

RECOLTIVATION OF THE DUMPING AREAS AND WATER MANAGEMENT ON THE EXAMPLE OF BROWN COAL OPEN-PIT "KONIN"

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In the paper is presented the characteristics of the brown coal open-pits Konin's, and characteristics of the outerdumps and terminal dumps in these open-pits with methods of their development.

The two methods of recultivation, using in the open-pits areas are described.

The quantities of pumped out from open-pits water, and a ways of ground waters level monitoring are shown. Also are described the ways of pit-water treatment and counteraction to the effects of the grounds drainage by pits.

1. INTRODUCTION

Poland is a country with reach brown coal deposits. 14 billion Mg of resources are in the documentary evidence, and 70 billion Mg of resources are estimated in perspective. For today and in the future the main use of the brown coal is burning it for the electric energy generating. The brown coal can be used also in agriculture, for the devastated and polluted soils recultivation, and to the water and waste treatment.

The excavations after brown coal exploitation are making the water basins for recreation, fish breeding and ashes and wastes disposals.

The brown coal deposits, which are located in the Konin locality, were known as early as 20 th years of our century. Only in 1945 was started the exploitation of Morzysław open-pit, for the new builded briquetting plant.

After the ending of this deposit exploitation, in the year of 1953 was started the exploitation of Niesłusz open-pit.

Basing oneself on the brown coal resources in the documentary evidence, was builded in the year of 1958 the power station in Gosławice with 583 MW plant rating, and in the year of 1969 was committed to exploitation the power station Pałnów with 1200 MW plant rating.

The builded power stations, based on the brown coal burning, caused increase of coal demand and starting of the new open-pits exploitation: Gosławice - 1958, Pałnów - 1962, Kazimierz Płd. - 1965, Juzwin - 1971, Lubstów - 1982.

2. CHARACTERISTICS OF THE WORKING OPEN-PITS OF KONIN MINE PLANT

For today are still working four open - pits: Pałnów, Kazimierz Płd., Juzwin, Lubstów. Coal year-output is on the level about 13 mln t, and a quantity of removed cover materials is about 74 mln m³. The average coal calorific value is 9400 kJ/kg, average sulfur content in the coal is 0,8%.

During 50 - year's exploitation was extracted out 374.536 mln t of coal and was removed to the new places 1.855.417 mln m³ of cover materials. The quantities of removed ground masses and start-point of terminal excavations recultivation is shown in the table 1.

The exploitation of brown coal with the open-pit method caused the new areas occupied with outer-dumps and excavations. From the beginning of mining activity to the end of the year 1994 was occupied for the mine plants needs the area 9194 ha. To the 1994 was given to the local administration 4164 ha of recultivated and developed areas.

Table 1

Open-pits characteristics (2)

	Meas. units	Pańków	Kazimierz Płd.	Juzwin	Lubstów
Start of exploitation	year	1962	1965	1971	1982
End of exploitation Start of terminal excavations recultivation	year	2000	1997	1999	2007
Coal resources	mln t	17,7	4,2	18,3	64,6
Depth of cover (average)	m	50,5	47,5	47,9	46,1
Depth of coal deposit (average)	m	8,8	6,6	9,0	28,8
Year - output	mln t	3,2	1,7	2,9	5,6
Removed cover materials masses value (yearly)	mln m ³	17,0	8,2	24,0	6,0

3. OUTER-DUMPS AND TERMINAL EXCAVATIONS

As a result of hitherto existing mining activity, are formed many outer-dumps and terminal excavations. The dumping areas are successive recultivated and prepared for the developing. The outer-dumps slopes are developing in the forestry-direction and top-area of dumps first of all in the agricultural direction. The previous outer-dumps are developed, as shows the table 2.

Table 2

Outer-dumps characteristics (2)

O. n.	Dump's name	Height [m]	Plane [ha]	Development direction
1	Morzysław	8 - 20	25	individual houses building
2	Nieshusz	12	60	allotments
	Nieshusz	20	43	forestry
3	Gosławice	40	70	forestry
4	Juzwin	70	340	forestry
5	Kazimierz	45	203	agricultural
6	Lubstów	40	193+215	forestry + agricultural

Dumping of the cover material, which is founded above the brown coal level is performed this way, that to the top of the dump are located heavy and dense clays - the most useful for the process of biological recultivation.

The recultivation works include:

1. The forming of the lateral slopes and top areas of outer- and inter-dumps.
2. The leveling of the adjacent areas.
3. The forming of the water basins slopes.
4. The biological covering of the dumps and terminal excavations slopes.
5. The making of the access roads.
6. The agrotechnical treatments.
7. The geodesic measurements and soil classification.

During the 50 years of brown coal exploitation were formed the after-exploitation terminal excavations in the open-pits, which were developed as follows (tab. 3.).

Table 3

Terminal excavations development (2)

O.n.	Open-pit's name	Plane (ha)	Excavation's development
1.	Morzysław	2,5	water basin for allotments communal wastes dump
	Morzusław	4,0	
2.	Niesłusz	18,5	water basin, fish breeding basin
3.	Gosławice	32,0	ashes dump for power station water basin in the briquetting plant's closed cycle
	Gosławice	32,5	
4.	Pałnów	57,7	mine-waters decanter ashes dump for power station
	Pałnów	332,0	
5.	Kazimierz	65,0	recreation water-basin fish breeding basin
		35,0	

As a result of Prof. Bender's long-term experiments on the dumping areas in Konin locality, the new model of after-mining areas recultivation was created. It is consist in biochemical transformations, which are occurred in top layer of dump's ground. To achieve this effect the following conditions must to be fulfilled:

1. Correctly forming of the slopes and top area of the dump in the limits of mining works, building of a new hydrogeological net and the access roads.

2. Renovation of the chemizm in the top layer of the ground through mineral fertilization in correct rates and compounds relations, which are depended on recultivated ground's properties and applied plants requirements.

3. Renovation of physical properties of the after-mining ground through mechanical cultivation which has stimulated the ground weathering processes and ground's homogenization.

4. After the making all of the mentioned above points, the including of plants to soil-forming process and the increase of the ground fertility is possible.

On the part dumping area, where the chemizm renovation was not done, the yields of rape even after 10 years are almost zero, and the yields of corns not exceed 0,3 Mg/ha.

On the dumps, where this renovation was done, the yields are higher than average yields obtained in the Konin locality.

The yields of the plants growing on the dumps fertilized with mineral fertilizers are setting together in the table 4.

Table 4

Yields of the plants under mineral fertilization (1)

Plant species	Fertilization's combination	Year				Average
		1980	1985	1991	1993	
Winter rape	0 NPK	0,0	0,0	0,0	0,0	0,0
	1 NPK	2,4	1,8	2,0	0,9	1,3
	2 NPK	2,9	2,3	2,1	1,2	1,8
Bread wheat	0 NPK	0,0	0,2	0,6	0,0	0,3
	1 NPK	1,9	2,4	3,2	2,1	2,7
	2 NPK	2,3	3,0	3,0	2,5	3,0

With the yields quantity is connected the amount of organic matter putting in the ground as a crop residues, straw and roots. It is an energetic and building material for soil's microorganisms.

After 20 years, the soil created from after-mining ground secured stable production on the 2,0 Mg/ha yield's level (without fertilization) and on the 4,0 Mg/ha yield's level (with fertilization).

For the agricultural direction of recultivation 3 models are worked out: a) rape-corn - consist in the alternating growing of rape and wheat;

b) feed - consist in the alternating 5-year's growing of lucerne and 2-year's growing of wheat;

c) feed - only lucerne growing.

The recultivated area amounted 4164 ha. On the 300 ha area of agricultural recultivation was made the soil classification. It was noticed, that after 15 years of growing the soil has higher class, than before mine building.

In the Bełchatów mine, cause the higher dumps and bigger areas, was made the sowing of grass and liquid fertilization using agricultural aviation. But these operations are many times more expensive, than traditional and costs from 600 to 650 USD/ha. It is not the best dissolution also because the grass influences not good on the later growing trees; the grass has taking away the water with nutrients.

The dumps slopes are planted with forest-creating plant species, as maple, great maple, ash, oak, larch, beech.

The slopes are fertilized every 4 years, with mineral fertilizer in amount 1 t/ha.

4. TERRAIN DRAINAGE AND COUNTERACTION TO IT'S EFFECTS

The brown coal exploitation is connected with drainage of the deposit and adjacent terrain, because of pumping out the big amount of water. As a result of open-pits Pałnów, Kazimierz and Juzwin drainage was created the depression funnel in the underground waters level (which were located in the Tertiary grounds) with an area about 260 km². The depression funnels in Quaternary grounds comprise the areas located in the near of excavations - to the several hundred meters from it's edge.

On the all area located around the open-pits Kazimierz, Pałnów and Juzwin were making 194 of sight-holes for the underground water level observing. Similar in the Lubstów open-pit, the ground water level is monitored using 135 sight-holes.

In the depression funnel's range are making quarterly measurements of ground water level in 1039 local farm-wells.

Because the ground drainage in many villages lacked the water in the wells. To secure the water supply for these people, the mine has

built about 700 km of water supply system, 31 hydrophore stations and deep bored wells.

The deposit drainage is making with two methods. First - using deep bored wells, which caused the underground water level decrease under the coal deposit's deepness. These waters are pure and their physic-chemical composition is near to drink-water. These waters are using for the mine - workers supply and their overflow is draining to the nearby lakes.

In the year of 1994 were pumped out the underground waters in quantities (2):

Pątnów open-pit	55,49 m ³ /min.
Kazimierz open-pit	52,98 m ³ /min.
Juzwin open-pit	51,83 m ³ /min.
Lubstów open-pit	22,47 m ³ /min.

All of the open-pits have pumped out, using deep bored wells in the year of 1994, water in the amount 95.804.000 m³.

The second method of drainage comprise the surface waters intakes from mine area and effluents of the underground waters to the excavation. These waters are mechanical polluted with coal suspension and clay particles. For the decreasing of suspension amount to the normative quantities these waters are purificated using settling ponds. For the Pątnów, Kazimierz and Juzwin open-pits were used as many-chamber settlings the inter-dumps, located in the part of mine-excavation, where coal was yet taking away. In the Lubstów open-pit polluted waters are purificated in 6-chamber settling with 19.700 m³ value. Each of the chambers have an additional plant filter. After the purification these waters are draining to the Warta river. In the year of 1994 were draining 64.681.000 m³ of waters drained with the second method.

5. SUGGESTIONS

1. Konin mine-plant as a first in Poland has used the recultivation model based on biochemical transformation processes in dumping ground, on which were achieved higher yields, than adjacent soil.
2. The outer-dumps slopes were recultivated in forestry direction and flat areas in agricultural direction.

3. The excavations of terminal pits were used as the communal wastes dumps, power station's ashes dumps, and water basins for recreation and fish breeding.
4. On the inter-dumps were located the settlings for the mechanical polluted water purification.
5. The water from the deep bored wells, which draining the open-pits can be useful for man water supply.

6. LITERATURE

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