

CALCULATION OF EXFILTRATION OF WATER FROM THE LAKES ON CEPLEA VALLEY SITUATED NEAR THE DEPOSIT OF CINDERS AND ASHES OF TURCENI POWER PLANT

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Abstract: *In this paper we present way in which ash and slag deposit Ceplea Valley of Turceni Power Plant, affecting the quality of surface and groundwater surrounding areas deposit.*

Key words: ash and slag deposit, groundwater, decantation ponds.

1. INTRODUCTION

By impounding the Valley of Ceplea and the storage in the headwaters of dams of the hydromass of cinders and ashes from Turceni Power Plant, the hydrology and hydrogeology substantially modified in the area of the drainage basin, quantitatively and qualitatively, respectively. Surface waters of Ceplea Valley are mostly collected in the retentions created from the decantation ponds. Groundwaters are strongly fed through the heads of layers in the versant area, being created a radial drainage oriented then towards the water meadow of Jiu River, with a higher flux as compared to that existent before the putting into service of the Electric Power Plant. There emerged surface wells on the valleys' versant, fed with water from Ceplea decantation pond.

2. APELE DE SUPRAFAȚĂ ȘI SUBTERANE

Surface waters and groundwaters. Accumulations created on Ceplea Valley practically collect the entire influx of surface waters rising from the precipitations in the affluent drainage basin of this river. The surface of the reception basin outside the control section of the last downstream water meadow is insignificant. By design in each of the three compartments of the deposit, the retention dams are fitted with a reserve of height of about 1m, which must not be occupied with hydromass, in order to be able to accumulate the waters coming from the extraordinary precipitations which can fall on the basin of Ceplea Valley upriver the deposit. Consequently, as there are no flows which discharge in Valea Ceplei brook, there is no direct pollution. However, the presence of permeable materials in the beds allow high rates of infiltration for the water in the deposit, and in order to correct the hydrostatic level in the area drainage works need to be carried out. Excess of water due to these infiltrations in the deposit or due to direct losses from the transportation pipes lead to sloughing of soils, phenomenon which is dealt in detail in the subchapter pollution of soils. At present, there exist no qualitative determinations of water in Ceplea Valley upriver of the deposit and downriver the confluence with Jiu river. Eventually, it may be judged that, as there exist no specific sources of pollution, the surface water on Ceplea Valley, upriver the deposit, does not suffer a significant pollution.

Groundwaters. Modifications made in the regimen of groundwaters in the drainage basin of Valea Ceplea river and the adjacent areas, by arrangement of cinders and ashes deposit of Turceni Electric Power Plant, constitute the main negative impact of this arrangement over the environment. Huge infiltrations of water in the deposit of cinders and ashes in the whole versant of the valley, surface wells, and especially sub-flooding of some important areas in Turceni locality appeared. In the affected areas has been caused the modification of the level of waters in fountains up to the discharge at surface, dislocations and landslides, flooding of basements and foundations of some houses, cracking of the walls of some houses and deterioration of hygiene conditions, comfort and, in general, deterioration of life conditions of local population.

Although geological studies carried out throughout the time excessively schematized the land's structure in depth and along the executed profiles, however, it can be emphasized the fact that there is an almost horizontal stratification of the types of land in the area- layers of gravel and sand alternate with clay layers.

Surface waters cut these layers vertically, creating conditions for the water to infiltrate through layer ends in the line of the valleys towards the water meadow of Jiu river. There exists the possibility of aberrances from the regularity of stratifications, intercalations of clay lens inside the sand and gravel layers, as well as less distinct delimitations between them.

Two main questions were stated when determining the negative impact of the modifications made in the hydrology and hydrogeology of Ceplea Valley drainage basin:

- to identify the modifications in the regimen of discharge of ground waters created by the deposit of cinders and ashes hydromass; efficiency of steps taken;
- to identify the qualities of groundwaters in the area as result of the chemical composition of the water which infiltrates from the deposit of hydromass with cinders and ashes.

3. CALCULATION OF WATER EXFILTRATION FROM THE LAKES ON CEPLEA VALLEY.

We adopt the following elements and data bases:

- The stratification between *the deposit* Ceplea Valley and the water meadow of Jiu River is quasi-horizontal;
- The directions of discharge of infiltration water are normal on the outline of the lake and the outline of the water meadow of Jiu River; the shortest geometric path is also the hydraulic path;
- the infiltrations coefficients in the horizontal direction in aquifers are in the range of values 5-15m/day (the maximum values could be met in the areas with gravel and sand, on certain sectors);
- anisotropy can be of orthotropic type, with values of the coefficient of orthotrophy

$$\delta = \frac{k_{oriz}}{k_{vert}} \approx 3, \quad (1)$$

where, k_{oriz} is the filtration coefficient on horizontal direction and k_{vert} is the filtration coefficient on vertical direction.

- thickness of permeable layer equivalent to $k=5-15 \text{ m/day}$ in the zone of confluence with the permeable layer in the water meadow of Jiu River is of $T=5m$;
- circulation by infiltration may be approximated by a varied gradual circulation, and rarely the water discharge which presents maximum interest is accompanied in the contact section with the water meadow of Jiu River.

In the analyzed documentation is schematically presented a longitudinal profile of discharge of groundwater between the deposit number 1 of Ceplea Valley and the Water Meadow of Jiu River, in a bee-line. We have:

- maximum level difference $\Delta H = 45m$;
- minimum length of infiltration way $L = 1800m$;
- thickness of permeable layer in the upriver section (equivalent thickness) $T = 5m$;
- infiltration coefficient $0,5-1$

For the homogenous environment: $k = k_x = 1-5 \cdot 10^{-2} \text{ m/s}$

For the orthotropic environment: $k_x = 1-5 \cdot 10^{-2} \text{ m/s}$

$$k_z = \frac{k_x}{3} = \left(\frac{1}{3} - \frac{5}{3}\right) 10^{-2} \text{ m/s}$$

$$\lambda = 3$$

$$k = \sqrt{k_x k_z} = 0,58 - 2,89 \cdot 10^{-2} \text{ m/s}$$

(2)

The equivalent length is $L = 600m$.

a. *Mediu omogen a. Homogenous environment*

$$\text{- infiltration rate : } v = k \frac{\Delta H}{L} = 1-5 \cdot 10^{-2} \frac{45}{1800} = 1,5 - 12,5 \cdot 10^{-4} \text{ m/s} \quad (3)$$

$$\text{- specific flow: } q = vT = 1,25 - 6,25 \cdot 10^{-3} \text{ m/s} \quad (4)$$

$$\text{- flow on 100m flow face: } Q = 0,125 - 0,625 \cdot 10^{-3} \text{ m}^3 / \text{s} \quad (5)$$

b. *Orthotropic environment*

$$\text{- infiltration rate: } v = k \frac{\Delta H}{L} = 0,58 - 2,89 \cdot 10^{-2} \frac{45}{600} = 1,35 - 21,67 \cdot 10^{-4} \text{ m/s} \quad (6)$$

$$L_e = L / \lambda = 1800 / 3 = 600 \text{ m} \quad (7)$$

$$\text{- specific flow: } q = vT = 1,175 - 108,35 \cdot 10^{-4} \text{ m/s} \quad (8)$$

$$\text{- flow on 100 m flow face: } Q = 0,217 - 1,083 \cdot 10^{-3} \text{ m}^3 / \text{s} \quad (9)$$

From measurements resulted flows of same size order in the trench implemented in Turceni village. At the same time it has been found out that the hypothesis of orthotropic environment is more plausible.

4. CONCLUSIONS.

Modifications carried out in the regimen of groundwaters within the drainage basin of the river Ceplea Valley and in the adjacent areas, by arrangement of the deposit of cinders and ashes of Turceni Power Plant constitutes the main negative impact of this arrangement over the environment. Huge infiltrations of water from the deposit of cinders and ashes in the entire versant of the valley, surface wells and especially the sub-flooding of important areas in Turceni locality occurred.

In the affected areas has been caused the modification of the level of waters in fountains up to the discharge at surface, dislocations and landslides, flooding of basements and foundations of some houses, cracking of the walls of some houses and deterioration of hygiene conditions, comfort and, in general, the deterioration of life conditions of local population.

By design in each of the three compartments of the deposit, the retention dams are fitted with a reserve of height of about 1m, which must not be occupied with hydromass, in order to be able to accumulate the waters coming from the extraordinary precipitations which can fall on the basin of Ceplea Valley upriver the deposit.

At present, there exist no qualitative determinations of water in Ceplea Valley upriver of the deposit and downriver the confluence with Jiu river. Eventually, it may be judged that, as there exist no specific sources of pollution, the surface water on Ceplea Valley, upriver the deposit, does not suffer a significant pollution.

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