



FILLING-UP OPEN MINE SPACES IN THE URANIUM MINE ŽIROVSKI VRH FROM THE SURFACE WITH FILLING CONCRETE

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ABSTRACTS

Due to the closure of uranium mine Žirovski vrh maintenance of mining spaces have been abandoned. Abandoning of maintenance consequently brought to abatement of supporting measures which resulted in widening of the destruction processes around excavated areas. In the case of uranium mine Žirovski vrh radiological contamination of the area above excavated spaces of blocks 1 and 2 could appear through cracks. Idea about filling up isolated places with the filling concrete which could be poured into the mine through drills, made from the surface, has emerged. For filling up excavated spaces in blocks 1 and 2 of uranium mine Žirovski vrh 11 wells have been made for integrating filling concrete in open mine spaces.

Key words: Injecting, Well, Remediation, Drilling, Cement Suspension.

INTRODUCTION

Due to the way how the excavated mine spaces were closed-out in the end of 1980's of the previous century, blocks 1 and 2 remained isolated. Long-term isolation of the area and top to bottom winning method triggered a destructive process which has advanced towards the surface. Due to demolished excavations and partially removed ore and consequent radiation, the usual way of closing down mining sites by filling them up from the inside was not possible.

We came up with an idea of performing the filling of isolated sites by the usage of filling concrete which could be brought into mine openings through wells made from the surface. For the purpose of filling-up excavated parts of blocks 1 and 2 in the uranium mine Žirovski vrh 11 wells have been drilled and used for integrating filling concrete into open mine spaces. At first 8 wells were made and filling of the block 1 was realized, so it was possible to check efficiency of the projected method. It was ascertained that the method is

usable since the level of the fill-up of the mine space was sufficiently high comparing to the filling-up done inside the mine. Due to positive experiences another three wells were made in the area of block 2.

Creation of wells for filling up openings in block 1 and 2

Creation of wells took place with a percussion rotational method using DTH hammers and compressed air. For the case of troubles which were expected in »Jazbeška luska« area another option of drilling with rolling bits and drilling mud with addition of bentonite had been anticipated.

Before starting with works a geodetic situation of the area had been well investigated using mining maps. Wells were positioned above areas which enabled as high level of filling-up openings as possible. In order to cut drilling costs all of the wells were projected with the same drilling parameters. Wells construction was as follows:

Column	Well	Tubing
Introduction column	Ø 584.2 mm (23")	Ø 508 × 6.3 mm (St37, weight = 77.9 kg/m)
Technical column	Ø 311.1 mm (12 ¼")	Ø 244 × 6.3 mm (St37, weight = 77.9 kg/m)
Reserve profile	Ø 431.8 mm (17")	Ø 355.6 × 6.3 mm (St37, weight = 54.3 kg/m)

Due to our presumption that »Jazbeška luska« will cause problems in the course of drilling, extra »reserve profile«, which could be used in case of a need, was added to the construction of the drill.

Cementation of the column

For additional stabilization of the well the columns were cemented. Cementation took place in accordance to Perkins – i.e. cementation through the tubes into the inter-space using separation fluids or caps. For cementing a cap in the inter-space a cementation basket was used.

PREPARATION OF FILLING CONCRETE, TRANSPORTATION AND TECHNOLOGY OF FILLING EXCAVATION SPACES THROUGH WELLS

Preparation of mine spaces for filling

Before the filling and stabilization of open mine spaces in blocks 1 and 2 started, it had been necessary to create ferroconcrete barricades around those two blocks in order to prevent the possibility of uncontrolled pouring of the filling concrete out of the area of former openings of the block 1 and 2.

Filling concrete preparation

Filling concrete was mixed in an existent concrete plant which was situated in the area of Jazbec, i.e. P-11. According to the data about the size of the openings it was estimated that it would take around 40.000 m³ of the filling concrete in order to fill-up all open spaces in the area of block 1 and 2. For filling concrete preparation the following ingredients were used:

- Sifted mining tailings, fraction 0/10 mm (gray flint sandstone)
- Electrofilter ashes from the steam power station Šoštanj
- Cement CEM II 42,5 N
- Chemical additives – retarder and aerant
- Water

For 1 m³ of the filling concrete 180 kg of cement, and 240 kg of ashes was used, the rest was composed of sifted mining tailings 0/10 mm and water. This recipe was tested in October 2003 in the ZJ 10/11 shaft. Aggregate 0/10 mm showed acceptable properties in prepared filling concrete.

Transportation of the filling concrete

Transportation of the filling concrete was carried out with concrete-mixing trucks. Influx of the well was equipped with a pouring funnel through which the concrete was poured-in. Special care was taken because of the danger of cap creation. Owing to advanced technology this did not happen. For just in case a drilling set of machinery was prepared so it would have been possible to pierce an eventual cap.

Filling-up with filling concrete through wells commenced on wells, located on the edges of excavated fields of the block 1 and 2. After completing outermost edges of the fields further filling through wells, located in the central part of former excavating fields continued. Filling of each well was finished when it was completely stuffed with filling concrete right to the top.

Inspection of filling concretes

At fresh filling concretes it was necessary to control quality of its making. This procedure included the following:

- Inspection of ingredients of the filling concrete (aggregate, cement, water and additives to the filling concrete (retarder and aerant));
- Inspection of fresh mixture of the filling concrete (temperature, water-cement factor W/C, consistency, containment of cement and containment of micro-pores);
- Examination of pressure solidity.

Remediation of well sites

When the works were finished, drilling and filling places, including working plateau and access road, were restored into their original states.

CONCLUSION OF FILL-UPS OF BLOCK 1 AND 2 EXCAVATED MINE STRUCTURES

During the fill-up of mine spaces the quality and quantity of the filling were constantly examined. It was concluded that places were filled with quality because the quantity of the filling was regularly controlled by observations made through the wells (using a camera) and from controlling points inside mine.

Quality of the material actually used and predicted before was within 5 % deviation. Less concrete was used than planned.

CONCLUSIONS

After ending the drilling works and filling of open underground spaces it can be concluded that all conditions, needed for a quality realization of works was met. Conditions, needed for quality realization of works are:

- good knowing of the problems;
- very good familiarity of geological circumstances in the area of the well;
- quality metrical data of the mine with a connection to the surface;
- good knowledge of used technologies;
- good workmanship;
- good cooperation between the projecting engineer and executants of the works.

Remediation was well implemented and carried out with minimal expenses.

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ZAPOLNJEVANJE ODPRTIH JAMSKIH PROSTOROV RUDNIKA URANA ŽIROVSKI VRH S POVRŠINE S POLNILNIM BETONOM

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POVZETEK

Zaradi zapiranja rudnika urana Žirovski vrh je bilo opuščeno vzdrževanje jamskih prostorov. Opustitev vzdrževanja ima za posledico popuščanje podpornih ukrepov, kar posledično vodi do širjenja rušnih procesov okoli odkopanih prostorov. S časom se zlasti v primeru nizkega nadkritja pojavijo deformacije površine nad odkopanimi prostori. V primeru rudnika urana Žirovski vrh bi preko razpok, ki se tvorijo v toku napredovanja rušnih procesov, prišlo do radiološke kontaminacije območja nad odkopanimi prostori blokov 1 in 2 rudnika urana Žirovski vrh. Kot ideja se je ponudilo izvajanje zapolnjevanja izoliranih prostorov s polnilnim betonom, ki bi se ga v jamo zapolnjevalo preko vrtin izdelanih iz površine. Za zapolnjevanje odkopanih prostorov blokov 1 in 2 rudnika urana Žirovski vrh je bilo izdelanih 11 vrtin, skozi katere se je vgrajevalo polnilni beton v odprte jamske prostore.

Po izvedbi vrtalnih del in zapolnjevanja odprtih jamskih prostorov lahko ugotovimo, da so bili izpolnjeni vsi pogoji, ki so potrebni za kvalitetno izvedbo del.

Pogoji potrebni za kvalitetno izvedbo del so:

- dobro poznavanje problematike;
- zelo dobro poznavanje geoloških razmer na območju izvajanja del;
- kvalitetni jamomerski podatki s površinsko navezavo;
- dobro poznavanje tehnologije po kateri se dela izvajajo;
- kvaliteten projekt za izvajanje del;
- kvaliteten izvajalec del;
- dobra sodelovanje med projektantom in izvajalcem.

Sanacija je bila izvedena kvalitetno in z minimalnimi stroški.

Key words: injektiranje, vrtina, sanacija, vrtanje, cementna suspenzija.