SANATION OF THE MINING SITES NEAR URBANE AREAS

Janko NUIĆ, Stanislav ZIKOVIC, Ivo GALIC,
Dragan KRASIC and Andrija MIKULIC
University of Zagreb, Croatia

ABSTRACT: During the past 30 years in the town of Mostar (Bosnia and Herzegovina) a surface coal mine was in operation so that the entire included area has been devastated. Working levels in spoil banks are not shaped and interestingly linked in an orderly manner, while the crater part is absent of adequate and functional forms and acceptable final contours. Large quantity of water is accumulated at the bottom of crater being in connection and on the level of the Neretva river which flows through the center of the town. During the war and still today, city waste has been laid into the lake, by the crater edges and elsewhere, so that mining area is turned into waste dump (200,000m³).

For a long time a shallower part of the coal layer in the pit is burning, developing hazardous gasses and spreading smoke which disturbs work and life of local citizens.

On the technically unsettled sites, local landslides appear deforming space and representing danger for people.

Vicinity of the urban zone (center of the town is only 500m distant) requires the undertaking of specific mining works under strict criteria for urban environment which makes this sanation a specific one.

Sanation of the space (forming sanitary depot, extinguishing fire) and technical recultivation of degraded areas require redistribution of large amounts of refuse masses and this may be achieved by direct and limited coal production (sanitary exploitation).

INTRODUCTION

On the coal deposit on which the town of Mostar lies, a coal mine has developed, being in function over hundred years, first by underground and then by surface pit.

Because of the war in Bosnia and Herzegovina mining works cased and the pit remained in the position of deep crater and unsettled inner and external depot of refuse mass. Lower part of the crater has been drowned to the level of the Neretva river being in direct connection with it.

During the war the city waste (cca 300,000m³) was thrown into the lake (surface of 5ha) as well as on the waste dumps of the coal mine area (43ha). Unstable slopes are in movement, coal burns in underground and on the surface dangerous gasses appear. Shape of the crater and lake is unressembling, waste depot space unfunctional and inadequate to urbane milieu.

Adequate sanation of the area is the basic goal which may be achieved by limited coal exploitation. By obtained overburden refuse masses the area can be suitably shaped and by selling coal the invested means may be refunded. Period of sanation, i.e. technical recultivation of the ground lasts 5 years and after that period biological sanation begins and entire area with the lake comes to be the first rate recreation centre of the town.

CONDITION OF MINING WORKS AND CURRENT PROBLEMS

Active part of the mine takes a significant space inside a small valley in which a relatively big town has been developed. In vicinity there is the Neretva river, flowing through the centre of the town. Surface exploitation had a classic concept namely, first an outer depot of 2,000,000m³ was formed and then an inner of over 20,000,000m³ refuse masses.

Thickness of the coal layer is 20m and profitable exploitation goes in the ratio of 1:3.5 m³ of coal/refuse m².

The highest quota of inner depot makes 140m and the lowest one of the underwall coal layer is +10m, so all activities have been carried on in the extent of 130m. The level of the surrounding city ground is on the quota of 80m, and in background there is a mountain massive up to the quota of 674m (Fig. 1).

The external waste depot filled the natural depression arising to the north from the crater
Fig. 1: Position of Surface Pit Inside The Mostar Valley.
n and the inner depot makes a number of irregular plateaus which are cut by gorges.

Slopes of the plateau are unsettled and crater visually dominates in space and wider surrounding, particularly when looked from main transport roads stretching by the border of Cretaceous massive.

By direct war activities the area has been additionally devastated, and the city's and other waste have been continuously drawn on and irregularly deposited into the crater and on waste depot places, so that the whole mining area (cca 76ha) represents a waste dump.

A part of roof deposits of the crater, because of excessive inclinations of working passenger, elimination of harmful influences on direct and wider surrounding and functionality of the space in sense of its further utilization. Visual contact is important since the area is locally predisposed as a part of larger urbane space which is in the crossing of main roads.

Elimination of harmful influences is crucial as the area is markedly spoiled with waste material and is in direct contact with the Neretva river which flows downstream through the urbane nucleus. Possibility of using the area for cultivation of vegetables and fruits as well as fish in the lake is an economic category and along with the recreation effect it fits into urbane milieu.

POSSIBLE SOLUTIONS AND PROPOSALS

Solutions for the sanation of devastated space are possible with or without continuing coal exploitation. Found situation is the result of forced interruption of production. An adequate sanation conditions redistribution of great quantities of refuse, from the inner to external depot or drawing on new quantities of overburden material by initiating exploitation.

It is possible to carry on the exploitation by pulling out all available reserves of coal only those which are technologically appropriate and economically justified.

ECOLOGICAL - SAFETY CONDITIONS AND INITIATIVES

Devastated mining area, in war destructed building objects as well as uncontrolled and unplanned and for long years laying of waste, demands urgent and adequate measures of sanation. These measures include convenient visual contact for an inhabitant or The level of exploitation predetermines future form and content of the sanated area. Laid down waste should be sanitized “in situ” or be removed and provided for on suitable location out of the urbane zone. By comprehensive and detailed analysis of the whole problem a limited and probable coal exploitation has been adopted, as well as forming of sanitary waste depot on convenient location “in situ” and solving of fire zone in the farme of shaping and reestimation of the crater space.

CHOOSEN SOLUTIONS AND EXPENSES

On the Fig. 2 a definite form and content of devastated mine area are shown; they will be reached by means of limited coal exploitation in the course of following 5 years.

On Fig. 3 and 4 characteristic cuts are shown in which existing and final state of sanation is seen. The location of sanitary depot in the frame of inner stock pile of refuse masses and the concept of liquidation of fire zone is seen in the example of Fig. 5.

Final form of the space appears after the planned distribution of 1 800 000m³ of crude overburden layer mass has been effected, as well as by exploitation of 500 000m³ of city waste. Finally, there is acquired a space of 24ha for orchards and vineyards on plateaus, 12ha on the slopes for plants and shrubbery for parks, and 7ha of the lake surface on the bottom of crater.
Fig. 2 Definite Contours of Recultivated Surface Pit

LEGEND:

- Existing state
- Projected state
- Dam
- 'H' hard rock

Fig. 3 Cross Sections of Surface Pit
Fig. 4: Characteristic Cross Section of Waste Depot and Inner Stock Pile

Fig. 5 Cross Section of The Zone of Crevices
The refuse found on mining area will be correctly sanitized on suitable location of depot, high (minimal 30m) above maximal level of underground water in a known - dug out and preconsolidated material of neogene, of small porosity for water (ceu 3x10^{-4}cm s^{-1}) and in geomechanic stable relationship inside inner stock pile of overburden in which the waste will participate with only 1.5%. There is abundant and constant inert overburden material for interlayer and final covering (overlaying strata) which increases isolation of the waste as the result of complementary activity.

Additional isolation (geomembrane + geotextile) as well as the concept of ground drainage, and degassing of waste depot are coordinated with modern criteria, regarding the greatness of problem waste depot place and time of activation.

It is to be stated that the waste depot is limited to existing "war" quantities which may be effectively, safely and cheaply sanitized in the frame of mining production. The location of a future depot of municipal waste of the town of Mostar is a great and current problem which solution is in course.

Fire zone will be liquidated by drawing in considerable amount of overburden layers with previously filled in crevices and by additional pit injection with cley-carthen material which can be obtained by cleaning the bottom of the lake in the crater.

Dynamics of all the works to be done on the pit and which are mutually conditioned and stimulated till reaching the final expressed form is given on Fig. 6 (Fig. 2).

**CONCLUSION**

There is analysed a problem of surface pit in a urbane milieu. Up-to date effected works do not follow professional criteria as regarding natural conditions of a deposit so as of space and time of execution.

Found state has been deteriorated by longer interruption of production and the whole mine zone has been changed into waste dump.

1030
Sanation foresees limited exploitation of coal by means of which required masses for creating space for inner and external depots, as well as for shaping and redestination of final crater of the pit are obtained. At the same time ground is being cleaned off gathered waste which is then sanitorily deposited in the frame of mining production. Expenses of all the works are covered by selling coal.

The example from practice is specific one, solutions for sanation are instructive, ecologically suitable and justified from the aspect of economy.

LITERATURE


10. Studies, projects, elaborations, expertises. Reports from RMU Mostar and urban plans of Mostar.