



## **PRODUCTION OF URANIUM IN NAVOI MINING AND METALLURGY COMBINAT, UZBEKISTAN**

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### **SUMMARY**

Under the conditions of constantly increasing level of development of the nuclear power, it is inevitable that the uranium stockpiles accumulated to 1985 will soon be depleted. This consideration underlies the development concept of uranium production in the Navoi Mining and Metallurgy Combinat, Uzbekistan. Because this product has become a source of hard currency revenues for the Republic, there will be a significant increase in the processed ore and output of uranium oxide within the next few years.

Uranium production in the Navoi Mining and Metallurgy Combinat represents a full-cycle operations ranging from geological survey through hydrometallurgical processing resulting in the output of uranium concentrate in the form of uranium protoxide-oxide ( $U_3O_8$ ). The NMMC uranium operations include the Hydrometallurgical Plant and three facilities accomplishing ISL mining facilities.

A successful start on the development of the Uchkuduk deposit by ISL method in the 1960s gave rise to scientific and production approach for development of other uranium deposits of the infiltration bedded (sandstone) type. Uranium recovery by ISL has become a separate mining branch within the 30-year period of its history and the contribution of this branch in uranium production has steadily grown. Since 1995 all uranium produced by Navoi Mining and Metallurgy Combinat is attributed to ISL.

During this evolution period of the ISL method, a whole range of systematic scientific research and practical works were carried out covering improvement of process flowsheets, equipment, operational methods and techniques for particular mining conditions at those specific sites.

In co-operation with design and scientific research institutions, a significant number of scientific researches, test works, design and engineering projects were achieved in order to create optimal conditions for ISL mining and further processing of pregnant solutions by sorption as well as to appropriately equip the mining sites and processing facilities.

During these periods, three principle flowsheets were tested and introduced at the ISL sites of the Navoi Mining and Metallurgy Combinat: sulfuric acid scheme, acid & bicarbonate scheme, weak acid scheme. Out of these three, the sulfuric acid and weak acid schemes have been more intensively developed.

The commercial scale operation of the new method of leaching, using as a leach the ore body water saturated with air, and practically free of reagents, resulted in the reduction of the mining cost and laid the foundation for environmentally friendly operational method.

Optimal parameters of the ISL process have been established including method of processing the pregnant solutions by sorption and the arrangement of the appropriate equipments; methods of well construction which is efficient for any particular conditions and ways to restore their productivity during the course of exploitation, a new production well grid arrangements in connection with hydrological and geological conditions of horizons under development, and an effective lifting equipment for pregnant solutions; methods for extraction of rhenium from ISL solutions as a by-product; and the recovery of scandium oxides from wastes after the hydrometallurgical treatment of the ISL solutions.

Under the transition to market-oriented economy the major effort of the Combinat is focused on reducing the cost of uranium production by the implementation of an up-to-date innovations in ISL technology. We are in the process of re-equipping our drilling facilities by replacing out-of-date and depreciated major equipment.

A new plant has been commissioned for the production of PVC casing pipes necessary for the completion of production wells thus covering the requirements of the entire ISL complex for the near future and for many years to come. Based on modern control and measurement instrumentation we introduce automated control systems for ISL process with broad communication transfer system allowing the integrated information exchange.

Introduced are the systems for automated design of ISL process preparation, which realize computer aided geological support and design of block mining procedure as well as operative planning of recovery and mining preparation works and metal transfer accounting during the course of operations. The park of logging stations is at the moment in the process of being changed to microprocessor computer-aided complexes to provide automated services during geophysical investigations of wells. For the deposits with complicated radiological condition we widely apply the direct method of uranium determination based on instant neutron fission which has increased the efficiency of logging.

The large number of uranium reserves in the Kyzylkum province lay the basis for the plan to significantly increase the uranium oxide production. The realization of the above mentioned innovations makes it possible to significantly intensify the ISL operations performance in the Navoi Mining and Metallurgy Combinat and ensure high revenues from uranium sales at the world market.