

AIR POLLUTION IN SURROUNDING ENVIRONMENT OF SASA TAILING DAM – AMBIENT AIR, PLANT DUST AND CEILING DUST

B.Krstev, A. Krstev, B. Golomeov, M. Golomeova, A. Zendelska, T. Danevski, B. Fidancev

¹University "Goce Delchev", Faculty of Natural and Technical Sciences, Shtip, R. of Macedonia

³University "Goce Delchev", Faculty of Computer Science, Shtip, R. of Macedonia

ABSTRACT. The current and recent activities in the lead-zinc Sasa mine or copper Bucim mine and flotation of galena and sphalerite or chalcocopyrite, producing metals for market, are reason for possible troubles from tailing dam-pond and surrounding river, ambient air and plant or ceiling dust. This appearance is significant for the surrounding environment, but legislative and ecological law directive limited the quantity of these. In this paper will be present results of investigations from plant (flotation), crushing and grinding section, ambient around the mine etc. with quality of ambient air and presence of dust in the environment using appropriate apparatus for these measurements.

Key words: Tailing dam, ambient air, dust, Sasa, Bucim

INTRODUCTION

Flotation tailing dams constructed and managed by appropriate mines for metal minerals can be ecological danger. In certain cases and periods they can be high contaminators of the environment, surface and ground water and air. That means that through the land, water and air they affect on the environment and all flora and fauna. Appearance of gas in pits or flotation plants. The air in the vicinity of these locations and dust from the plants or the one from the winds are ecological problems that must be limited in accordance with the law standards and normative, in order to meet the law regulative. This paper is based on inspection of ambient air, aerosols and dust in mine "Sasa" in order to enable problem detection and their potential solution, as well as improvement of the environment.

Disposal of the mining activities, such as flotation plants from galena and sphalerite or chalcocopyrite ores, are possible risk elements for the anthropogenic impact for the life environment or working environment. Specially, if it's well known that these disposal are located in the mountain valleys (Sasa mine, Bucim mine, Toranica Mine etc.). The tailing dams with present sands (including different minerals, such as galena, sphalerite, pyrite, and chalcocopyrite) are contributors or possible pollutants for surface or underground water in the surrounding environment. The presence of the heavy metals in these pollutants and sands are hazard for people, animals and plants. The wind activity is a factor for sand moving, especially in the case of weather changes and climate conditions. The moving of the dust at the ceiling of the house is a possible hazard appearance having in the mind the sands are minerals bearing means and pollutants for environment. The possible troubles or havaries in the tailing dams are the possible hazard for the people around these objects.

Dust concentration measurements in the mining atmosphere around the Sasa and Bucim mines (2011-2012)

According to the carried out measurements of the dust concentration (concentration of mineral particles in the atmosphere or ambient air), there are the cases of air pollution of the working or life environment, in the working places such as flotation plant, places for inventor, places for reagents or crushing & grinding mills. According to the state regulation for the permitted values for levels and types of pollutants materials in ambient air, with the measurements are accepted the concentration of respirable dust PM₁₀. The measurements of the dust concentration in the mining atmosphere are carried out according to the EK 50081-1, 1992 и EK 50082-2, 1993 – standards for measurements of generic emission for residential, commercial, easy industrial or industrial environments.

Tabl. 1 Result of dust concentration

Measure date: 2010.	Dust concentration in ambient air			
Measure place	N		E	
T1 –Industrial circle	42305948		22305948	
T2 –Tailing base 4	Established mean (24 hours)		Limited values (24 hours)	
PM ₁₀	0,040	µg/m ³	0,05	µg/m ³
	0,037		0.05	
Climate conditions				

The measurements of the dust concentration are carried out by MicroDust pro, with cyclone sampler and PUF PM₁₀ filter, by the principle of Forward light scattering 880 nm infrared source, with the measurement range and interval 0,001-2500 µg/m³.

This device is calibrated according to the ISO 12103-1 A2.

Tabl. 2 Dust concentration in Flotation plant Sasa mine

FLOTATION SASA		
FLOTATION Ball&Rod Mills		
FLOTATION Flotation plant (Pb&Zn)		
FLOTATION Lead pressing		
FLOTATION Zinc pressing		
FLOTATION Concentrates stocks		
Measurement date: 18.7.2011 r.	Dust concentration in the ambient air	
	Measured value µg/m ³	* Limited values µg/m ³
PM ₁₀	1,40	1,37
PM ₁₀	1,00	1,37
PM ₁₀	0,70	1,37
PM ₁₀	1,23	1,37
PM ₁₀	0,70	1,37
PM ₁₀	1,23	1,37

Tabl. 3 Dust concentration in Flotation plant Bucim mine

Flotation Bucim		
Flotation Ball Grinding		
Flotation Flotation		
Flotation (Filter press)		
Flotation Concentrate Stocks		
Measure date: 2012	Dust concentration in ambient air	
	Measured value µg/m ³	* Limited values µg/m ³
PM ₁₀	2,05	1,37
PM ₁₀	1,40	1,37
PM ₁₀	1,00	1,37
PM ₁₀	0,70	1,37
PM ₁₀	1,23	1,37

According to the carried out measurements, the dust concentration treated measure of concentration of particles or dust concentration in the ambient or atmosphere in the mineral (processing plants (flotation, grinding, pressing, inventor or stocks for concentrates etc.) in the Sasa and Bucim flotation. The measurements are carried out according to the existing standards ISO (1CS 13.040.20), using the modified sampler with impactor with maximum capacity of 1-3 m³/h. It's moveable instrument or device with possibility of sampling in the period of 1 minute to 24 hours.

Tabl. 4 The methods, device and standards for dust concentration measurement:

	Measurement method	Analytical interval
PM ₁₀	Impactor with cyclone and flow from 1 to 3 m ³ /h.	0,1 - 2500 µg/m ³

Dust collection of ceiling dust samples in the Sasa and Bucim mine surrounding



Fig. 1 Samples location Sasa tailing dam (red points)



Fig.2 Samples location – Bucim tailing dam

It's evident from the results that As and Cd aren't in the framework of the EU standards. Concentrations of the Co, Cr, and Ni are low. Concentrations of the Cu, Pb, and Zn are high. It's evidently in the case of the Sasa and Bucim impact to the working and life environment.

Tabl.5 Carried out chemical analysis of ceiling dust samples, Sasa surrounding

N ^o	As, mg/kg	Cd, mg/kg	Co, mg/kg	Cr, mg/kg	Cu, mg/kg	Fe, mg/kg	Mn, mg/kg	Ni, mg/kg	Pb, mg/kg	Zn, mg/kg
1	100,4	59,60	<1	31,57	401,0	64,50	4,10	34,80	76,25	65,35
2	72,5	36,95	<1	28,34	420,2	37,50	2,95	35,95	64,80	63,90
3	84,5	40,72	<1	33,59	384,8	43,95	2,60	29,30	73,80	44,50
4	114,4	69,42	<1	32,75	535,0	56,00	3,75	31,10	65,95	48,00
5	120,0	55,60	<1	33,55	470,0	54,10	3,30	31,50	64,25	46,50
6	130,5	56,50	<1	30,50	435,2	49,10	2,85	27,45	54,80	54,60
7	133,5	50,70	<1	35,50	359,1	45,10	2,60	25,40	83,85	54,50
8	134,4	65,05	<1	32,05	430,7	55,35	3,70	35,90	44,35	56,50
9	100,5	46,95	<1	31,30	425,0	45,50	3,80	28,10	64,55	54,10

Tabl.6 Carried out chemical analysis of ceiling dust samples, Bucim surrounding

N ^o	As mg/kg	Cd mg/kg	Co mg/kg	Cr mg/kg	Cu mg/kg	Fe mg/kg	Mn mg/kg	Ni mg/kg	Pb mg/kg	Zn mg/kg
1	20,5	20,60	<1	31,00	507,0	55,50	4,10	24,80	26,25	25,30
2	22,5	30,90	<1	28,00	520,2	57,50	4,95	25,05	24,80	23,90
3	24,5	20,75	<1	23,90	654,8	55,95	4,60	29,30	22,85	14,50
4	34,4	19,20	<1	22,75	535,0	56,00	5,70	31,10	25,95	18,00
5	20,0	15,60	<1	23,55	570,0	54,10	5,30	31,50	24,00	16,50
6	13,5	16,50	<1	30,50	535,2	49,10	6,85	25,45	24,80	24,60
7	33,5	20,70	<1	30,50	559,1	55,10	4,10	25,40	23,85	24,50
8	14,4	25,05	<1	30,05	530,7	55,35	4,70	25,90	24,30	26,50
9	10,5	26,95	<1	31,30	525,0	55,50	4,80	28,10	24,50	24,10

CONCLUSION

The measurements of the dust concentration in the mining atmosphere are carried out according to the EK 50081-1, 1992 и EK 50082-2, 1993 – standards for measurements of generic emission for residential, commercial, easy industrial or industrial environments.

The measurements of the dust concentration are carried out by MicroDust pro, with cyclone sampler and PUF PM₁₀ filter, by the principle of Forward light scattering 880 nm infrared source, with the measurement range and interval 0,001-2500 µg/m³. This device is calibrated according to the ISO 12103-1 A2.

According to the measurements it's evidently that the results for As and Cd aren't in the framework of the EU standards. Concentrations of the Co, Cr, Ni are lower (EU standards).

Concentrations of the Cu, Pb, Zn are higher (EU standards). It's evidently in the case of the Sasa and Bucim impact to the working and life environment.

REFERENCES

- B. Krstev, B. Golomeov: „Tailing dams”, Faculty of Mining, Geology and Polytechnic -Stip, Republic of Macedonia, 200
- D. Salatic, D. Knezevec: "Technological basis of plant projecting in mineral processing" ,Mining Institute – Beograd, Serbia
- B. Krstev, B. Golomeov: „Engineering of Mining Environment", Faculty of Mining, Geology and Polytechnic -Stip, Republic of Macedonia, 2008