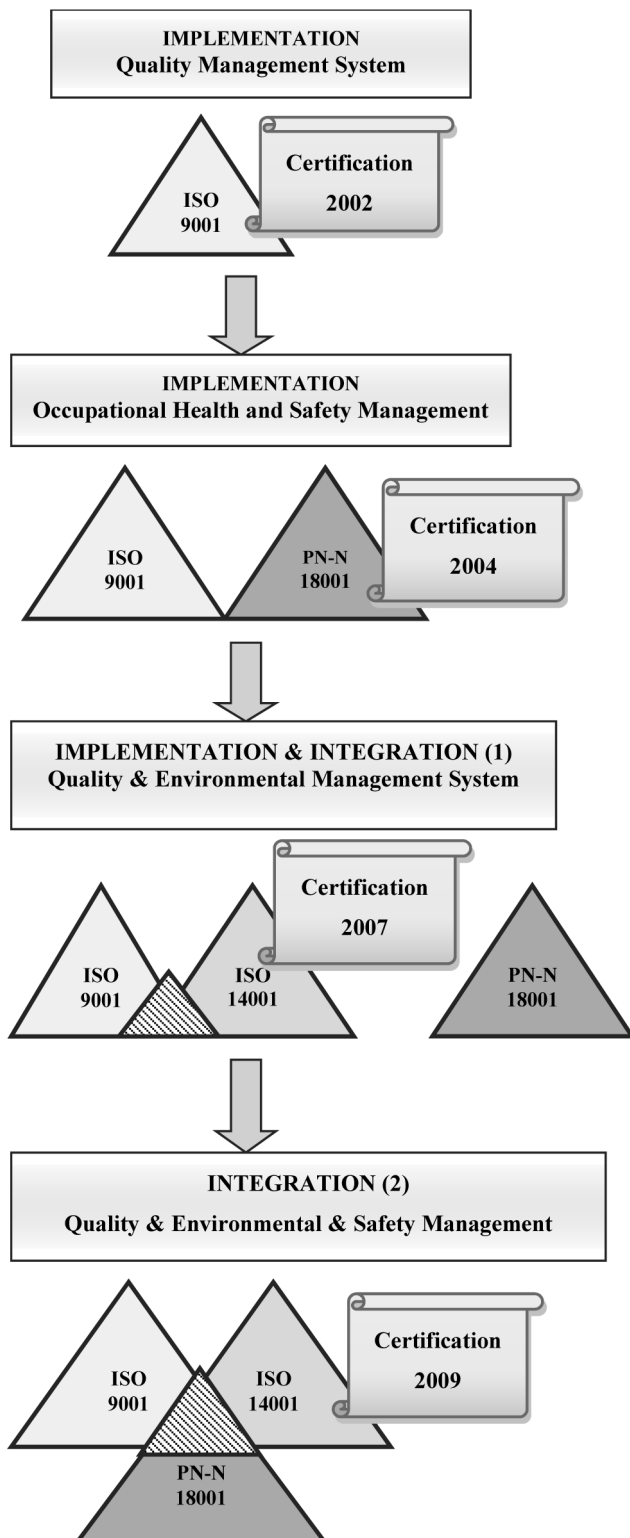


Fig. 4. Stages of integration of Quality, Environmental and Occupational Health and Safety Management Systems in chosen coal mine

The continuous progress of the computer technology opens new ways of the computer science activities. The virtual reality can be effectively adapted to education process using both traditional and e-learning methods [15]. An important task in the field of health and safety carried out to improve the quality of training of mining crews, using modern techniques currently available in this area[14]:

- constantly upgraded multimedia systems are used to relay important information on the prevention of accidents and safety;
- a special team produce the training films (based on your own scenarios), using a real workplaces and with the participation of workers in the mines;
- the training rooms are equipped with computers, so it is possible to use techniques of e - learning.

These actions are aimed at reliability in the transmission of content, and above all better remember and consolidate information training. Surveys conducted among the employees making the most from training, show high scores in terms of content and teaching effectiveness [14].

7. Analysis of the effects of shaping a safety culture in the selected enterprise

Mining in Poland is a branch of economy in which there is a high degree of occupational exposure of workers, and therefore the probability of acquisition occupational diseases. This results from the fact of occurrence in the work environment various threats e.g.: dust, noise, vibration, chemicals.

The occupational diseases, which occurred in chosen enterprise are presented in Table 2.

Table 2. The occupational diseases occurring in chosen enterprise in 2009-2010

Type of occupational diseases	2010	2009
Pneumoconioses	54	46
Damage to hearing	4	11
Vibration disease	21	21
Skin diseases	0	1
Musculoskeletal diseases	2	4
Nervous system diseases	1	1
Summary	82	84

Pneumoconioses are the most common occupational disease among miners, they are an important medical and social problem. Silicosis of miners in coal mines is formed following the inhalation of dust mine. The source of air dust in mines include: working shearer loaders and paving, crushing, drilling holes in the ground, dams ventilation, loading trucks at the loading points, etc. [16,17].

Since 2001 is noted down increase in the number of detect pneumoconiose cases at an early stage among the workers in the chosen coal mine (fig. 5). Early detection of this disease obliges the employers to increased frequency of medical control over the discussed group of employees.

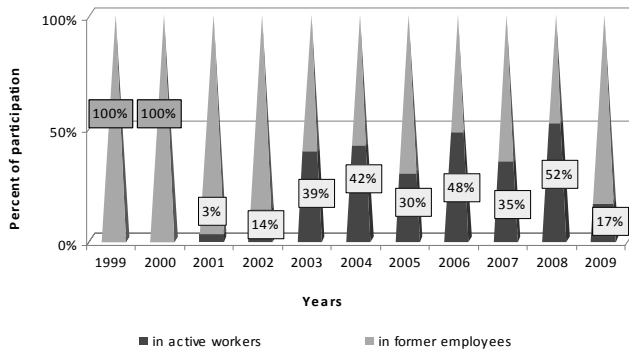


Fig. 5. The level of detection pneumoconiosis in the chosen coal mine in 1999-2009

The increase is the result of detection:

- a system of training, raising workers awareness as regards health and safety and preventing neglect alarming health symptoms
- the introduction to the schedule medical tests so-called - final tests, which allow to assess the health status of retiring employees;
- use of modern and accurate medical equipment, allowing faster and more effectively detect the initial stage of pneumoconiosis.

The level of the safety culture is connected with the level of the industrial safety which can be characterized in accident rate number [5]. The analysis of industrial accidents can be carried out in three basic forms which characteristic was presented in Table 3.

Table 3. Kinds of accidents analysis [5]

Kind of analysis	Comparison of quantity	An example
absolute	quantity of specific occurrences	by consequences load
indicatory	occurrences according to specific indicators characterizing analyzed phenomenon	intensity factor dynamics factors
generic	occurrences according to specific criteria	by event occurrence place

To allow for the comparison of accident severity rate was set accidents. The ratio of gravity C (1) determines the number of days of sick leave attributable to an accident (excluding fatalities) [18]:

- accident severity rate (excluding deaths)

$$C = \frac{L}{I_w - I_s} \tag{1}$$

where:

I_w - the number of accidents at work during the test period,
 I_s - the number of fatal accidents during the test period,
 L - total number of days of incapacity for work due to accidents.

Knowledge of accident rates is to include comparing the level of safety in various industries, enterprises or time periods and allows the determination of high risk [19]. In Figure 6 is presented accident severity rate against the number of accidents in chosen coal mine.

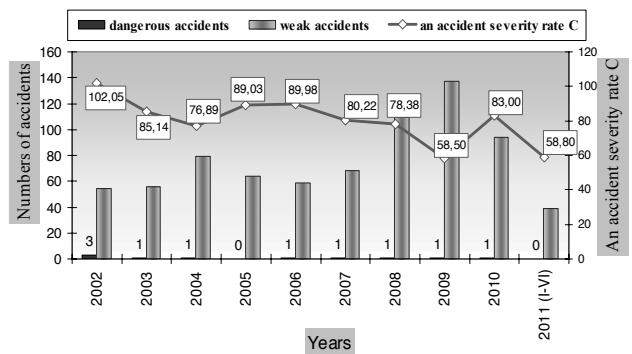


Fig. 6. An accident severity rate against the number of accidents in chosen coal mine

Based on the analysis of the figures contained in the figure can be seen that in selected mines throughout the range of fluctuation in the rate occurred severity of accidents at work. On the basis of the figure can be concluded that:

- the lowest severity rate of accidents over the test period considered in 2009 and its value was 58.5;
- in 2002 recorded the highest number of severe accidents (the number was 3) and simultaneously recorded the highest (102.05);
- in the first half of 2011 the value of the index was low compared with other years and was 58.8.

There are several main types of hazardous events, which were presented in the Figure 7.

The Figure 8 was presented graphical interpretation of the number of accidents recorded in the chosen coal mine, taking account of the events that caused the injury.

On the basis of the figure can be seen that the most of accidents noted in 2008-2011 (I-VI), were caused as a qualifying event: stumble, slip or fall of workers (mean 28.4%), or it is a result of contact with the machinery and equipment in motion (16.6%). To the 'other events' was included:

- actioning corrosive and stinging substances;
- actioning an electric current;
- an excessive effort;
- other event caused by a technical threat.

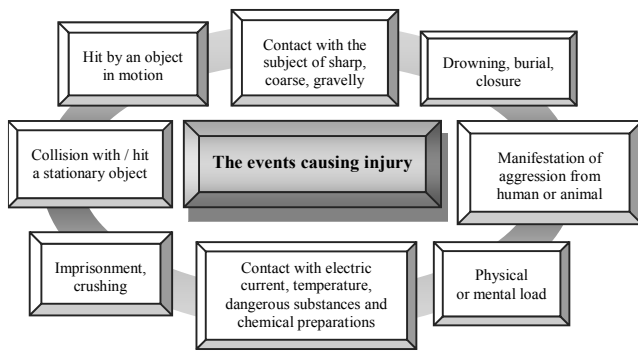


Fig. 7. Hazardous events caused injury

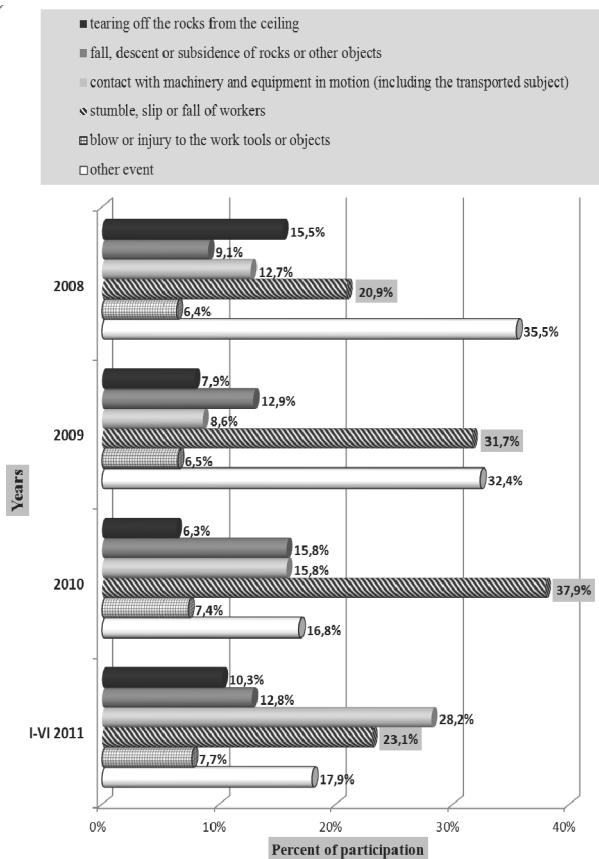


Fig. 8. Hazardous events caused injury in the chosen coal mine

Large impact on accident rates are the employees. Therefore, prevention efforts should be focused mainly on: increasing the control of workplaces, intensifying surveillance of employees at work and the systematic education of the miners in the field of occupational safety and health.

This statistic is a consequence of the specific work conditions in each coal mine too. Narrow passages, uneven ground, the rock mass movements and vibrations caused by heavy machinery or transportation, so the reasons which can not be completely eliminated, can cause stumble and falls employees.

Each hazardous event causing injury is a consequence of such inadequate organization or structural defects in materials, improper employee behavior or other circumstances.

There are several main causes of hazardous events, which are presented in Figure 9 [19,20].

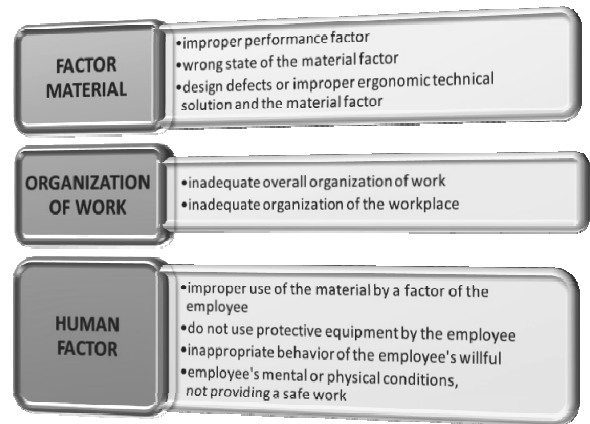


Fig. 9. Main causes of hazardous events

In the present coal mine in 2009 - 2011 (I-VI) accidents were caused by a number of technical, organizational, human or natural reasons. They were systematized and separated the most common causes of accidents at work in this company and presented in Figure 10.

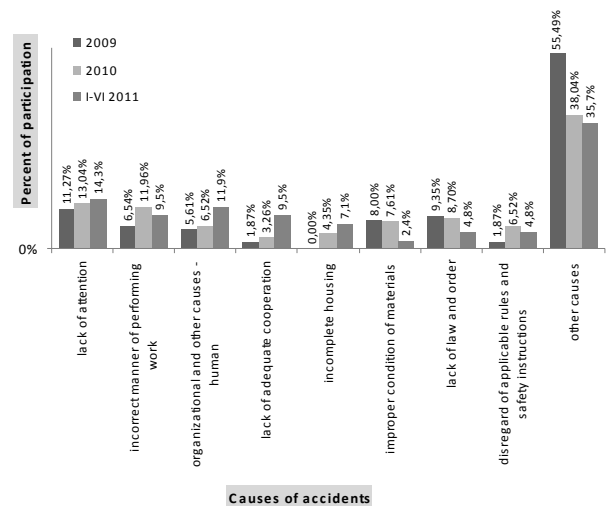


Fig. 10. Main causes of hazardous events in the chosen coal mine in 2009-2011 (I-VI)

The data presented in the figure inform that the most frequent of accidents at workplaces in this enterprise is the lack of attention of the employee. Dangerous occurrences, which are a consequence ensuing from the lack of attention, were in the years 2009- 2011 (I-VI) respectively 11.3%, 13% and 14.3% of all recorded accidents. Further reasons that have a large influence

on the occurrence of hazardous events is a incorrect manner of performing work (the cause one of ten accidents).

Based on the data presented it can be concluded that the behavior of employees in the workplace has a significant impact on safety. In this area safety culture is important. To become a dangerous occurrence must be some circumstances. Disregard regulations, lack of attention, a disorder in the workplace can lead to accidents. This confirms the fact that the promotion of safety culture in the work environment is necessary.

8. Conclusions

Developing a safety culture is an essential element of continuous improvement of safety and hygiene management system. The regular training, access to the information scope of OSH and motivational system are a good investment. The chosen enterprise has a rich infrastructure, there are many natural and technological hazards, so every improvement in the health and safety is a success. The company, which developing high safety culture can expect from employees greater caution, prudence, respect for rules and instructions bench, and to use of personal protection. Safe behavior in the workplace is a fewer accidents and occupational diseases. Continuous improvement of safety systems is a long and difficult process, but it brings results. The prevention efforts should be focused mainly on: increasing the control of workplaces, intensifying surveillance of employees at work and the systematic education of the miners in the field of occupational safety and health.

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