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## DUST SURVEY AT BUCKET HOISTING IN GLAVNYI SHAFT OF NOVOKONSTANTINOVSKAYA UNDERGROUND MINE AT SE "VOSTGOK"

*Novokonstantinovskaya* underground mine of the State Enterprise "VostGOK" is the largest in Europe in terms of uranium ore reserves. The deposit is opened by three shafts: *Glavnyi*, *Razvedyvatelno-Ekspluatatsionnyi №6* (*RE*-6) and *Ventilatsionnyi-1*. With the designed annual output of 1,5 mln t of ore its real output makes about 330 thousand which is caused by the limited hoisting capacity of the shafts *RE*-6 and *Ventilatsionnyi*-1.

One of the scenarios of increasing output of mining uranium ores at this mine considers use of *Glavnyi* for bucket hoisting. Simultaneously, it is used as a ventilating shaft and this causes a problem of dust pollution as the dust is blown off during hoisting. In this case, the current safety rules allow for maximum permissible concentration of dust not exceeding 0,6 mg/m$^3$. So, the process of dust formation while bucket hoisting in the shaft was studied to determine the possible dust pollution level.

As the dust pollution level is in direct dependence on the coarseness of the ore hoisted in the bucket, its granulometric composition was first determined. The performed sieve analysis of uranium ore samples showed that fraction -1÷+0 mm content which is potentially the source of dust formation makes about 0,03%. This means that a БПСМ-4 bucket to be used contains 7-7,5 t of rock mass, 2-2,3 kg of which being the above mentioned fraction. Such assumption being of the stochastic nature, the actual weight of ore fines in a bucket may make from 1-1,5 to 3,5-4 kg. Thus, to ensure observance of dust pollution norms even in the most unfavourable conditions, the worst case, i.e. the maximum -1÷+0 mm fraction content, was modeled.

Besides, such factors as moisture of ore and fines distribution were considered as well. The latter depends on bucket loading methods. The distribution is evener if a belt or a plate feeder is applied. Due to segregation when applying a vibrofeeder, there are 3-4 times fewer fines in the upper layer of the ore in the bucket. This produces considerable impacts on the dust level.

The research was conducted in the wind tunnel AT-2K-250/500. When modeling the process, it was important to comply with the similarity criteria such as rock particle sizes, the air flow rate, the kinematic coefficient of the medium viscosity. Change of the modeling scale causes the problem of these factors' compliance with real data. As the air tunnel diameter could not be changed but the air flow rate could be regulated, it was decided to place actual samples of rock mass of the granulometric composition characteristic of the mine into the stand and to measure the dustiness level at the speed of the air flow corresponding to the one in real conditions. The obtained data on the dustiness level in the model were adjusted considering the bucket-model area relationship, the amount of air moving through the shaft per time unit in real conditions and in the model.

The results of the laboratory studies, the forecast dust pollution rate in real conditions and possible excess of the rate permissible for these conditions are given in Table 1.

Table 1

Results of the laboratory studies of dust pollution at bucket hoisting

| Bucket loading method | Rock mass properties | Dust pollution level | | Excess of permissible dust pollution, times |
|---|---|---|---|---|
| | | modeled, mg/m$^3$·s | calculated for real conditions, mg/m$^3$·s | |
| Belt or plate feeder | Natural moisture | 12,0 | 6,5 | 10,8 |
| | Watered bucket surface | 3,6 | 2,0 | 3,3 |
| | Bischofite-treated surface | 0,6 | 0,3 | 0,5 |
| Vibrofeeder | Natural moisture | 3,2 | 1,7 | 2,9 |
| | Watered bucket | 0,8 | 0,44 | 0,7 |

| | | | | |
|---|---|---|---|---|
| | surface | | | |

As is seen, regardless of the bucket loading method, insufficient moisture of ore results in the excessive dust pollution.

When a belt or a plate feeder is applied to load the bucket, even if the upper layer of ore in the bucket is watered, excess of the permissible dust pollution rate will be 3-3,5 times as much. In this case, the ore surface should be treated with the bischofite-water solution which effectively binds fines and therefore prevents their blowing off during hoisting. Even sufficient natural moisture of ore (not less than 4%) or thorough watering of the ore in the bucket ensures dust level decrease up to 0,7 of the rate set for such conditions.

Thus, on the basis of the conducted studies of bucket hoisting to be applied in *Glavnyi* shaft, when designing the underground loading facility, application of the vibrofeeder should be provided for loading a bucket. Sufficient natural moisture of ore (not less than 4%) or thorough watering of the ore in the bucket ensures observance of the current dust pollution norms for the downcast air.

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## FEATURES GAS CONTENT AND PRODUCTION OF COAL BED METHANE IN THE LVIV-VOLYN COAL BASIN

In coal basins are considerable amounts of gas, which at 80-98% consists of pure methane. There are also hydrogen sulfide, carbon monoxide and others. World reserves of methane in coal seams exceed natural gas reserves in traditional deposits. Within the coal basins located in the territories of China, Russia, the USA, Australia, Ukraine, Poland, South Africa, India, Germany, methane reserves amount to over 260 trillion cubic meters [1]. Ukraine is among the