НАУЧНО-ТЕХНИЧЕСКИ СЪЮЗ ПО МИННО ДЕЛО, ГЕОЛОГИЯ И МЕТАЛУРГИЯ
SCIENTIFIC AND TECHNICAL UNION OF MINING, GEOLOGY AND METALLURGY
НАУЧНО-ТЕХНИЧЕСКИЙ СОЮЗ ПО ГОРНОМУ ДЕЛУ, ГЕОЛОГИИ И МЕТАЛЛУРГИ

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5. Draining, stability and consolidation of slopes in opencast mines and quarries. Quarries v dumps and tailings pools.
6. Ecological monitoring. Recycling and waste utilization. Reclamation of broken lands.
7. Economy, organization and management of the technological processes and production w in the open and underwater mining of minerals. Markets and realization of the products.
8. The mining legislation and his harmonization with European normative base. Educa qualification and specialization of mining experts of opencast and underwater minin minerals.

CONTENTS

E. DRAINING, STABILITY AND CONSOLIDATION OF SLOPES IN OPENCAST MINES AND QUARRIES. QUARRIES WASTE DUMPS AND TAILINGS POOLS

F. ECOLOGICAL MONITORING. RECYCLING AND WASTE UTILIZATION. RECLAMATION OF BROKEN LANDS

G. ECONOMY, ORGANIZATION AND MANAGEMENT OF THE TECHNOLOGICAL PROCESSES AND PRODUCTION WORKS IN THE OPEN AND UNDERWATER MINING OF MINERALS. MARKETS AND REALIZATION OF THE PRODUCTS

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THE RELIABILITY OF CHOICE FOR WATER SUPPLY SYSTEM OF THE STANARI THERMAL POWER PLANT

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ABSTRACT

Company EFT Mine and Thermal power plant Stanari d.o.o. planes to the and 2013. years to con: Thermal power plant with power of 420 MW in Stanari (Bosnia and Herzegovina). This paper pre: analysis of choices of number and location dewatering wells from the aspect of water supply reliability the thermal power plant in town Stanari.

Key words: Thermal power plant, Stanari, dewatering wells.

1. Introduction

For the need of reliable water supply of the future thermal power plant "Stanari", with 420 M' output it is necessary, in order to check system's working reliabilty, to perform preliminary analis' number of wells even at an early phase, so that they can provide quantity of water of about 16 certainty.

Location of the power plant is in the central part of Republika Srpska, respectively in the northe Bosnia and Herzegovina and it is in Doboj municipalty (Fig 1.).

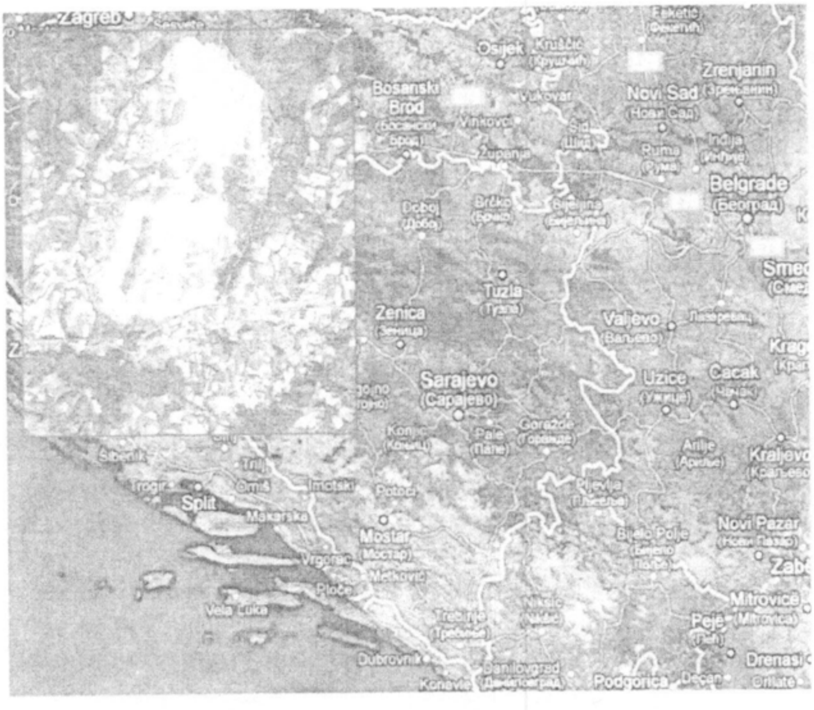

Fig. 1. Geographical position of the mine and future power plant "Stanari"

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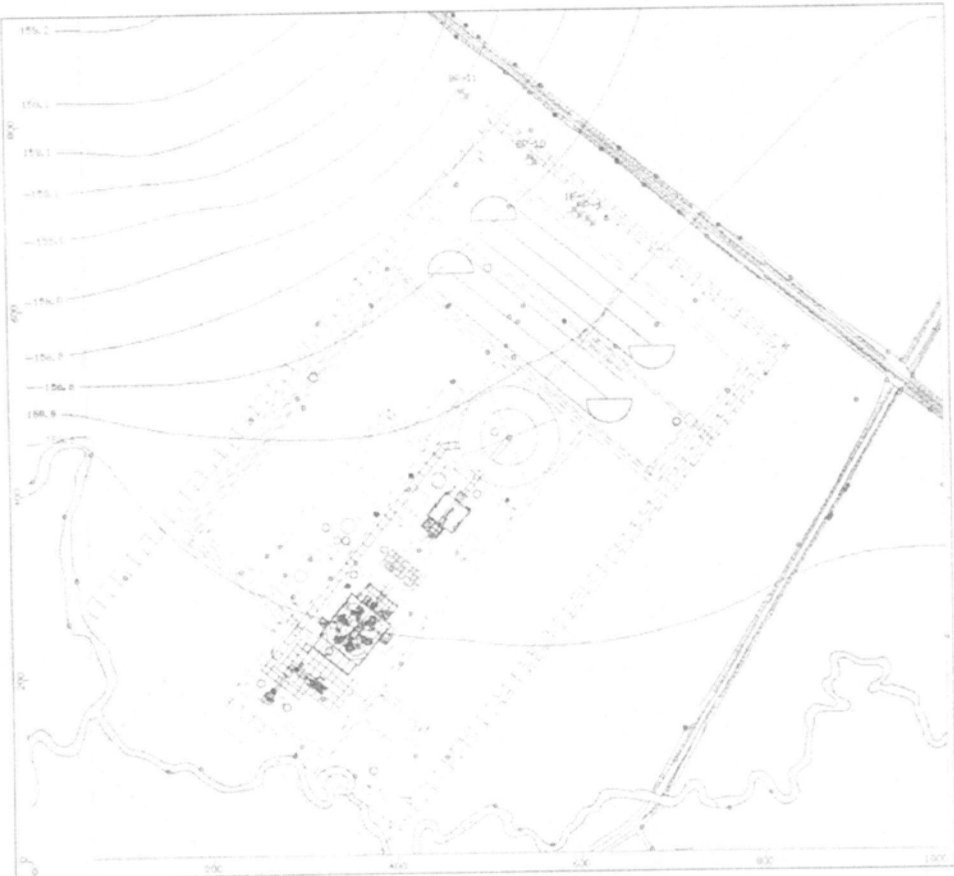
place where the plant should be built is a plateau on a hilly and mountaineous terrain, of mostly age and steep slopes. On the south side of the exploration area which is planned for power plant on there are river basins of rivers Radnja and its tributary river Ostruznja. Northern side of the s intertwined with the network of creeks Klasnjak, Kosnjak, Radava and Lipanj. On the northern and de of the envisaged location, there is a developed road network as well as the Sunja – Doboj railway

ng data obtained by the hydrogeological survey of the location of the planned thermal power plant groundwater level was constructed in the area of the future thermal power plant "Stanari" (Fig. 2.)



g. 2. Piezometeric level of groundwater in the area of the future thermal power plant "Stanari"

2. Selection of the Number of Wells

e increase of the reliability of the system of wells can be made in advance through the predicted f reliability of units or by the introduction of parallel lines. When the selection and evaluation of certain of reserves is done, it is necessary to determine the conditions for the normal function of the system, le interval of its decrease and to determine the state of failure. For a normal system function, n of the planned capacity (Q) is required. In the period of the state of permissible partial failure the hould provide the capacity which is not less than $Q_d = K_d{}^*Q$. The limit value of the coefficient of K_d, which can be anything from 0 to 1, is defined based on parameters of reliability of the system P), the influence of working environment, factors of organization (O) and permissible level of capacity of the system of wells within a specified time. For the value $K_d = 0$ total failure of the system within a time is allowed, while for $K_d = 1$ the decrease of the planned capacity is not allowed.

The basic type of structure of the reserve of the system reliabilty is using the parallel numb Optimization is reduced to the finding of such number and arrange of wells that at minimum level provides the necessary reliability by simultaneous operation.

The reliabilty of the system is increased with increasing the number of reserve lines or eleme or reserve coefficient which represents the relation between conditionally set number of reserve (N_r) (N_o) wells ($K_r = N_r/N_o$), when the system technologically consists of $N = N_r + N_o$ number of wells. If th a minimal number of wells whose failure causes the system failure the following relations are valid:

N_O=N-M+1, i M=N-N_O+1=N_r+1, so:

N_r=M-1.

When the reserve is used by the principle of simultaneous function of all wells, each and eve the system in function in the normal conditions has the capacity Q/N. The limit state before the syst is the state when only conditionally essential wells (N_o) remain in function. Capacity od each well in increases to the level K_d * Q/ N_o. The failure of M wells leads to the system failure. In this way number of basic elements of system is determined based upon the value of Qd. Although the total c realized within the allowed limits, it is lower than planned capacity (Q_d<Q), so that decreasing of th of wells in function usually leads to the increase of capacity of remaining wells in function.

The remaining number of wells in the water supply system depends from the given value K_d. number of possible wells with reserve is N = 2. While using the reserve of the capacity with simu function of three lines or groupes of wells, the capacity along each line is Q/N. For N = 2 capacity of o approximately 0.5*Q. When placement is being done of any larger number of wells the initial cpacity well is less than 0.5*Q. If given value K_d <0.5, two wells allow realization of the system reserve. Work provides the function of only one well. With N = 3 the capacity of one well is Q /3 =0.33*Q. Working such system is provided with function of any two wells (0.5*Q < 0.66*Q) so conditionally there are t and one backup well.

Water demand for water supply of the future thermal plant "Stanari" will be provided with functic wells with determined optimal capacity of 8 l/s each. As determined limit value of the coefficient of utili the reliability of function of each well from K_d = 0.65, than it is clear that two wells do not provide reali the reserve of the system water supply (0.50 < 0.65)

For three wells (N = 3), working state of the system is provided with function of anz tv (0.65*Q<0.66*Q) so conditionally there are two basic and one reserve well. The conditional coeff reserve is K_r=N_r/N_O=0.5.

General task of calculation of system reliability of the system of wells is to determine indicator characterize the function. The calculation contains defining criteria and types of system failures, also r indicators and determinig structural schemes based on the analisys of the system function including repairing and contol.

Mostly used indicators of reliabilty are mean time of the function until the failure of the probability of the set time, the intensity of the cancellation and renewal as well as stationary proba work. Flows crossing the state of recovery to function state, and vice versa define the transition intens and (β).

The function of the system to the failure, as a continuous random value, can be described with distribution depending of the system's features and its elements, working conditions, character of failu Simpliest and the mostly used is the exponential distribution function with the following function c distribution:

$F(t)=P(T<t)=1-\exp(-\lambda t)$,

where: T – work duration, t – given time of work, λ – distribution parameter

Distribution parameter is:

$f(t) = dF(t)/dt=\lambda \exp(-\lambda t)$.

Reliability function is:

$P(t)=1-F(t)=\exp(-\lambda t)$. (2.5.)

Mean time of function until failure:

$t_r=\int P(t)dt=\int \exp(-\lambda t)dt=1/\lambda$. (2.6.)

Failure intensity:

$\lambda(t)=f(t)/P(t)=\lambda \exp(-\lambda t)/\exp(-\lambda t)=\lambda$. (2.7.)

Structural schemes which represent graphical display of wells in the system unambiguously can define function or failure of the system of wells. Elements of the system can be connected in a serial, parallel or combined way. If the failure of elements simultaneously represents failure of the system the connection is serial but if the system fails only after the failure of a part or all the elements it is the parallel type of connection.

The system of the wells is a system that consists of (n) parallely connected elements, so the probability of the system function $P_S(t)$, for the probabilities of function of each element $P_i(t)$, is:

$$P_S(t) = P_1(t)\, P_2(t) \ldots P_n(t) = \prod_{i=1}^{n} P_i(t). \quad (2.8.)$$

The group of wells is a system which consists of (m) parallely connected elements, where the probabilty of failure of each $Q_j(t) = 1- P_j(t)$, so the probabilty of the system failure is:

$$Q_S(t)=Q_1(t)\, Q_2(t) \ldots Q_m(t) = \prod_{j=1}^{m} Q_j(t). \quad (2.9.)$$

Probabilty of the system function is:

$$P_S(t)=1- \prod_{i=1}^{n} (1- P_i(t))=1- \prod_{i=1}^{n} (1- \exp(-\lambda_i t)). \quad (2.10.)$$

Having in mind the existance of the water reservoirs as a part of the future thermal power plant "Stanari", for the smooth operation of 24 hours , required reliability of the system of three wells is 95%.

Reliability of function of each and every well, as a serially connected sequence of elements is:

$P_S=P_1{*}P_2{*}P_3{*}P_4{*}P_5=0.8{*}0.95{*}0.95{*}0.95=0.65$,

Where: P_1- reliability of the function of pump,

P_2- reliability of the function of other elements of pump,

P_3- reliability of the function of the well and complete pipeline,

P_4- reliability of the impact of working environment,

P_5- fall of reliability due to organizational factors.

Stationary probability of thermal power plant water supply system from three wells is:

$P_{S2}=1-(1-P_S)^3= 1-(1-0.65)^3=0.96$.

With a group of three wells, with the reserve water tank, the possibilty of the increase of capacity and reliability of function of individual wells as needed, required safety of water supply of the future thermal power plant „Stanari" is completely achieved.

3. Conclusion

In this work, the possibility of choice of number of wells for the reliable water supply of the future thermal plant "Stanari" in Stanari with capacity of around 16 l/s is explored. Optimization came down to finding such number of wells that at the minimal level of function, by their simultaneous function provide required reliabilty.

Based on hydrogeological investigation data it has been concluded that the location on which the building of the future thermal power plant "Stanari" is planned is potentially rich with underground waters necessary for safe water supply.

With a group of three wells with capacity of 8 l/s each (one in reserve), with a reserve water possibilty of the capacity increase and reliabilty of function of individual wells as needed, the required water supply of future thermal power plant "Stanari" is achieved completely.

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