

NUCLEAR KNOWLEDGE DEVELOPMENT IN ARMENIA

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Abstract. Armenia has rather rich history of nuclear knowledge development. During the last several decades, depending on circumstances related with the ANPP main mile stones - construction, putting into operation, shutdown, restarting - nuclear knowledge was having its ups and downs. Though it has high level of development, there has been yet a need of preservation accumulated nuclear knowledge, and appropriate proceeding with the nuclear knowledge in Armenia.

Nuclear knowledge in Armenia, for the last several decades, has been on a rather high level of development. Although in the Republic there are several branches of nuclear knowledge, in particular –in nuclear physics, this article is about the nuclear energy knowledge.

Beginning with the second half of the last century, the need of high–skilled nuclear specialists in the country has arisen because of the idea to construct the first nuclear power plant in the Caucasus. It was to be not only the first nuclear power plant in our republic, but also the first in the whole Trans-Caucasian region.

In 1963, an Armenian Institute “Energosetproekt” has developed the project “Pre-feasibility Study of New Capacities Implementation into the Energy System of Armenia”. Within this study, the Institute defined that to cover the increasing electric energy demand, it is necessary to construct in Armenia a nuclear power plant. Also, the required terms for the units commissioning were defined in that document: first power unit was to be put into operation in 1973, and the second – in 1974.

In 1966, on the basis of the above mentioned study, the decision was made by the Council of Ministers of the former Soviet Union to begin the construction of the Armenian Nuclear Power Plant (ANPP) which was to be of two power units of WWER -440 type.

All the basic design, construction and mounting activities were performed by All-Union organizations, Armenian specialists were fully involved into those works. They were sent to various scientific centers of the former USSR for obtaining the appropriate nuclear knowledge by training and staging at nuclear power plants with the same type of reactor.

Investigation and research of the site selection and design statement for the ANPP construction and the engineering –geological analysis of the area were originally carried out by Gorky branch of “Teploelectroproekt” Institute. More than 20 competitive sites were considered before the ANPP site selection. It was finally considered to be in Metsamor, Hoctemberyan region, 28 km westward from Yerevan and 16 km from the boarder with Turkey. It was to be the first NPP in the Soviet Union planned to be constructed on a site with such high seismicity. The research of the ANPP site seismic conditions, which started in 1968, in the phase of its design period, hasn’t stopped during the period of documentation preparation, plant construction and continued during its operation up to the present days. For the project of plant expansion, in 1973 -1978, a detailed research on geotectonic and seismic conditions of the site was carried out by the Armenian Institute “Geophysics and Engineering Seismology”. The set of survey and research works proved that the seismic conditions of the ANPP site was characterized by the level corresponding to the 8-th degree of MSK -64 scale. Due to the specific seismic features of the ANPP location, the root design improvements of V-230 project were made not only in the construction part, but also in a reactor facility design as a whole, and, as a result, the project got its new serial number – V-270.

The ANPP was commissioned in 1976, with achieving the initial criticality for Unit 1 on 22 December 1976, and for Unit 2 - on 5 January 1980.

Following the 1988 earthquake, the Government of the former Soviet Union made a decision to shut down the ANPP. Unit 1 was shutdown on 25 February 1989 and Unit 2 – on 18 March 1989. After the disintegration of the USSR, Armenia was suffering from the energy crisis caused by shortage of domestic energy resources. In April, 1993, the Government of Armenia made a decision to restart the ANPP. Unit 2 was considered to be the safer of the two. It was restarted on 5 of November 1995, and the power unit has been in successful operation by now.

During the period of the ANPP restarting, Armenia was in need of many specialists of nuclear energy to be involved into the works of construction, maintaining, commissioning of the power unit, and its further operation including the engineering support. Armenian specialists were having practice at various scientific centers of former USSR for obtaining the appropriate nuclear knowledge by training and staging at nuclear power plants with the same type of reactor.

In 1973, in Yerevan Polytechnic Institute, a new specialty – “Nuclear Power Plants and Installations”- was established at the Department of Energy, and at the Physics Department of Yerevan State University the specialty of “Physics of Nuclear Reactors” was created. Before that time, those institutions were preparing many specialists, though not for nuclear power, such as Instrumentation & Control specialists, Thermal and Electrical engineering specialists, Chemists, Mechanics and others, for working at the power plants of the Republic.

At the same time, there arose the need of domestic teachers in that area of knowledge. More than 10 nuclear specialists from Armenia were sent to nuclear centers of Moscow and other nuclear centers of Soviet Union to study as post-graduates in the field of nuclear energy with the further getting their PhD degrees. It was to provide Armenia with domestic teachers - trained personnel experienced in this area of knowledge. Those specialists, on their coming back to Armenia were occupied not only with the lectures delivering but also with the science-research work.

After the Armenian NPP was shut down in 1989, the need for nuclear power specialists in Armenia decreased, and the specialty “Nuclear Power Plants and Installations” was canceled in the Yerevan Polytechnic Institute.

The year 1993 might be considered the year of rebirth for nuclear knowledge in Armenia, because the decision to restart Unit 2 of the Armenian NPP was made in that very year. The specialty “Nuclear Power Plants and Installations” was resumed, and the Polytechnic Institute has nowadays its annual output of 12 -15 graduates with the diplomas of “NPPs specialists”. Moreover, the new specialty was also established for studies at the Yerevan State University – the “Physics of Nuclear Reactors”, with the annual graduation of 4 -5 specialists.

It was necessary to establish in Armenia science –research centers to develop nuclear science activity in a country. In 1973, based on one of departments of the Science-Research Institute of Energy, the “Nuclear Energy Science-Research Department” was created. Mainly, it was carrying out the research on studying the accidental regimes of the NPPs operation and their seismic safety, as well as on the development and creation of the training system for the operational personnel of NPPs. Further (1976), it became a branch of All-Union “Science-Research Institute for NPPs Operation” of Moscow. The Branch have developed the diagnostic system SIAZ for anti-seismic protection of NPPs which was installed on all the nuclear power plants of the former USSR. Then it became the leading institution developing training system for the operational personnel of NPPs both in the Soviet Union and Socialist countries of East Europe. In 1986, the Branch developed the first digital full-scope simulator for the fifth power unit (WWER -1000) of the Novovoronezh NPP. The Branch was to carry

out the research work for all WWER type units. Since the institution was of All-Union significance, it was in charge of a big amount of work relevant to the nuclear power at that time. The number of the employees at the Branch was more than 450 persons.

After the disintegration of the USSR and the closure of the ANPP, the scope of work of the institute has decreased significantly. Those were bad times in the history of the science – research institution. There have arisen many problems related to the preservation of nuclear knowledge that was accumulated during the times of its previous intense activity. When the nuclear power plant in Armenia was restarted, the institute experienced its rebirth. Now its name is “Armatom” institute, and it is one of the main ANPP supporting organizations in Armenia. The institute has performed the following activity for the ANPP:

- together with the “CORYS T.E.S.S.” (France), developed and implemented the multifunctional training simulator;
- together with the S-R Institute of NPPs Operation (Russia), developed and implemented several diagnostic systems for the ANPP;
- together with the DS&S (USA), developed and implemented the Safety Parameters Display System (SPDS), as well as the main informational – computing system for the plant;
- together with the PNNL Battelle and Argon NL (USA), developed the Deterministic Safety Analysis for the ANPP;
- together with the SOGIN (Italy), developed the Probabilistic Safety Analysis for the ANPP.

Besides, the institute is performing many other activities for the ANPP, as well as for many Russian NPPs.

In 1983, the “Atomenergoseismoproekt” facility was established based on the Department of Seismic Research of “Armatom” institute. Its objectives were to carry out the sites seismic studies for all new built nuclear power plants in order to evaluate properly the level of seismicity for those sites. “Atomenergoseismoproekt” was performing the work in all areas of the whole territory of the former Soviet Union, as well as of some foreign countries. After the disintegration of the USSR, the scope of work of the institute has decreased significantly. Like many other big science–research institutions, which were previously under the supervision of the central management of the Soviet Union, “Atomenergoseismoproekt” had bad times during the transition period of gaining an independence by Armenia. And also, there were existing the problems related to the preservation of already accumulated nuclear knowledge there.

In 1993 -1995, during the period of preparation for the restart of Unit 2 of the ANPP, “Atomenergoseismoproekt”, under the supervision of the IAEA, was carrying out the set of work to finalize the study of seismic conditions of the site of the power plant. It was done in order to have a final decision on all relevant issues and in substantiation of possible recommissioning and further operation of the ANPP. As a result, it was proved that the ANPP was erected on a whole, non-destructed, block, so, the absence of tectonically active break under the ANPP was proved.

In 1987, the “Atomservice” facility was created to perform a very important task of providing the Armenian NPP with technical support. During the period of preparation for the restart of Unit 2 of the ANPP, “Atomservice” was participating in work on development of inspection and testing programs necessary for recommissioning of the plant. Now, all the adjustments work and elaboration of new and reviewing the old operational procedures have been fulfilling by the facility.

The above mentioned institutions were established in Armenia not only to support the ANPP, but also because at that time it was planned to build nuclear power plants in Georgia and Azerbaijan, too.

The ANPP support functions of “Armatom”, “Atomservice” and “Atomseismoproject” were restored. Those and some other institutions were involved into the large-scale activities related with the ANPP restart. “Atomseismoproject” re-evaluated the seismic conditions of the ANPP site. Now the institution is providing the services also for the nuclear power plants of Russian Federation. The “Atomservice” participated in works on elaboration of inspection and testing programs for the plants. “Armatom” elaborated and implemented a compact training simulator, multifunctional training simulator, as well as participated in works on Probabilistic and Deterministic Safety Analysis development for Unit 2 of Armenian NPP.

In 2000, the “Nuclear and Radiation Safety Research-Technical Center”, intended to enforce the process of licensing, was established at the ANRA.

Thus, after the collapse of the USSR, the scope of works that were performing by Armenian nuclear organizations on an All-Union scale, was reduced, and the nuclear knowledge had become unclaimed.. Nevertheless, after the ANPP restart, the need of that knowledge appeared to be increasing, and, although some quantity of it might have been lost (documents, procedures, trained personnel), it can be said, that the nuclear knowledge in Armenia is on a rather high level nowadays.

At the same time, nuclear knowledge in Armenia has a number of problems. It is necessary to carry out an inventory of all the knowledge that was accumulated in country’s institutions, to collect all the unwritten nuclear knowledge that is kept by many people who are already parted from the nuclear field. It has to be developed a special database for storing all the knowledge, and provide the corresponding specialists with the access needed.