OVERVIEW AND ANALYSIS OF THE DEVELOPMENT OF URANIUM MINING IN THE REPUBLIC OF BULGARIA

Abstract: A historical aspect of uranium mining in Bulgaria has been made until its eradication in 1992. Described are the measures taken pursuant to Decree-Law No. 74 / 27.03.1998 on the liquidation of the consequences of uranium mining and processing and the gaps to be eliminated in this regard. Up to the end of uranium mining in 1992, the annual uranium yield was 660-680 t, of which 430 t was obtained by geotechnical method - drilling with drilling of the sand-type uranium. They are poor in uranium (below 0.05%), but with a few times cheaper yields (an average of $ 40 / kg for 1970-1990). Possible new uranium extraction from this type of field and mine wastewater could reach 350 t per year at a value not exceeding 80 $ / kg. It is possible to investigate and prove 40-50 000 tons of new uranium ore deposits in Bulgaria mainly in the sand-type deposits at a depth of up to 650 m.

KEYWORDS: URANIUM MINING, BULGARIA, URANIUM DEPOSITS, LIQUIDATION , LOCATION

1. Introduction

Uranium mining in Bulgaria has 47 years of history (1945-1992) and is one of the earliest in Europe. Uranium deposits in Bulgaria (48 in number - Figure 1) include a variety of genetic and industrial types [1]. 48 mines have drained uranium under Decree No. 74 of the Council of Ministers of 1992, whereby the government of Philip Dimitrov took the decision to liquidate the uranium mining and another 30 were in the stage of exploration and trial exploitation.

Many experts believe that the liquidation of uranium mining in Bulgaria in 1991. was carried out hastily, as a result of which a number of technical solutions for this activity were not realized in a number of areas. No adequate measures have been taken to fully recultivate the areas around uranium mining and uranium processing plants. The world practice shows that no country, except Bulgaria, has protected its uranium deposits without being completely exhausted, and even after that it is producing uranium from the old embankments around the mines. And neither party eliminates its uranium production if there are nuclear power plants. Bulgaria, however, shut down uranium mining in 1992 and threw more than 50 million leva from the budget and much under the PHARE program for mine clearance and land reclamation.

2.1. Historical overview of the production of uranium ore in Bulgaria

First began to extract uranium in Bulgaria the Germans - in 1938 in Buhovo. Already in the first year they emit 100 tons of metal. In 1939, with the beginning of the war, they stopped. After the end of the Second World War uranium mining was renewed in strict secrecy, but already by the Soviet-Bulgarian mining company. It existed until 1956, when the uranium mining hat created the unification of „Rare metals”, which is called the ”state in the state”. It employs 13,000 people. It controlled geological exploration, extraction, processing and export of the resulting uranium concentrate [7]. Under his hat were the other companies: Buhovo, „Trakia” - Plovdiv and „Rodeo” - Smolyan. The Bulgarian product bears the name “triamine octooxide” (or oxide-zinc).

The classical technology of digging uranium ore is at a loss. This is an expensive process, but because of the strategic production of the raw material is still maintained in a number of mines.

The other scheme is geotechnology. It is clean and very cheap. There are only tailings ponds at the two uranium ore processing plants - Eleshnitsa and Buhovo. Modern technologies allow uranium to be extracted from much poorer ores, and uranium can be extracted from the pits in both tailings ponds. The yellow cake - the commercial product with a 30% to 60% uranium content was obtained after processing at the Eleshnitsa plant, and in Buhovo it was further baked and a concentrate with a uranium content of about 80% was obtained. From there it was transported in containers to the Soviet Union where the nuclear fuel was produced and it was back to our Kozloduy NPP.

By genetic types, the uranium deposits in Bulgaria are magmatic, hydrothermal and exogenous (sandstone and infiltration type). As industrial types, they refer to small (stocks up to 1000 t) and medium (up to 10 000 t). The magmatic fields are associated with alkaline and acidic magma massifs and are characterized by high contents of radioactive elements (uranium and thorium). They do not represent an industrial interest. However, it is possible to refer to the deposits related to primary uranium enrichment in the lepidotit gneiss (the Narechen and Zdravets locality in the Narechen ore region). They are connected with the infiltration deposits created by the uranium enrichment of the airaths grown on granites (Plašty, Senokos, Selishte, Smilyan-Lipetz, Beslet etc.[9]).

Relatively large is the group of hydrothermal deposits. By age, they are Old Middle-Eastern, located in the Balkan and Srednogorski areas (Buhovo, Proboinitsa, Kurilo, Sliven, Rosen) and young Alpesian - in the Rila-Rhodope region (Partizanska Polyana, Beli Iskar, Kostenets, Dospat, Cheroka, Sarnitsa, dozens of redundancies) [7]. Common characteristics of this type of field are: strict structural control of the ore; relatively large vertical width (up to 600-1000 m); close mineral associations - quartz-carbonates, often zeolites.

Another group is also the exogenous (sandstone) deposits of paleogenegenic age localized in the peripheral and inland gravel basins of the Rila-Rhodope massif: Gorna Trakia (14 fields - Momino, Belozem, Huskovo, Maritsa, Okop, Tenevo etc.). Fig. 2. Local (Eleshnitsa) and Strumski graben (Simitli, Zlatolist). Only the uraniums of the Smolyanovtsi and Vinishte (Montana) localities are associated with non-oxidized Upper Persian sediments [4].

The researched and proven stocks in the history of uranium mining in Bulgaria are 35 374 t [1]. Of these, the amount of uranium extracted is 16 255 t by classical (mining) and geotechnical
Within the scope of the mines from the classical, underground extraction (Mills Druzhba 1 and 2 in Eleshnitsa, Smolian and Buhovo ore field, Narechensko Olevo area, etc.), huge amounts of mining are accumulated at the end of the winding and reclamation activities, due to the decommissioning of water in the mines after the uranium mining cease and the natural recovery of the deposits and the STN (static water level) in the sites. Only in the

This approach to constructing such mine-only mining equipment also has a certain ecological effect because soon or later the mining waters run to the surface and create a potential danger of contamination of surface run-off waters with uranium.
Brejani, Senokos, Simitli, Eleshnitsa, Igleshi.

The cessation of uranium mining and uranium processing, a number of biological recultivation activities have been carried out in all sites. These include meliorative activities to restore the soil fertility of agricultural lands within the boundaries of geotechnical plots. Total for the period 1997-2002 were recultivated and returned to the owners in real boundaries with restored soil fertility ~ 11 700 hectares of arable land [4].

Liquidation of each mine starts with the closure of shafts and horizontal galleries. The entrances are blocked with concrete walls, while the above-ground bunkers and buildings are destroyed, and then technical and biological recultivation of the affected lands is undertaken.

Parallel to the above-mentioned activities since 1998 and nowadays, radiation monitoring of the waters for the assessment of the quality of the underground and surface waters, the impact of the uranium mining activity as well as the results of the biological recultivation are performed in all sites. Through monitoring the water quality and the content of radionuclides as a consequence of the uranium mining activity were monitored over time.

What does the state of the former uranium fields look like today?

The overall process of rehabilitation of these plots and their conservation has not been fully completed, despite the degraded millions of levs from our government and the Phare program and funds from other countries and institutions. This is a major concern both among professionals and the local population because it has a direct impact on its everyday life, livelihood, lifestyle, and quality of life. Most of these are mountainous areas and the population is mainly engaged in the production of animal and plant products and tourism. Extremely alarming is that there is no marking or it is not in good condition in these places, and they are located near tourist routes, eco-paths, settlements and more.

Following the liquidation, some of the mines “resurrect” with new features. The closed uranium mine in the Rhodope village of Barutin was turned into a regional landfill of four municipalities - Devin, Borino, Dospat and Satovcha. Near Kostenets also has the idea of using a closed uranium mine as a garbage disposal site. Under legally defined conditions, mines could be used as landfills or quarries. Only sanitary requirements and norms to prevent incidents related to the past of these sites should be observed [8].

Many people from the region of the Iskar Gorge, including Svoje, have worked in the Uranian mine near Lakatnik. For its time, the mine was the newest and most modern uranium mine in Bulgaria. More than 600 meters of underground galleries and shafts were excavated in search of the ore. The area has been thoroughly studied, and the Balkan mine, as they once called it, has been given great hopes, said Vassil Chanev, director of the state-owned company "Ecoengineering PM", which liquidated and reclaimed uranium mines in Bulgaria. More galleries had to be excavated, even the deck of the Pobednica river had been diverted and passed through the underground canal. However, it has never been possible to get the real reserves and extraction. The ore was extracted, but in small quantities, from the gravel in the digging of the galleries, and now uranium can only exist in the soils around it. So the still unfinished mine went directly into technical liquidation, and later technical and biological reclamation, and eventually to get to ... its current semi-operational exploitation. Semi-gravelly, because, according to people living in the area, inert materials are still used to make roads and rail embankments from uranium embankments from former mines. And even used in construction [7].

To the south of Melnik are the villages of Lozenitsa and Vinograd. It is very curious for the casual people that the shaft of the old mine “Melnik” is located 10 meters from the bus stop between the villages. Those waiting here know about it, but it is not visible to strangers, it does not bother anyone. Random passers by this route also ignore it as there is no mark indicating an increased background. And there is.

At the foot of Western Pirin there are other uranium deposits - Brejani, Senokos, Simitli, Eleshnitsa, Igleshi.

Mines Melnik was closed half a century ago and was therefore not considered too dangerous in the 1990s when the list of mines for technical liquidation was defined. However, it is one of the 30 sites identified by government decree at the end of 2007, subject to risk assessment.

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25 km away from our capital, near the town of Buhovo were some of the mines richest in uranium in Bulgaria. The first uranium mining activities in this area date back to 1938 when the Germans began to harvest this valuable raw material. Later, a plant was constructed to process the extracted ore and extract uranium and tailings pond to it.

For rehabilitation of the TMF and adjacent sections, over 6 million leva have been allocated under the PHARE program, the necessary events have been made and the necessary information is placed in prominent places. But no one can prevent the local population from going through these territories, growing fruit and vegetables near the recultivated areas and feeding their livestock from the pastures around the settlements.

In the immediate vicinity of the Selslavi quarter of Sofia are some of the mines richest in uranium in Bulgaria. They are located next to the village and the end houses are bordered by the territory of the uranium mining enterprise. Even the fences of many of the houses are made of blocks from the former mines, the wind is constantly receiving radioactive dust, and the rainwater flowing over the yards enriches the yards with “enriched” material. Unfortunately, the millions of leva given for the reclamations of uranium masses have failed to reach this remote region of our country.

The problem with uranium mines in Bulgaria has existed for a long time and the measures taken to solve it are not effective enough or the result is not satisfactory. In the area of the village of Eleshnitsa there is the famous area for processing and extraction of uranium ore. There is also a tailing pond near the Zeveda processing plant. It is said that Eleshnitsa is the best rehabilitated area compared to the rest of the country and perhaps with the most invested resources. There are, however, views on stolen funds and incomplete rehabilitation leading to landslides and leakage from the TMF in the Maritsa River. In terms of measured surface values, they are around norms.

Consideration of uranium resources and uranium mining in the Republic of Bulgaria is not the first time. Every time it has been emphasized that the resources of uranium ores and uranium ore resources and the most up-to-date mining technologies used (geotechnical drilling and combined geotechnical) for decades of the last century are the most serious arguments for the restoration of this activity in the country.\n
No matter how much alternative energy sources are highlighted, mankind will resolve and work hard to solve its energy problems by using nuclear power. Uranium is needed to develop energy. Nuclear power guarantees long-term independence, even more so if it is tied to the resumption of uranium mining in Bulgaria.

3. Conclusions:

1. Government documents have been adopted for solving the problems with the consequences of priority liquidated sites of uranium mining and uranium processing;

2. Some objects of uranium mining and uranium processing are without monitoring networks for radiation control and do not carry out official monitoring, there are no warning signs and no explanatory work is done among the local population;

3. Liquidation and recultivation works have already been compromised due to their poor design and/or performance and insufficient technical support of existing facilities;

4. There is a radio-ecological risk because of unresolved management problems and the complex cleaning of contaminated by natural radionuclides waters emanating from uranium mining sites.
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