



REGULAR MONITORING, ANALYSIS AND FORECAST OF RADIOECOLOGICAL ENVIRONMENT OF AZGIR TEST SITE

E. Akhmetov, I. Agymov, Zh. Gilmanov, A. Ermatov, A. Zhetbaev

Nuclear Physics Institute
National Nuclear Center of the Republic of Kazakhstan

Nuclear Physics Institute (NPI) has been carrying out investigations on transformation of nuclear energy, testing of heat releasing elements and construction materials for nuclear installations, radiation physics of solid body, development and implementation of nuclear physics methods and nuclear technologies in industry, investigation of the consequences of different type nuclear explosions on the territory of the Republic of Kazakhstan.

The authors of this project have been carrying out their investigations in the fields of structure of excited nucleus states in reactions of non-elastic scattering of fast neutrons of nuclear reactor and charged particles in the accelerator, ultra-cold neutrons, creation of intensive sources, transportation along neutron lines, interactions with various media, radioecology.

The objective of investigations: basing on the results of regular annual measurements of radiation conditions on the sites of underground nuclear cavities of the Azgir test site, specific concentrations of radionuclides and heavy metals in soil and underground aquifers on the test site and adjacent territories to obtain data on migration and transfer of radionuclides and heavy metals. This will give a real possibility to make probability predictions of ways and qualitative characteristics of spreading of radionuclides and heavy metals in the region of the northern Pricaspian lowland.

The Essence of the Problem The Azgir test site is located in the arid zone of the Great Azgir salt cupola near the Azgir village of Kurmangazinskiy rayon, Atyrau region. This cupola is located in the western periphery of Pricaspian salt-bearing province situated to the north of the Caspian sea between the Bolga and Emba rivers.

From 1966 till 1979 17 nuclear explosions were made in salt layers of 10 boreholes at the depth from 15m. to 1,500m. to produce underground cavities for different purposes. 9 cavities of the total volume of 1,200,000 cubic meters were formed, 7 explosions were made in A2 borehole, funnel crater of 600 m. in diameter and 15 m. depth was formed in A9 borehole, it was filled with water. The documents provided by the Federal Nuclear Center of the Russia Federation state that A1-A5 cavities are filled with water, A7 and A10 cavities are partially filled with water and only cavities A8 and A11 are dry.

Cavity A10 was used for disposal of radioactivity contaminated soil and cavity A3 for disposal of radioactivity contaminated metallic parts and constructions. The volume of radioactive wastes with summary activity equal to 50 Ku disposed on the territory of 100,000 sq.m. totals to 24,000 cubic meters. Moreover, all boreholes contain emitting radioactivity of the radioactive products of nuclear explosions which amounts to of the radioactive products of nuclear explosions which amounts to 1,500 Ku for (-nuclides and 50,000 Ku for (-nuclides. When these cavities were opened 10,000,000 Ku of radioactive gases were injected into atmosphere, sites of A2, A3 and A10 cavities

were contaminated with cesium-137 (to 23 K/kg). On the A1 site and adjacent territory concentrations of strontium-90 and plutonium isotopes exceeding MPC were detected. Concentrations of radionuclides of cesium-137 and strontium-90 were also detected in ground waters of A1, A2, A3 and A5 sites.

Federal Nuclear Center of Russia Federation carried out deactivation and rehabilitation of all the sites but they were made according to the out-of-date project, the problems of conservation of underground cavities were not solved, the technology of radioactive wastes conservation was not justified, the technique of determination of possibility of usage of rehabilitated territories was not developed. According to the materials of NNC RK and Hydrometeorological Service RK (1995) contamination of cesium-137 in soil to the depth of 5 cm is still rather high and ranges from 80 up to 13,600 mKu/sq. km with global content of 65 mKu/sq. km, concentration of plutonium-239 exceeds MPC in separate points. There are no reliable data on beta- and alpha-contamination.

VNIPIET and Atomenergoproekt of the Russian Federation carried out design, technological and economical investigations on creation of the sites for radioactive wastes disposal on the base of existing dry cavities in Azgir. The proposed disposal of wastes of activity of the order of 100,000-200,000 Ku amounting to 10-20% of radioactive wastes which have already been disposed in Azgir cavities will not create any problems under solution of problems of cavity stabilization and isolation.

It should be noted that problems of radioactive waste disposal are very acute in Kazakhstan what is caused by the lack of disposal for final removal of radioactive wastes into deep geological formations corresponding to the standards and requirements of IAEA and ICRD.

It follows from the above that the available data on radionuclide contamination of ground waters are insufficient for univalent determination of the ways of migration and transfer of radionuclides in aquifers, therefore it is necessary to conduct investigations on possibilities of radioactive wastes disposal in salt layers, to estimate conditions on sites and adjacent territories what will enable to develop real programs of liquidation or considerable decrease of all post-explosion consequences and restoration of the environment.

Major Tasks

- Development of technical requirements for carrying out regular examination of radionuclide and heavy metal contamination of the Azgir test site.
- Preparation of material and technical base for field works on the Azgir test site.
- Radiometric measurements on the sites and around them.
- Taking of soil, soil and ground waters samples both on the test site and on the adjacent territories.
- Spectrometric and radiochemical investigations of soil, soil and ground water samples.
- Analysis and generalization of the results creating premises for forecasting of the radioecological conditions.
- Investigation of the possibility of radioactive waste disposal in underground cavities.

Technological Decision A number of useful field, research and analytical investigations is to be carried out:

- Radiometric measurements on the sites and around them include on foot surveying along profiles M 1:2000 and (-spectrometric measurements using spectrometers to determine radionuclide concentrations in soils.
- Soil and ground water sampling is carried out every summer on sites and adjacent territories in certain points according to the scheme specified in technical requirements, soil samples are taken both on the surface - 5 sm. depth) and profile (0 - 5 sm., 5 - 20 sm.) in fixed points.
- Examination of radionuclide and heavy metal contamination of ground waters includes inspection of special boreholes on the sites and wells and sources of drinking water outside of the test site, optimization of sampling technique, conservation and concentration of water samples, full chemical water analysis for pesticides and heavy metals.
- Spectrometric and radiochemical investigations of soil, soil and ground water samples are made for more detailed determination of contamination with technogenic and natural radionuclides. In radiochemical analysis much attention is paid to the processing of soil particles to detect real concentration of (-nuclides in soil samples. Specific activities and amounts of strontium-90, plutonium-239,240, americium-241 are determined.
- Concentration of cesium-137, strontium-90 and other radionuclides is determined using (- and (-spectrometry of dry sedimentation of water samples, complete hydrochemical analysis on the presence of heavy metals is also carried out.

Expected Results

- Detection and outlining of local areas of radioactive contamination on the site and adjacent territories.
- Data on real structure of spreading and concentration of technogenic and natural radionuclides and heavy metals in soil layer of the test site region.
- Results of analytic investigations of water samples of underground sources of the site and adjacent territories with measurements of concentrations of radionuclides, heavy metals and other toxic substances.
- Premises for forecasting of ways and quantitative parameters of migration and transfer of radionuclide and heavy metals in underground cavities in aquifers.
- Data base on radioecological conditions in the region of test site.

Conclusions on potential possibility of usage of underground cavities of Azgir as disposal for radioactive wastes.