

INFLUENCE OF URANIUM MINES IN THE FORMATION OF NATURAL BACKGROUND RADIATION

ВЛИЯНИЕТО НА УРАНОДОБИВНИТЕ МИНИ ПРИ ФОРМИРАНЕТО НА ЕСТЕСТВЕНИЯ РАДИАЦИОНЕН ФОН

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Abstract: First began to draw uranium in Bulgaria the Germans - in 1938 in Buhovo. In the first year they draw 100 tons of metal. In 1939 they stopped. After the Second World War, uranium mining was renewed in secrecy, but this time by the Soviet-Bulgarian mining company. 48 mines have drawn uranium according to decree № 74 of the Council of Ministers in 1992, the government of Philip Dimitrov takes the decision to liquidate the uranium and another 30 were under investigation and trial operation. It is largely based in southern Bulgaria. Every year the world produces about 42,000 tons of uranium. One third of the yield is in Canada where deposits are 5 million tons. The control in the system of the Ministry of radiation status of the environment which is near former mines extracting uranium, includes field radiometric measurements and laboratory analyzes of soils, waste products in tailing ponds and landfills, sediments, groundwater and surface waters. A network of stations is built for monitoring of soil, groundwater and surface water and air, and produces agricultural products in the areas of uranium mining.

Keywords URANIUM MINES, URANIUM, CONTROL MONITORING, BUHOVO, RHODOPES, RADIATION CONTROL, RADIOLOGICAL RISK, LIQUIDATION, RADIONUCLIDES

1. Introduction

Many experts believe that the liquidation of uranium mining in the country in which they are finally exhausted, and even then there is extraction of uranium from old dumps. And no country liquidates its uranium production, if it has nuclear power plants. However, Bulgaria closed uranium mining in 1992 and threw over 50 million lev budget and a lot more under the PHARE 1991, was carried out hastily, with the result that in many areas are not realized complete technical solutions for this activity. Experience shows that no country in the world except Bulgaria, doesn't close its uranium deposits program for the eradication of mines and land reclamation.

First began to draw uranium in Bulgaria the Germans - in 1938 in Buhovo. In the first year they draw 100 tons of metal. In 1939 they stopped. After the Second World War, uranium mining was renewed in secrecy, but this time by the Soviet-Bulgarian mining company. It existed until 1956, when as a cap uranium grouping is formed "Rare Metals", which is referred to as a "state within a state." It had 13 000 people-workers. It controlled the geological measures, mining, processing and export of the obtained uranium concentrate. Under his hat were the others: "Buhovo", "Trakia" - Plovdiv and "Rise" - Smolyan.

48 mines have drawn uranium according to decree № 74 of the Council of Ministers in 1992, the government of Philip Dimitrov takes the decision to liquidate the uranium and another 30 were under investigation and trial operation. It is largely based in southern Bulgaria. The most famous are Eleshnitsa Sborishte, White Water, Dolna Banya. Near Buhovo are made mining developments, near Sofia there is uranium in Seslavtsi and Kremikovtzi

In the Rhodope mountain the areas are four: near Eleshnitsa / 15 km away from Bansko /, Dospat, Smolyan, Velinograd. In Thracian Valley - Stryama, Rakovski and around Plovdiv, Yambol Municipality. There is uranium in Montana, Simitli, Sliven and Stara Zagora, Burgas, Veliko Tarnovo, Gabrovo, Lovech and Pleven, Targovishte, Shumen, Ruse, Razgrad, Silistra, Dobrich and Varna. In 1974 the output reached 400 tons per year. Before the decision to liquidate the industry in 1992, uranium mining reached 645 tons per year. Throughout the time till 1989 the yield is secret, while production is strategic. Export is entirely to the Soviet Union.

The Bulgarian product is named "triuranievosmookis" (or oxide-zakis). The classical technology of digging uranium ore is on loss. This is an expensive process, but that is because of the

strategic production. The other scheme is geotechnological. It is clean and very cheap. Tailings have only two plants for processing uranium ore - "Eleshnitsa" and "Buhovo." Now technology enables the extraction of uranium from much poorer ores and tailings piles in both can still be extracted uranium. Yellow cake - commercial product uranium from 30% to 60% is obtained after processing at the plant in Eleshnitsa, and in Buhovo was firing extra and was received a concentrate containing uranium about 80%. From there it is transported in containers to the Soviet Union, where nuclear fuel was produced and was sent back to our Kozloduy NPP.

Every year the world produces about 42,000 tons of uranium. One third of the yield is in Canada where deposits are 5 million tons. The richest deposits of uranium are in Australia and in the top ten are still Kazakhstan which declared its intentions by 2012 to become the largest producer of uranium, and South Africa. In Bulgaria uranium reserves are estimated at 20,000 tons. From them suitable for exploitation by geotechnological method are 12,000 tons and in practice can be extracted 6500 tons. However, they could secure our nuclear power for at least 20 years. Geotechnology is applicable for deposits in Plovdiv, Yambol, and the valley of Struma. Experts in the industry believe that Bulgaria is fully capable of pulling 300 tonnes of uranium per year. Only a small mine with no more than 100 people staff gave 600 thousand dollars a year profit at all deductions for taxes, transport, food, prevention of the workers export and further processing of the metal to the commercial product.

Until 1992 most of the minimum prices on the London stock exchange. The three-uranium eightoxide costed \$ 42 per kilogram. In regular supply the price jumped nearly doubled - to \$ 70 per kilogram. Now the price is about \$ 140 per kilo, which would bring 42 million dollars annual profit of Bulgaria in the resumption of uranium. However, the trend is the product to reach a price of 200 dollars per kilogram. That's what dictates the interest of Canadian and Russian producers to the revival of uranium mining in Bulgaria. The control in the system of the Ministry of radiation status of the environment which is near former mines extracting uranium, includes field radiometric measurements and laboratory analyzes of soils, waste products in tailing ponds and landfills, sediments, groundwater and surface waters. Radiological parameters of soil, bottom sediments and waste materials are evaluated by analysis of samples from the network of the EEA for the control of potential pollutants. Water samples are analyzed radiochemically regarding to the targets set out in BS 2823 "Drinking water" - total beta radioactivity, uranium and radium.

2. Materials for Production of Prototype Parts

With the entry into Decree №74/27.03.1998 on eliminating the consequences of the extraction and processing of uranium ores is assigned to the "Ecoengineering -RM" Ltd. to organize and supervise technical liquidation activities, technical and biological reclamation of scrubbing results and conduct a comprehensive departmental monitoring of environmental components. Despite the existence of a legal basis, not all sites are built and operated monitoring networks as approved by the Chairman of the Energy Committee "Instruction on organization of monitoring system design, construction and operation of networks for environmental monitoring in the affected by uranium industry development ". The liquidation of every mine begins with closing the shafts and horizontal galleries. Blocking the entrances with concrete walls, parallel overhead bunkers and destroying buildings and then taking technical and biological reclamation of affected lands.

In the Phare project "Comprehensive Program for cleaning and monitoring areas affected by mining and processing of uranium in Buhovo" in March 1999 is built a local system for basic environmental monitoring in the area of Buhovo - Yana (LSBM). The system consists : two monitoring container located in Buhovo and in Yana, two reception centers - in "Rare Metals" Ltd Buhovo and EEA - MoEW and information board for continuous public information installed on the cultural center in Buhovo . The LBMS is intended to carry out continuous monitoring of indicators of environmental rehabilitation activities before, during and long after the completion of restoration works in the area. Monitoring containers are equipped with measure instruments for continuous monitoring of total dust, radiological parameters power of gamma radiation dose, concentration of radon in ground-air meteorological parameters: direction and wind speed, temperature and humidity on the ground air, atmospheric pressure and precipitation.

A network of stations is built for monitoring of soil, groundwater and surface water and air, and produces agricultural products in the areas of uranium mining. Measurements show that there is no risk for people, animals and plant life, because values for heavy and toxic elements and radionuclides are below the limit concentrations. In 2001, after the closure of sites for uranium, in reference to the "NRA" Sofia were carried out radiation measurements for researching the radiation status of this region. The results of the measurements of background radiation are given in Table 1. In Table 2. are given the specific activity of soil samples from the surface layer 0 -10 cm, from places which are expected to have a lot of dirt.

Measuring points	Coordinates altitude	Background radiation * Sv / h
1. Levels near "The breeding-pond"	N42 18 10.3 E24 54 39.5 204.0 m	0,23 - 0,28
2. Levels near the canal	N42 18 20.9 E24 54 08.2 204.2 m	0,18 - 0,20
3. Uranium mining site	N42 18 22.4 E24 53 55.1 183.7 m	0,24 - 0,31
4. Stock tubes "Rare metals"	N42 18 36.2 E24 53 44.3 182.1 m	0,22 - 0,23
5. Road to Padarsko village	N42 19 11.9 E24 53 36.4 219.1 m	0,21 - 0,22
6. Village	N42 18 34.3 E24	0,20 - 0,22

cemetery	53 32.6184.5 m	
7. "Cemetery" of "Rare metals"	N42 17 59.1 E24 53 01.6179.4 m	0,23 - 0,24

Table 1. Results of measures of natural background radiation in the vicinity of Momino village.

Place of samplers	U-238 [Bq/kg]	Th-232 [Bq/kg]
Momino village	90	67
"The cemetery"	72	83
"The breeding-pond"	37	44
To uranium mining site		
Rakovski city	73	68
Parvomay city	73	70

Table 2. Contents of radionuclides in soil samples, Momino village

The area, which has conducted uranium mining activities in the Rhodopes, starts not far from Asenovgrad and extends to the southern border. He is known as the center of tourism and recreation activities. Ongoing for decades uranium questioned the radiological purity, despite the talks of the liquidation events.

Receipt of uranium ore in these areas is done by digging pits / gallery /. For the transportation of ore are built roads and Mine excavated mass without industrial uranium forms a "mound" near the adit, which gradually overgrows. Open pits are walled, buried with earth and they are indistinguishable, but some of them are broken partitions. Given the radiological significance of the problem, the first studies were carried out in the upper stream of the Arda River in 1996 with a project funded by the MEST. Figure 1. shows the area of research and the points of samplers. Periodically conducted measurements showed that the level of background radiation does not exceed 0,28 Sv / h, v area. The content of radionuclides in the soil and water samples turned out to be within the average for the country [2].

The only point in which it was found to increase the background radiation (0,40 Sv / h) audits area but close to dysfunctional ramp for loading the uranium ore. This provokes taking radiation measurements in uranium indoor areas, which was funded in three consecutive years of NRA Sofia [3, 5, 6]. Object of research were three divisions - Gerzovica and Kiselchovo, Smolyan, Narechenski ore yield area, Belocherkovski rid, Plovdiv.



Fig. 1. Location of sampling from the closed uranium mines.

On figure 1. are reflected the points where samplers were made.

These are the places that were open to the adit of closed mines and there is expected aggravated radiation situation. After inspection by the responsible institutions they have identified the following deficiencies in the former uranium mines, which must be removed with funding from PMS №№ 3 / 15.01.2014g. For allocating the funds on programs for technical liquidation and conservation of objects from the mining sector for 2014.

MDP "Eleshnitsa" factory "Star" - Eleshnitsa village. Potential danger is the collector channel under the plant tailings and wastes dumping mining workings that are not reclaimed.

2.Object "Sunrise" (Dospat) - Barutin village. It is necessary to stop farming in the "Potato levels" until the completion of the reclamation activities. The measured specific activities of the uranium-238, radium-226, lead-210 and thorium-230 in the arable soil are in excess of 2 to 45 times the natural background levels for these radionuclides in the area of Barutin village. The waters of river Barutinska in the area are mainly contaminated by mine waste water. It is necessary to indicate the pitch and inform the population that the waters of self-discharge of shaft 3 and the river Barutinska are with increased content of natural radionuclides.

3.Object "Balkan" - Tserovo village.

Adit №№ 1 and 2 are left open, as the dumps are not reclaimed. Potential danger of radiation contamination is the embankment of Adit 1.

4.Object "Gabra" - Gabra village. Unfinished reclamation of embankment of Adit 2.

5.Object "Iskra" - Katina village. Reclamation is not complete and has not resolved the issue of treatment of mine water.

6.Object "Georesurs" - y-s "Brezhani" "Haying," "Igralishte." Mining waters from Adit 2 in "Brezhani" and gallery in "Igralishte" are available for animals to drink. The sorption column is not removed in "Haying" and the issue with the leaking contaminated water is not resolved. Due to erosion processes rock material from the dumps was pulled down in the valleys. It is necessary to prevent its further movement.

7.Object "White Water" - Ochusha village. After the commissioning of the treatment plant for purification of mine water a comprehensive assessment must be made of the radiation contamination along the river Ochushnitsa.

8.Object "Geostroycomplex" - Seslavtsi village. Particularly serious is the problem with mining water expire - channel under sorption "Chora" Adit 93, which is very near to the village Kremikovtsi, channel after tailings plant "Metallurg" and gallery 123.

The results and their comparison with the normative Documents warrant some general assessments and conclusions.

a / in settlements located near the surveyed former uranium mining areas and adjoining farmland concentration of natural

radionuclides in soil and the level of background radiation is not changed.

b / after the liquidation of the mining mines, access to some of them is not sufficiently restricted.

c / in places where radiation background was repeatedly increased in comparison with the natural, the access should be limited for the population, despite the slight radiation risk.

d / in loading ramp "Gerzovica" the liquidation procedures should be completed and the sould should be deactivated in restricted area station. Around the embankment of uranium ore "Revie fields" - Dobralak village a concrete wall should be built, precluding spillage or inappropriate use of the ore mass.

The results of the research are available for the relevant municipalities so the local community can be informed and the manifestations are limited of radiophobia or credulity on the side of people in those areas. Moreover, evaluations, more broadly, will help to conduct an adequate economic policy in the surveyed regions.

Even to resume uranium production in Bulgaria, now it would be very expensive and would require huge investments. All mines have been sealed for a long time. We'll have a new drilling at great depths, which is very expensive.

Of course, on the other side of the scales will stand usefulness of any resumption of uranium - thousands of new jobs, new technologies, fuel for both our nuclear power plants. But in this situation it will also need to build a new plant for processing uranium, which also means new risk of new contamination at still unliquidated old. But potential investors - canadians or russians in need of huge investments will probably want all the profits for themselves. Which will not be profitable for Bulgaria, unless Bulgaria does not produce bulgarian technologists and technical equipment, workers - specialists in uranium yield, that is how it will enter the era of technology and will save a lot of taxpayer money.

3. Conclusions:

1. Government documents have been accepted to solve the problems of the consequences of priority liquidated uranium mines and uranium processing;
2. Some uranium mines and uranium processing are built without monitoring networks for radiation control and do not conduct departmental monitoring;
3. Compromised are already committed liquidation and reclamation works, due to the poor quality of their design and / or implementation and insufficient maintenance of already built facilities;
4. Radiological risk exists due to unresolved issues with management and complex purification of contaminated with radionuclides natural water flowing from the mining sites.

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