15th International Research/Expert Conference
"Trends in the Development of Machinery and Associated Technology"
TMT 2011, Prague, Czech Republic, 12-18 September 2011

DEPENDENCE OF GEOLOGICAL RELATIONSHIPS AND DUST EMISSIONS IN THE „OLD CAVE" ZENICA

Mr.Sc. Muratović Fahrudin
RMU "Zenica" d.o.o. Zenica

ABSTRACT
For exploitation on the facility "Old cave" economically most important major, above major, I, II, III floor coat. The most intensive extraction of coal dust occurs at: service (receipt and transport) of coal, construction of mining facilities, transportation excavations, at the onset of the current manifestation of deep pressure.
Dust around the fan installation is not exceeded the allowable limit, and therefore does not affect the environment. Security measures for mining scope who's making into loading, transporting, and preparation coal reflected in the form of setting up sprinklers and water dams and watering before and after blasting.

1. INTRODUCTION

The development of the mightiest and coal beds in the "Old cave" are quite variable. Above major coal layer is mainly developed in the whole area and potency varies from 4,5 to 8 m. It is characteristic that the main coal layer that lies beneath above major, changing its potency on the same line, but only in the opposite sense. With increasing layer thickness above major and his coal quality. Otherwise, it is characterized by continuous emergence of marly-limestone dressings to his position layer is divided into three panels: A (roof), B (medium) and C (floor) boards. [1]
Overlaying layer consists of marly limestone, a shelf is very sturdy and compact yellow calcareous marl. Coal above major layer is quite prone to spontaneous combustion and the carrier is quite large amounts of methane. Releasing pit pressure in this layer is gradually but now in the form of strong tension and rock bursts. [1]
Direct contact overlaying the layers are firm and hard marl, which during excavation collapse in large chunks and blocks. Immediate shelf was clay marl thickness ranging up to 15 m., which is in contact with water swells strongly. [2]
Due to considerable depth and a solid layer overlying the main layer is characterized by a strong but not so dangerous tension that occasionally manifest in the current release of removing coal at the head of the site, and sometimes in the form of heavy rock bursts.
The geological structure of the wider area „Old cave" participate rocks of Upper Cretaceous and oligomiocen limnick rock formations that are separated on oligomiocen, older miocene and miocene hun polifacijal complex.

2. CHARACTERISTICS OF COAL DUST

Conducted laboratory tests characteristic of coal dust, the coal seams have shown that under certain conditions, the dust shows explosive, flammable and aggressive traits. [3]

2. 1. The sources of dust generation in „Old cave"

According to the character creation of coal dust, there are two main groups of sources including:

- technological resources that are tied to the disintegration of coal and rock dust, and have the mine atmosphere of a dominant influence;
- current ventilation, and air transport excavations waves.

In the „Old cave“ the most intensive extraction of coal dust occurs when:

- exploitation (receipt and transportation) coal
- mining production facilities
- transport excavations,
- the phenomena of the current manifestation of deep pressure. [3,4]

3. AIR EMISSIONS

Air emissions are emitted from

- chimney boiler on the Old Pit, boiler K-1 (acidic gases, greenhouse gases and particles)
- chimney boiler in the building of the directorate RMU „Zenica“, boiler K-2 (acid gases, greenhouse gases and particles),
- the steam locomotive „Separation“; (acid gases, greenhouse gases, particulates),
- the fan diffuser and diffuser auxiliary fan (greenhouse gases and dust),
- with the concrete surface of the industrial cycle (dust)
- heaver coal - vipera (dust)
- loaders for loading of coal and tailings (dust)
- trucks for transportation of coal and tailings (dust)
- crusher for crushing coal and tailings (dust)
- screens for peep (dust)

3.1. Emissions of dust particle

Largest source of dust particles in and round the industry:

- chimneys boiler
- diffusers main and auxiliary fans
- export pane
- the concrete surface of the industrial cycle
- heaver coal -viper
- loaders for loading coal and waste
- trucks for transportation of coal and overburden
- crusher for crushing coal and overburden
- screens for peep [1,6]

The dust generated during loading, transport and preparation (chopping and separation) coal, and the work of the locomotive to drive „Separation“ threatens to adversely affect the environment, especially the dust is removed from the flue gases when working steam locomotive (2044 mg/m^3) and boiler (K-1 and K-2). Measurement of particulate matter (dust) in the industrial circle conducted in September 2008, the laboratory RMU „Zenica“ d.o.o. Zenica.

3.2. Testing of dust

To determine the air of dust in the working and auxiliary premises used konimeter german production CARLZEISS J-ena 740327. The work of the instrument is based on a given volume of air suction. Dust captures the sudden suction plate coated oil emulsion. Sampling is currently. The instruments are easy and quick handling and evaluation of results is done by counting using a special projector and is measured in particles per cm^3 (č/cm^3). For the determination of dust on the air in workplaces and facilities for crushing separation used the gravimetric method using an instrument „Barbara-3“. The instrument is designed to mimic the mechanism of dust deposition in the respiratory pathways of the human organism.

Table 1. Chemical analysis of operation "Old cave" by measuring points

Mjerno mjesto	Profil (m^2)	Uk.vlaga %	Pepeo %	Nesag. %	Sagorivo %	Isparivo %	c- fix %	Koksni o. %	Vol.bez vla.i pep.	W %
MM1	9,00	13,27	27,61	40,88	59,12	31,07	41,32	55,66	52,56	22,98
MM2	4,00	16,96	50,93	67,89	32,11	17,50	31,57	65,53	54,52	7,37
MM3	13,00	17,49	55,34	72,83	27,17	17,11	27,55	65,40	62,98	5,95
MM4	5,50	12,75	56,80	69,54	30,46	18,99	24,21	68,26	62,35	2,96
MM5	13,00	17,13	36,02	53,15	46,85	34,93	29,05	47,95	74,55	18,77
MM6	8,00	22,12	25,54	47,66	52,34	32,99	41,47	44,90	63,02	23,82

MM7	5,00	16,27	23,59	39,86	60,14	37,62	38,78	46,11	62,56	23,05
MM8	4,00	13,84	48,49	62,34	37,66	28,19	23,32	57,97	74,85	10,64
MM9	4,50	17,09	17,33	34,42	65,58	38,76	43,90	44,15	59,11	29,28
MM10	6,00	18,35	20,29	38,64	61,36	39,31	40,40	42,34	64,06	24,87
MM11	7,00	17,66	17,71	35,37	64,63	39,42	42,87	42,92	61,00	31,12
MM12	5,50	23,47	27,27	50,74	49,26	33,35	39,38	43,18	67,71	21,72

Floating dust makes the air dispersion composition in which the air is dispersed areas, and dust dispersed phase. Harmful to human health is dust from 75 µm to 0 µm, and especially dust from 10 µm to 2 µm. The total amount of sampled dust, the smallest fraction of 75 µm to 0 µm ranged from 9,1% of the total sampled mass.

Out of space dust ranged from 9,58 to 351,4 mg/m^3, and the permitted limit for coal dust is 10 mg/m^3. [5]

In the period of recording were measured following basic parameters:

- Total emissions output airstream „Old cave“ on the diffuser fan (the fan capacity): 1980 m^3/min
- Depression the fan: 2280 Pa
- Barometric pressure: 97.33 kPa
- Absolute tributary of methane: 2.77 m^3CH_4/min
- Absolute tributary of carbon dioxide: 7.05 m^3CO_2/min.

Coal dust in the pit of „Old cave" based on a series of studies on the properties of dust all done by authorized institutions, belongs to: explosive hazardous, flammable and slightly aggressive dust. In the pit, according to „Technical design of protective measures against coal dust“ appropriate measures to reduce dust and floating deposited dust. Along the transport system was laid fire on the pipeline which, according to the regulations, fire hydrants installed for fire protection and sprinklers for the overthrow of coal dust on reloading places.

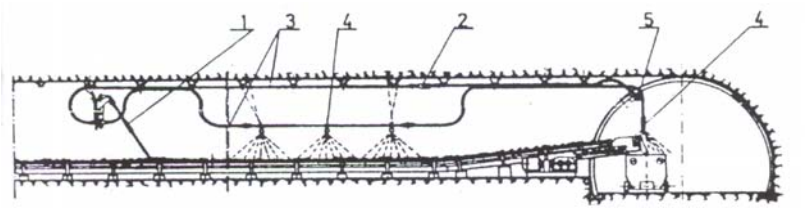
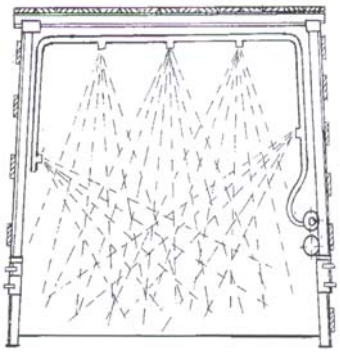


Figure 1. Automatic sprinklers „Rosa“ for wetting the reloading and conveyor belts (1-lever to open the flow of water, 2-filter, 3- inlet pipe, 4-spray nozzle, 5-valve)

In preparation sites and spoil flexible jagged water pipeline which performs wetting and soaking the material before and after blasting. In addition to wetting the workings and open pit mining is used in the ink-water plugs, which reduce dust emissions. Felling of dust in the premises of the outgoing airstream is done through flexible pipes that water supplies with piping drinking water from a drainage pipe or pipeline for siltation. [1,6]



Laid down at the dust in the pit of electric (transformeters, cables, switches, motors, etc) are regularly cleaned to prevent inflamed of dust. Consistently the implementation of these measures eliminates the possibility of inflamed, explosions and aggressive action of coal dust in the pit. Likewise, the implementation of these measures, reducing dust emissions through the fan into the atmosphere. Emissions of dust on outdoor plants plant „Old cave“ is reduced by spraying and wetting of coal over the installed fire protection system piping. Laid down at the dust from the concrete surfaces and roads in the industrial circle drive „Old cave - Mine“ from time to time to clean-washed by outsourcing services and maintenance of ventilation or fire department facilities “Old Cave“ Separation, in the regular exercises. [6]

Figure 2. Type solution of water curtain

4. PROTECTION MEASURES

Under the measures of protection from hazardous coal dust implies a complex series of actions to be taken to avoid the possibility of creating conditions under which it could lead to inflammation and eventual explosion of coal dust. Protective measures are divided into technical and active measures.

4.1. Measures of protection against flammable coal dust

Basic measures of protection in terms of combustible coal dust are deposited prevent the accumulation of coal dust, and to maintain the normal operation of plant and equipment and routine control of the same. Coal dust is usually builds up in the following places:

- transporters (below the conveyor)
- parts of ventilation space around the bulkhead door silencers,
- electrical components - equipment and installations. [2]

4.2. Measures of protection against aggressive dust

Coal dust in pit „Old cave“ contains 4,60% free SiO_2 and from this aspect shows aggresive properties. Measures of protection against aggressive dust consists in the application of complex methods to prevent, formation and breakdown of suspended dust in the pit. The methods used to reduce the concentration of airborne dust by wet method:

- the use of water in ampoules mining,
- previously wetting coal seam,
- the wetting of coal substance during loading, transportation and transfusion.

Test ways to eliminate the application of dry particulate coal dust are:

- improving the ventilation holes,
- elimination of deposited coal dust from the premises,
- the use of air - mechanical foams, etc.

Measurements are made instrument type CPM - 3, which mimics the deposition of dust in the respiratory pathways of the human organism. Comparing the results with the MAC come to the conclusion that the measured concentrations of airborne coal dust does not exceed the permissible value. Measures of protection against aggressive coal dust is composed primarily of employees to prevent inhalation of dust in mining operation. They can be divided into two main groups.

- Collective or general measures
- measures for personal protection against aggressive coal dust

These protection measures relating primarily to the creation of coal dust, then toppling already emerged as a floating dust removal and dust were deposited as a measure against the aggressive action of the human organism on. These measures can be called collective protection, and general measures in the fight against coal dust. Use personal protective equipment is the second group of measures and primarily involves the use of protective masks in workplaces where there are excessive concentrations of coal dust and particulate concentrations over the MAC. [1,2,3]

5. LITERATURA

[1] B. Tomislav, S. Mičević: Utvrđivanje zaprašenosti, agresivnosti, zapaljivosti i eksplozivnosti ugljene prašine u „Staroj jami“ rudnika mrkog uglja Zenica 1984. godina
[2] S. Slijepčević: Tehnički projekat „Mjera zaštite od eksplozivne ugljene prašine u Staroj jami Zenica, 1991.
[3] H. Tanović: Rudnička prašina, Tuzla 1999.
[4] K. Bajramović: Eksplozivnost prašine mrkog uglja u funkciji sadržaja vlage i pepela, Tuzla 2004.
[5] H. Uljić: Sigurnost i zaštita u rudarstvu, Univerzitet u Tuzli, 1998.
[6] A. Adilović, S. Mičević: Efikasnost vodenih zavjesa kod obaranja prašine pri mašinskoj izradi prostorija, Tuzla, 2000.
[7] K. Bajramović, S. Mičević, J. Marković: Eksplozivnost prašine mrkih ugljeva u funkciji granulometrijskih sastava, Tuzla, 2005.