NUCLEAR AND RADIATION SAFETY IN KAZAKHSTAN

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Abstract

Major factors, by which the radiation situation in Kazakhstan is formed, are:
enterprises of nuclear fuel cycle, including uranium mining and milling activity and geological exploration of uranium; nuclear power plant and research reactors; residues of atmospheric and underground nuclear explosions, which were conducted for military and peaceful purposes at the different test sites; mining and milling of commercial minerals accompanied by radioactive substances; using of radioactive sources in industry, medicine, agriculture and scientific research.

Since 1991, after getting of sovereignty there was started creation of own legislative basis of the country for the field of atomic energy use. It includes laws, regulation and standards for nuclear and radiation safety of nuclear installations, personnel, involved in the activity with using of atomic energy, population and environment. Applicable system of state regulation in this area, including the central regulatory body in the field of atomic energy use and various ministries, agencies and committees, was created. As a result of these reforms, regulatory activities were improved in the country.

This paper presents the current matters of nuclear and radiation safety in Kazakhstan and some difficulties, which Kazakhstan encountered during the transition to an independent state.

1. INTRODUCTION

The Republic of Kazakhstan, one of the new independent countries of the former Soviet Union, is located immediately to the south of Russian Federation and west of China. It encompasses over 2.7 million sq. km of land area and has a population of over 14 million. Before disintegration of Soviet Union Kazakhstan had no own legislative base in the field of atomic energy use and had no state bodies, called to execute the control at observance of security measures by atomic energy use. Since 1991, after getting of the sovereignty, Kazakhstan started developing of its own legislative and regulative system in this area. In accordance with the Decrees of President appropriate structures in Kazakhstan were created. They are: Atomic Energy Agency, as a main Supervising governmental body, National Nuclear Centre combining all nuclear related scientific institutes, and National Corporation of Atomic Energy and Industry Enterprises KATEP. On 14 February 1994 Kazakhstan joined the International Atomic Energy Agency.

The general purpose of activity in the field of atomic energy use in Kazakhstan is safely and effective ensuring safety of the present and future generations and environment protection from radioactive contamination both by normal and extraordinary situation. According to this tasks the Republic of Kazakhstan needs the effective system for the assurance and guarantees for protection of population and environment against the possible negative influence of atomic energy usage.

The present situation in the field of nuclear and radiation safety on the territory of the Republic of Kazakhstan is formed currently by the following main factors.

- Activity of the enterprises of uranium mining and milling industry, including geological exploration of uranium: As is known, the Kazakhstan takes one of the first places in the world on quantity of prospected uranium stocks (about 50 % of uranium stocks of former USSR). A long time (more than 40 years) development more than 20 deposits was conducted [1]. The enterprises of this industry branch are located practically on all territory of Kazakhstan. Ulba metallurgical plant in the East of the country produces nuclear fuel for NPP.
• Power and research reactors: In Kazakhstan there are 5 nuclear installations, including one nuclear power plant BN-350 in Aktau-city, and four research nuclear reactors of the National Nuclear Centre. One of them is located in Almaty, and three of them are located in Kurchatov-city (on the former Semipalatinsk Test Site). The decommissioning procedure of the NPP BN-350 reactor has started pursuant to the Governmental Decree of 22 April 1999. All research reactors operated so far.

• Nuclear explosions: As a result of conduction of nuclear explosions (about 500 atmospheric and underground explosions for military and peaceful purposes) on Semipalatinsk Test Site and other sites were formed the waste of low activity on a surface and average activity in cavities of explosions as a kind of melt mountain mass [2,3]. The volumes of the waste are evaluated as 12.3 million tonnes with activity of surface contamination of 11.6 thousand Ci and underground contamination 12.87 million Ci.

• Activity of the enterprises of mining and milling of commercial minerals containing radioactive elements: Number of Kazakhstan deposits of polimetals, phosphors rare earth contains uranium, which at a production of ores is extracted together with main ores and, as a rule, is not divided and can be accumulated in concentrates, and more often leaves in tailing. On some coal deposits top of a part coal are also accompanied uranium. This coal will not be realised as a fuel, and is subject to radioactive waste management. During the study of the territory with oil deposits were find the areas with soil and industry equipment contaminated by natural radionuclides Ra-226 and Th-232.

• Use of radioisotopes in medicine, industry and scientific research. In Kazakhstan in many branches of medicine, industry and scientific research use a kind of radiation sources. Every year about 100 thousand of sources with total activity up to 25,000 Ci are using. Annually 10 thousand of sources more set out for storage. The radionuclides types of sources are from H-3 to Am-241.

The solution of problems of nuclear and radiation safety of the population and waste safety is possible only at availability of the necessary legislative base and with system of the state regulation of radiation safety.

2. LEGISLATIVE BASE

Before disintegration of the Soviet Union Kazakhstan had no own legislative base in the field of atomic energy use and had no state bodies, called to execute the control at observance of security measures by atomic energy use. The documents, regulating safety of activity in given area, were the Norms of Radiation Safety NRB 76 / 87, Basic Sanitary rules OSP- 72/ 87 and various departmental documents. State Committee on Safely Atomic Energy Use Supervision of USSR (Gosatomnadzor) executed the control in this field.

After getting of the sovereignty in 1991 to the Republic of Kazakhstan were begun and carried out till the present time work on the creation of legislative base in the field of atomic energy use and radioactive waste management based on main principles of International Basic Safety Standards [4]. Thus experience in the field of the nuclear right of a number of advanced countries, such as Germany, Finland Russia, Ukraine was used [5].

At the present time in Kazakhstan there is the following legislation base in this field:
In 1997, April 14 the Law on Atomic Energy Use [6] was adopted. The Act defines nuclear energy concepts, sets out a structure for the peaceful use of nuclear energy, the protection of public health and environment, the non-proliferation of nuclear weapons and nuclear and radiation safety. It authorizes the Government to designate those State Bodies, which regulate nuclear and radiation safety and the licensing of various types of nuclear activity. That is the basic Law in the nuclear legislation of the country. In 1998, April 23 the second Law of the nuclear legislation of Kazakhstan was adopted. It is Law on Radiation Safety of Population [7]. This Law aims to protect the population from adverse effects of ionizing radiation. It deals with the right of individuals in the context of such safety, the duties of users of ionizing radiation sources and the responsibilities of State bodies.

Others Laws of the Republic of Kazakhstan in this field are:
• on Sanitary-epidemiological Wellbeing of the Population;
• on Protection of the Environment;
• on Subsoil and Subsoil Usage;
• on Licensing;
• on Social Protection of Citizens, affected by the nuclear tests at Semipalatinsk Test Site.

Others legislative acts in this field are:
• the Decrees of the President, Decrees of Parliament and Government;
• decrees about bodies of state management, regulation and inspections;
• system of the rules and norms of nuclear and radiation safety;
• system of state standards and rules;
• system of the documentation of ministerial regulation.

In addition 100 regulation documents more, including acts of Soviet Union and developed in Kazakhstan, as well as Norms of Radiation Safety NRB-99 [8], developed and accepted in Russian Federation in 1999 used now, and Regulation for the Safe Transport of Radioactive Materials, which was elaborated on the base of IAEA Transport Regulation, 1996 Edition No. TS-R-1, and adopted in 1 March 1999 [9].

Republic of Kazakhstan have signed and joined such international treaties and conventions as Treaty on the Non-Proliferation of Nuclear Weapons, Convention on Nuclear Safety, Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Thus, Republic of Kazakhstan took obligation to execute the International requirements of safe atomic energy use.

3. SYSTEM OF STATE NUCLEAR AND RADIATION SAFETY REGULATION

President, Parliament and Government of Kazakhstan, realizing the high national responsibility in discharging the functions took a decision to create a system of State nuclear and radiation safety regulation. Various State bodies are responsible for the following functions. In accordance with the nuclear legislation of the country Atomic Energy Agency (since 1999 Kazakhstan Atomic Energy Committee (KAEC)) is defined as a Central regulatory body in the field of supervision for nuclear and radiation safety. According to the provision on KAEC adopted by Governmental Decree of 23 September 2000, it is responsible for:
• Realization of State Policy in the field of safely atomic energy use.
• State control of nuclear, radioactive and special non-nuclear materials, dual-use goods. Providing Regime of Non Proliferation Nuclear Weapons, nuclear and radiation Safety during the using of atomic energy.
• Export and import control of nuclear materials, technologies, equipment, special non-nuclear materials, dual-use goods and equipment, radioactive sources and isotope goods.
• Preparation of Annual reports connected with safety status of entities using atomic energy.
• Development of acts, regulations, standards, rules in the field of atomic energy use.
• Licensing all types of activities in the field of atomic energy use.
• Consideration and concordance of papers bottomed safety of nuclear installation during the all stages their life cycle.
• State account and control of nuclear materials and supervision for providing of physical protection during their storage, transport and use.
• Providing and Coordination of co-operation of Kazakhstan Institutions with IAEA and other International organizations in the field of atomic energy use.
• Emergency preparedness.
• Coordination and organization of research and scientific activity in the country and participation in the international co-operation in the field of atomic energy use.
• Preparation of proposals for upgrading and improvement of legislation of the Republic of Kazakhstan in the field of atomic energy use.
• Other functions.

The Agency on Health of the Republic of Kazakhstan with its sanitary-epidemiology stations provides medical services necessary for the protection of the public and employees at risk. It is responsible in context of its competence for regulating and inspecting the manufacture, use, storage, transport of nuclear materials and radioactive sources. It also carries out the account all radioactive sources and gives the
sanction to work with sources, renders the medical help to personal, which works with nuclear materials. The Ministry of Natural Resources and Environmental Protection is responsible for protection of the environment against radioactive contamination. It co-ordinates the work on investigation of the radiation situation in Kazakhstan and executes the State ecological examination of the projects. Others Ministries and Departments of the Republic of Kazakhstan with their responsibility are: Ministry of Energy and Mineral Resources is responsible for the co-ordination of all types of activity in the field of atomic energy use. The Ministry of Internal Affairs verifies the fire safety and physical protection standards of all facilities which use atomic energy or in which radioactive waste is managed. The Agency on Emergency Situations is responsible for monitoring compliance with measures on the prevention of emergency situations and sets out measures to protect the public against radiation exposure in the event of such situation. The Department of Safety of Industry and Mines, within this Committee, is responsible for the regulating of industrial equipment. All those State Bodies representative the first level of the system of regulation.

The second level is formed by the various national institutions carried out the direct radiation control and measurements. The institutes of the National Nuclear Centre of the Republic of Kazakhstan (Ministry of Energy and Mineral Resources) are controlling the radiation situation at the all territories of nuclear test sites and carried out the measurements of concentrations of radionuclides in soil and water here. State enterprise ‘Hydromet’ with its network (Ministry of Natural resources and Environmental Protection) carried out control of global fall of the radioactive substances at the territory of the country. Joint Stock Company ‘Volkvogeology’ (Kazatomprom, Ministry of Energy and Mineral Resources) executes the radiation monitoring at the objects of uranium mining and milling. The control of external irradiation dose and levels of radionuclides in soil, water, food and other products is also carried out by laboratories under the Ministry of Agriculture and different scientific laboratories and various research institutes of appropriate profile.

4. SOME SPECIFIC POINTS OF SAFETY

During the transition from the former Soviet Union to an independent state Kazakhstan encounteres some specific difficulties in safety area, which were not before. For example, the spent fuel from NPP, which before was transferred to Russia for storage, now must be stored in Kazakhstan, because the legislation of Russian Federation forbid to storage the radioactive waste of other countries. Another problem were connected with the necessity of regulation of personnel of nuclear facilities activity and assurance of its radiation protection.

Solution of those tasks needs to create the special institutions for design, construction and built of the nuclear entities. It is necessary to develop and implementation of licensing procedure for those kinds of activity, special requirements for personal involved in this activity. Assistance from international organizations such as IAEA, NEA OECD, regulatory bodies of USA, UK, Sweden under different technical co-operation project is very important and topical. Kazakhstan participates in more than ten TC projects during every year. That may be a big project such as Interregional Model project on upgrading of radiation an waste safety infrastructure, in which involved many governmental and research institutions, or local projects for separate organizations connected with the local specific task. We will consider some of those projects.

According to the conception of the decommissioning of the NPP BN-350 reactor, the creation of facilities for long-term storage is necessary [10]. For this purpose, we are now setting up a project to build new containers for the disposal facilities. This project provides for the construction of 8 containers with a volume of 200 m³ each. Those containers will be connected with the operating system for the drain gully water. Waste that was collected before will be solidified with concrete and transferred for storage to the BN-350 disposal facility. Storage equipment will be in special canyons covered by stainless steel. Into each canyon there will be a signalling apparatus for the control of the solution level. This project provides a special complex of the measures on technical condition control of equipment during all period of operation.

In connection with the reactor BN-350 spent fuel management the dry storage method has been chosen. The choice of dry disposal is based on the conception used in Argonne National Laboratory (USA) during more than 30 years for storage of radioactive materials of experimental breeder reactor II (EBR-II). This
method uses a silo in-ground configuration. The choice is based on detailed options study using the following criteria:

- minimize proliferation and safeguards risks;
- minimize technical risk;
- minimize environmental and safety risk;
- minimize political risk;
- minimize cost.

Currently the storage siting is carried out. The project will be realized during next 6-7 years. National company KATEP-AE was defined as a main management company on the decommissioning of reactor BN-350.

During all steps of this project Kazakhstan received the assistance from Nuclear regulatory commission of USA. Those were exchange of experience between the Kazakhstan’s and international experts during the workshops, seminars and work meetings, technical and financial support.

One of the main encountered difficulties is the necessity of development and implementation of new regulation documents. Assistance of international organizations in this area is very important and useful. So, a good experience Atomic Energy Committee of Kazakhstan received during the participation in the IAEA TC Project KAZ/9/006 ‘NPP Sitting’. Few regulatory documents on qualification, selection, training and authorization of personnel involved in activities connected with the use of atomic energy were elaborated under support of Division of Nuclear Power (Department of Nuclear Energy of the IAEA) in duration of last two years and now their are used in Kazakhstan. This work is very important for the present and future activity of all entities involved in the field of atomic energy use. Requirements of those documents are mandatory for all entities, involved in this activity. Big variety of Kazakhstan nuclear facilities and considerable amount of personnel involved in nuclear activities in a combination with limited resources dictate outstanding need in an implementation of thought-out, balanced and systematic approach to the development and upgrade of Kazakhstan nuclear training and qualification infrastructure. These considerations were the basis for planning and implementation of the IAEA and Kazakhstan joint activities.

One of the important points of safety is personal dosimetry. During the former Soviet Union this service was provided by the sanitary-epidemiology departments of Ministry of Health. Film dosimeters were used usually. Unfortunately, the power of this service was limited, and it had no possibilities of quality upgrading in this area. Now in Kazakhstan was created the radiation laboratory under support of IAEA Interregional Model project on upgrading of radiation and waste safety infrastructure in East and West Asia, in which Kazakhstan participated from 1996 to 2000. This laboratory uses the modern equipment. TLD-system HARSHAW-6600 is used for providing of personal dosimetry service. Laboratory staff had training in Germany on the base of the Bicron Company, which is one of the leaders in this area in the world. Now laboratory has about three thousand dosimeters, and this service covers about 50 private and state (local and foreign) companies, which conducted the activity in the different area of using of atomic energy.

5. CONCLUSION

At the present time in Kazakhstan:
In the field of Nuclear legislation the Laws on the Atomic Energy Use and on Radiation Safety of Population are elaborated with using of international experience in this area and adopted by Parliament of the Republic of Kazakhstan. National Regulation for the Safe Transport of Radioactive Materials was elaborated on the base of IAEA Transport Regulation, 1996 Edition No. TS-R-1, and adopted in 1999. Some regulation documents of the former Soviet Union, and Norms of Radiation Safety NRB-99, developed and accepted in Russian Federation in 1999, are used also. The State system, which includes the number of Ministries, Agencies and Committees of Kazakhstan, for the supervision and regulation in the field of nuclear and radiation safety, was created. Atomic Energy Committee controlled all types of nuclear activity by means of licensing.
Some specific difficulties in safety area and the way of their solution were described also. As shows the experience of international co-operation the participation in the different projects of multi-aspect nature is very important and useful.

References


