NATIONAL URANIUM COMPANY SA BUCHAREST ROMANIA

68 Dionisie Lupu Street
010458 Bucharest
Tel.: +40 21 318 52 58 Fax: +40 21 312 91 46 E-mail: bucuresti@cnu.ro

ENVIRONMENTAL IMPACT OF URANIUM MINING

NATIONAL URANIUM COMPANY SA BUCHAREST – ROMANIA

Dorin FILIP

8 JULY 2009

SHORT HYSTORY

- Since the commissioning of "SOVROM KUARTIT" company in 1950, a russian – romanian joint – venture , various geological and mining activities for uranium ores were undertaken , covering all the surface of Romania
- The surface and underground mining had an environmental impact at all the mine locations
- Various activities for environment monitoring and remediation were undertaken since the seventees at all urnaium mines in Romania

THE NATIONAL URANIUM COMPANY S.A. PRESENT MINING ACTIVITIES AND LONG TERM CLOSING PROGRAMME

- In present the NUC company has one mining area with two underground mines in operation (SUCEAVA mines)
- The operational SUCEAVA (N-E Romania) mines are ensuring the uranium ore for a processing plant located in Feldioara – Brasov county (Feldioara Branch)
- The BANAT mines (S-W) and BIHOR (N-W) after more than 50 years of ore production are to be closed and submitted to environmental remediation
- The flooding of the BANAT mines (Lisava, Ciudanovita, Natra) will be a controlled process, undertaken in steps during a few years period

THE NATIONAL URANIUM COMPANY S.A.
LOCATION OF MINING ACTIVITIES

INDUSTRIAL PROCESSING OF URANIUM ORES

- Starting from 1978 was commissioning the single uranium processing plant, for ores transported from all romanian uranium mines
- For the storage of contaminated tailings a wet waste storage (tailings pond) was built near the new plant
- A waste water decontamination plant was commissioned ensuring trace uranium removal from water discharged to Olt River
- Uranium maximum allowed limits were established for waste waters

Water monitoring sample locations for the tailings pond area at Feldioara milling plant

The environmental impact of the milling plant Feldioara , after 30 years of uranium ore processing, is very low, beyond the controlled mill area.

The waste waters discharged in OLT river meet the national regulatory body requirements for radionuclides content .

Closing out of the old uranium mines and environmental remediation of the uranium legacy

- 1998- a new department dealing with the closing out of old uranium mines and remediation of the areas affected by uranium geological and mining activities, was opened within the headquarters of NUC company
- 1998- all three Banat mines and also the Avram Iancu underground mine in Bihor sunt were closed out and put into „care and maintenance status"
- The first government approval for closing out and environmental remediation was published
- 1998 – 2000 the feasibility studies for Banat mines closing were the basis for the Closing out and Environmental Remediation Technical Project
- All activities related to closing out of mines will be funded from the state budget

Environmental remediation at the Banat undergound uranium mines

Two main issues are addressed for the Banat mines :

- A) The remediation of waste piles (dumps): 20 waste rock piles are sppread within the surface of the mining area ; the gamma dose rate at the surface is higher that the CNCAN (regulatory authority) allowed limit (0,300 microSv / hour) ; an engineered covering system was designed for all the waste piles ; some relocation of contaminated material is also foreseen within the former mines location ;

- B) Decontamination of mine waters pumped from underground :

  The mines waters must be decontaminated for many years after the controlled flooding of the underground mines ; a new plant for uranium and radium removal shall be commissioned on place in the following period ; a long period monitoring programe will be implemented at the mine site , covering both the closing out period and the after – closure period (50 years ?) ;

Legacy of uranium ore mining at Banat – Caras Severin county

Old waste rock piles, buildings and a closed shaft at the Lisava mine.

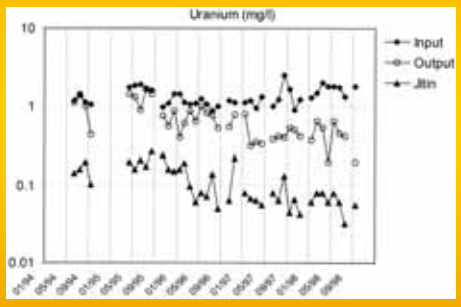
Relocation and covering of contaminated waste rocks, dismantling the surface facilities and backfilling of the shaft are the main remediation activities.

TREATMENT OF MINE WATERS

- Pumping from underground and treatment of mine waters are carried out at the closed BANAT mines and at the operational SUCEAVA mines (known as the Crucea and Botusana mines)
- At the BANAT mines the mine waters are pumped through 2 main shafts at Ciudanovita and Lisava
- Two treatment plants are in operation at the BANAT mines having a total capacity of 2500 m^3 / day
- At the SUCEAVA mines two treatment plants are in operation for the mine waters collected within the G8 and G9 adits from both mines
- In present only uranium is removed by all 4 plants using the ion exchange method

Suspended solids settler for mine waters at the Banat mines

BANAT – WATER SAMPLES ANALISYS for the 1994 – 1999 period at the treatment plant (before mines closing out)



BANAT MINES – CONTAMINATED WATER TREATMENT STRATEGY AFTER COMPLETING FLOODING

- The strategy was fixed based by a PHARE feasilibility study on the Ciudanovita mine closing and flooding and one study of the romanian INCD-MRR Institute for studies and projects
- A single treatment plant will be in operation at the LISAVA location
- The present plant will have to be upgraded to ensure the removal of both U and Ra
- The present mine water decontamination Ciudanovita plant will remain as backup for the LISAVA PLANT in case of high flow treatment demand
- Flooding will be undertaken in 2 or more steps, during at least 4 years

BANAT – MINE WATER STRATEGY IN PRESENT AND AFTER COMPLETING FLOODING OF ALL 3 MINES

- The discharge requirements for mine waters are low concentration values for both uranium and radium
- Dilution in streams is limited by the contamination of surface water courses due to surface liabilities (sterile and low grade material stored on piles)
- Variable flows of brooks during the year
- Flooding of the mine to a fixed level ensured by continous pumping of mine water
- A – 70 m roadway, 4 km long, has to ensure flowing of mine water from Ciudanovita mine to P3 shaft of Lisava mines
- A 400 m water column pressure will be at the – 70 m roadway

WATER PUMPING SYSTEM AFTER FLOODING OF THE BANAT MINES

- View of the present mine water treatment plant at the Lisava site
- Pumping of mine waters will be ensured by two shafts during many years until the water quality enables its discharge into the local brooks

Objectives for water quality remediation

- Investments are mandatory to be made at the Banat mine sites for mine waters treatment at the closed underground mines
- The final scope is avoiding the contamination of surface waters used mainly for agriculture purposes
- Low residual values for Uranium and Radium in discharged waters are requested by the Environmental Local Authority, for water samples taken downside the mines (0,1 mgU/l and 0,1 ÷ 0,15 Bq/l)
- Upgraded plant can ensure a high yield of radionuclides separation
- Transfer of U and Ra waste products outside the mines area is the preffered option for long time mine water treatment.

SUCEAVA MINING BRANCH

Water quality monitoring at the operational uranium mines :

- Samples of mine waters are analysed for Uranium, Radium, pH ;
- Samples of surface waters and sediments are analysed for Uranium, Radium (25 sampling locations) ;
- No radiological impact of the surface waters on local inhabitants was found during a 25 years period ;

Uranium and Radium removal from mine waters

SUCEAVA BRANCH – the operational mines




MONITORING OF TRANSPORT FACILITIES


- The railway station near Suceava mines is under radiological monitoring due to proximity of Vatra Dornei town
- Uranium ores are stored within railway station storage facility
- Railway transport of the uranium ore is ensured by authorized wagons

MONITORING AT THE SUCEAVA MINES

- The monitoring system is aproved by the local environment protection authority
- The analysis are realized by the branch's own laboratory or by other laboratory
- Gamma dose rate is measured within the mining area and also along the road to Argestru railway station
- Water samples from surface waters are taken every month
- There is no impact on the surface waters flowing outside the mining area

MINE WATERS TREATMENT FACILITIES AT THE SUCEAVA OPERATIONAL MINES

- View of Industrial water facility

- Detail of mine water storage

DETAILS ON THE WATER DECONTAMINATION PROCESS

- New facility for mine waters decontamination
- New ion exchange process for the uranium removal and recovery
  - 1500 m^3 / day water treatment plant

SUCEAVA MINES – MONITORING WATER QUALITY

- Monitoring of mine water and surface water quality is ensured by a new laboratory
- Modern laboratory to analyse uranium in various water samples
- Analysis of uranium eluate concentrate solutions are realized for the mine water treatment plant

Rock piles at the operational SUCEAVA mines

About 300 000 m^3 of rock piles are located within the mining area. The piles will need stabilization and covering works after closin out of the present underground mines.

SUCEAVA MINES
REMEDIATION OF ROCK PILES

- Rock piles located within the mines area are built on the mountain slopes.
- Stability is the main issue addressed by the remediation works before closing of the Suceava Branch mines .

SUCEAVA BRANCH

- Radon activity is monitored near the mine adits
- Beyond the mining perimeter there is no influence of the radon activity compared to background
- Some increase values for radon are found at the surface of rock piles stored near the adits

BIHOR MINING BRANCH

- Mining of uranium ores since 1952 to 2008 at BAITA PLAI at Avram Iancu mines had an important impact insight the mine perimeter
- Large contaminated rock piles have to be stabilized and covered (more than 50 000 square meters)
- Some stabilization works were already been undertaken

Rock piles at the BIHOR closed mines

- Rock piles having low radioactive activity are located within a 3 km^2 mining perimeter
- Some rocks are low grade ore resulted after radiometrical sorting of ores in the 1952 – 1964 period
- Technical Projects had to be designed for the mine Baita Plai.For Avram Iancu mine there is a Technical Project for environmental remediation and some works have already been undertaken.
- A mine water treatment plant is scheduled to be built near the Poiana adit – Avram Iancu mine

NUC's DEPARTMENT FOR MINES CLOSING OUT

- The mines closing out department within the National Uranium Company deals with care and maintenance of closed mines, underground works for closing the mines, environmental remediation of uranium mining areas
- The feasibility and technical projects for environmental remediation are followed by the remediation works, funded by the state budget (Minitry of Economy) and planned by this department
- The department ensures the link with local authorities, local population, regulatory bodies, environment local agencies, for each closing out project.

CONCLUSIONS

- The environmental impact of the uranium activities is only within the mining areas
- The problems to be addressed are mainly the contaminated rock piles and the mine waters discharged in the surface waters
- Monitoring of environment factors is a permanent task of the National Uranium Company
- The environmental impact will be decreased following the completion of remediation works at the closed uranium mines
- Environmental remediation activity is a costly but mandatory project for the following years