SEBASTIAN NAPIERAJ
AGH – University of Science and Technology,
Krakow, *Poland*

EFFICIENCY OF METHANE DRAINAGE OF COAL SEAMS IN POLISH UNDERGROUND MINES

Добыча угля в польских шахтах производится в условиях природных угроз, таких как наличие метана, возможность возгорания и взрыва угольной пыли. Шахтная вентиляция является одним из основных средств контроля содержания метана. Отвод метана в польских угольных шахтах производится с эксплуатационных участков, узких выработок, особенно при их прохождении, и из выработанного пространства. Отвод метана оценивается по потоку метана от вентилируемой зоны до системы вентиляции.

The coal exploitation in Polish mines be led in conditions of associated natural threats, such as methane, fire and coal dust explosion threats. The drainage of orogene is one of the basic middle self-control of methanated threat. To possibility of drainage of orogene led from surface and from underground excavations with holes. Methane drainage in Polish coal mine be lead from: exploitation working, dog heading, especially in time their driving, goaf. Methane drainage is estimated across methane stream flow accompanied in drainage processes to catfish of methane flow from drainage and ventilation.

Methane drainage in Polish coal mines

Main drainage system aim – as way of fighting methane threats – is maximally large methane downloads from rocks and coal seams. Drainage system is additionally – independent from mining excavations – built-up from pipelines and methane drainage holes, hermetically closed, by which the methane floats away.

To the drainage net methane flows in from ambient rocks and the coal seams, whereat this inflow is additionally provoked in the holes with underpressure which generate pump stations situated on minehead. Bearing that in mind the place of guidance one may distinguish the drainage of the rock holes mass to lower the methane content in the air:

- exploational excavations,
- corridor excavations,
- spaces of goaf.

However taking into consideration the time of realization of rock mass drainage holes, we can distinguish:

- the drainage before exploitation of coal seams,
- the current realized in exploitation of coal seams.

It in drainage aim executed in rock mass the hole about 2 m long and puts in it the drive tube (fig.1), which is sealed at the hole outlet.

To the space between drive tube and sides of hole we press cement milk through, to plug the outlet of the hole. This all is done to avoid sucking the air to the hole while working under considerable depression.

With so prepared tube we drill proper drainage holes. The length of holes comes to 110 m, and practical diameter is 65, 85 or 95 mm, what depends from the kind of rocks mass.

Efficiency of methane drainage can by defined in following way:

-coal mine

$$E_0 = \frac{100V_m}{V_m + V_k},$$

where: E_0 – Efficiency of methane drainage in coal mine; Vm – methane piped away by drainage; Vk – methane piped away with the usage of the vent,

-region

$$E_0 = \frac{100V_m}{V_m + V_r},$$

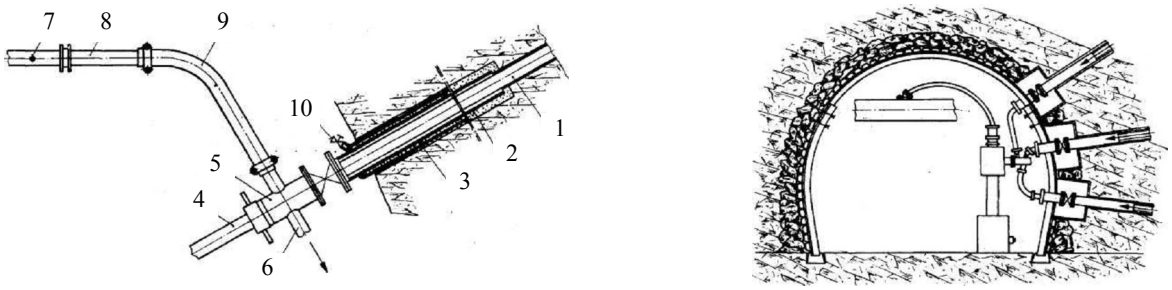

Fig.1. Drainage hole drilling
1 – drainage hole 0-65 mm, 2 – drive tube, 3 – cement, 4 – drill rods, 5 – rod stuffing-box, 6 – outlet water, 7 – methane pipes, 8 –measurement element, 9 – drilling fluid hose, 10 – cut out

where E_0 – efficiency of methane drainage in coal mine; *Vm* – accompanied from region with drainage methane; *Vk* – methane accompanied ventilating from region.

Drainage exploational excavations

In Polish coal mine longwall mining system is applied.

The group of holes is drilled from side wall or from suitable niches next to the wall while distance among groups of holes carries out about 20 to 50 m. The number of holes ranges from 2 to 10 holes in group, with the length about 60 m and diameter 65 mm.

Efficiency of methane drainage in exploational

Efficiency of methane drainage in exploational excavations depends from many factors:

1. coal natural seam,
2. system of exploitation,
3. system of control the roof,
4. system of ventilation,
5. drainage system
6. the parameters of drainage holes, and peculiar from:

a) work parameters of the net,

b) air pressure occurring in exploational excavations,

c) depression of air in pipes depends from pump station.

Efficiency of methane drainage in exploational excavations in 2003

Table 1 shows the efficiency factor of drainage system in exploational excavations in coal mines in 2003.

Efficiency of methane drainage in exploational excavations in Polish coal mines in 2003 ranged from 2 % in coal mine «Halemba» to 67 % in coal mine «Pokój».

Drainage corridor excavations

The methane drainage depends on capturing the methane with drainage holes from corridor excavations and is used in aim of assuring the acceptable methane content in the air, defined in mining recipes.

Table 1
Efficiency of methane drainage in exploational excavations in 2003

Coal mine	Presence of methane		Efficiency
	Drainage	Ventilated	
Pokój	2,25	1,09	67,37
Krupiński	39	73,8	34,57
Szczygłowice	8,28	17,29	32,38
Zofiówka	23,5	59,38	28,35
Jankowice	11,2	29,06	27,82
Budryk	24	63,3	27,49
Wesoła	22,9	63,3	26,57
Rydułtowy	17,32	49,14	26,06
Pniówek	61,7	177,3	25,82
Wujek	2,5	8,31	23,13
Anna	4,75	16,46	22,4
Borynia	5,3	26,67	16,58
Śląsk	2,03	14,66	12,16
Makoszowy	2,36	18,75	11,18
Chwałowice	1,29	11,81	9,85
Silesia	5,17	56,9	8,33
Sośnica	5,75	64,85	8,14
Bielszowice	4,77	54,91	7,99
Staszic	2,08	34,11	5,75
Jas – Mos	3,1	51,38	5,69
Marcel	2	44,03	4,34
Brzeszcze	6,3	193,5	3,15
Halemba	1,11	52,53	2,07

Efficiency of drainage corridor excavations

Efficiency of methane drainage in exploational excavations depends from many factors:

natural coal seam:

- system of excavations driving
- system of ventilation
- drainage holes system.

Table 2
Efficiency of methane drainage in corridor excavations in 2003

Coal mine	Presence of methane		Efficiency
	Drainage	Ventilated	
Staszic	5,78	24,22	19,27 %
Jankowice	1,2	21,42	5,31 %
Krupiński	2,5	54,75	4,37 %
Jas-Mos	1,3	36,18	3,47 %
Marcel	0,75	34,68	2,12 %
Brzeszcze	2,7	147,6	1,80 %
Pniówek	2	145,9	1,35 %

Efficiency of methane drainage in exploational excavations in Polish coal mines in 2003 ranged from 1,35 % in coal mine «Pniówek» to 19,27 in coal mine «Staszic».

Drainage spaces of goaf

Because chosen spaces always have the connection between the neighbouring excavations, therefore the considerable quantities of air are sucked into drainage's pipelines, which in consequence leads to significant lowering of the concentration of methane, as well as drainage effect.

Goaf drainage can have essential meaning for fighting against the threats of methane exploational and goaf excavations.

The efficiency drainage goaf after exploitation in coal-pits stone in 2003

Goaf drainage can be guided with the help of:

- pipelines introduced directly for isolating dam,
- pipelines left in goaf,
- drainage holes bore over goaf.

The efficiency in table 2 introduces the drainage of corridor excavations in coal-pits stone in 2003 year.

From introduced composition results we can see that seventeen mines uses goaf drainage. These mines are 45,94 % of total circuit mines of pit-coal in Poland.

Table 2
Efficiency of methane drainage in corridor excavations in 2003

Coal mine	Presence of methane		Efficiency
	Drainage	Ventilated	
Chwałowice	4,34	7,43	36,87
Jas-Mos	13,9	36,18	27,76
Krupiński	16,6	54,75	23,27
Brzeszcze	43,2	147,6	22,64
Marcel	8,6	34,68	19,87
Pniówek	29,4	145,9	16,77
Jankowice	4,1	21,42	16,07
Zofiówka	8,9	50,49	14,99
Staszic	4,08	24,22	14,42
Bieloszowice	7,81	47,1	14,22
Rydułtowy	6,73	66,46	9,2
Silesia	3,64	53,26	6,4
Wesoła	3,5	59,8	5,53
Halemba	1,79	50,74	3,41
Śląsk	0,4	14,26	2,73
Sośnica	1,43	70,6	1,99
Budryk	1	62,3	1,58

Conclusions

Conducted analyses' and investigations lead to following assertions and conclusions:

1. Work safety in coal-pits stone, under guidance of exploitation of carbon in conditions of strong methane threat, requires the usage of the varied technical methods as well as preventive methods.

2. In mining practice, the efficiency of process drainage depends from delimitation the relation of size of expense stream methane accompanied in process accompanied to catfish of expenses of methane drainage in processes drainage and ventilation.

3. Drainage systems influence in essential way efficiency drainage which is extremely

important regarding work safety and mining production profitability in coal-pits stone.

REFERENCES

1. Berger J., Nowak E.: Pozyskiwanie metanu metodami wiertniczymi z wyrobisk podziemnych i z powierzchni w kopalni Jastrzębskiej Spółki Węglowej S.A. Wiadomości Górnicze nr 2 1999 r.

2. Borowy B., Michalik H., Nawrat S., Stobiński J.: Kształtowanie się zagrożenia wyrzutami metanu i skał w kopalniach ROW oraz niektóre metody jego zwalczania. XII Międzynarodowe Kolokwium, Nowa Ruda 1988 r.

3. Maciejewski W., Nawrat S., Stobiński J.: Niektóre zagadnienia z zakresu odmetanowania kopalń. Zeszyty Naukowe AGH Górn. Nr 126 Kraków, 1986 r.

4. Myszor H.: Lokalizacja otworów drenażowych w rejonach ścian. Przegląd Górniczy nr 7-8 1980 r.

5. Kozłowski B., Grębski Z.: Odmetanowanie górotworu w kopalniach. Wydawnictwo «Śląsk», Katowice 1982 r.