



Crisis Management in Mining Companies in the Event of an Epidemic Threat

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<http://doi.org/10.29227/IM-2020-02-39>

Submission date: 23-10-2020 | Review date: 28-11-2020

Abstract

The emergence of the epidemic in Poland at the beginning of 2020 was reflected in the economic activity, including the operation of mining enterprises. Many of them were forced to take immediate measures to protect the health and life of employees and their families, as well as maintain financial stability in connection with the economic slowdown that took place in the initial period of the epidemic. Preventive measures taken by the management contributed to limiting the spread of the coronavirus among mine workers. The article presents the characteristics of the crisis caused by the epidemiological situation due to the SARS-Cov-2 virus, the challenges faced by mining enterprises during the pandemic, the directions of actions aimed at stopping the spread of the coronavirus among employees, and the epidemiological situation in one of the hard coal mining companies.

Keywords: mining companies, epidemic, crisis, crisis management

Introduction

The occurrence of an epidemic threat in a given country means that the government needs to introduce many restrictions, which not only limit the current activity of the society but also severely affect the operation of many enterprises, including those belonging to the mining sector. Pursuant to the Act of December 5th, 2008 on preventing and combating infections and infectious diseases in humans, an epidemic threat is defined as a legal situation introduced in a given area in connection with the risk of an epidemic in order to undertake preventive measures specified in the Act [1]. Closure of borders, economic slowdown, suspension of investments and other activities by certain companies, or a drop in demand for the raw material produced are just some of the difficulties that mining companies must face during an epidemic. In addition to the problems related to the functioning and implementation of the planned investments, mining companies need to deal with the most important problem at the moment, namely ensuring the sense of safety for their employees and their relatives. Due to the inability to completely cease the work of underground mining plants for the duration of a pandemic, it is necessary to systematically implement, for example, those tasks that are necessary to ensure the continuity of their operation. Failure to act, even for a very short time, to use preventive measures or to maintain mining excavations may result in huge material losses, and in extreme cases, contribute to the necessity to close a given plant. This means that enterprises conducting underground mining activities, as one of the few, cannot completely suspend their operation and, despite the occurrence of a threat, must continue carrying out their tasks. Therefore, developing a strategy for mining enterprises to deal with an epidemic crisis is quite difficult and complex. This is because their management boards need to develop such rules and procedures that, on the one hand, will ensure economic security and continuity in the implementation of planned investments [15, 13, 14], in the first place, those aimed at maintaining workings, and on the other hand, guarantee the sense

of peace and safety for all employees performing their tasks during an epidemic.

The following article attempts to describe the operation of mining enterprises in the event of a crisis related to an epidemic in the territory of the Republic of Poland.

The concept of crisis and a crisis situation in an enterprise

Crisis is a term derived from the Greek word – "krisis" – which in translation means a choice, a decision-making process, a struggle, and also a fight in which activities are carried out under time pressure [2]. It can also be understood as a condition that threatens a company's survival and the achievement of its goals. It is emphasized that the crisis is an undetectable situation. In general it means an unstable situation that requires reform [16]. In addition, it limits the time available for taking remedial actions and surprises decision-makers with its occurrence, thus putting strong pressure on them [3]. However, it should be remembered that this concept is a well-known term for entrepreneurs. Crisis is closely related to a crisis situation, which, unlike a crisis, concerns a state that results from the formation of certain unfavorable phenomena over time. It is crucial to emphasize that it does not pose a direct threat to the existence of an organization but leads to an unsatisfactory assessment of its activities from the point of view of changes taking place in the environment and/or in relation to the model conditions [4].

So far, mining companies have struggled with many crises, the background of which was immensely diverse. A decline in demand for coal, changes in crude oil prices, increasingly difficult geological and mining conditions, coal imports, restrictions related to gas emissions and instability and uncertainty of economic, socio-environmental and political conditions [5, 9, 10, 11, 12] are just some of the reasons that led to the emergence of a crisis in mining companies, and have always required the management board to take immediate action to mitigate their effects [5]. Therefore, the concept of crisis and a crisis situation in a mining enterprise has become the subject

Tab. 1. Challenges faced by mining companies during the coronavirus epidemic. Source: own elaboration
 Tab. 1. Wyzwania postawione spółkom górniczym w czasie epidemii koronawirusa. Źródło: opracowanie własne

| ECONOMIC | ORGANIZATIONAL | HEALTH-RELATED |
|--|--|---|
| <ul style="list-style-type: none"> - decline in demand for the manufactured raw material resulting from the suspension of many investments, - decline in the company's stock market value, - the need to find additional capital for the purchase of protective measures for employees, - loss of strategic recipients, - loss of financial liquidity, - the need to limit funds for own investments, - reduction of employee wages | <ul style="list-style-type: none"> - the need to introduce a temporary ban on entering the mine area for external stakeholders, - adapting workplaces to the guidelines issued by state institutions concerned with limiting the spread of the virus, - providing an appropriate amount of protective and disinfecting agents to mines, as well as organizing teams to supervise the process of room and workstation disinfection, - reorganization of working time, - limiting contact between employees to the necessary minimum, - introducing remote work for those positions that do not require being on the premises of the plant, - organizing underground transport in accordance with the guidelines regarding the number of people, - preparing teams and rooms in the plant in case it is necessary to gather the crew | <ul style="list-style-type: none"> - employees' fear of illness, - problems with access to protective measures or their insufficient amount in the initial phase, - preparing a procedure in the event of an accident in the workplace, - organizing medical points where employees can seek advice |

of many scientific papers [6, 13, 14]. When talking about a crisis, it is also worth paying attention to the concept of crisis management, i.e. all those activities aimed at controlling and overcoming the situation, as well as trying to develop certain actions to be implemented once it occurs [13].

An epidemic as a complex crisis for mining enterprises

The outbreak of the coronavirus epidemic in March 2020 presented all enterprises with a very difficult task. An epidemic means the occurrence of more cases with a given disease in a given area and in a given time than statistically expected [7]. If this situation takes place in more countries in the world, it can be called a pandemic. As already mentioned, the crisis itself is not an issue that companies have not dealt with before. In most cases, they have even managed to develop action plans in the event of their occurrence. Nevertheless, in the case of previous crises, they usually had to deal with only one problem requiring intervention. This time, however, management boards were forced to take immediate action on three planes simultaneously: economic, organizational, health-related.

The announcement of the occurrence of an epidemic in a given country by the government is connected with the introduction of a number of measures aimed at stopping the epidemic development as much as possible and controlling its course. For almost all enterprises, this means the occurrence of a number of difficulties related to the current operation. Companies concerned with activities that do not allow them to continue them remotely, or those that do not have assets enabling them to suspend their operation and survive in this period, as a result of long-term limitations, are not able to cope with their effects. This often means the loss of many jobs, and in extreme cases, leads to their liquidation.

In the case of companies extracting hard coal using an underground method, the problem is much more complex. Firstly, mines that comprise mining enterprises, despite their resources allowing them to survive during a crisis, must maintain the continuity of works. It is related to the specificity of their functioning. On a daily basis, apart from mining,

mines must simultaneously carry out a number of preventive works. These include inspection of excavations, rock mass, ventilation of excavations, control of the amount of water from the rock mass, fires, etc. It is related to the presence of employees on the premises of the plant. Therefore, as mentioned in the introduction, mining enterprises, at the time of the emergence of an epidemic, are forced to prevent the economic and organizational effects of the emerging crisis and must take measures to stop the spread of this epidemic among employees while in the workplace. In the case of economic and organizational difficulties that may lead to a crisis, the following can be distinguished: a decrease in demand for the produced raw material, stock market collapses, an increase in the costs of existing investments, difficulties related to restrictions on functioning in the existing reality, and reorganization of work. In addition, there are challenges related to the pathogen itself: fear among employees and absence. These and other problems contributing to the deepening of the crisis that arose as a result of the epidemic are presented in Table 1.

It is worth emphasizing that, so far, both the difficulties and the effects of the crises reported have been related mainly to either economic or organizational problems. The outbreak of the coronavirus epidemic forced employers to simultaneously take measures to protect the health and life of employees on a very large scale. Therefore, the simultaneous overlapping of so many aspects that must be mastered in a very short time allows for defining the present crisis as a complex crisis.

Recommendations on the operation of industrial plants issued by the Chief Sanitary Inspectorate (GIS) in connection with the spread of SARS-Cov-2 virus in the territory of the Republic of Poland [8]

Due to the fact that in the last few decades, there have been no epidemics on a scale as large as the coronavirus epidemic, no actions were taken to develop procedures for the operation of enterprises during biological threats. As a result of the pandemic in March 2020, the GIS issued recommendations on the operation of industrial plants for the duration

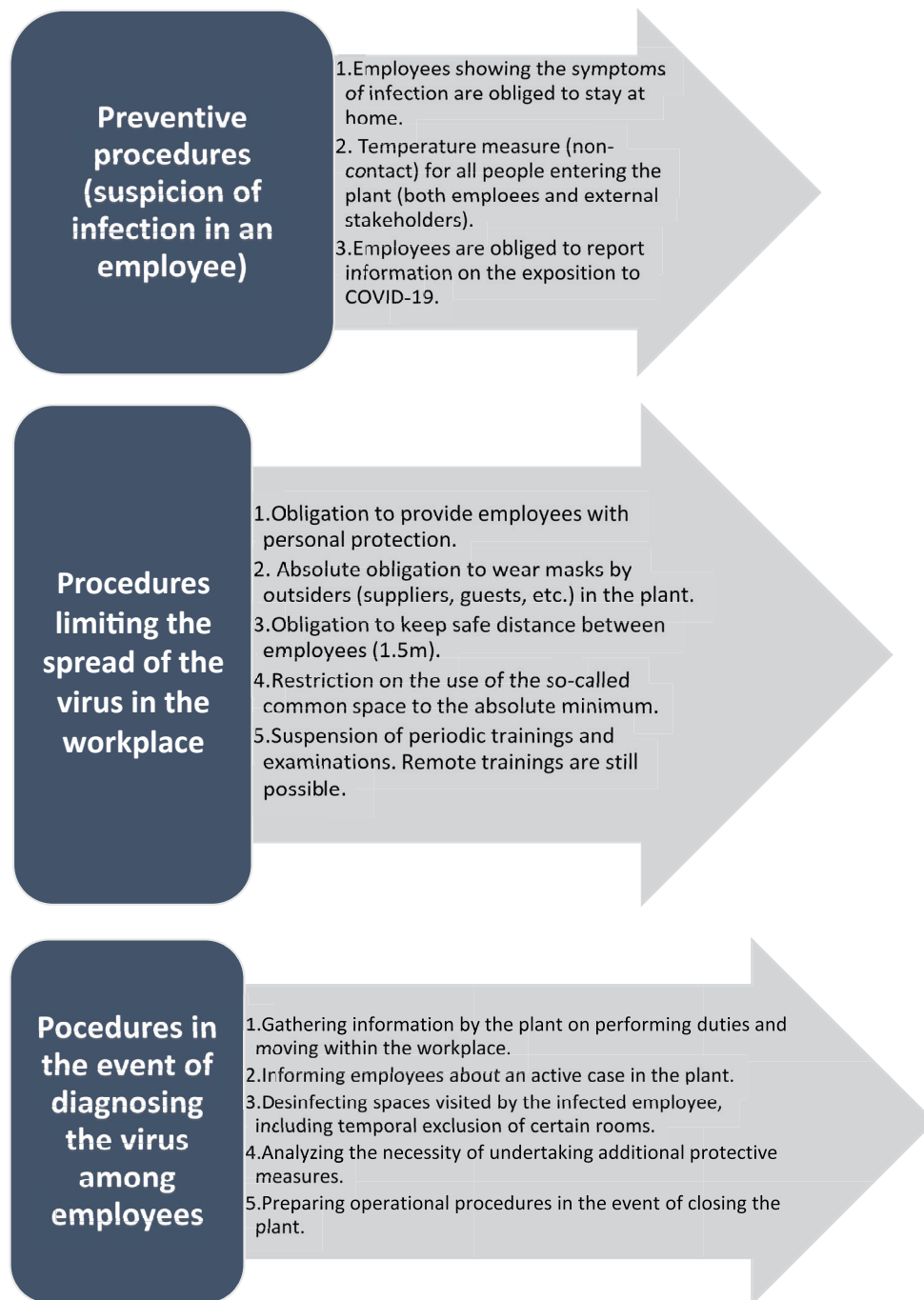


Fig. 1. GIS recommendations on preventing the spread of the coronavirus for industrial plants. Source: [8]

Rys. 1. Wytyczne GIS dla zakładów przemysłowych. Źródło: [8]

of the epidemic threat. They have been divided into 3 groups: prevention, restriction and procedure in the event of a threat. This makes entrepreneurs not only to develop methods to control cases among employees but also to provide them with protective measures. All GIS guidelines and recommendations are presented in Figure 1.

In addition to the recommendations on the operation of enterprises during the epidemic, the GIS has published additional guidelines to help limit the spread of the epidemic and they include [8]:

1. To prevent the spread of the pathogen:
 - implementation of procedures aimed at collecting information (every day) on the health condition

of employees, contacts with infected individuals or those at the risk of infection.

2. To limit the spread of the pathogen:
 - restriction on contacts between employees,
 - work in small teams isolated from the rest,
 - limiting contacts between employees from individual shifts through the reorganization of work,
 - different times of starting and ending work as well as adjusting breakfast breaks to reduce clusters of employees,
 - remote work for employees whose duties can be successfully performed from home,

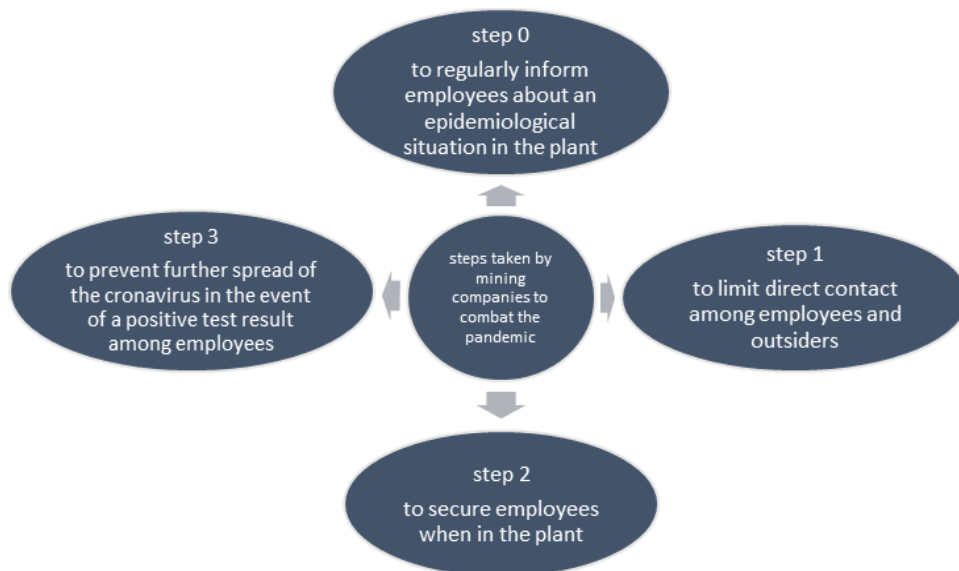


Fig. 2. Steps taken by mining companies to combat the threat of the coronavirus. Source: own elaboration
 Rys. 2. Kroki podjęte przez spółki górnicze w walce z zagrożeniem koronawirusem. Źródło: opracowanie własne

- limiting the number of employees in social rooms,
 - suspending contacts with external stakeholders (remote meetings are recommended),
 - if it is necessary to meet a larger group of people, such as employee briefings, it is recommended to conduct them outdoors. In the case of meetings held indoors, the best possible ventilation of the rooms should be maintained by opening windows and doors;
 - preventive decontamination procedures throughout the plant.
3. When an employee tests positive:
- Depending on the possibility, it is recommended that employees work remotely or refrain from work for a period of two weeks in the case of those who have contact with an infected co-worker. If necessary, reserve personnel should be mobilized. In the absence of symptoms for a period of 2 weeks, employees may return to work.

Operation of mining companies during the epidemic

The new reality caused by the outbreak of the coronavirus epidemic has forced the management boards of mining companies to take immediate action to limit the spread of the epidemic among employees. When compared to the crises that mining enterprises had struggled with before, these tasks were much more complex, for instance, due to the need to deal with difficulties in the economic, organizational and epidemic fields at the same time. The previous crises required mainly one aspect to be resolved. In the case of economic problems, mining companies, after years of experience, have developed many plans on how to survive this type of breakdown. This time, the crisis related to the epidemic itself turned out to be the most difficult to deal with.

In order to ensure the safety of their employees and their relatives, the management boards took immediate measures to prevent the development of the epidemic in the mining plants. In the first place, a decision was made to introduce

remote work for all positions in the mining industry, the tasks of which could be carried out without the need to stay in the mine. These activities allowed for a significant reduction in the number of people present on the premises of the plant, thus reducing the risk of further spread of the pathogen. Additionally, contacts with external stakeholders were limited to emergencies only. In other cases, they were conducted remotely. However, the most difficult task that had to be performed was securing those employees whose work did not allow for remote continuation. In this case, the immediate procedure used was to measure the temperature of all employees entering the plant and to limit contact between these employees. It should be remembered, however, that limiting contact between employees who carry out mining or repair works underground is extremely hard and, in some cases, even impossible to achieve. In this case, mining companies focused on introducing the need to constantly use personal protective equipment, such as masks and gloves. Additionally, a procedure to be followed in the event of an incident in the mines, belonging to individual companies, was specified. The exact steps taken by the companies to prevent the spread of the coronavirus in the mines are shown and described in Figure 2.

Regular information provided to employees about the epidemic situation in their workplace is a crucial step that was applied in the fight against the epidemic. It allows companies both to avoid chaos and implement subsequent steps to increase the sense of safety among employees.

In the case of the first step, aimed at limiting direct contact between employees and external stakeholders, mining companies decided to implement the following procedures:

- To introduce remote work in office positions both in individual plants and management boards.
- To reduce the number of employees (some employees, in the initial phase of the epidemic, used their outstanding leave).
- To introduce distance between employees: in the case of surface workers (necessary office workers) and un-

Tab. 2. The epidemiological situation in hard coal mines of PGG S.A. (as of September 3rd, 2020)

Tab. 2. Sytuacja epidemiologiczna w kopalniach węgla kamiennego PGG S.A. (stan na dzień 03.09.20 r.)

| PGG S.A. | Employment status (as of sept. 3rd, 2020) | Number of infected employees (growing till Sept. 3rd, 2020) | Number of healthy employees (as of sept. 3rd, 2020) |
|--|---|---|--|
| <i>KWK Murcki - Staszic</i> | 3849 | 345 (9%) | 3504 (91%) |
| <i>KWK Myslowice - Wesola</i> | 3252 | 8 (0,25%) | 3244 (99,75%) |
| <i>KWK Wujek</i> | 1350 | 62 (5%) | 1288 (95%) |
| <i>KWK ROW - Ruch Chwałowice</i> | 2796 | 322 (12%) | 2474 (88%) |
| <i>KWK ROW - Ruch Jankowice</i> | 3086 | 703 (23%) | 2383 (77%) |
| <i>KWK ROW - Ruch Marcel</i> | 2902 | 311 (11%) | 2591 (89%) |
| <i>KWK ROW - Ruch Rydułtowy</i> | 2738 | 32 (1%) | 2706 (99%) |
| <i>KWK Piast-Ziemowit - Ruch Piast</i> | 3452 | 24 (1%) | 3428 (99%) |
| <i>KWK Piast-Ziemowit - Ziemowit</i> | 3634 | 44 (1%) | 3590 (99%) |
| <i>KWK Ruda - Ruch Halemba</i> | 2305 | 27 (1%) | 2278 (99%) |
| <i>KWK Ruda - Ruch Pokój</i> | 1155 | 33 (3%) | 1122 (97%) |
| <i>KWK Ruda - Ruch Bielszowice</i> | 2774 | 657 (24%) | 2117 (76%) |
| <i>KWK Bolesław Śmiały</i> | 1719 | 94 (5%) | 1625 (95%) |
| <i>KWK Sośnica</i> | 2006 | 460 (23%) | 1546 (77%) |

derground workers (workshops), keeping a distance of 1.5 m from individual positions (unfortunately, not all positions can maintain the recommended distance).

- To change working hours (introduction of a 3-shift work system of 6 hours each, with two-hour breaks enabling the disinfection of rooms and limiting employees' contact from individual shifts).
- In the case of external stakeholders, the preferred contact via mobile devices or postponing the visit to the site to another date. This type of contact is also dedicated to employees from various shifts and from different departments to reduce the possibility of spreading the virus.
- To limit the number of crew in underground transport (trains) and in mine cages, as well as to prevent the formation of clusters of workers waiting for transport.
- To organize additional entries/exits from workplaces in order to reduce the number of people gathering at the same time.
- To organize meetings and divide duties in small groups, in large rooms with open windows (in the case of favorable weather conditions conducted in the fresh air).
- To maintain safe distance between employees while waiting to enter the plant, before congresses, during meetings, when using a bathhouse, when contacting workmates, and during work.
- To suspend business trips, conferences, and to cancel courses and other events for the duration of the epidemic.

The second step is to protect employees from contact with the virus and to recognize people suspected of being infected by:

- measuring the temperature of employees before entering the plant,
- wearing masks by all employees from the moment they enter the mine,
- disinfecting rooms that employees use most often, or where the risk of infection is greater: bathhouses, cloakrooms, corridors, rooms where employees

gather, some offices, lamp rooms, underground stations;

- disinfecting the company's means of transport, both underground and surface: trains, buses;
- arranging hand disinfection points on the premises of the plant and disinfecting gates in front of the entrance to the mine cage,
- introducing a ban on taking snuff,
- avoiding touching objects, handrail buttons, etc., and using protective gloves.

The third step is to prevent possible further contamination among crew members when the virus emerges:

- To organize the crew's work in a way that limits contact between employees: work in permanent groups and on specific shifts.
- To introduce an obligation to undergo a two-week quarantine in the case of return from abroad, contact with an infected person and at the request of the employer.
- To prevent employees with symptoms of infection from working.
- To test employees for the presence of the coronavirus in the event of an active case among them,
- To allow only employees who have a negative test result to work when a larger number of positive cases occur.
- To arrange isolation tents in front of the mines, with the possibility to obtain medical advice, and isolation rooms in the mine for employees with symptoms.
- To introduce an obligation to inform superiors about all disturbing symptoms and contacts with the potentially infected.
- To be compliant with hygiene rules (frequent washing of hands, covering the face when sneezing or coughing, and keeping distance from others).

The epidemiological situation in Polska Grupa Górnicza S.A. (as of September 3rd, 2020)

Despite the implementation of measures and procedures aimed at preventing the spread of SARS-Cov-2 virus among employees, as well as the discipline to comply with these recommendations, it was not possible to completely limit the

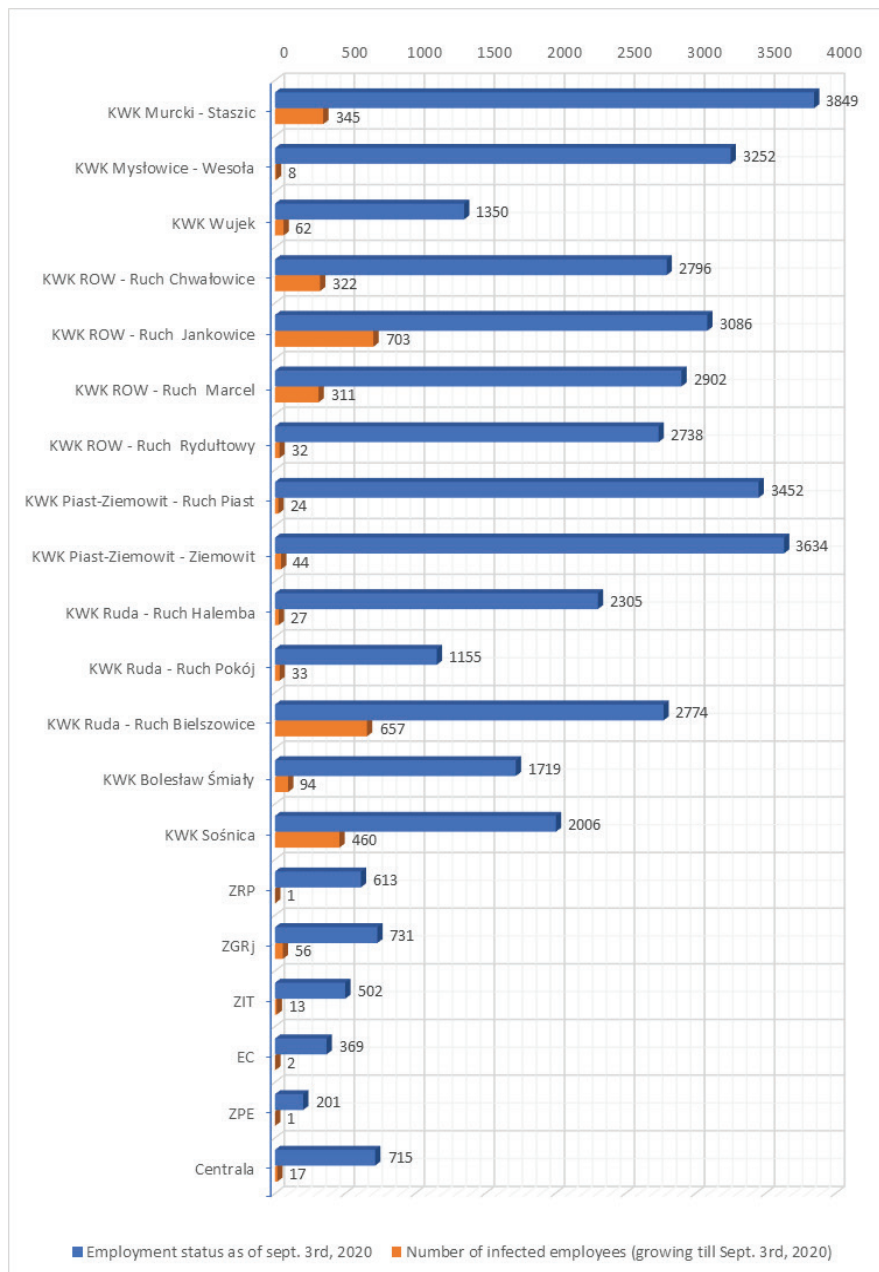


Fig. 3. Comparison of the number of employees of PGG units to the number of individuals with a positive test result for the coronavirus. Source: own elaboration
 Rys. 3. Zestawienie liczby pracowników jednostek PGG do ilości osób u których stwierdzono pozytywny wynik testu na koronawirusa. Źródło: opracowanie własne

infiltration of the virus into the mining plants. This is due to the fact that some of the employees have close relatives who work in the health service, and initially it was hospitals and other medical centers that posed a threat in the spread of the virus. In addition, loosening the restrictions in the second half of April 2020 contributed to the increase in disease incidence, and thus increased the risk of virus transmission to the mines. It is worth adding that the vast majority of people working in mining are young, and thus the initial symptoms were difficult to detect, or no symptoms were present. Only the screening tests allowed for more accurate depiction of the epidemiological situation of the mining sector employees [17]. In the case of Polska Grupa Górnicza S.A., 3,212 infections were confirmed among all employees (the total number of PGG S.A. employees is 40,149). The exact number of employees who tested positive is presented in Table 2 and in a

diagram (Fig.3.). These data refer to cases reported until Sept. 3rd, 2020.

Table 2 presents a comparison of the number of employees of the mines belonging to Polska Grupa Górnicza SA who tested positive for SARS-Cov-2 virus to the number of healthy individuals in the period from the occurrence of the pandemic to September 3rd, 2020. The comparison is presented both in numbers and percentages. The mines where the percentage of infected individuals was greater than 10% included those belonging to KWK ROW: Chwałowice, Jankowice, Marcel; the Sośnica mine and KWK Ruda - Ruch Bielszowice . In the case of the remaining mines, the percentage ratio of the infected to non-infected ranged from 1 to 10%. The smallest percentage, only 0.25% of infected individuals in relation to the total number of people employed, was found in KWK Mysłowice - Wesola. Figure 3 presents a comparison of the

number of individuals who tested positive for SARS-Cov-2 virus, including employees from mines and other bodies belonging to Polska Grupa Górnicza S. A., as well as the number of employees in individual units and plants.

The total number of employees of the mining plants belonging to Polska Grupa Górnicza S. A., who tested positive for SARS-Cov-2, was 3,122 by Sept 3rd, 2020 and accounted for 8% of all employees. The number of people who were not employees of the mining plants but were employed in Polska Grupa Górnicza S. A., and who also tested positive for coronavirus, was 90, which is less than 1% of all employees of the company. As already mentioned, the total number of people with a positive test result was 3,212 as of Sept. 3rd, 2020, which is slightly over 8% of all employees.

Conclusion

The outbreak of the coronavirus epidemic influenced the way hard coal mines operate throughout the region. In addition, along with the epidemic threat, mining companies were forced to deal with the effects of the worldwide crisis caused by the pandemic overnight.

Over the years, in the event of economic problems, coal mining companies have managed to develop procedures to help survive this type of crisis and to collect additional funds in the event of problems with maintaining financial liquidity.

The biggest issue faced by the management boards was to ensure the safety of employees and their families, as well as to prevent the rapid spread of the coronavirus. For this purpose, a number of measures were applied to limit the spread of the pathogen, including remote work, personal protective measures, distance among employees, or contact via mobile devices.

The analysis of the incidence data among employees of Polska Grupa Górnicza S.A showed that the total number of positive cases as of Sept 3rd, 2020 was 3,212 and accounted for 8% of all employees.

The vast majority of people with positive test results involved employees of the mining plants belonging to Polska Grupa Górnicza S.A. This number amounted to 3,122 cases. The largest number of cases in relation to the number of people employed was reported for KWK ROW - Ruch Jankowice, and it amounted to 703.

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Zarządzanie kryzysowe w przedsiębiorstwach górniczych w sytuacji zagrożenia epidemicznego
Wprowadzenie stanu epidemii na terenie Polski na początku 2020 roku miało swoje odzwierciedlenie w działalności gospodarczej, w tym działalności przedsiębiorstw górniczych. Wiele z nich zostało zmuszonych do podjęcia natychmiastowych działań mających na celu zapewnienie ochrony zdrowia i życia pracowników oraz ich rodzin, a także utrzymania stabilności finansowej w związku ze spowolnieniem gospodarczym jakie miało miejsce w początkowym okresie epidemii. Działania profilaktyczne, podjęte przez zarządy spółek górniczych, przyczyniły się do ograniczenia rozprzestrzeniania się koronawirusa wśród pracowników kopalń. W artykule przedstawiono charakterystykę kryzysu wywołanego sytuacją epidemiologiczną spowodowaną wirusem SARS-Cov-2, wyzwania, jakim musiały sprostać przedsiębiorstwa górnicze w czasie pandemii, oraz kierunki działań spółek górniczych mających na celu zahamowanie rozprzestrzeniania się koronawirusa wśród pracowników, a także sytuację epidemiologiczną w jednej ze spółek górniczych wydobywających węgiel kamienny.

Słowa kluczowe: przedsiębiorstwa górnicze, epidemia, kryzys, zarządzanie kryzysowe