

**NATIONAL REPORT
OF THE REPUBLIC OF ARMENIA**

CONVENTION ON NUCLEAR SAFETY

YEREVAN, AUGUST 2004

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NATIONAL REPORT OF REPUBLIC OF ARMENIA

CONVENTION ON NUCLEAR SAFETY

Introduction

This report has been prepared in accordance with the requirements of Article 5 of the Convention “On Nuclear Safety”, and it includes the information on the fulfilling by Armenia the obligations following the Convention.

The Energy Policy of Armenia, being focused on realization of the strategy program for providing the country with the required quantity of electric energy, is directed also at the implementation of obligations that were assumed by the Republic upon the Convention mention above.

The experience Armenia had during 1993 -1995 shows that to prevent new energy crises, it is necessary for the country to ensure its energy safety and energy independence. The most important object of the national energy sector, contributing much to this goal achievement, is Armenian NPP which is under the policy of upgrading its safety continuously. The development of the legislative and regulatory basis for the nuclear safety is the centre of attention of the Armenian Government.

In 2001 -2002, in the frame of the IAEA Program on Technical Cooperation, there was developed the project titled “Energy and Nuclear Power Planning study for Armenia” which was published in July 2004 as TECDOC -1404.

In this document, two options of the development of the Energy Sector of Armenia were considered:

1. with the use of the thermal power plants only;
2. with the use of both the thermal and nuclear power plants.

The second option of the Energy sector development, taking into account the criteria of energy safety and energy independence, ecology, as well as from the social point of view, is preferable. In the future, it would also allow to decommission the ANPP safely and economically effectually.

In October 2003, the agreement was signed between the Inter RAO EES and the Ministry of Energy of RA about the turn over of the financial management of the ANPP to the Inter RAO EES of Russia.

Inter RAO EES is obliged to deliver fresh nuclear fuel to the ANPP in time. Russian specialists are responsible for the management of the plant financial flows. The nuclear power plant remains the property of the Republic of Armenia. This agreement will allow to upgrade the operational level of the ANPP because the regular delays in the fresh nuclear fuel delivery to the plant were resulting in low load factor of the ANPP.

The ANPP generates 35 -40% of all electric energy produced in Armenia, and its share in the primary energy totals to 22 -25 %.

The Government of Armenia has its distinct attitude towards the decommissioning of the ANPP. The power plant can be decommissioned before its design life-time expiry date (2016) if the following requirements are met:

- The level of the country’s energy safety should not be lower than that of the current one;
- The electric energy produced by the ANPP should be replaced with the energy equal both in quantity and production regime;
- The decommissioning of the ANPP should not lead to the worsening of the social conditions for the population, which may be caused by the rise of the electric energy cost.

CHAPTER 1. GENERAL PROVISIONS

1.1. Existing Nuclear Installations

In Armenia this Convention is applied to one nuclear installation - the Armenian NPP. The ANPP is located 28 kilometers from Yerevan, the capital of Armenia, and consists of two WWER-440 units. At the ANPP site there is the dry spent fuel storage facility. The technical specifications of the ANPP and dry spent fuel storage facility are set in the second national report of the RA.

The ANPP Unit №1 was put into operation in 1976 and the Unit №2 in 1980. In 1989, following the earthquake in December 1988 in Armenia, both units were shutdown under the USSR Government decree, though the earthquake didn't impact the ANPP and it remained in its normal operating condition.

In April 1993, the Government of Armenia decreed to restart the ANPP Unit №2 due to the energy crisis in the RA. At the same time Armenian, Russian and Western organizations initiated the safety reevaluation measures.

In November 1995, after implementation of the restoration and safety improvement measures (of highest priority), the ANPP Unit №2 was restarted.

The safety improvement measures are to be implemented throughout the whole lifetime of the ANPP operation.

The ANPP Unit №1 is in conservation regime (long-term shut down).

In 2003 the last 11th HSM of the DSFS was loaded with dry shield canister with spent fuel.

CHAPTER 2. LEGISLATION AND REGULATION

2.1. Legislative and Regulatory Framework

After the adoption of the decree, stipulating the restart of the ANPP's Unit №2, the Armenian Government has undertaken the specific actions aimed at establishing the legislative and regulatory framework for safety.

The Armenian Nuclear Regulatory Authority – ANRA was established by the Government decree № 573 dated November 16, 1993.

Taking into account that the ANPP was designed, constructed, commissioned and operated in compliance with the regulations of the former USSR, Armenian Government decreed to enforce in Armenia the safety rules and regulations of the Russian Federation until the relevant national laws and regulations are developed.

In 1996 there were introduced amendments to the administrative code of the Republic of Armenia. The amendments entitle the ANRA to impose sanctions to offender of the legislation in the field of atomic energy utilization.

On March 1, 1999 the National Assembly (Parliament) of the Republic of Armenia adopted the “Law on Safe Utilization of Atomic Energy for Peaceful Purposes” which is the basic legal document for settling relations in the field of the atomic energy utilization and is called to ensure fulfillment of obligations of Armenia under the international treaties in the field of atomic energy utilization (as amended and supplemented, 18 April 2000).

On May 30, 2001 (with further amendments as of 16 March 2004) the National Assembly (Parliament) of the Republic of Armenia adopted the “Law on Licensing” that establishes types of activities subject to licensing (also in the field of the atomic energy utilization) and settles relations related to licensing.

On April 18, 2003 the National Assembly (Parliament) of the Republic of Armenia adopted the “Criminal Code of the RA” that specifies the types of crimes and liabilities in the field of atomic energy utilization.

On February 19, 2004 the RA Government adopted the draft law on amendments and supplements to the “Law on Safe Utilization of Atomic Energy for Peaceful Purposes” and submitted to the Parliament of the RA.

Amendments and supplements are aimed to extend authorities of the regulatory authority and the operating organization and to settle relations concerned with the physical protection of nuclear materials and nuclear installations following the requirements of the international treaties to which Armenia is a party.

The list of basic legislative documents enforced in Armenia is set in the Annex 1.

2.2. Regulatory Authority

The ANRA is a state authority, responsible for regulation of nuclear and radiation safety in the Republic of Armenia. The authorities of the ANRA are established in the “Law on Safe Utilization of Atomic Energy for Peaceful Purposes” and the ANRA Statute. In accordance with the President ordinance № 912-N as of 27 June, 2002, the ANRA was reorganized into an inspection on nuclear and radiation safety at atomic energy utilization within the administration of the Ministry for Nature Protection of the RA. The ANRA statute was approved under the Government decree №-2183-N on 26 December 2002 (as amended, 04 March 2004).

In accordance with the mentioned above, the ANRA:

- Develops and submits safety norms and regulations to the minister of nature protection for further submission to the RA government;
- Performs safety assessment of activities, objects and equipment in the field of atomic energy utilization;
- Licenses activities, as well as physical persons implementing activities and holding positions important in terms of safety in the field of atomic energy utilization;
- Controls fulfilment of requirements of the legislation of the Republic of Armenia and issues licences in the field of atomic energy utilization;
- Withdraws license if a licensee does not comply with license terms;
- Controls the preparedness of organisations and entities operating atomic energy utilisation objects and involved in the national emergency response system;
- Controls fulfilment of the obligations of the Republic of Armenia under the international treaties in the field of atomic energy utilization jointly with the state authority entrusted by the Government of the Republic of Armenia with responsibility for international relations;
- Co-operates with international and foreign organisations on safety matters;
- Controls the safeguards applicable to nuclear materials;
- Regulates the physical protection of atomic energy utilization objects and nuclear materials
- Inspects atomic energy utilisation objects and activities implemented there;
- Other authorities established in the legislation of the Republic of Armenia.

The ANRA status within the Government of Armenia and the ANRA organizational structure are set in the Annexes 3 and 4.

The ANRA is financed through the budget of the Ministry for Nature Protection of the RA.

2.3. Responsibility of License Holder

Pursuant to the “Law on Safe Utilization of Atomic Energy for Peaceful Purposes” (Article 19) and the Statute (point 4.3) of “HAEK ” CJSC (the formal name of license holder), the overall responsibility for safe operation of atomic energy utilization object rests with the ANPP - Armenian Nuclear Power Plant.

CHAPTER 3. GENERAL SAFETY CONSIDERATIONS

3.1. Priority to Safety

The Government of Armenia gives the highest priority to nuclear and radiation safety. The official statement of the Government of Armenia points on the importance of nuclear and radiation safety to which a special attention is paid along with other issues related to the national security.

The founding of the Nuclear Safety Council under the President of Armenia, which involves the recognized world authorities in nuclear science and engineering, emphasizes the concern of the Armenian leadership by the issues related to establishment of the adequate safety level.

3.2. Financial and Human Resources

3.2.1. Financial Resources of ANPP

The ANPP is financed from:

- In payments from energy consumption which are spent for operational needs and implementation of low-cost safety improvement measures;
- Budgetary funds of the Republic of Armenia which are spent on implementation of safety improvement measures;
- Credits which are spent on implementation of safety improvement measures and engineering and technical support;
- International assistance which is spent on implementation of safety improvement measures.

3.2.2. Human Resources of ANPP

The personnel competence plays an important role in the ANPP safety. Therefore the ANPP personnel recruitment, as well as maintaining and upgrading of their competence are under the focused attention of the ANPP and the Ministry for Energy that supervises the NPP.

All positions, important in terms of safety, are occupied by specialists with university degree who start working on their own only after special training and examination.

The ANPP personnel is periodically retrained (qualification maintaining) on program approved for each position with passing exams: operating personnel – once in two years, management personnel – once in three years.

At the ANPP the operating personnel on-site training and retraining is performed on individual programs developed on the basis of standard training programs set in the job specifications. In the periods indicated in the program the personnel must undergo:

- Theoretical training;
- Practical lessons on mock-ups, software, simulators;
- On-the-job training;
- Examination in the range mentioned in the job instructions (the ANPP personnel holding posts important in terms of nuclear and radiation safety are examined by the ANRA examination commission);
- On-the-job duplication with participation in the emergency and fire exercises;

In 2000 the ANPP commissioned multifunctional simulator WWER 440 that copes with a number of tasks related to training of the operating personnel in normal, transient and accident conditions.

The ANPP has specified measures intended to improve effectiveness of the simulator used at training and retaining of the control room operating personnel. The measures intended to extend the simulator capabilities, as well as to increase training scenarios and develop education materials are also in place. Besides, the simulator is being corrected and improved. The ANRA has approved the use of the simulator as education tool for emergency exercises for team work in real time. Training is implemented in accordance with the annual schedule and the approved emergency training programs. The personnel is actively participating in international workshops and symposiums in order to improve qualification and learn advanced experience

3.2.3. Financial Resources of Regulatory Authority

The ANRA is financed from the state budget of Armenia.

3.2.4. Human Resources of Regulatory Authority

The ANRA employs 16 specialists the majority of which have more than 15 years work experience in the atomic energy field. All ANRA employees have university degree and one has PhD degree.

The ANRA staff continuously works on its qualification upgrading in accordance with the individual training plans which are developed for each calendar year.

The ANRA implements program for systematic maintaining and upgrading of its specialists qualification via retraining international training courses and seminars.

3.3. Human Factor

Human factor is one of the important safety components at operation of nuclear installations.

The regulation of human factor at the ANPP is implemented by:

- Extending knowledge level and competence by means of training and self-training
- Motivation of activity through establishment and explanation of its objectives, establishment of encouragement and punishment system
- Clear allocation of responsibilities by means of official establishment and description of functions.

The ANRA performs the regulatory control in the following directions:

- Control and assessment of the NPP personnel training (licensing of personnel implementing activities important in terms of the NPP safety, control and assessment of quality of training process, methods, means and personnel training programs, control of the training center activity).
- Control of the ANPP personnel professional activity (in particular, analysis of human errors, control of quality of activity and management quality, control on adherence to the requirements of normative documents on safety).
- Agreement of technical decisions and design changes (in particular, review and approval of technical decisions and design changes of safety important systems).

3.4. Quality Assurance

The adequate quality assurance at the ANPP designing, site research, construction, commissioning and operation till 1989 was in places in accordance with regulations existing in USSR at that time. The system of state standards, quality control, expertise, agreements and test acceptance was in place for the quality assurance of performed activities. Before the ANPP Unit 2 restart, the RF VNIIAES had developed the quality assurance program for operation on the basis of PN AEG-1-028-91 "Requirements to NPP Quality Assurance Program". In accordance with this document the appropriate quality assurance programs (POKAS) are established at the ANPP. And the responsibility for implementation of POKAS on the whole rests with the operating organization. The ANPP has initiated development of a new quality assurance program for operation. New version of POKAS (E) is developed and implemented in compliance with IAEA recommendations (Safety Series No 50-C/SG-Q) and international ISO standards.

The whole activity of ANPP is divided into 30 activity areas and development of a significant administrative procedure package is planned to manage the activity areas in compliance with them. In addition a system of a quality audit and quality system inspection is being implemented at ANPP to allow regular assessment of quality system efficiency and performance of adequate correcting activities aimed at its further improvement.

3.5. Assessment and Verification of Safety

In 1993, after adoption of the decree on the ANPP Unit №2 restart, the Western, Russian and Armenian organizations initiated activities on safety reevaluation and prioritization of deficiencies.

The deterministic and probabilistic methods were applied in the safety analysis. A list of initiating events was developed for the deterministic analysis. On the basis of this list there was performed analysis of transients, design and beyond design accidents. The analysis was performed by the competent Russian organization with application of Russian codes. There were used also American codes for comparison of the results. Besides foreign organizations and the IAEA experts were involved in assessment and prioritization of safety deficiencies

On the basis of performed analysis and assessments there was developed a list of safety improvement measures for Unit №2 with the following priorities:

- Highly important, strictly scheduled as conditions of operational license
- Important, but not connected to operational license
- Others, necessary to be implemented but not strictly scheduled.

The list was approved by the ANRA after review and assessment of submitted materials on safety analysis.

In 2001 the ANPP in cooperation with the DOE started preparations for SAR development (training and retraining of specialists for establishment of analytical group, information collection and establishment of database to be used at the SAR development, analysis of systems and so on). The SAR is developed in compliance with the requirements to SAR form and contents established by the ANRA. There has been approved the schedule of development and submission of separate sections of the SAR to the ANRA According to the schedule the SAR development will be completed in 2005.

In 2004 the ANPP completed development of PSA level 1. The PSA included internal initiating events, internal fire and flooding and external initiating events except for earthquake. According to the PSA results CDF equals to $9.28E-05$ (Total CDF from internal IEs). In 2005 the ANPP plans to initiate development of seismic PSA.

The ANRA plans to review the PSA results. The IAEA IPSART mission is planned to review the PSA.

The ANRA is supported by its Technical Support Organization (established in 2001) in review of separate sections of the SAR and the PSA.

3.6. Radiation Protection

3.6.1. Legislative and Regulatory Framework

Currently, the issues related to the radiation protection of the NPP personnel and population are governed by the Law of the Republic of Armenia “On Safe Utilization of Atomic Energy for Peaceful Purposes” and relevant rules and regulations.

Simultaneously, the development of national legal acts on radiation protection and safety is in process. In this process, the experience of other countries and new international approaches, as well as recommendations of the IAEA and ICRP to radiation protection and safety of ionizing radiation sources are taken into account. In particular, the draft of standards on Protection Against Ionizing Radiation and Safety of Ionizing Radiation Sources and the draft of rules for Protection against Ionizing Radiation” are on the stage of agreement.

3.6.2. The Occupational and Public Exposure Dose Limits

The exposure dose limits for the ANPP personnel and population residing in the ANPP supervised area are established by the occupational and public exposure dose limits and also by the ALARA principle introduction.

The exposure dose limits for the ANPP personnel and population residing in the ANPP supervised area are controlled by:

- Monitoring of the radiation situation in the ANPP controlled and supervised areas;
- The radiation exposure-prone works carried out according to the special dose-orders and on the programs, approved by the ANRA;

- Registration the occupational doses of persons working in the ANPP controlled area;
- Registration the doses of critical groups of members of population residing in the ANPP supervised area by TLD dosimeters.

The change of collective and individual equivalent dose of the ANPP personnel within the period of the ANPP operation is set on the Figures 1 and 2.

The Table 2 demonstrates the collective equivalent dose of population in the ANPP supervised area.

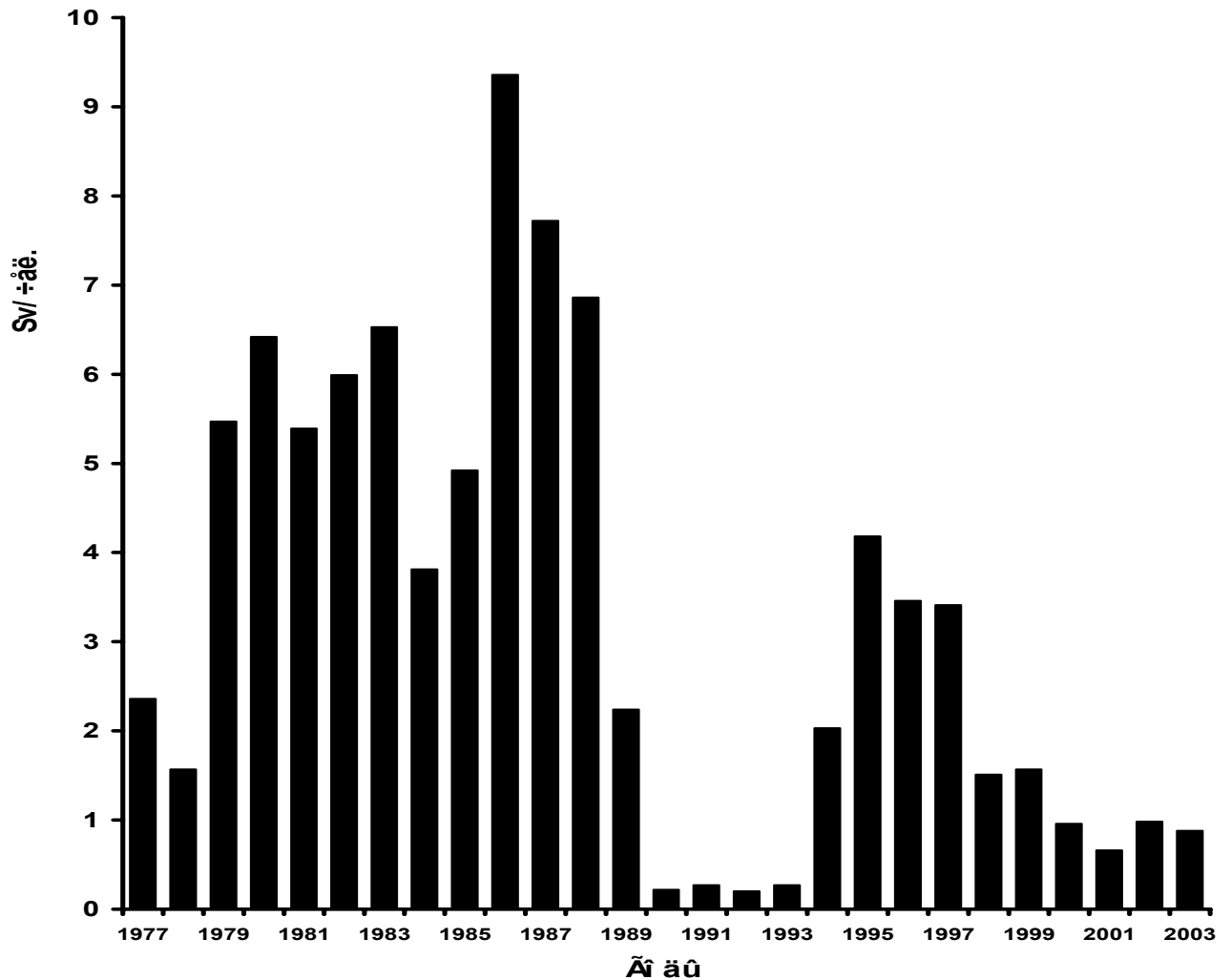


Figure 1. Collective Equivalent Exposure Dose of ANPP personnel for 1977-2003

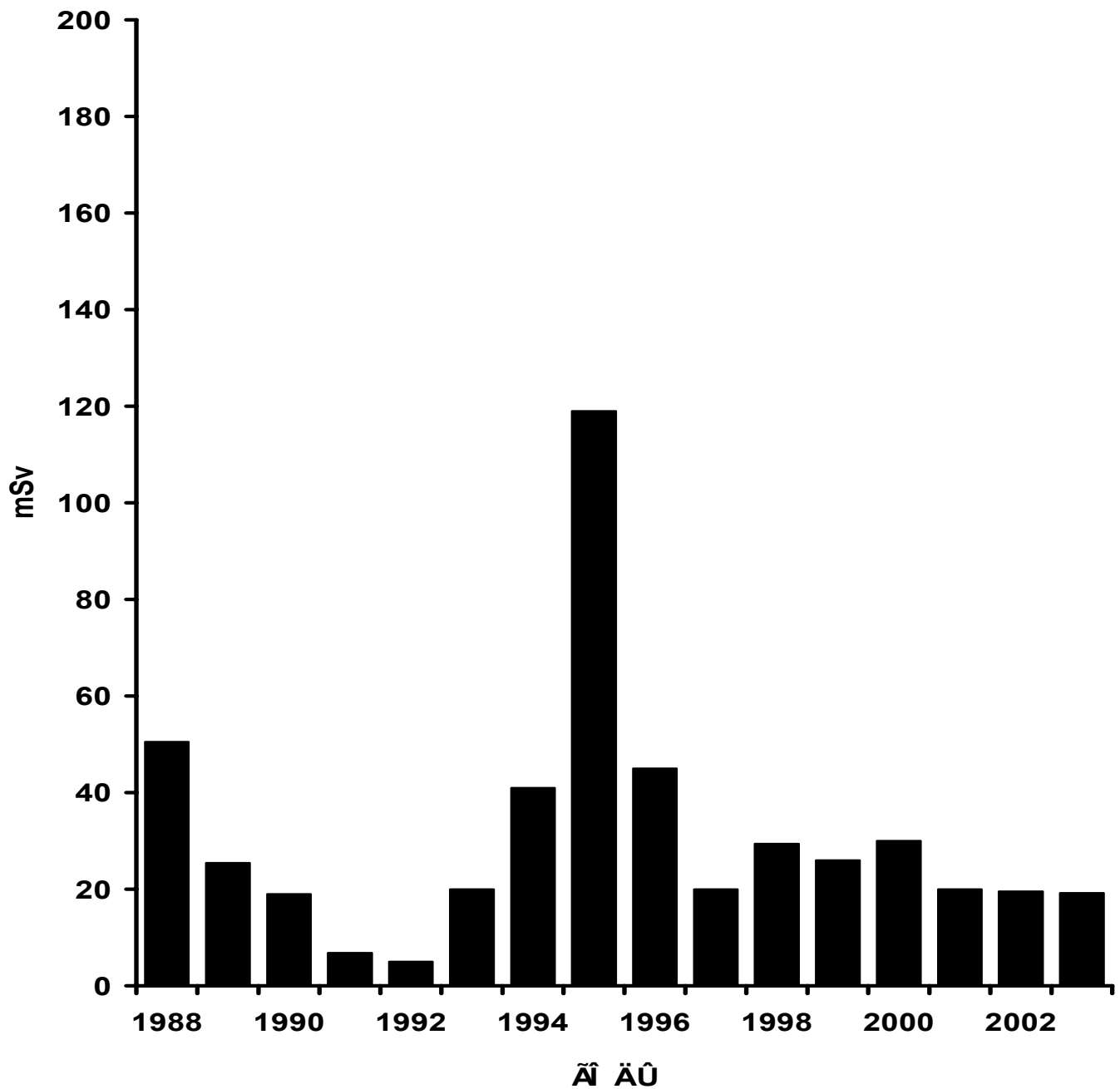


Figure 2. Individual Equivalent Dose of ANPP personnel for 1988-2003

Table 2. Collective Equivalent Dose of Population Residing in ANPP Supervised Area for 2003 personnel

NPP site (as control point)	0	-	1.43
Aknaich village	3.5	SE	1.14
Metsamor town	5	S	1.34
Egeknot village	4	SSE	1.23
Aygeshat village	9	WSW	1.35
Agavnatun village	10	ENE	1.10
Armavir town	11	WSW	1.03
Echmiatsin town	14	E	1.27

The data set in the table 2 is received by means of a network of TLD installed in the settlements of the supervised area. The settlements situated in different directions and distances from the ANPP are selected.

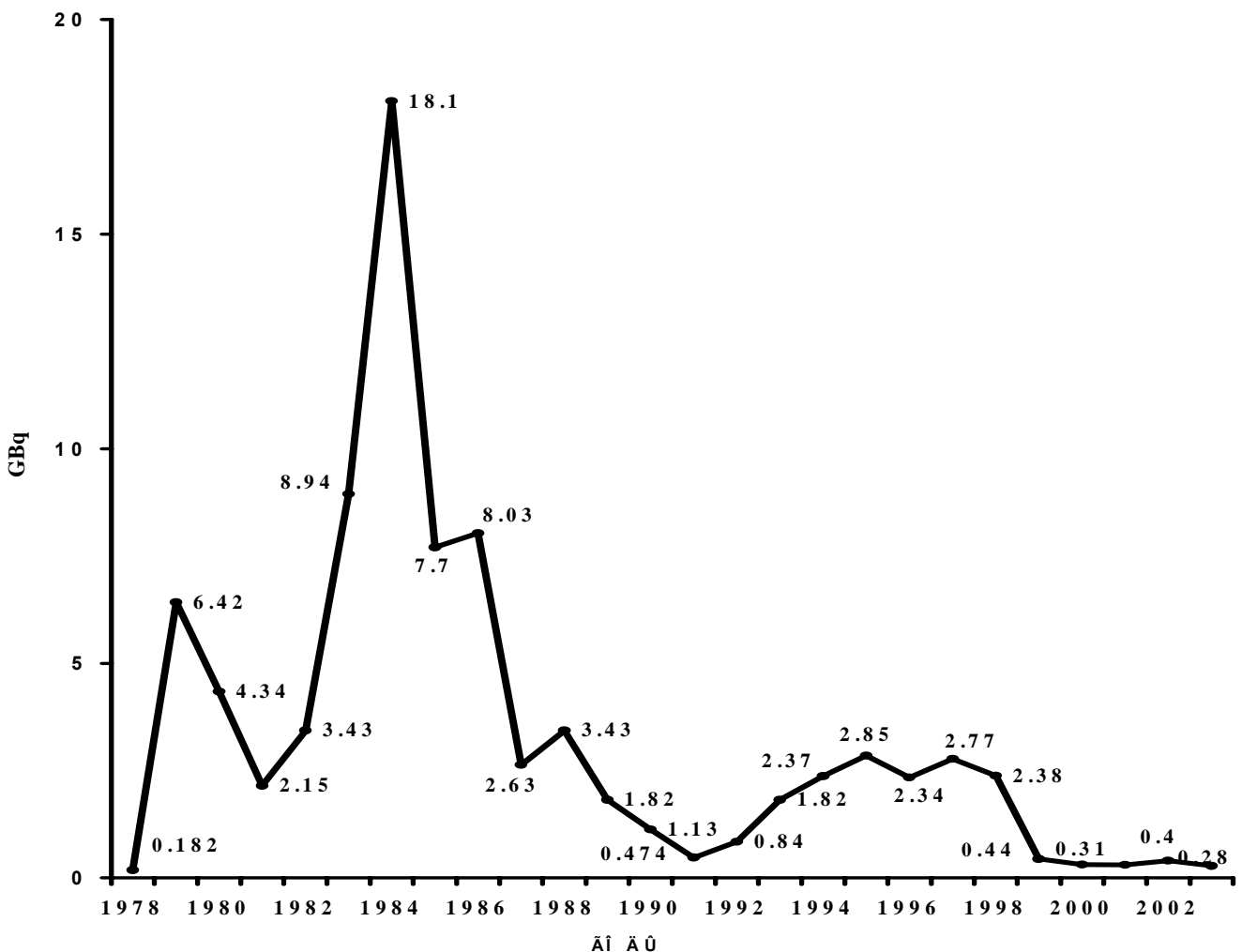
Although the winds in the area of the ANPP location mainly blow in the north-east-east direction, in all settlements there are registered comparatively similar values of the equivalent collective dose (1.03-1.35 mSv).

The received integral doses of population are within the dose limits for population from the natural background, approximately 5% of which is the dose generated from man-made sources (global fall-outs, consequences of the Chernobyl accident). It should be noted that the radioactive releases from the ANPP are approximately 100 times below the permissible release limits.

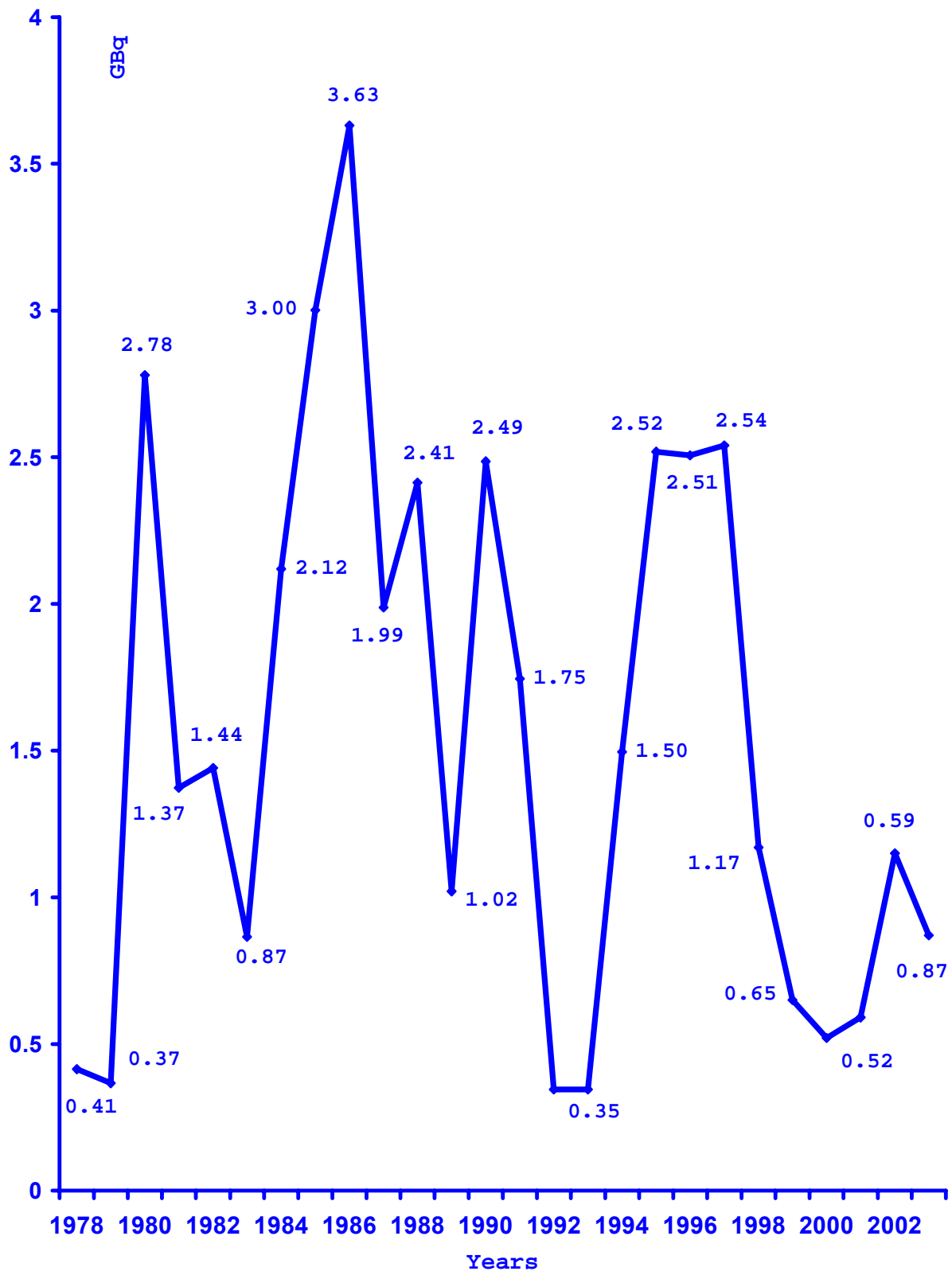
TLD dosimeter is installed also on the ANPP site. It allows to control the dose limit of the ANPP personnel who do not have access to the controlled area.

3.6.3. Fulfilment of conditions for radioactive materials releases and discharges

The permissible limits of radioactive releases and discharges from the NPP are established by the ANRA on the basis of the basic dose constraints. The figures 3 and 4 demonstrate the data related to radioactive releases and discharges from the ANPP.



(permissible value of annual release is 203 GBq)



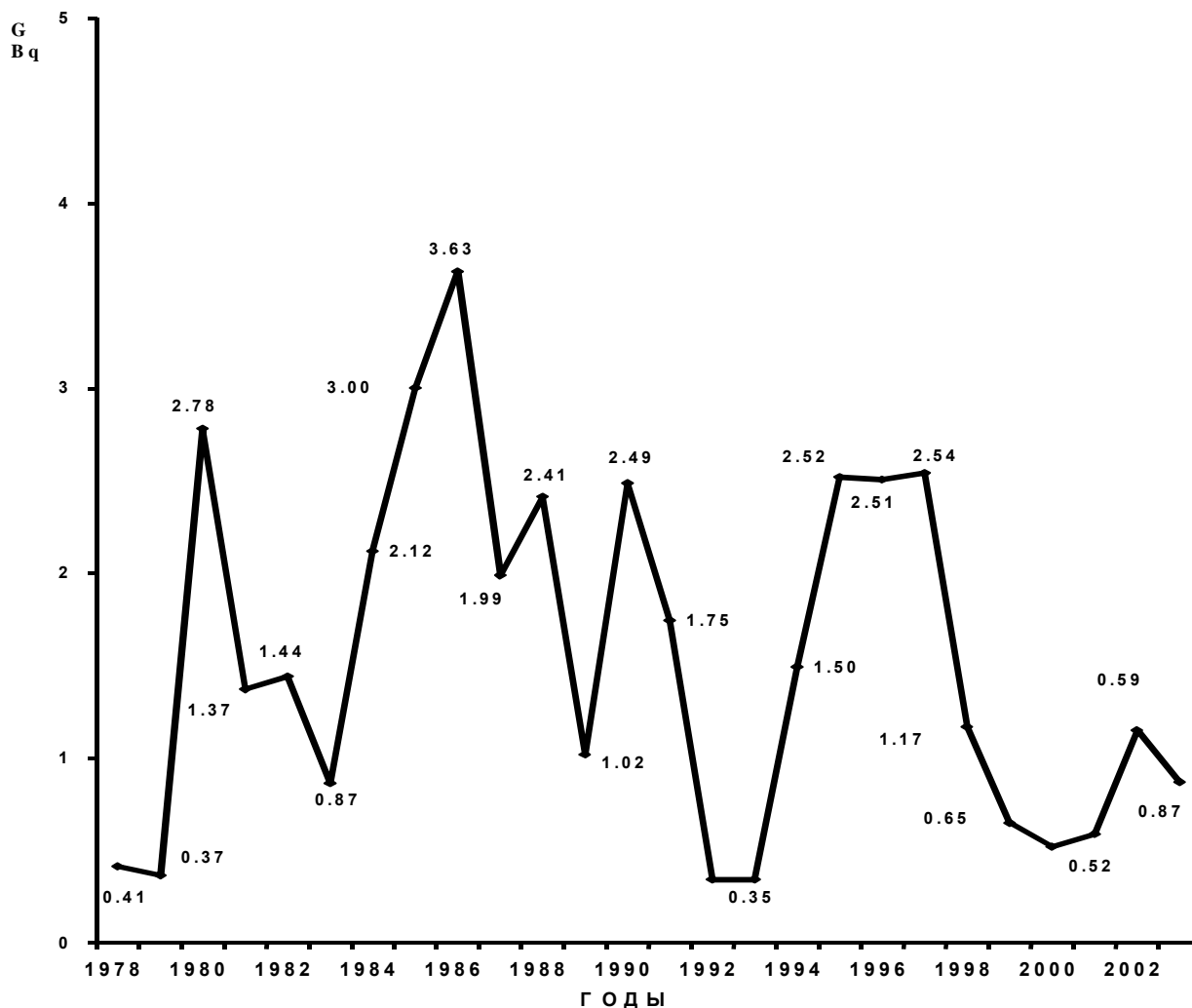


Figure 4. Annual releases of long-lived radionuclides in liquid effluences (Sr+Cs) for 1978-2003 (permissible value of annual release is 55 GBq)

3.6.4. Introduction of Optimization Principles (ALARA principle)

At the ANPP the introduction of organizational and technical measures for decrease of the personnel dose limits, especially during the scheduled annual maintenance is in process. The measures are implemented according to the program on “Introduction of ALARA principle at NPP operation”.

3.6.5. Control of Environmental Radiation Impact

The environmental radiation impact of the ANPP is controlled by the NPP laboratory of external irradiation control. Within the ANPP supervised area the control is established over the radioisotopes contents in the air, fallouts, underground waters, soil, greens, and also in several kinds of foods (meat, fish, milk, vegetables, fruits and so on). The radioisotopes contents in the underground waters nourishing Aknalich Lake, Sevjur river and other nearest water objects is controlled by sampling from bore holes.

The monitoring methodology and the sampling points locations are established in the NPP design.

3.7. Emergency Preparedness

3.7.1. Legislative Framework

In Armenia the basic legal acts regulating the response to nuclear and radiation emergencies are the “Laws of the Republic Armenia on Safe Utilization of Atomic Energy for Peaceful Purposes” and on “Population Protection at Extreme Situations”.

The development of national regulations on emergency planning and preparedness which take into account the IAEA recommendations is in process. In particular, the regulation establishing the basic requirements of emergency planning and response at nuclear and radiation emergencies is enforced.

3.7.2. Structure of the National Emergency Response System

The key organizations of the national emergency response system are the ANPP, EMA and ANRA. The EMA functions as the national coordinator on organization of activities on population protection. Thereto, the EMA has established the analytical and informational center equipped with modern equipment and communication means.

The ANRA is the national advisor on response organization and also the competent authority and contact point under the Convention “On Early Notification about Nuclear Accident”.

3.7.3. Classification of Emergency Situations

The ANPP currently develops the emergency classification system based on the principle of symptom-oriented analysis of situation at object and adjacent to it territories.

3.7.4. National Emergency Response Plan

The national emergency response plan establishes functions of organizations involved in the national emergency response system, as well as material, human and technical resources for implementation of population protection measures.

In accordance with the basic requirements to emergency planning and response at nuclear and radiation emergencies, the EMA develops national emergency response plan for nuclear and radiation emergencies at the ANPP (ANPP off-site plan). In parallel, emergency response plans of state and local authorities and dedicated organizations with emergency response functions are being developed.

The development of plans is to be completed in 2005.

3.7.5. ANPP Emergency Response Plan

The temporary plan of emergency response to nuclear and radiation emergencies of NPP is still in force at the ANPP. The plan establishes the functions of the structural divisions of the ANPP emergency services, as well as material, human and technical resources for implementation of personnel protection measures.

The development of the ANPP new emergency response plan (ANPP on-site plan) is in process and to be completed in 2005. The plan will comply with the basic requirements of emergency planning and response at nuclear and radiation emergencies.

3.7.6. Emergency Notification

The responsibilities for notification about nuclear and radiation emergencies at the ANPP are established in the the basic requirements to emergency planning and response at nuclear and radiation emergencies and will be fixed in the emergency response plans. In particular, the responsibility for population notification rests with:

- The NPP - for population notification in the NPP preventive action zone;
- Local authorities, if necessary also the EMA, - for population notification outside the preventive action zone.

The responsibility for international notification of nuclear and radiation emergency at the ANPP and also for receiving information from other countries about accidents at NPP rests with the ANRA.

3.7.7. Emergency Training and Exercises

The emergency trainings and exercises are conducted according to the approved schedules in order to maintain permanent preparedness of the ANPP emergency personnel and other organizations of the national emergency response system.

In 2005 it is planned to conduct full-scope emergency exercises on the national level with the purpose to test new plans and detect weaknesses in the emergency response system. On the basis of the exercise results there will be defined measures for strengthening of the emergency preparedness. The institute of emergency situations of the EMA RA annually organizes training on response to emergencies for 300-400 different levels officials of state authorities. The population training to undertake actions during emergencies is organized by the EMA via special TV programs (TV program “Emergency channel” on the state TV) and also by publishing and disseminating of educational materials (books, booklets and etc.).

3.7.8. International Cooperation

The Republic of Armenia is a party to a number of international treaties and agreements on emergency response and planning matters (Annex 1).

The Armenian organizations cooperate on different matters related to emergency response and planning with the IAEA (in the frameworks of technical cooperation projects), as well as with organizations of USA, UK and EC (in frame of TACIS project). It is planned to hold international emergency preparedness exercises in Armenia in 2005.

CHAPTER 4. NUCLEAR INSTALLATION SAFETY

4.1. NPP Site

4.1.1. Site Factors Affecting Safety

The ANPP siting was performed in 1968 in accordance with the regulatory documents enforced at that time. In doing so, all site factors that could affect the ANPP safety were practically taken into account:

- The ANPP industrial site is located on solid crystal basalt block;
- The seismic capability of the NPP site is acceptable;
- Geological conditions of the site are stable;
- Ground water table level is on depth 85-90m;
- Volcanic hazard on the site is negligible.

Other natural events (flooding, tornado, landslides and so on) on the territory of the site are not observed.

The implementation of a set of survey and research works has confirmed that the seismic conditions of the ANPP site are characterized by MDE corresponding to 8 degree on MSK-64 scale. Due to absence of the corresponding normative basis for the reactor vault and primary circuit equipment, in order to ensure the nuclear safety the specialized organizations recommended to accept 0,4g for ground acceleration of the site.

When “Seismic Design Codes for NPP “ (1987) were published, there were initiated activities on seismic resistance strengthening of main building, equipment and pipelines of the ANPP.

In 1987-1995 at the ANPP there were implemented the following main activities related to seismic safety upgrading:

1. Strengthening of constructions, structures and buildings up to 8 degree according to PN AE G-5-006-87.
2. Reconstruction of energy supply systems of 1 and 2 reliability group by separation into 2 independent channels; seismically resistant accumulators are installed;
3. Strengthening of structural elements of longitudinal and transversal shelves by additional steel links;
4. Installation of additional links between columns of the turbine hall;
5. Strengthening of non-structural external panels and walls.

4.1.2. ANPP Safety Acceptability with respect to Site Factors

With respect to the new data on the earthquakes occurred on the territory of Armenia and neighboring countries there was decided to perform overall seismic safety re-evaluation of the ANPP Unit №2 before the restart. To this end, on the basis of the performed overall geophysical and seismological researches in 1995 there was developed a report “Additional study of seismic conditions of the ANPP site”.

On the basis of the research results in the framework of technical cooperation with the IAEA there was developed “Technical guideline for the seismic re-evaluation program of the ANPP Unit №2”. There was recommended a new Review Level Earthquake (RLE) for the ANPP site with the following features:

- A free field surface horizontal peak ground acceleration of 0.35g, which corresponds to the 84th percentile.
- A 50th percentile response spectra shape for rock site, as provided in USA-NUREG/CR-0098.
- Vertical acceleration component equal to 2/3 of horizontal acceleration component.

On the basis of the mentioned guideline there was developed the ANPP Unit №2 seismic re-evaluation program. The program specified the methods, criteria, and procedure for regulation of re-evaluation process and the work schedule.

The Unit №2 seismic safety re-evaluation process includes:

- SSEL development, which necessary for reactor safe shutdown during RLE and keeping in safe shutdown condition during 72 hours after earthquake occurred.
- Evaluation and assessment of seismic capacity of structures, systems and components, included in SSEL.
- Seismic upgrading and strengthening of structures, systems and components included in SSEL, if necessary.

In 2002-2004 the implementation of tasks included in the ANPP Unit №2 seismic re-evaluation program was proceeded. In doing so:

- The scenario and procedure for NPP safe shutdown was developed and agreed;
- The safe shut down equipment list has been developed.

There were also implemented a number of numerical studies intended to fulfill the tasks on seismic response evaluation, including:

- Probabilistic Seismic Hazard Analysis of the site
- ANPP site seismic response analysis
- Evaluation of Floor Response Spectra of main building and redundant diesel generation station to reviewed level earthquake
- Evaluation of main building base soil capacity

The mentioned developments were reviewed by US BNL and IAEA experts. On the basis of experts' recommendations the seismic qualification of the ANPP systems, structures and components were performed.

The implementation of seismic PSA is planned for 2005

The activities on seismic safety reevaluation and the ANPP unit 2 seismic strengthening is planned to complete in 2005.

4.1.3. Evaluation of NPP Impact on Environment and Population

The evaluation of the ANPP impact on environment and population in the ANPP supervised area is performed by the ANRA on the basis of the data from the ANPP monthly and annual reports as well as on the basis of inspections results. The assessment is reflected in the monthly reports and annual reports of the ANRA to the Government of Armenia.

The analysis data of the parameters of radiation releases and discharges from the ANPP demonstrate that the exposure doses of the population critical group from radiation releases and discharges of the ANPP is below 1 $\mu\text{Sv}/\text{year}$ (dose constraint for NPP -0.25 mSv). Hence, the individual risk of stochastic effects rising from radiation impact on population in the ANPP supervised area during normal operation is about 7×10^{-8} in a year which is fifteen times less than the negligible risk level equal to 10^{-6} in a year.

4.2. Design and Construction

The design of the ANPP as well as other first generation NPP-s with WWER-440 was developed in 60-ies according to the rules, regulations and standards enforced at that time.

The ANPP is designed with respect to the defense in depth concept with some deviations. The major deviations are as follows: ineffective localization system, insufficient protection of ECCS against common cause failure.

The safety principle lies in protection against operator errors and is based mainly on organizational activities and directed primarily on prevention of dangerous initiating events.

The safety systems were designed with respect to the single failure principle, but without respect to the common cause failures. The technical measures were undertaken only to ensure the safety during small LOCAs with conventional diameter 32mm. The localization system was designed on the basis of the mentioned above LOCA size. At that they based on the condition that during accidents with the given LOCA size the water level in the reactor would always be above the reactor core level, and water supplied by the emergency pumps would ensure sufficient cooling that excludes significant damage to fuel.

The mentioned safety approaches, lied in the basis of the ANPP design, established the specific technical solutions for the safety important systems. It is necessary to mention also the advantages of the ANPP design accepted by the international experts – existence of significant safety margin between nominal operation level and critical parameters both for fuel and equipment. Reactor V-230 has self-regulating property as a result of which the power fluctuations attenuate prevention of unfavorable consequences.

The unique property of WWER-440 is the significant inventory of primary coolant and cooling water in the steam generators. The relations of coolant inventories and cooling water of the primary circuit to the reactor power exceed more than twice the similar values of other NPPs. It provides with the opportunity in long-term passive cooling of the reactor core.

Taking into account seismic activity of the ANPP site the additional measures were undertaken to ensure seismic resistance of structures, technological and electromechanical equipment and systems. In this connection the reactor was marked V-270.

4.3. NPP Operation

4.3.1. Authorization for NPP Operation

Before the ANPP Unit №2 restart there was performed the safety analysis and developed the commissioning program (point 3.5).

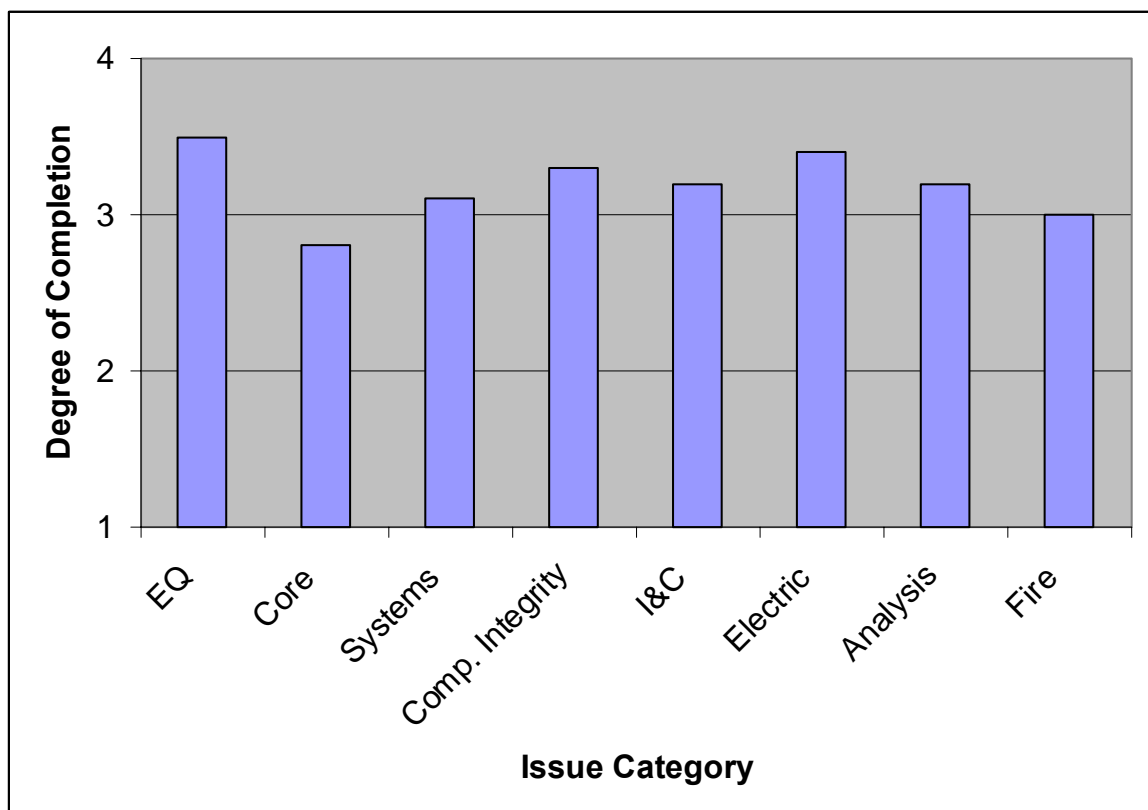
After implementation of restoration works and safety improvement measures of highest priority to safety (Safety Category 4 on TECDOC-640) and inspection of the NPP readiness to the restart in 1995 the ANRA issued authorization on the ANPP restart and operation. The authorization was conditioned by further introduction of the safety improvement measures according to the approved list of technical measures for the ANPP Unit №2 safety improvements for 1998-2004.

In 2003 at the request of the ANRA there was organized the IAEA Design Safety Review Mission with the purpose to evaluate fulfillment of requirements set in the IAEA TECDOC 640 for WWER.

In the period 1993-2003 there were implemented 130 safety upgrading activities at the ANPP aimed at elimination of safety deficiencies. On an average 10-12 essential activities, in regard with safety turn out well annually

In 2003, the IAEA performed a detailed review of the extent to which ANPP has resolved the TECDOC-640 design issues. The status of recommendations on elimination of design safety deficiencies indicated in IAEA TECDOC 640 (Ranking of WWER-440/230 NPP safety issues) IAEA Expert Mission was reviewed at ANPP.

Figure below illustrates the degree to which issues have been resolved.



It is stated in expert conclusions that:

- there is no issue that was not treated by plant at all;
- 18 issues are completely resolved, and all IAEA recommendations are met;
- 38 issues had resolution degree 3 (i.e. IAEA recommendation intent met, but the issue not resolved completely);

- 6 issues had resolution degree 2, i.e. the highlighted issues are under implementation.

In 2003 the safety upgrading programme for 1998-2004 has been revised and a new version of List of Activities for Safety Upgrading was developed and approved by ANRA and Ministry of Energy. In the development of the List the previous experience was considered, and also:

- IAEA TEC DOC-640 “Ranking of WWER-440/230 NPP safety issues” and the result of IAEA mission at ANPP;
- Activities implemented at similar NPPs in RF and Eastern Europe countries;
- International projects on WWER NPPs safety analysis;
- Final Report of IAEA-EBP- WWER-15 on WWER and RBMK NPPs safety programme.

The safety issues were categorized according to the impact on defence-in-depth and correspondingly the implementation priority was specified.

The new List is based on the principle of continuous ANPP safety step-by-step improvement in the following areas:

- (1) primary circuit integrity assurance;
- (2) improvement of safety system reliability;
- (3) improvement of safety important component and system reliability;
- (4) decrease of initiating event occurrence probability;
- (5) improvement of confinement integrity and leak-tightness;
- (6) extension of the design-basis accident spectrum;
- (7) management of the beyond-the-design-basis accidents;
- (8) improvement of operational safety.

The scope of almost all implemented technical activities was revised and additionally new activities were included with implementation schedule up to 2010. The List includes 8 technical and scientific-research activities of priority aimed at the assurance of acceptable safety level and to be implemented by 2010. More detailed information can be found in the Report of the Design Safety Review Service of the Armenian NPP Unit 2 Metsamor, 3 – 14 November 2003. The ANPP Unit 2 modernization plan for 2004-2010 has been reviewed and will be improved on the basis of review and assessment results of the SAR and the PSA level 1.

4.3.2. Safe Operation limits

The safe operation limits and conditions are established in the “Technical Specifications on Operation of the ANPP Unit №2 with WWER-440 (V-270)”.

Before the ANPP Unit №2 restart in 1995 this document was revised with respect to safety analysis and experience of operation both the ANPP and similar NPP-s of other countries, as well as the results of tests performed during the restart.

According to the regulations enforced in the RA “The Technical Specifications on Operation of the ANPP Unit №2 with WWER-440 (V-270)” is regularly revised. .

4.3.3. Compliance of NPP Operation, Technical Maintenance, Inspection and Testing with Approved Technical Specifications

The ANPP Unit №2 is operated according to the approved operational instructions developed on the basis of “Technical Specifications...” and manufacturers’ instructions.

The technical maintenance, inspection and testing of nuclear installation are performed on the approved programs and schedules developed according to the requirements of the regulatory documents.

4.3.4. Regulations Establishing Response Actions in case of Anticipated Events and Accidents During NPP Operation

In accordance with the safety regulations the ANPP developed and received the ANRA's approval for the special emergency instructions that establish actions of the personnel responsible for nuclear installation management during extreme situations at the NPP.

The actions on organization of the NPP personnel protection are specified in "The emergency response plan during nuclear and radiation emergencies at the NPP" (ANPP on-site plan). A new package of emergency procedures is being developed, oriented on events with application of some symptom-oriented elements at state diagnostics. Blanks on operator reaction on signals were developed. Final version of technical specification, analogous by format to those used at western NPPs is prepared. Document on the stage of coordination with design organizations.

4.3.5. Engineering and Technical Support of NPP in all Safety Important Areas

The engineering and technical support to the ANPP in all safety important areas is mainly rendered by Armenian organizations, as well as organizations of Russian Federation, USA, UK, Italy, EC and IAEA .

4.3.6. NPP Event Reports

The existing regulation on investigation and registration of NPP operational events was developed with respect to the recommendations of the IAEA Safety Guide N93 "Systems for Reporting Unusual Events in Nuclear Power Plants" as of 1990 and the IAEA TECDOC-573 "The Analysis of Safety Important Events at NPP (ASSET)" as of 1990. The regulation is mandatory for the operating organization.

The regulation establishes the categories of events during the NPP operation with reporting criteria and mandatory assessment on the INES scale. The regulation establishes also the procedure for the operating organization on submission of reports on events important in terms of safety to the regulatory authority, and also the form and contents of preliminary information and final event report.

4.3.7. Organization of Collection and Analysis of Information on NPP Operational Experience, Application and Transfer of Analysis Results

From 1996 Armenia is a member of the Incident Reporting System (IRS). In the framework of this system the ANRA receives information related to operational experience of different types of reactors, analyses it, makes primary exemption and transfers to the operating organization.

The ANPP nuclear safety and reliability department, as well as radiation protection department are involved in organization of compilation and analysis of information related to the operational experience. The ANPP has a database related to the ANPP operational experience since its commissioning.

The peculiarity of atomic energy in Armenia is the operation of only one NPP. So the study of operational experience is performed through information exchange with foreign operating organizations that have units similar to the ANPP units.

The operating organization is a member to the WANO. It receives documentation related to operational experience of WWER type reactors and also other types of reactors and uses it in its work.

In its turn the regulatory authority and operating organization transfer to the IRS and WANO the information related to the ANPP operational experience.

4.3.8. Optimization of Radioactive Waste Management, Conditioning and Disposal at NPP

The measures on optimization of radioactive waste management, conditioning and disposal were implemented throughout the whole period of the ANPP operation. In particular, at the NPP there is a deep evaporation facility to minimize the volume of medium level radioactive wastes. The compactor of solid low-level radioactive wastes was installed at the ANPP in 2000. The issues related to conditioning and final disposal of all radioactive wastes stored at the ANPP will be considered in the framework of NPP decommissioning program.

LIST OF LEGSLATIVE AND REGULATORY DOCUMENTS

International Treaties of the RA

1. Treaty on the Non-Proliferation of Nuclear Weapons. Ratified on 24.09.1991.
2. Convention on Early Notification about Nuclear Accident. Ratified on 22.06.1993.
3. Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency. Ratified on 22.06.1993.
4. Vienna Convention on Civil Liability for Nuclear Damage. Ratified on 22.06.1993.
5. Convention on Physical Protection of a Nuclear Material. Ratified on 22.06.1993.
6. CTBT Comprehensive Nuclear-Test-Ban Treaty". Signed 01.10.1996.
7. Agreement between the Republic Armenia and the International Atomic Energy Agency for the Application of Safeguards in connection with Treaty on the Non-Proliferation of Nuclear Weapon", signed on 23.09.1993.
8. Convention on Nuclear Safety. Ratified on 24.09.1997.
9. Protocol Additional to the Agreement between the Republic Armenia and the International Atomic Energy Agency for the Application of Safeguards in connection with Treaty on the Non-Proliferation of Nuclear Weapon". Ratified and enforced on 28 June 2004
10. Revised Supplementary Agreement Concerning the provision of Technical Assistance by the IAEA to the Government of the RA. Ratified 04 June 2003

Legislative Acts

1. Law of the Republic of Armenia on supplements and amendments to the Code of the RA on administrative offences, the Criminal Code of the Republic of Armenia and in the Criminal Procedural Code of the RA". (Law on sanctions at breach of the requirements of laws, safety rules and regulations in the field of atomic energy utilization) (5.12.1996).
2. Law of the Republic of Armenia "Safe Utilization of Atomic Energy for Peaceful Purposes" (01.03.1999) with supplements as of 18.04.2000.
3. Law of the Republic of Armenia on "Licensing" (27.06.2001).

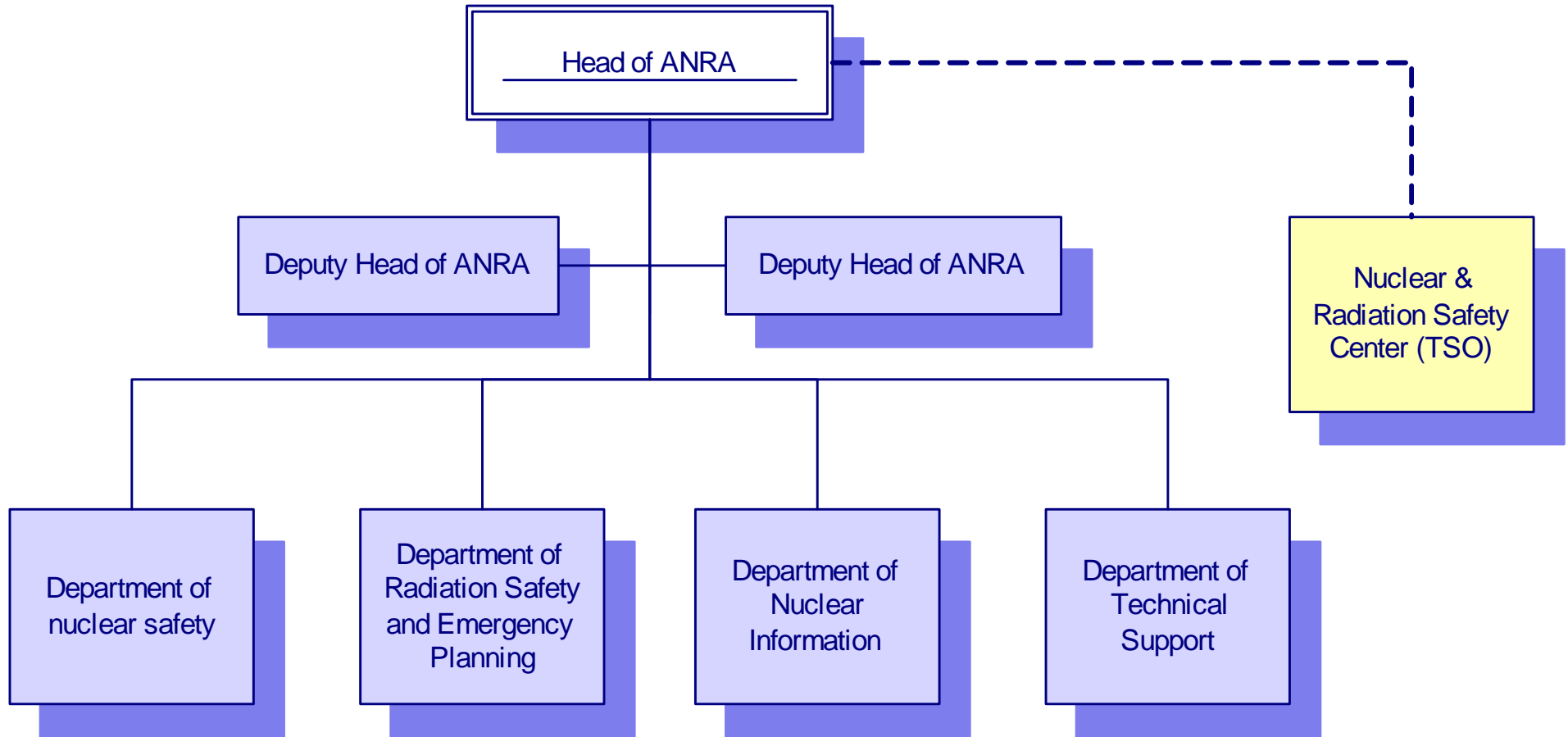
Decrees of the Government of the Republic Armenia

1. Decree of the Government of the Republic Armenia №573 as of 16.11.1993 on the Armenian Nuclear Regulatory Authority (establishment of the regulatory authority)
2. Decree of the Government of the Republic Armenia №389 as of 22.08.1994 on NPP safety rules and regulations (application of regulations of Russian Federation in Armenia)
3. Decree of the Government of the Republic Armenia №465 as of 19.07.1999 on approval of the list of atomic energy utilization objects important in terms of safety.
4. Decree of the Government of the Republic Armenia №768 as of 22.12.1999 on approval of the list of activities and positions important in terms of safety.
5. Decree of the Government of the Republic Armenia №70 as of 19.02.2000 on the Armenian Nuclear Regulatory Authority (acknowledgment of the ANRA as the regulatory authority pursuant to the Law of the Republic of Armenia "Safe Utilization of Atomic Energy for Peaceful Purposes").
6. Decree №385 as of 22 June 2000 issued by Prime Minister of the Republic Armenia on approval of the ANRA Statute.
7. Decree of the Government of the Republic Armenia №342 as of 25.04.2001 on establishment of the Scientific and Technical Center on Nuclear and Radiation Safety, CJS.

8. Decree of the Government of the Republic of Armenia №452 as of 24.05.2001 on resting the responsibilities for regulation of safety of ionizing radiation sources and protection against ionizing radiation in the Republic of Armenia to the ANRA.
9. Decree of the Government of the Republic Armenia №640 as of 12.07.2001 on approval of procedure for organization and conduct of safety expertise in the field of atomic energy utilization.

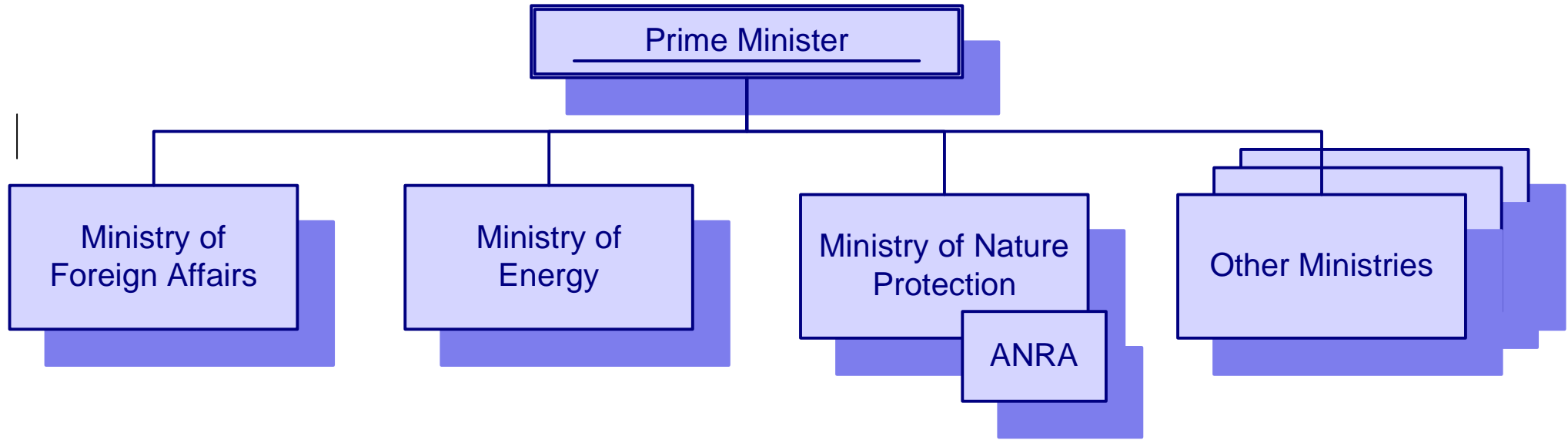
ANNEX 3

ANRA ORGANIZATIONAL STRUCTURE



ANNEX 4

ANRA STATUS WITHIN THE GOVERNMENT OF THE RA



ANNEX

List of Abbreviations

ALARA	As Low As Reasonably Achievable
ANPP	Armenian Nuclear Power Plant
ANRA	Armenian Nuclear Regulatory Authority
ASSET	Assessment of Safety Significant Events Team
CJS Company	Closed Joint Stock Company
DBA	Design Based Accident
DG	Diesel Generator
DSC	Dry Shield Canister
DSFS	Dry Spent Fuel Storage Facility
EC	European Commission
ECCS	Emergency Core Cooling System
EMA	Emergency Management Administration
HSM	Horizontal Storage Module
IAEA	International Atomic Energy Agency
INES	International Nuclear Events Scale
NII	Nuclear Installations Inspectorate
I&C	Instrumentation and Control
IRS	Incident Reporting System
LBB	Leak Before Break
LOCA	Loss of Coolant Accident
MCP	Main Circulation Pump
MCR	Main Control Room
MDE	Maximal Design Earthquake
MSIV	Main Steam Isolation Valves
NDT	Non-Destructive Testing
NIAEP	“Atomenergoproekt” Scientific-Research and Design- Construction Institute of Nizhni Novgorod
PSA	Probabilistic Safety Assessment
POKAS	Quality Assurance Program for WWER NPP
RLE	Review Level Earthquake
SAR	Safety Analysis Report
SG SV	Steam Generator Safety Valve