

# Coal Deposits' Mining with High Content of Natural Radionuclide

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**Abstract:** The article considers the methods of working off of coals with high content of natural radionuclide (NRN) that allow for the coals' completeness of the getting and environmentally reducing their safety on the example Urtuysky brown coal' deposit opencast mining located in Trans-Baikal region.

**Keywords:** Coal, radioactivity, completeness, method of getting, charge, classifying.

## 1. Introduction

The most vulnerable point in the coal power is the adverse environmental impact of the coal fuel cycle. In the recent years attention is attracted the radiation pollution generated by coal industry and coal heat-electric generations.

The one of the most important problem of the coal power there are the radiation hazard of coal mining and coal heat-electric generations connected with natural radionuclide containing in coal. Sometimes the modern world underestimates this problem but this problem demands limit attention.

Coals with a high content of radionuclide are very often. According to ecologists the fuel power by coal is among the most significant pollution sources of environment by radionuclide but it wasn't taken serious steps to limit outburst of NRN with coal burning products. The serious problem is the storage of ash and slag near heat-electric generations. They occupy large areas that are not used for a long time and they are centers of heavy metal accumulation and high radioactivity.

## 2. Characteristic of the work

Detailed studies Urtuysky brown coal deposit allowed establishing that heavy and radioactive metals carried to certain energy grades of coal and having a real coupling with carbonaceous rocks and geological structures involved in the formation of coal deposits.

In this regard there are was an opportunity to allocate energy coals at the stage of geological exploration, characterized by certain concentrations of radioactive elements. It allows to separate the coal reserves on household (burning in furnaces), energy (burning at Heat-electric generation, hydroelectric station), complex (high content concentrations of radioactive elements and not subject to a use as energy, the possible use - gasification).

Development of technology schemes of radiation quality coal' control at the stages of the forecast availability of radionuclide in the formation of parties to prepare for burning coal to the power station, will significantly reduce the negative impact of radionuclide in coal on the environment and provide the greatest fullness of extracting it from the depths.

The uranium contamination of coal mass at several deposits predetermines the need to consider the permissible conditions for coal burning power plants and calculate the volumes of waste (disposal) of the complex coal.

The main standard parameter that determines the possibility of burning coal mass is the value of the maximum permissible emission of uranium, which for Krasnokamensk Heat-Electric

Generation approved in the amount of 3.1 tons / year.

This required the determination of uranium reserves in the loop section and the total number of coal mass with high content of uranium, by which can be adjusted by the amount of uranium in the coal with an annual averaging mode. Distribution of operational reserves of coal mass it is executed on the basis of statistical processing of coal intervals

wells tested for uranium and used to calculate the average uranium content.

The criterion is the average grade of uranium content on coal horizons within the interval (bench height of 12 m) which subsequently served as the basis for drawing level quality maps for radiation parameters.

Number of stocks rock mass distribution on the ledges (level) is shown in Fig. 1.

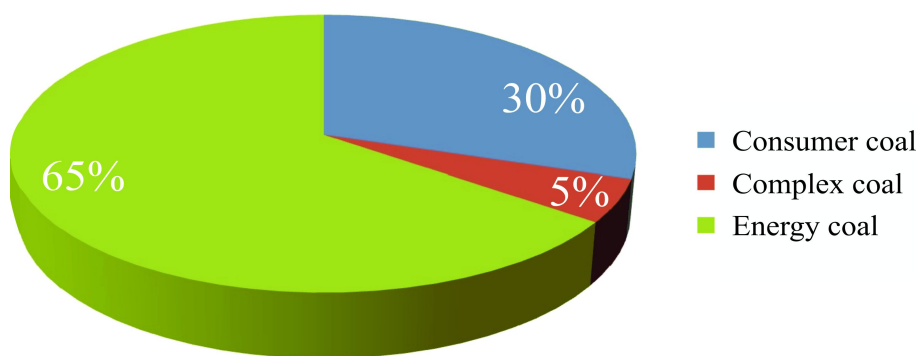


Fig . 1: Diagram of distribution of reserves of rock mass on grades of Urtuysky deposit

Radiation quality control system for coal technological stages includes two main areas:

- Quality control of coal in the planning stage through sectional level quality maps ;
- Operational control of radiation quality of coal by the mining, preparation parties products and solving the problem of its radiation safety.

The basis level quality maps on the methods of calculating the reserves of coal mass and the content of radioactive components of the coal interval wells within the horizons. Analysis of materials exploration and research allows to predict the quality of saleable coal in seams, blocks, on the horizons and mining sites . Level maps of coal quality - this is the graphics (plans) horizons mining, coal reserves delineated and counted according to detailed and more additional investigation. Basis for the construction of maps is combined distribution plan

NRN that as isohypses reflect the content of uranium, radium and thorium.

Combined plan of natural radionuclide (NRN) is based on a uniform grid equal to the distance between the lines of exploration. The isoline calculated the average content of uranium, radium and thorium, the average content of these elements is estimated approximately in each sector grid.

Border calculating blocks rebuilt by geological sections for which the reservoir area and skyline exploration longitudinal and transverse lines on the network 125h 50 m are divided into sectors. This system allows dialing the number of the optimal design data and simultaneously the area of the sector is with a height equal to the capacity of the horizon (shoulder) - 12 m.

For each sector the volume of coal is calculated and averaged qualitative indicators, combined with the plan horizon, locking and network exploration

Calculations are made in averaging mode quality, method of solving the problem of linear mixture, which is used in mining.

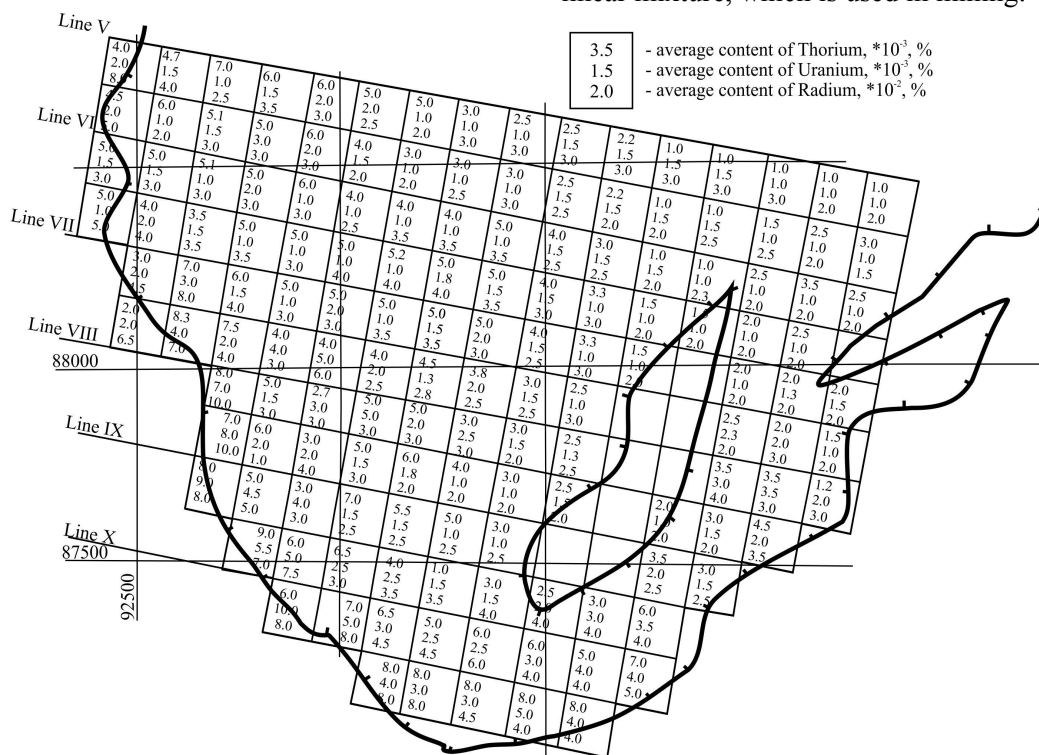


Fig.2: Combined plan NRN content in the coal stratum of by M

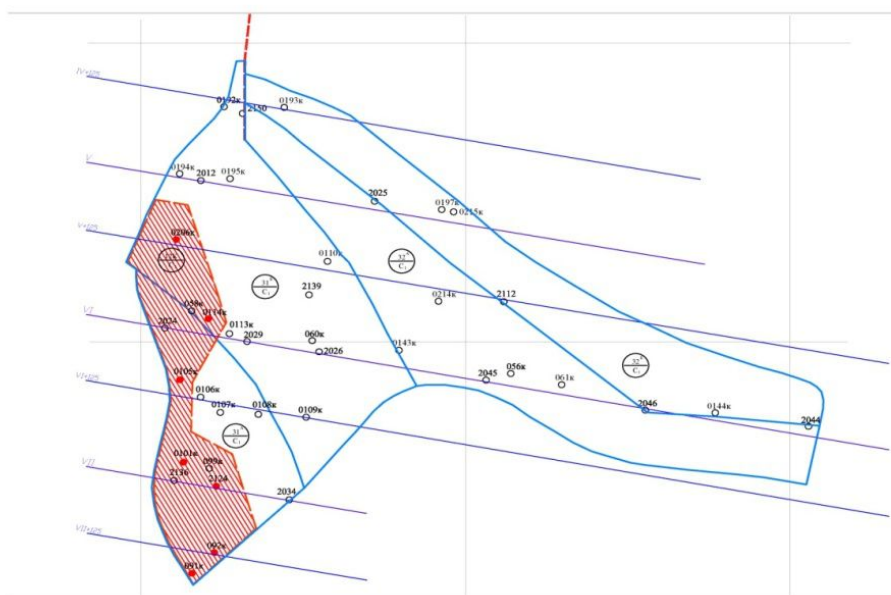


Fig.3: Scheme of the region comprehensive of coal

The coal' quality parameters calculated on the maps for planning of mining operations , conducted choice of optimal directions of work , placement of mining equipment , forecast indicators of quality in the long term .

For development of reserves based on selective and selective extraction of coal grade chosen car variant of opening , which makes it possible to manage the traffic flow of coal and

generate batch of finished products required quality.

Most unfavorable to the degree of contamination within the coals are detail - explored areas planned to practice using the "election recess» (Fig. 3). In this situation, «selectively» chosen land, providing a "negative impact» on the radiation quality coal, which will continue to be practiced selective and gross ways.

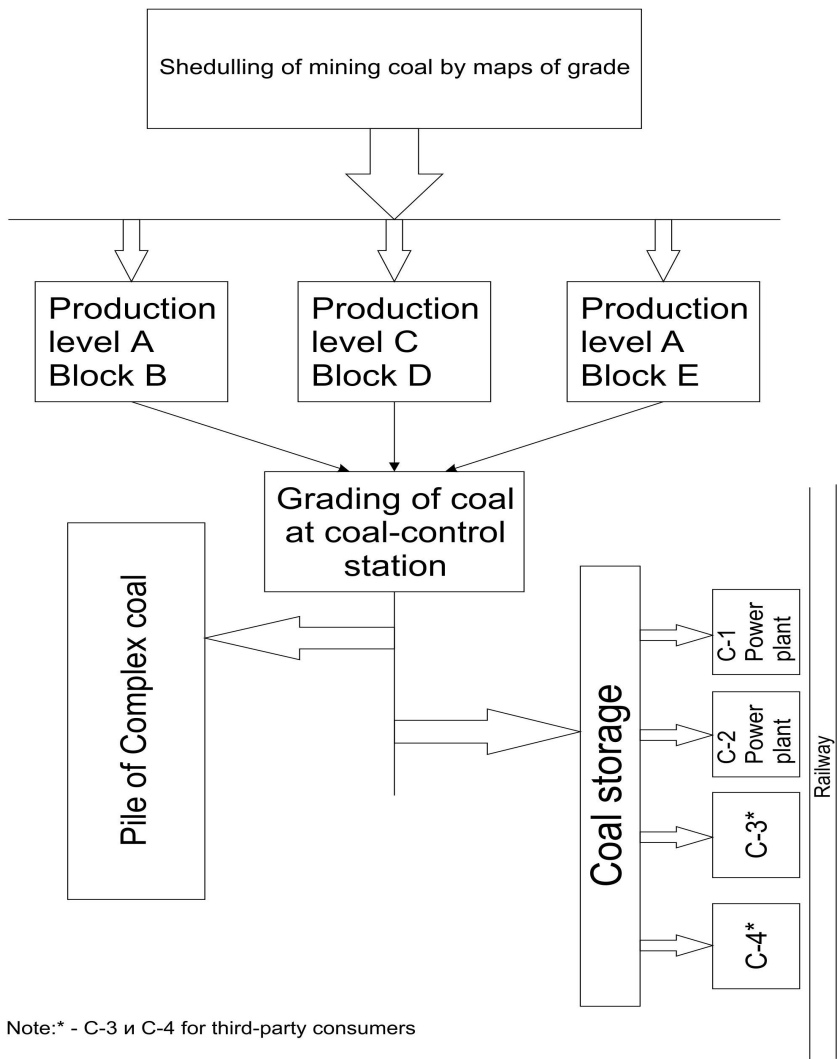


Fig.4: Scheme of mining coal with regard of its radiation property

Selective recess using the same system development that the common recess.

The difference is in the separation of different grades of coal freigh traffic ,

changing the sequence of individual mining areas due to the formation of M for need to stabilize the quality of each variety. When this option is selected sequential mining grade sorting coal in the experimental section of coal quality control (ESCQC) and the preparation of the charge on the coal storage piles .

Such an option of different grades of coal mining in the development of acceptable fields of any capacity with different angles of incidence , provided consistency of distribution of selected varieties of coal along strike and dip. Mixing varieties produced not working face and in a coal face eliminating the isolated loading coal types in the same slaughter and significantly reduce the time of loading.

Gross coal excavation method on the lower horizons will improve the performance of loading equipment and reduce the cost of mining compared to selective extraction by 15-30%. Expediency selective extraction or gross

development determined by the total cost per unit of reserves and given grade coals by radiation parameters.

The general scheme of mining coal radiation parameters using sectional level quality maps as Fig.4:

When producing *Grade complex* - coal unsuitable for thermal purposes (uranium content , % -  $\geq 0,01$ ; total specific activity , pCi / g -  $\leq 46,85$ ; estimated specific gamma activity , mR / h -  $\geq 74$  ) are stored in special dumps for their long storage.

When designing complex coal dumps must take into account the following factors: land relief, water cutting of a site, amount of precipitation, the formation of storm and flood waters , the distance transport of radioactive coal .

When forming the blade to its full scope consecutive isolation is provided of each of its parts, by covering the surface of the blade by synthetic polymer frother that prevent moisture from entering the blade and dusting the blade (Fig. 5) .

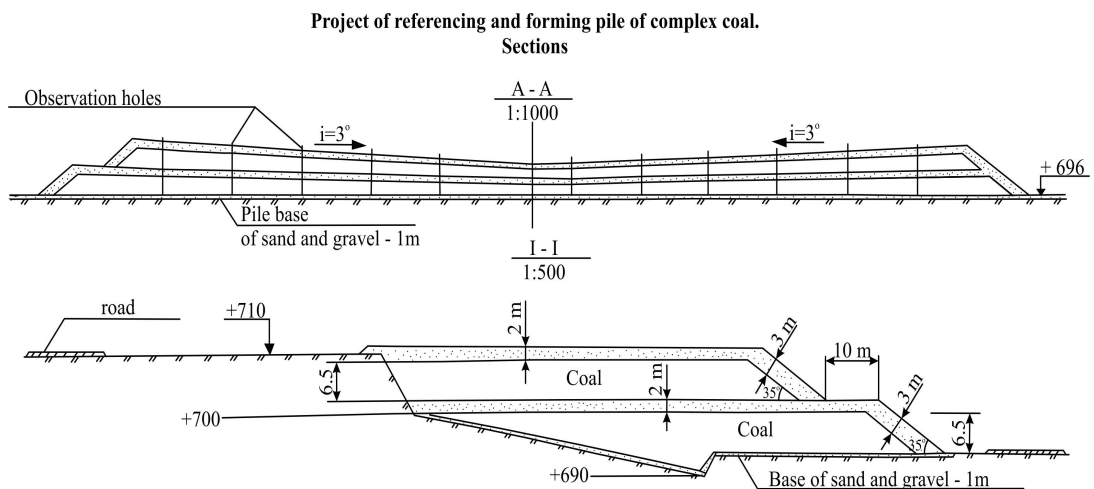


Fig.5: Dump of complex coal (cut)

A detailed study of blocks allocated to the disposal of land identified for the election recess upper part of the deposits, which allowed transferring part of coal in

the energy grade and reducing losses. Application of the method of coal production planning using level mapping also allowed reducing losses during

extraction of coal with a high content of radioactive elements. The total planned loss of coal deposit at 2.6 %, the actual (01.01.10 g) - 2.0 %, which characterizes the efficiency of the adopted system of field development.

### **3. Conclusion**

Results of research on Urtuysky brown coal deposit in Transbaikalian are the solution of an actual scientific - technical problems to develop an efficient brown coal technologies and their quality control taking into account the best use of the mineral, by reducing losses and reduce the negative environmental impact of radionuclide contained in these coals.

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