**Zygmunt Kajdasz**
**Director**
**Central Mines Rescue Station**
**Bytom, Poland**

# The rescue operation in "BRZESZCZE" Hard Coal Mine in 2003

On April 1, 2003 at 9.24 p.m. at the 108 longwall, the 364 west seam at the depth of 740 / 640 m (Fig. 1) in the Hard Coal Mine "BRZESZCZE" in Brzeszcze the methane ignition and explosion took place, resulting in fire.

As a result of the accident, 12 miners were injured, including 11 who suffered scalds of various degrees. One miner was left in the air-heading in front of the 108 longwall. The 108 longwall was being exploited in a longitudinal method with the fall of roof. The 364 seam was classified as the $4^{th}$ methane category and as the B-class with respect to the coal powder explosion risk. The length of the longwall was 254 metres and the seam thickness was 2,0 through 2,2 m, with the 1470 m overrun passage. The ventilation of the longwall was ensured by the "U" system, with the airflow of 2400 $m^3$/min. The area in question was protected by the system of automated manometry, with the use of continuous-operation methane detectors. The 108 longwall was subject to methane removal with the use of holes, drilled from the air-heading..

On April 1, 2003, during the $3^{rd}$ shift, 46 miners were directed to work at the 108 longwall (including two inspectors), air-heading and the carrying gangway.

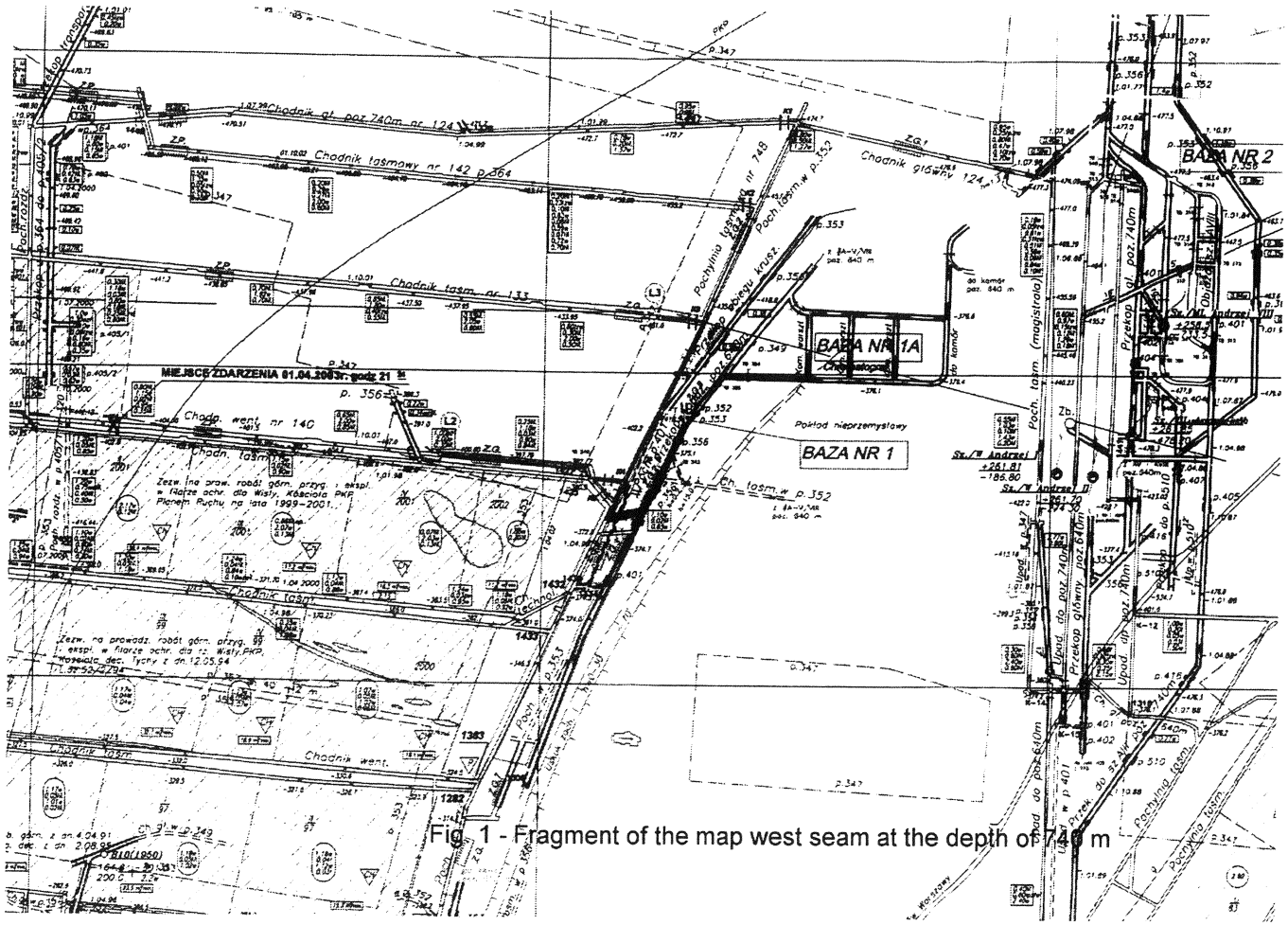


Fig. 1 - Fragment of the map west seam at the depth of 740 m

**Fig. 1**

While the exploitation work was underway at the longwall, in the air-heading the setup of the drilling rig was done along with dismantling of the ϕ 200 mm pipeline.

Durign the 3rd shift at the 108 longwall, the JOY heading machine, having cut the coal heap, approached the upper chamber and, after clearing the machine route, was drawn back to Section 130 at 8.30 p.m.

Around 9.20 p.m. the foreman in charge of the shift, having inspected the site at the 108 longwall, went over to the telephone no. 6117, mounted on the air-heading's wall, 25 meters away of the front of 108 longwall, to report to the coal mine dispatcher. While the foreman was lifting the handset of the telephone, a sudden blow of air coming from the 108 longwall overthrew him, and then a wave of hot and dusty air came.

The foreman reported to the dispatcher about the incident at 9.24 p.m. The dispatcher ordered him to draw the whole team back from the area of the 108 longwall. During the telephone conversation the communication got broken.

According to the foreman's report, before the accident happened, the air was felt sucked in the direction of the 108 longwall and another blow of air took place. Once after the second blow, one miner from drilling department was running through the air-heading with his clothes smouldering. The foreman extinguished fire on the miner's clothes and they both moved back in the direction of the 108 longwall and next, trough the wall to the carrying gangway.

Moving back through the 108 longwall, together with the injured miner, the foreman led also the whole team out, that was present at the longwall, **without using absorbers**. Another contact of the foreman with the dispatcher was made from the telephone located in the vicinity of the wall conveyor drive unit. The foreman informed the dispatcher about moving with the team back from the 108 longwall.

The dispatcher confirmed the command to continue moving back from the 108 longwall as well as to count the team members at the crossing point of the carrying gangway with the haulage plane.

The command of moving miners back, all those working at the remaining foreheads and longwalls from the west side of the mine, was given in agreement with the dispatcher of the methane detecting department, using both the telephone and loudspeaker communication system.

In obedience with the command of the dispatcher, the 108 longwall team moved back to the crossing of the carrying gangway with the 748 haulage plane, where the team was counted (42 people altogether).

Two miners from the drilling department, employed at the air-heading, together with the foreman, moved back in direction of the 748 haulage plane, **using the POG absorbers.**

While the three people were moving back in the air-heading, when they were at the distance of around 300 –350 metres from the gangway outlet to the 748 haulage plane, the third blow took place.

The location of miners in the area of the 108 longwall, soon before the following ignitions and explosions of methane is shown in fig. 2.

In the immediate endangered zone 46 employees were present.

45 employees altogether were moved out of the 108 longwall area. Consequently, as the number of employees from the 108 longwall indicated, one miner from the drilling department was found missing. During the event that miner, according to the other employees' statements, was in the air-heading, dealing with the disassembly of the $\phi$ 200 mm pipeline (methane removal).

The dispatcher, having received from the foreman information on the accident at the 108 longwall, undertook actions to draw the teams from endangered zones as quickly as possible (informing the teams at individual foreheads,

directing the escaping route, receiving reports from those moving back). He also undertook procedural actions as set forth by the Rescue Operation Plan. The coal mine dispatcher designated also the following:

1) the fire danger zone,

2) locations for 15 alerting posts (at the beginning of the rescue operation) in order to prevent unauthorised persons from entering the endangered zone,

3) the location of the rescue base, in cross-cut at the depth of 640 m to the crushing system cross-cut (Base no. 1).

Afterwards, the dispatcher at 9.45 p.m. directed two rescuer teams of the "BRZESZCZE" Coal Mine to proceed with the rescue operation.
At 11.14 p.m. 2 teams of rescuers arrived at the mine's rescue station from the Regional Mining Rescue Station from Jaworzno (OSRG). The teams were immediately directed to the rescue base at the depth of 640 m.
According to the proposal of the team of experts, the rescue actions were immediately undertaken with respect to the following:

- preparation for nitrogen pumping into the carrying gangway of the 3rd shift of April 2, 2003,

- separation of the 108 longwall area by means of explosion-proof dams in the gangways.

During the inspection of the exploitation sites at the depth of 740 m, the damage was revealed, presumably resulting from explosion at the 1449 dam area, located in the main 124 gangway, at the depth of 740 m.

At 8.00 a.m. on April 3, 2003 the meeting of the Advisers' Team was held, during which the explosion at 2.20 p.m. was reported to happen at the exploitation site, which was observed in a form of short disturbance to the ventilation in the carrying gangway. This took place at the plug made of insulation foam, behind which the nitrogen was pumped. The damage of insulation dam was reported, which had been built in the main 124 gangway at the 364 seam. As a result of the dam's destruction the migration of air occurred, in the direction of the fire centre. The above event created the necessity to stop such migration, by building two explosion-proof dams located at:

- the main gangway at the depth of 740 m, to the west of the haulage plane (K-1),
- the 142 carrying gangway, at the 364 seam, to the west of the haulage plane (K-2).

At 1.40 p.m. the explosion of gases at the 108 longwall took place, what destroyed the temporary insulation dam, made of insulation foam in the carrying gangway, what was confirmed at 3.17 p.m., once the site was explored by the team of rescuers.

Due to the explosion, the construction of the explosion-proof dam was stopped in that site.

The team assumed that construction of the K-1 and K-2 dams would restore the ventilation at the 108 longwall, to the state, which was present before the destruction of the insulation dam, built in the main 124 gangway at the 364 seam. The above would largely contribute to the reduction of access of air to

the fire centre, and would enable continuation of construction of the explosion-proof dams of the 108 longwall gangways.

For both dams the ϕ 800 mm air-ducts in explosion-proof casing, one for each dam, were designed.

On April 5, 2003, at 9.18 a.m. air-ducts in both, the K-1 and K-2 dams were simultaneously closed.

Pumping the nitrogen into the carrying gangway was continued. At 8.30 a.m. pumping the nitrogen into the 124 gangway was started for the 364 m seam (behind K-1 the explosion-proof dam).

Further on, it was resolved on construction of the following:

- the K-3 the explosion-proof dam in the carrying gangway,
- the K-4 and K-5 the explosion-proof dams at the outlet of the 108 longwall.

During another session of the Team of Experts on April 12, 2003, having analysed the current situation at the fire, it was stated that the process of methane combustion in the exploitation sites within the 108 longwall area had been stopped and that it was possible to undertake inspection of that area.

Afterwards, the air-ducts in the K-3 explosion-proof dam were opened and ventilation of the 108 longwall was started with the airflow of 370 $m^3$/min.

The chromatographic analysis of the air sample collected from the no. 2 line at 2.00 a.m. indicated that ignition of methane in the ventilated area occurred (rapid decrease of the oxygen and methane concentrations, with the increase of the oxide, carbon dioxide and hydrogen concentrations at the same time).

At 3.00 a.m. the rescue operation leader commanded simultaneous closing the air-ducts in the K-3 and K-5 explosion-proof dams. 12-hour waiting time was commanded.

At 4.50 a.m. pumping of the nitrogen was started again, into the vicinity of the 108 longwall, behind the K-3 dam with the flow rate of approximately 20 $m^3$/min.

Between April 18 and 25, 2003 the following actions were covered by the rescue operation:

- continuing of pumping nitrogen, behind the explosion-proof plug (until the rescue operation was suspended on April, 25 2003, the amount 752.000 $m^3$ of nitrogen was pumped),
- between the explosion-proof dams K-5 and K-3 the system of pipelines was built, with water circulation pumps and water-cooling units, in order to maintain re-circulation of fire gases, and for the removal of methane from the gas mixture, characterized by low oxygen and high methane concentration,
- the adjustment of the pressure difference at the insulation dams was performed in the vicinity of the 108 longwall,
- frequent performance of chromatographic analysis in individual sites, by the rescue operation leader.

Fig. 2 - The location of miners in the area of the 108 longwall on Aprill 1. 2003