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EXPLORATION OF WASTE DISPOSAL CONDITIONS RESULTED BY SODA PRODUCTION

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ABSTRACT
During soda production in Fabrika Sode (Soda Plant) in Lukavac, waste material that can be used as raw material for new products appears as well as scrap that cannot be used further. Unused scrap is laid down for that purpose in prepared basins. In that space are laid down sludge made by purification of salt water with caustic sludge as well as by preparation of boiler water with small scrap of quenching of quicklime and waste alkali.
This paper presents research results of waste disposal conditions suspensions incurred by soda production. Also measures for removal of possible ecological and other problems are given that can appear on and around these basins for waste disposal.
Key words: investigation, waste disposal, waste, soda, suspension,

1.INTRODUCTION
During soda production in Fabrika Sode (Soda Plant) Lukavac, waste material that can be used as raw material for new products appears, as well as the waste that cannot be used further. Waste that cannot be used further have been disposed in prepared basins for the purpose of waste disposal. In such a space, waste sludge incurred by purification of the brine along with caustic suspension, as well as waste incurred by preparation of boiler water with waste resulted from slaked lime distillation, have been disposed.
For daily production of 800 tonnes of raw bicarbonate, during one year appears 220,000 tonnes of waste waters and sludge that have to be disposed in prepared basins. Transportation of waste materials to mentioned basins is being performed by the pipe-lines. Basins are formed in a close vicinity of the Spreča river on the alluvium made of clay materials. This mode of the waste disposal presents a great risk of appearing of the ecological catastrophe for pollution of the Spreča river and arable land downriver of the basins for waste disposal. That is why it is necessary to check safety conditions of mentioned basins on the regular basis, as well as to check correctness of the drainage system ant water conditions in close proximity of the basins for waste disposal.
This paper presents research results of waste suspensions disposal conditions, as well as the measures for removal of possible ecological and other problems that can appear on and around these basins for waste disposal.

2.ANALYSIS OF THE BASINS SLOPE STABILITY
Stability analysis was performed for the profiles with ordinal numbers 1-1 to 10-10. Profiles position is shown on the situation map given at the figure 2. Based on this geodetic base, profiles for calculation of the stability were defined.

Data needed for the stability calculation, as position of co-ordinate system for the calculation model, are outlined at the profiles. Calculations are performed with the assumption of circular sliding plane by Bishop method with program REAME.

2.1. Reame method

REAME presents program that can be used for determination of the safety factor in slopes based on symmetrical sliding plane. Program has several possibility like inclusion numerous different types of soils, simulation of influence of water through presentation of piezometric level, or through presentation of the pore pressure. This program also provides calculation of the static or seismic safety factor. Contrary to the Bishop method, algorithm of finding the critical circle is mere simple and provides more radius controls for one circle and for more circles also. Algorithm for finding the safety factors is given by equations 2 and 3 , while equation 1 provides safety factors form performed through pore pressure. Designations used in equations are presented at the next figure 1.

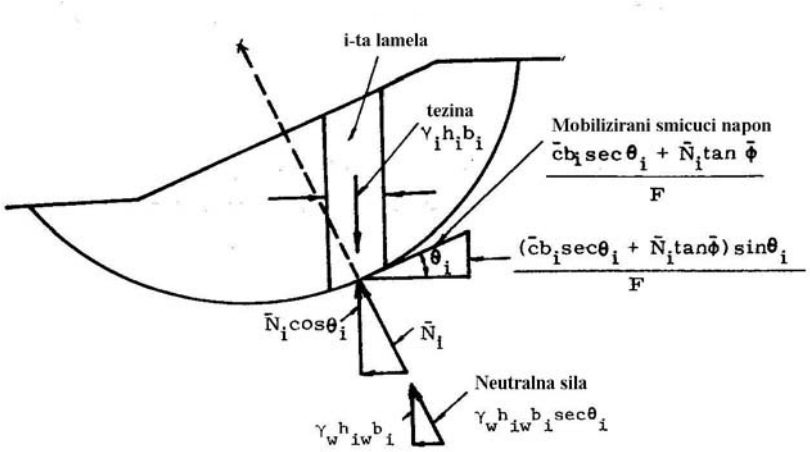

Figure 1. Designations used in equations

$$F = \frac{\sum_{i=1}^{n} \frac{\bar{c}b_i + (1-r_u)\gamma h_i b_i tg\bar{\phi}}{\cos\theta_i + (\sin\theta_i\, tg\bar{\phi})/F}}{\sum_{i=1}^{n} (W_i \sin\theta_i + C_s W_i a_i / R)} \qquad (1)$$

$$f(F) = F\sum_{i=1}^{n}(W_i \sin\theta_i + C_s W_i a_i / R) - \sum_{i=1}^{n} \frac{\bar{c}b_i + (1-r_u)\gamma h_i b_i tg\bar{\phi}}{\cos\theta_i + (\sin\theta_i\, tg\bar{\phi})/F} = 0$$

$$F_{m+1} = F_m - \frac{F(F_m)}{f(F_m)}$$

Parameters needed for calculations are based on the laboratory investigations performed earlier:

- volume weight, γ = 12.4 – 14.6 (13.0) kN/m^3
- cohesion, c = 16 – 22 (10) kN/m^2
- angle of internal friction, $\varphi = 30^o$ (30^o)

Data in brackets were used in calculations. Analysis of position of sliding plane centre of circle, is performed for three value of the pore pressure coefficient, $\mathbf{r_u}$.By the concurrent investigation it was established that value of r_u= 0,1 corresponds to approximately dry slope, r_u= 0.3 for natural moisture level of the slope sediments, while r_u= 0.6 corresponds to the slope with mostly presented water. Calculation of stability was performed for all slopes of each strip individually, and 25 analysis was

performed in total. Stability analysis results show that all slopes, independently of the water presence level, have safety factor much more than 1.3, and that these are very stable.

3. ECOLOGICAL RISKS

By in situ and laboratory exploration works, basic geological, hydrogeological and geomechanical characteristics of the sediments of the waste disposal basins, were established. Base of the basins ought to be constructed with drainage systems, but it was not performed in a such a way and instead drainages were partially constructed in the embankments. Disposal of the waste sludge includes releasing of sludge behind the basic embankments at each about fifty meters, in order to the most coarse particle being sedimented as closer as possible to the embankment providing the base for further adding.

Investigation of the water in piezometers have shown that immediate floor is polluted by disposed materials, despite the fact that it is made of clays. Upon drying of the sludge, when stronger winds appear, white dust raise and sediment at distances more than 10 km. Special problem appears in a period of massive precipitations and releasing huge quantity of water in the Spreča river out of lake Modrac situated upriver of the waste disposal basins. During 2001 and 2002, due to extreme flooding, one part of disposed sludge was drifted by the Spreča river, while one part of sludge left in the Spreča field downriver the basins. This has caused annihilation of animal life in Spreča river, and at the same time pollution of the arable land in the Spreča field.

By covering with soil, the area of former waste basins could be transformed in the cultivated area, or disposed material possibly used as a raw material for new products.

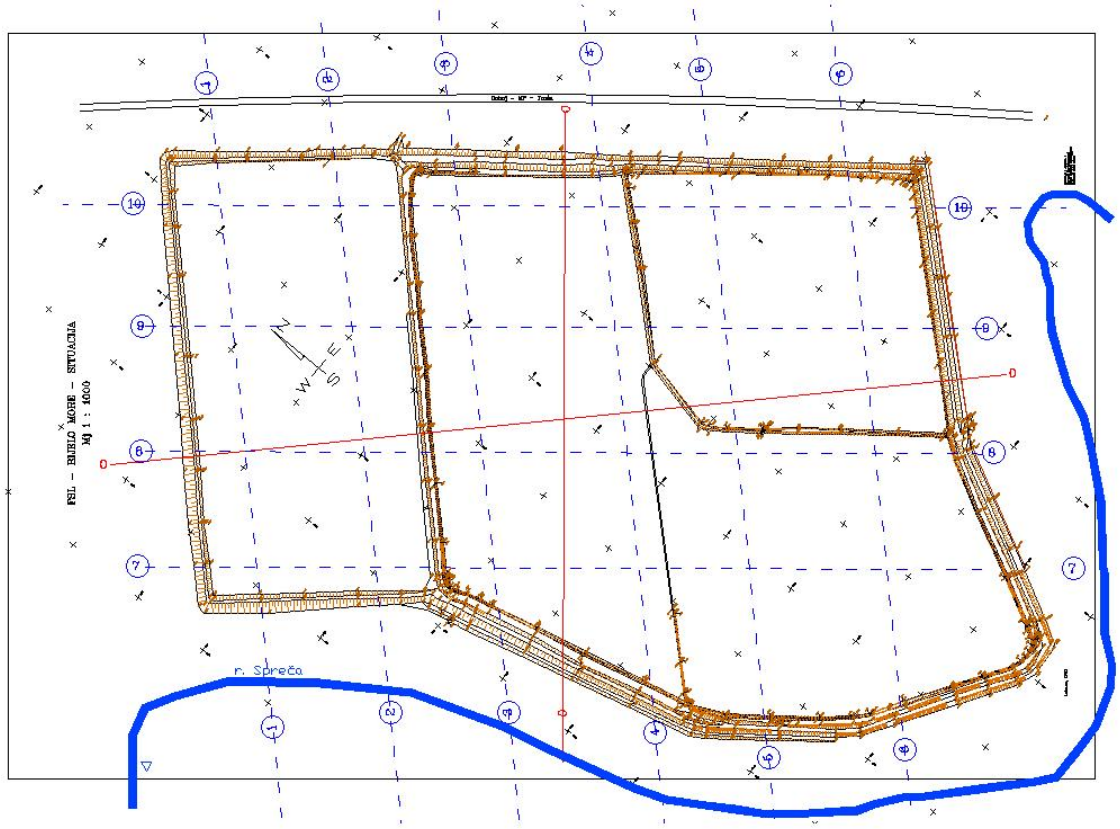

Figure 2. Situacion map of Bijelo more

4. CONCLUSION

By the end of nineteenth century , soda production started in Soda Plant in Lukavac and disposal of sludge in close proximity of the plant also. By development of the Lukavac city the plant itself and its basins for waste disposal arrive in the city, causing an extreme problem in the last thirty years. This paper deals with research of safety of existing basins for waste disposal, ecological risks, and possibility of its reduction. The dam of basins is stable, but all other risks exists that permanently

endanger the Spreča river, arable land in the Spreča field downriver the basins, as well as the air in a broader environment. The possible solution could be overlying of existing basins for waste disposal with soil from neighbouring collieries.

5. REFERENCES:

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