

RADIATION RISKS AND MONITORING OF TRANSBOUNDARY RIVERS OF KAZAKHSTAN

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The condition of the water resources of the Republic of Kazakhstan is characterized with their whole deficiency as well as their high pollution and desiccation. The situation is also aggravated with much relaxation of work coordination on regulation of trans-boundary river flows and control of their water quality as a result of the USSR collapse and isolation of separate republics. The absence of objective information on water condition of rivers and their contamination sources creates a danger of high ecological risk and psychological stress for inhabitants, localities of that related to the basins of these rivers, and serves as reasoning for claims (occasionally unreasonable) to neighboring countries. With this connection, organization and carrying out of radiation and hydro-chemical control and monitoring of the environment (first of all, water) in the basins of trans-boundary rivers of Kazakhstan are an extremely actual problem for the republic. Following rivers are the largest trans-boundary ones in Kazakhstan: Ile, Syrdariya, Ural and Irtysh. Table 1 presents principal information on these rivers.

Table 1. General information on the main trans-boundary rivers of Kazakhstan

River name	Trans-boundary countries	Total river reach, km	Water flow into Kazakhstan, m ³ /c
Ural	Russia	2428	400
Syrdariya + Naryn	Uzbekistan	3019	450
Ile	China	1001	330
Irtysh + Black Irtysh	China, Russia	4248	800

All these rivers are of great importance for people's life-support of the republic. At the same time presence of a number of large industrial centers, agricultural enterprises and radiation-dangerous objects in the basins of these rivers creates a potential danger of chemical and radiation contamination for their water flows. A scheme of arrangement of ecologically dangerous facilities, taken from Ref.1, is given in Fig.1.

Among the principle factors influencing on ecological and radio-ecological situation in the basins of these rivers can be followings:

- The Ural springs from the southern spurs of the Ural mountain range, where mineral resource industry and metal manufacture are widely developed. The Ural and its tributaries are implicated to radioactive fallouts from the air nuclear explosion performed on 14 September 1954 during Totski troop exercises (W=40 kt). The upper reaches of the Ural are implicated also to the territories of radioactive contamination in consequence of the radiation accident at the Mayak enterprise in 1957 (known as the Kyshtym accident) and wind pollution with radioactive silts from Karachai lakesides in 1967 (known as Karachaev accident). At the territory of Kazakhstan the Lira objects (6 underground nuclear explosions), the test-site Kapustin Yar and a number of industrial enterprises on mining and processing of organic and mineral resources are implicated to the basin of this river.



Figure 1. Scheme of arrangement of ecologically dangerous facilities

- The Syrdariya is the main life-supporting and sweet-water artery of South Kazakhstan. At the territories of neighboring countries numerous of mining and metallurgical, chemical and other manufacturing centers and enterprises are implicated to the vast basin of the Syrdariya River. Among them one can emphasize the mining complex Mailuu-Su (Kirghizia); the largest enterprise on uranium processing Vostokredmet in Chkalovsk City (Tajikistan), numerous industrial enterprises and plants in Uzbekistan (Kibraï, Angren, Yangiabad, Navoi and other cities). Besides, at the territories of these countries (especially, of Uzbekistan) an intensive agricultural activity is carried out in the Syrdarya River basin. At the territory of Kazakhstan there are numerous industrial enterprises on uranium mining and processing (Shyili town) and heavy metals (Shymkent City) in the basin of this river.
- Ile and Irtysh rivers spring from China. China is a country of high population density. On its territory an intensive agricultural and industrial activity is carried out in the basins of these rivers. Besides, radioactive fallouts from nuclear explosions performed at the test-site Lobnor (more than 43 explosions) could influence on water content of these rivers. Particular and negative consequences can be connected with 16 air and ground explosions performed during 1964-1980 (W=10 Mt). There are grate number of agricultural enterprises and mining-and- metallurgic plants at the territory of Kazakhstan in the basins of these rivers. It is significant that the Semei test-site, on the territory of which 456 nuclear explosions were performed, is implicated to the basin of the Irtysh River.

Current situation is of special concern of community and international organizations (UNEP, UNDP, OSCE, NATO, etc.). Fig.2 illustrates main problems of the Central Asia in the area of environment and safety [1].



Figure 2. Scheme of main problems of the Central Asia in the area of environment and safety

All the listed events and circumstances, in a high probability, can influence on water quality of all the foresaid rivers. Objective information on its influence rate is required. The most acceptable form of the control of radiation and hydro-chemical situation in the basins of trans-boundary rivers is their monitoring based on modern nuclear-and-physical methods of analysis. Very important factor in organization of such monitoring system is participation of all the countries concerned with the basin of the river under the control. There is a work experience of many years in Central Asia on monitoring of large Syrdarya and Amudarya rivers. These works have been carried out since 2000 with the framework of the International project Navruz [2-4]. Participants of this project are organizations of nuclear profile from Uzbekistan, Kyrgyzstan, Tajikistan and Kazakhstan. The collaborator of this project is the Sandia National Laboratories (SNL), USA. Experience of these works was used in preparation of the International project "Caspian Rivers" [5], contemplating organization of the system of radiation and hydro-chemical monitoring of Volga, Kura, Ural and Emba rivers, flows of that comprise 90 % of all the flows in the Caspian Sea. Participants of this project are scientific institutions from Russia, Georgia, Armenia, Azerbaijan and Kazakhstan. The collaborator of the project is the SNL as well. It is discussed an analogical and international project on radiation and hydro-chemical monitoring of Ile and Irtysh rivers with participation of scientific institutions from China, Kazakhstan and Russia.

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