



Selected Elements of a Safe Work Environment in Hard Coal Mines in the Polish Mining Sector

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<http://doi.org/10.29227/IM-2019-02-35>

Submission date: 01-09-2019 | Review date: 19-10-2019

Abstract

Working in the mining industry is associated with many hazards involving various accidents at work and occupational diseases. Due to the specific nature of work performed by miners at development and working faces, the safety of their work is a significant element in the strategies of mining companies. The notion of a safe work environment in hard coal mines in the Polish mining sector is very broad. For the purposes of this article, we focus on selected elements of the work environment, such as medical examinations, occupational health and safety training, personal protective equipment, workwear, meals and drinks, occupational diseases, harmful factors, hardship allowance, and the organisational culture.

This article aims to analyse the formal and legal considerations underlying selected elements of a safe work environment in hard coal mines. The analysis is extended to include surveys on employee appreciation for their work and on the need for rewarding safe work. The surveys were carried out among underground workers of two mining companies.

Keywords: work environment, regulations and documents, safety, mining

Introduction

Improving health and safety, and preventing accidents in work environments have long been regarded as matters of priority, as every job is associated with a certain degree of hazard. Accidents at work and occupational diseases include employee absenteeism, dissatisfaction with the work provided, low quality and work efficiency, rotation of qualified staff and measurable economic losses. The priority for the Polish entrepreneur should be the introduction of a modern enterprise management model, a model based on the implementation of activities aimed at preventing the adverse effects of work done by employees [1]. In the case of the mining industry, the risk of occupational diseases and accidents at work, especially those which are difficult to predict, is greater than in other sectors. Due to the specific conditions in which miners work, safety is a significant element in the social area of the strategies of mining companies [2, 3, 4, 5, 6, 7, 8]. The long-standing efforts in the field of technical safety at work, effected over the course of restructuring and reorganisation of the industry and causing changes in the way coal mining companies operate, as well as the transformation of the working conditions of their employees [9, 10, 11], have led to substantial changes in the organisation of underground work, equipment, and the used machinery and technologies.

For decades, ensuring safety at work has been one of the core objectives of the mining industry. Expenditures on health and safety at work in the mining industry are gradually increasing, which is a commendable trend. A safe work environment is largely created by the employer, who has certain legal obligations. However, workers' awareness, their

knowledge, skills, and commitment are of crucial importance when it comes to preventing hazardous situations which may impact on human health and life. Polish hard coal mining is still a strategic branch of industry for Poland and people, i.e. the social capital, have always been the most important organisational resource.

The rules and documents governing employers' occupational safety obligations

All employers are tasked with creating a work environment for employees which meets the requirements of labour law. At the same time, the employer must also oblige employees to comply with all instructions which make their work environment safe.

The primary obligations of the employer in respect of providing a safe work environment include

- organising work in a safe and hygienic manner,
- providing OHS training and systematic refresher courses,
- ensuring OHS observance,
- improving the existing safety status,
- ensuring procedures to prevent accidents at work and occupational diseases,
- assessing and documenting work-related occupational risks, and taking the necessary preventive and technical measures to reduce or limit the risks through the proper organisation of work and the application of the necessary preventive measures, as well as through the provision of information and training to employees,

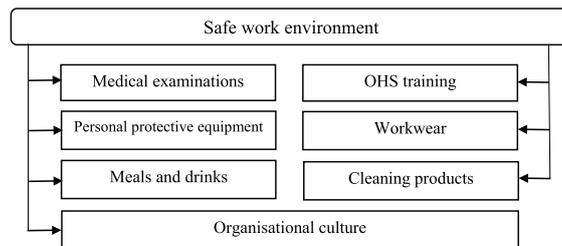


Fig. 1. Selected elements of a safe work environment
Rys. 1. Wybrane elementy bezpiecznego środowiska pracy

- adapting working conditions and processes to the employees' capabilities and characteristics of the workplace, in particular through the appropriate selection of machines and working tools, and other technical devices, as well as adapting working methods, including replacing hazardous engineering processes, devices, and substances with safer or less-hazardous ones,
- providing the means necessary for first aid, firefighting, and evacuation.

These obligations give rise to costs which may not be passed onto employees. In general, the indicated basic obligations binding on the employers in various industries result in different needs for means aimed at improving the work environment in a given enterprise.

The principal legal acts concerning the employer's obligations as regards mining safety are the Act of 9 June 2011 – Geological and Mining Law and secondary legislation thereto, including the Regulation of the Minister of Energy of 23 November 2016 on the specific requirements concerning the operation of underground mining facilities [12, 13].

The legal acts which regulate the core responsibilities of the employer resulting from the employment relationship are the Labour Code and collective agreements in the form of Corporate Collective Labour Agreements and Working Regulations [14, 15].

The former serves as the basis for operations of all companies, including government-owned companies. The legislation currently in force was passed on 26 June 1974 as the Labour Code (Journal of Laws of 1974, No. 24, item 141, consolidated text Journal of Laws of 2019, items 1040, 1043). Pursuant to Article 1, the Labour Code “defines the rights and obligations of employees and employers”. It constitutes the primary set of rules governing the rights and obligations in an employment relationship as regards all employees and employers.

The latter, collective agreements, are important legal instruments regulating collective employment relationships – referred to as characteristic [16, 17] or specific [18]. As such, they have a normative, i.e. binding, nature, which means that they afford stronger legal protection of employees than obligation-setting mechanisms alone [19]. Section 11 of the Labour Code, entitled “Collective Labour Agreements”, stipulates that: “Agreements must define:

1) the conditions to be met by the contents of an employment relationship...,

2) the mutual obligations of the parties to the agreement, including those relating to the application of the agreement and the observance of its provisions” (Article 240 § 1 of the Labour Code).

On the one hand, this document regulates working conditions, which are often more favourable than those specified in the Labour Code regulations; on the other hand, it defines the rights and obligations of the employee and the employer in respect of work.

Selected elements of a safe work environment

Figure 1 presents selected elements of a safe work environment in hard coal mining. These include, first and foremost, occupational health and safety training, medical examinations, workwear, and personal protective equipment provided by the employer to the employee, as well as meals and drinks, and cleaning products. A safe work environment is also created by the organisational culture of the mining company.

Medical examinations (pre-employment, periodical, checkups)

The conditions of the work environment and the impact they have on people over the course of their professional activity determine, to a significant extent, the pathologies in employees associated with the manifestation of occupational diseases and a decrease in the quality and productivity of work. Employee health deterioration can be avoided through early detection of pathologies and appropriate preventive measures.

In accordance with the regulations in force on the provision of preventive healthcare for employees, employers are obliged to provide their employees with preventive healthcare by specialists and occupational medicine physicians.

Occupational medicine examinations are performed in accordance with the Regulation of the Minister of Health and Social Security of 30 May 1996 on medical examinations of employees, the scope of preventive healthcare for employees and medical certificates issued for the purposes provided for in the Labour Code [20]. Obligatory pre-employment and periodical examinations and checkups of employees, and other healthcare services, are performed on the basis of an agreement concluded between the employer and an occupational medicine provider. Pre-employment examinations are intended for newly hired employees, minor employees reassigned to a new position, and other employees reassigned to positions characterised by factors harmful to health, or conditions which are more onerous than those in the previous



Fig. 2. Incidence of occupational diseases in 2014-2018 in total mining and hard coal mining [31]

Rys. 2. Występowanie chorób zawodowych w latach 2014-2018 w górnictwie ogółem i wydobywaniu węgla kamiennego

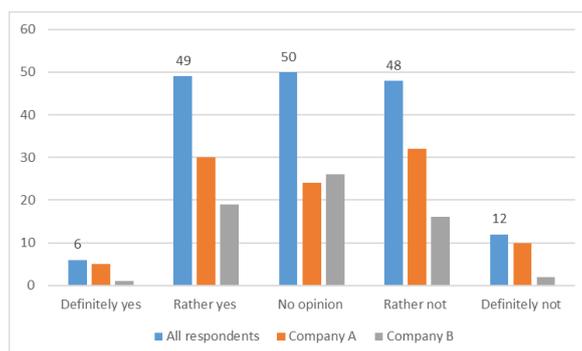


Fig. 3. Miners' sense of appreciation by their employers. Compiled by the authors based on the results of the conducted surveys

Rys. 3. Poczucie uznania górników przez ich pracodawców. Opracowane przez autorów na podstawie wyników przeprowadzonych ankiet

workplace. Pre-employment examinations include general medical examinations, laboratory and other specialised tests, depending on how harmful and onerous the workplace is. Periodical examinations are performed in periods set by occupational medicine physicians, while employees who have been incapable of work for more than 30 days must undergo checkups.

As in the case of pre-employment examinations, the scope of periodical examinations is determined by the working conditions, the degree of work onerousness and its harmful effects, and the examinations are performed in accordance with the methodological guidelines on the preventive examinations of employees, constituting Appendix 1 to the referenced Regulation of the Minister of Health and Social Security of 30 May 1996. The employer may not employ a person without an up-to-date preventive examination certificate stating that there are no impediments to employment in a given position.

Occupational health and safety training

Providing employees with training in and information on occupational risks, and on the preventive measures and methods of risk reduction is fundamental to preventing the negative impact which work environment conditions can have on employees in terms of occupational diseases and accidents at work.

Occupational health and safety training is provided as initial and periodic training.

Initial training is provided in the form of instruction, in accordance with the applicable programmes developed for individual position groups, and includes:

- general initial training referred to as “general instruction”;
- initial on-the-job training referred to as “on-the-job instruction”.

Initial training is provided before the employee is permitted to work. Such training must be completed by all newly hired employees, as well as students in internships and students of vocational schools undergoing vocational training, or student's practical training in the workplace.

The aim of initial training is to bring up to date and enhance the knowledge and skills of trainees in occupational health and safety, and to familiarise them with new technical and organisational solutions in this field.

Initial and periodical training programmes define the details of the training, its form, and duration for individual position groups. The programmes are devised by the employer or a licensed training provider, in consultation with the employer. The scope of and programmes of training are adjusted to the type and conditions of the work performed by trainees.

The frequency and scope of training depend on the nature of the work. The rules in this respect are laid down in the Regulation of the Minister of Economy and Labour of 27 July 2004 on occupational health and safety training [21]. During the training, employees are given detailed instructions and recommendations concerning OHS regulations applicable to their positions, and after completing the training and familiarising themselves with the regulations, the employees confirm this in writing.

Due to the nature of the mining work and the related hazards and frequent accidents at work and occupational dise-

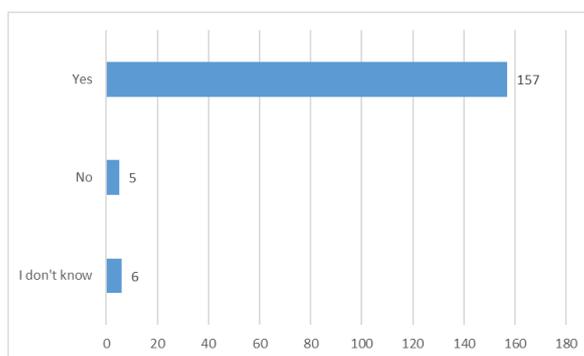


Fig. 4. Answers to the question: "Should safe work be rewarded?". Compiled by the authors based on the results of the conducted surveys

Rys. 4. Odpowiedzi na pytanie: „Czy bezpieczna praca powinna być nagradzana?”. Opracowane przez autorów na podstawie wyników przeprowadzonych ankiet

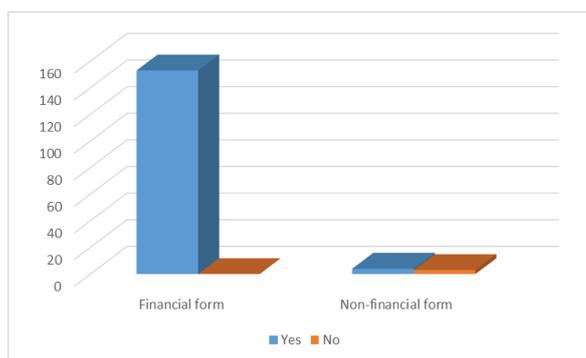


Fig. 5. Form of reward for safe work. Compiled by the authors based on the results of the conducted surveys

Rys. 5. Forma nagrody za bezpieczną pracę. Opracowane przez autorów na podstawie wyników przeprowadzonych ankiet

ases, the majority of hard coal mining companies have expanded the scope of training, increasing the number of training days and topics covered, and also introduced professional adaptation programmes for newly hired employees. Through this, they can improve the knowledge and awareness of their employees, and thereby increase occupational safety standards in their hard coal mines.

Workwear and personal protective equipment

In accordance with the applicable regulations, the employer takes measures to protect employees against health risks in the work environment. This is aimed at preventing the exposure limits for these risk factors from being exceeded, and eliminates mechanical hazards. Personal protective equipment is used if hazards cannot be avoided or limited through collective protection measures or appropriate organisation of work. Pursuant to Article 2376 of the Labour Code, the employer must provide the employee with personal protective equipment, free of charge, to secure him/her against health risk factors in the work environment, and also explain employees how to use their personal protective equipment. In addition, the employer is obliged to provide the employee, free of charge, with workwear and safety footwear that meet the requirements specified in the relevant standards. As far as employee obligations are concerned, pursuant to Article 211 of the Labour Code, they must use collective protection measures and their personal protective equipment, workwear and safety footwear in accordance with their intended purpose.

The types of personal protective equipment, workwear and safety footwear which must be used because of health

risk factors in the work environment, and the rules for their provision to employees, as well as the expected periods of their use, are regulated by employers through Corporate Collective Labour Agreements, Working Regulations, Internal Regulations, and instructions.

Personal protective equipment should:

- be appropriate to the working conditions and hazards at the workplace,
- meet ergonomic requirements and match individual users' needs,
- provide appropriate protection against the existing hazard without increasing the hazard, and if more than one hazard has been identified, and several pieces of personal protective equipment must be used, such equipment should be compatible.

Meals and drinks

The employer provides meals, also known as regeneration meals, for working in onerous conditions. These can take the form of hot and cold meals, breakfast packages or food products for employees to prepare their meals on their own (all such meals and products should have appropriate calorific values). The right to a supportive meal, pursuant to the Regulation of the Council of Ministers of 28 May 1996 on supportive meals and drinks, is vested in employees who perform work associated with physical exertion, causing, in a work shift, an effective energy expenditure exceeding 2,000 kcal (8,375 kJ) for men and 1,100 kcal (4,605 kJ) for women or exceeding 1,500 kcal (6,280 kJ) for men and 1,000 kcal (4,187 kJ) for women, when such work is performed in enc-

Tab. 1. The amount of allowance for working under harmful, onerous and hazardous conditions in representative hard coal mines. Compiled by the authors on the basis of documents made available by the mines

Tab. 1. Wysokość dodatku za pracę w szkodliwych, uciążliwych i niebezpiecznych warunkach w reprezentatywnych kopalniach węgla kamiennego. Wykonane przez autorów na podstawie dokumentów udostępnionych przez kopalnie

Degree of harm	Amount of allowance depending on the degree of harm				
	Percent	Amount [PLN/h]			
I	2%	0.32	0.39	0.42	0.37
II	3%	0.48	0.59	0.62	0.54
III	4%	0.64	0.78	0.80	0.70
IV	5%	0.80	0.98	0.99	0.86

losed spaces, where, for technological reasons, the temperature is kept constantly below 10°C or the thermal load index (WBGT) is above 25°C, or where the work is performed in open spaces in the winter season [22]. Underground workers are also entitled to meals. Supportive meals are provided for each day worked in accordance with the aforementioned rules. Usually, the meals are not provided directly, but in the form of vouchers to purchase foodstuffs.

Organisational culture

Increasing emphasis is being placed on instilling certain fundamental behaviours which can prove necessary in the event of an accident or need for aid. The establishment of an organisational culture is an opportunity to build a safe work environment in the mining industry. Safety is shaped by the daily behaviour of all employees, which is based on their beliefs and values [23, 24, 25]. Nowadays, highlighting the role of the human factor has become a major element in the occupational safety culture, as seen in many enterprises implementing programmes to shape safe attitudes and behaviours in employees [5, 24]. It is the occupational safety awareness of employees that has a tremendous impact on the way they think and act in the work environment [26]. The appropriate organizational culture enables, among others shaping the level of security culture and improving working conditions [4, 27, 28, 29, 30]. Therefore, the organisational culture is regarded as one of the milestones in the development of occupational health and safety management [25].

Occupational disease

Mining and industrial processing are among the sectors of the Polish economy with the largest number of workers employed in adverse or aggressive work environments. The incidence of occupational diseases in these sectors of the Polish economy has remained high for years. However, mining is characterised by a higher incidence rate of occupational diseases relative to the number of people employed. In 2018, this was nine times higher than the incidence rate of occupational diseases recorded in industrial processing. The incidence of occupational diseases in the Polish mining industry has been high for several decades, with several hundred new cases of occupational diseases recorded every year among employees and former employees. This pattern does not match the trend of incidence recorded in the sectors of the Polish economy. As regards the mining industry, pneumoconiosis and occupational hearing loss are the most common occupational diseases as shown in Figure 2. The diagnosed cases of these two occupational diseases constitute, on average, 90% of all occupational diseases recorded in the Polish mining industry

in 2014-2018. In the Polish mining industry, most cases of occupational disease are recorded in the hard coal mining sector.

Harmful factors

Working in the mining industry differs significantly from other types of jobs, in particular when it comes to the working conditions, and these can be extreme. Miners work in hot, humid, dusty and noisy spaces, so their work in development and working faces should be particularly appreciated and rewarded and should be appropriately motivated to perform such difficult and dangerous work [32, 33, 34].

Methods

The survey sample consisted of people working in the energy sector, and in particular in the mining sector. The statistical sample of 169 people consisted of blue-collar workers from seven Polish mines.

A survey was carried out among underground miners working in two coal mining companies (A and B) to see whether and to what extent they feel appreciated by their employer, and also whether there was a need for rewarding safe work. The survey included qualitative methods involving IDI – in-depth interviews with representatives of mines and mining companies and with industry experts before constructing a questionnaire and quantitative methods. The research objective of the survey was to obtain information on, among other things, the employer's appreciation of the work they performed and the need to reward work safely.

Figure 3 presents the answers of the respondents. In company A, more than 65% of the respondents felt underappreciated for their work, and in company B this was the case for more than 66% of the respondents.

In the entire surveyed group, the distribution of the responses was nearly equal among the three possible options “rather yes” – 49, „no opinion” – 50 and „rather not” – 48. Furthermore, six persons stated that they definitely felt appreciated, while twelve indicated no such feeling at all. Four of the surveyed miners did not answer this question.

The miner's workplace and the conditions underground are unlike anywhere else. Miners must perform their work very carefully, in accordance with the applicable standards and occupational health and safety regulations. They must complete systematic training courses in this field and adhere to the regulations at workplace, bearing in mind their own safety and the safety and health of other miners on working faces.

The authors, who interviewed miners several times about their compliance with OHS rules and regulations, were informed that, despite the employees being familiar with these regulations, not all of them complied with the regulations.

This weak link in the system was also demonstrated in other studies [25]. This state of affairs is corroborated by the answers to the following question: “Should safe work be rewarded?” (Fig. 4).

More than 93% (157) of all the respondents definitely concluded that safe work on the working face, in accordance with all the OHS regulations, should be rewarded, and 6% thought that safe work should not be rewarded. Only one respondent gave no answer.

Almost all (153) persons from the group who answered “yes” opted for a financial form of rewarding safe work. Only four respondents preferred a non-financial form of rewarding safe work, and three persons stated that no such reward should exist. The respondents’ choices are presented in Figure 5. Given the vast majority of coherent responses in this respect, it appears that the inclusion of such an element in the remuneration of the analysed occupational group could improve their earnings for the performed duties and work.

Allowance for working under harmful, onerous and hazardous conditions

In the case of the allowance, it is important to identify the hazardous factors which, in turn, characterise working in special conditions which may cause an occupational disease, disability or even death. The labour law strictly defines who can perform certain professions. Furthermore, special working conditions translate into different systems of retirement, and serve as a basis for allowances under separate regulations. Employing a person to work in harmful conditions entails specific obligations on the part of the employer. The employer is obliged to inform the employee of the hazards which may occur at the given workplace, organise OHC training at its own cost and, if necessary, provide specialist protective workwear and safety footwear [35].

The harmful factors present at the workplace include: physical factors, psychophysical factors, and biological and chemical factors which can cause poisoning, infections, and allergies. The hazard stems from the contact with chemical substances, irradiation or inhaling toxic fumes. In such a case, the employer is obliged to perform appropriate measurements facilitating risk assessment within 30 days of commencing business activity, and to keep a register of harmful agents or substances, which should serve as a basis for establishing the working rules in the company. Measuring the parameters of the work environment, including the present harmful and onerous agents, as well as hygienic assessment, are conducted by an accredited laboratory at the expense and commission of the employer. The results of the tests must be communicated to all exposed employees.

“The matter of allowance for working in harmful conditions is regulated by internal corporate documents, e.g. working and remuneration regulations. There are virtually no laws and regulations addressing this issue. Therefore, it is a goodwill gesture of the employer to compensate employees for the stress caused by working in such conditions. Currently, employers rather strive to improve working conditions than to pay allowances and compensations” [35].

Working in harmful conditions and working in special conditions should not be treated the same way, since these are two different concepts.

Employees who are exposed to harmful agents are entitled to receive an allowance for working in harmful conditions, particularly onerous conditions or hazardous conditions. These, in long term, can result in a decrease in medical fitness and deterioration of health manifested as an occupational disease. The employer can offer allowance to compensate for onerous work. It is one of the elements of remuneration for underground workers in hard-coal mines [36]. In the majority of mining companies, regulations on allowance for working in harmful, onerous and hazardous conditions are provided for in Corporate Collective Labour Agreements, Working Regulations or Internal Regulations.

An allowance defined in such a way:

- is due for working in harmful, onerous and hazardous conditions,
- is not a mandatory allowance,
- can be of a periodical and irregular nature, depending on the circumstances of work and the working conditions.

Regulations in place on the employer’s premises should include a list of positions in which work is regarded as involving harmful, onerous or hazardous conditions. Such work can include work associated with excessive physical or mental exertion related to:

- elements of the microclimate (e.g. temperature and humidity),
- workplace (e.g. inside closed containers),
- manner of work (e.g. awkward postures, excessive load on the musculoskeletal system, forced movement when operating mechanical devices, quickly causing fatigue).

Allowance entitlement ceases automatically when the employee has stopped performing work for which the allowance is provided” [37].

The Labour Code, Chapter 5, as at July 2019, Articles 220-225, includes provisions concerning regulations on the permissibility or prohibition of the application of material and technological processes in workplaces which can constitute potential hazards to the health or life of employees [38].

Harmful conditions do not determine retirement benefits, such as the option of early retirement. Most regulations include information on early retirement for working in special conditions, which do not equal harmful conditions.

The amount of this allowance is provided for in the rules for allowances for work performed under conditions which are harmful to health, onerous and hazardous. This relates to the onerous conditions affecting the miner while at work. In most mining companies, there are four degrees of harm related to working conditions, including exposure to coal dust and free crystalline silica, microclimate conditions, vibrations, noise, radiation, artificial lighting, wet environment, and hazards related to methane, rock bump, etc. The amount of the allowance entitlement is determined in financial terms (for each hour worked in conditions considered to be harmful; the employer must specify the number of hours an employee must work in harmful conditions in order to be eligible for the allowance) or as a percentage of the lowest rate of pay and is due for the time worked in certain conditions, as presented in Table 1.

Conclusions

Polish hard coal mining is still a strategic branch of industry for Poland where people, i.e. the social capital, have always been the most important organisational resource. The employer's task is, on the one hand, to inform employees about the occupational risks associated with their work and, on the other hand, to act in such a way as to minimise the risk of occupational disease. From the formal and legal point of view, it is the employer who bears the responsibility of introducing continuous improvements in safety and health and preventing accidents at work. However, workers' awareness, their knowledge, skills, and commitment are of

crucial importance when it comes to preventing hazardous situations which may impact on human health and life. Preventive health protection measures should improve employees' awareness of various hazards at and outside work. Increasing emphasis is being placed on instilling certain fundamental behaviours which can prove necessary in the event of an accident or need for aid. All this should shape the organisational culture in hard coal mining companies.

This paper was supported by the AGH University of Science and Technology [No. 16.16.100.215].

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Wybrane elementy bezpiecznego środowiska pracy w kopalniach węgla kamiennego w sektorze polskiego górnictwa

Praca w branży górniczej niesie ze sobą wiele niebezpieczeństw w postaci różnego rodzaju wypadków przy pracy czy chorób zawodowych. Ze względu na specyfikę wykonywanej przez górników pracy w przodkach przygotowawczych i eksploatacyjnych, bezpieczeństwo wykonywanej przez nich pracy jest znaczącym elementem w strategii przedsiębiorstw górniczych. Pojęcie bezpiecznego środowiska pracy w kopalniach węgla kamiennego w sektorze polskiego górnictwa jest bardzo obszerne. Dla potrzeb niniejszego artykułu skoncentrowano się na wybranych jego elementach, takich jak: badania lekarskie, szkolenia z zakresu bezpieczeństwa i higieny pracy, środki ochrony indywidualnej, odzież robocza, posiłki i napoje, choroba zawodowa czy czynniki szkodliwe, dodatek za pracę w warunkach szkodliwych, uciążliwych i niebezpiecznych, a także kultura organizacyjna.

Celem artykułu była analiza formalno-prawnych uwarunkowań wybranych elementów bezpiecznego środowiska pracy w kopalniach węgla kamiennego, którą poszerzono o badania dotyczące poczucia docenienia pracowników przez pracodawcę za wykonywaną przez nich pracę oraz potrzebę nagradzania za bezpieczne jej wykonanie. Badania przeprowadzono wśród pracowników na stanowiskach robotniczych pod ziemią w dwóch spółkach węglowych.

Słowa kluczowe: środowisko pracy, przepisy i dokumenty, bezpieczeństwo, górnictwo