

REPUBLIC OF ARMENIA



CONVENTION ON NUCLEAR SAFETY

6th NATIONAL REPORT

August 2013

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INTRODUCTION

The sixth National Report of the Republic of Armenia (RA) provides an overview on implementation of the obligations undertaken under the Convention on Nuclear Safety.

The national nuclear program of the RA is concentrated on strengthening the legal and regulatory infrastructure on nuclear and radiation safety in the atomic energy utilization field, continuous safety improvement of the Armenian Nuclear Power Plant (the Armenian NPP) and development of efforts to ensure the country's energy security and independence.

The report has been prepared in accordance with the Guidelines regarding the National Reports under the Convention on Nuclear Safety.

SUMMARY

The RA ratified the Convention on Nuclear Safety on 24 September 1997.

This report addresses changes in the national legislation, describes practices, challenges and issues related to the nuclear safety the licensing system, as well as demonstrates the efforts of the RA put to improve the nuclear safety by enhancing the national arrangements and international cooperation to meet the obligations under the Convention on Nuclear Safety.

The RA operates one nuclear power plant – the Armenian NPP Unit № 2, which is operated in accordance with the license issued by the Armenian Nuclear Regulatory Authority (ANRA). The Armenian NPP provides in average 45 % of the electricity consumed in the country and is a very important component of the national economy, ensuring the energy security of the country. The safety level of the Armenian NPP is continuously improved through implementation of the safety upgrades as specified in the List of the Armenian NPP Safety Upgrading Measures. Following the accident at the Fukushima Daiichi NPP the interest of the public, media and the Government of the RA on issues related to nuclear safety has significantly increased. In particular, the RA Government requested the ANRA and the Armenian NPP to increase efforts on nuclear safety and emergency preparedness and to join the EU initiative related to conduct of stress tests. So, the national report on stress test of the Armenian NPP will be submitted to the EC by the end of 2013. More detailed information is provided in the National Report of the RA prepared for the Second CNS Extraordinary Meeting (August 2012).

In 2005 the Government of the RA approved the “Energy Development Strategy in the Context of Economic Development of the Republic of Armenia”. The document outlines the Government's intention to construct nuclear power plant unit(s) aimed to strengthen the country's energy independence and energy security. The decision has been made to construct 1060MWe AES-92 unit with a service life 60 years.

Though, the Government of the RA decided to initiate the construction of a new nuclear power unit(s), at the same time it undertakes necessary actions to keep the Armenian NPP Unit № 2 operational for an extended lifetime. Thus, on 19 April 2012 the Government of the RA adopted a decree №461-N on design lifetime extension of the Armenian NPP. There have been identified a number of actions to be undertaken, in particular development of the Armenian NPP long-term operation program. Following the decree the ANRA has established the requirements to the design lifetime extension of the Armenian NPP.

This national report addresses all aspects related to fulfillment of the obligations under the Convention on Nuclear Safety, as well as the issues raised during the fifth review meeting.

1. GENERAL PROVISIONS

1.1. EXISTING NUCLEAR INSTALLATIONS

Article 6. Existing Nuclear Installations

Each contracting party shall take appropriate steps to ensure that the safety of nuclear installations at the time the Convention enters into force for that contracting party is reviewed as soon as possible. When necessary in respect to the Convention, the contracting party shall ensure that all reasonably practicable improvements are urgently made to upgrade the safety of the nuclear installation. If such upgrading cannot be achieved, plans should be outlined to shut down the nuclear installation as soon as practically possible. The timing of the shutdown may take into account the general situation in energy production and potential alternatives, as well as the social, environmental and economic consequences.

There is only one nuclear installation in the RA covered under the Convention on Nuclear Safety - the Armenian Nuclear Power Plant (Armenian NPP). The construction of the Armenian NPP was started in 1969. The Armenian NPP design is based on the first generation of V-230 reactor and takes into account the seismic specifics of the plant site. The Armenian NPP consists of two WWER-440 type units, designated as version V-270. The Unit № 1 was commissioned in December 1976, and the Unit №2 - in January 1980. The installed capacity of each unit is 407,5 MWt, and the design lifetime is 30 years. The Armenian NPP was shutdown shortly after the Spitak earthquake of 7 December 1988, with its epicenter located 80 km north of the plant site. Though the plant didn't suffer any damage, and both units of the Armenian NPP remained in operation, the USSR Board of Ministers adopted decree to shutdown the plant. Thus, the Unit №1 was shutdown on 25.02.1989 and the Unit №2 was shutdown on 18.03.89. Both units were in long-term shutdown condition, but not decommissioned. To overcome the energy crisis on 07.04.93 the RA Government adopted decree to restart the Armenian NPP Unit №2. Before and after the Armenian NPP Unit №2 restart, several hundred safety upgrades were developed and implemented and are continuously implemented in accordance with the RA Government Decree № 474 as of 05.10.1994 on approval of the Concept for the Armenian NPP Restart and the List of the Armenian NPP Unit №2 safety upgrading measures, which is periodically revised and updated taking into account operation experience of the Armenian NPP and other countries operating similar NPPs, new IAEA safety standards, recommendations made by the expert and review missions organized in frame of the international and technical cooperation projects with the IAEA, EC and other countries and international organizations.

The Armenian NPP with the IAEA support completed the Project on development of the Comprehensive Safety Upgrading Programme of the Armenian NPP taking the results of the SAR, PSA and additional safety analyses with regard to the safety goals and criteria agreed with the ANRA and including LOCA-200 as design basis accident. The goal of the Comprehensive Safety Upgrading Programme was to address safety issues identified at the Armenian NPP by several IAEA missions and provide solution for the unresolved issues with high ranking.

The following safety related measures have been performed in the reporting period covering 2010-2013:

- Installation of a new neutron flux monitoring system "Impulse";
- Installation of a new system for automatic monitoring of boron solution concentration;
- Installation of new filters for SG compartment sump protection from clogging;
- Modernization of the Armenian NPP radiation protection system;
- Reconstruction of refueling machine;
- Activities aimed at increasing MCR-2 habitability: improvement of MCR conditioning, filtration and air cleaning system, MCR radiation system improvement by installing emergency filtration system for the cases of radioactive releases into atmosphere (adjustment activities will be completed in the first half of 2013);

- Installation of supports and dampers on high energy pipelines at elevation 14.7 based on implementation of the systems and components seismic qualification program.

Within the same period the following measures were implemented:

- Activities aimed at safety important equipment harsh environmental qualification;
- Activities aimed at implementation of Emergency Shutdown Panel (ESP) and Post-Accident Monitoring System (PAMS), ESB and PAMS boards have been installed, 70% of cables were laid,
- 50% of overall scope of activities within the framework of “Modernization of Unit №2 reactor facility protection and interlocks” project: separation of the safety systems protection and interlocks channels, replacement of cable penetrations in I&C sensors room in the confinement by the hermetic ones.

Under the leadership of the IAEA's Division of Nuclear Installation Safety, the OSART team performed an operational safety review of the Armenian NPP in May-June 2011. The mission experts identified 7 good practises and made 14 recommendations and 12 suggestions, the implementation of which was reviewed by the OSART follow-up mission in June 2013.

2. ESTABLISHING AND MAINTAINING LEGISLATIVE AND REGULATORY FRAMEWORK

Article 7. Legislative and Regulatory Framework

- 1. Each contracting party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations.*
- 2. The legislative and regulatory framework shall provide for:*
 - (i) the establishment of applicable national safety requirements and regulations;*
 - (ii) a system of licensing with regard to nuclear installations and the prohibition of the operation of a nuclear installation without a licence;*
 - (iii) a system of regulatory inspection and assessment of nuclear installations to ascertain compliance with applicable regulations and the terms of licences;*
 - (iv) the enforcement of applicable regulations and of the terms of licences, including suspension, modification or revocation.*

The overview of the legislative and regulatory framework to govern the safety of nuclear installations in the Republic of Armenia is provided in the 5th national report.

2.2. LEGISLATIVE AND REGULATORY FRAMEWORK OF THE REPUBLIC OF ARMENIA

2.2.1. National Safety Requirements and Regulations

The overview of the process of establishing and revising the national safety requirements and regulations is provided in the 5th national report of the Republic of Armenia.

The following legal acts were adopted in the reporting period:

- The Republic of Armenia ratified the Amendment to the Convention on Physical Protection of Nuclear Material signed on 8 July 2005 (Decision 058-N adopted by the National Assembly as of 18 March 2013 and the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Decision 050-N adopted by the National Assembly as of 21 March 2013).
- The draft law of the RA on amendments and supplements in the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes passed the first reading at the National

Assembly of the RA. The draft Law establishes provisions on accounting for and control of nuclear materials, requirements to accounting of nuclear materials at the nuclear facilities and locations outside the facilities on the levels of state and operator, exemption and termination of safeguards, submission of accounting reports and other issues related to the safeguards implementation.

- The RA Government Decree №1344-N adopted on 10 October 2010 on approval of amendments to the Government Decree № 609-N as of 12.05. 2005 on approval of the licensing procedure and licence form for site selection of nuclear installations and the Government Decree № 649-N as of 12.05. 2005 on approval of the licensing procedure and licence form for construction of nuclear installations. The amendments and supplements establish new safety approaches to licensing of site selection and construction of new nuclear installations to ensure the compliance with the IAEA safety standards on site selection and construction of nuclear installations.
- The RA Government Decree №1552-N adopted on 25 November 2010 on approval of amendments to the Government Decree № 1219-N as of 18.08.2006 on approval of radiation safety norms and the Government Decree № 1489-N as of 18.08.2006 on approval of radiation safety rules. The amendments and supplements stipulate new approaches and indicators the application of which will ensure strengthening the radiation safety of personnel, population and environment.
- Government Protocol Decision №43 as of 04.11.2010 on approval of the concept on radioactive waste and spent fuel safe management in the RA.
- RA Government Decree №1611-N adopted on 17 November 2011 on amendments and supplements to the Government Decree № 400-N as of 24.03. 2005 on approval of the licensing procedure and licence form for operation of nuclear installations. The amendments established new requirements and conditions to operation license submittals to ensure the NPP safe operation.
- Government Decree № 418-N as of 05.04.2012 on approval of procedure on investigation of NPP operational events.
- Government Decree № 461-N as of 19.04.2012 on approval of extension of design lifetime of Armenian NPP Unit No2.
- Government Decree № 1085-N as of 23.08.2012 on approval of the requirements to extension of design lifetime for Armenian NPP Unit No2 operation.
- Government Decree № 1411-N as of 08.11.2012 on approval of Design Safety Requirements to New NPP Unit(s).
- Government Decree № 1546-N as of 13.12.2012 on approval of Method on Seismic Hazard Assessment for New NPP Site.
- Government Decree № 708-N as of 04.07.2013 on approval of Site Safety Requirements to New NPP Unit(s).
- Government Decree № 709-N as of 04.07.2013 on approval of List of Internal Legal Acts Applied in Atomic Energy Utilization Field in Russian and in English.

The complete list of the legal acts enforced in the RA is provided in the Annex 2.

Ministerial Acts

- “Requirements to content and form of program on decommissioning of nuclear installations” approved under the order N 219-N issued by the ANRA Chairman on 29 August 2011 (registered by the Ministry of Justice of RA 27 September 2011 under the state registration № 12511432).

- “Requirements to format and content of environmental radiation monitoring system of nuclear energy utilization installation” approved under the order N 134-N issued by the ANRA Chairman on 16 May 2012 (registered by the Ministry of Justice of RA on 31 May 2012 under the state registration № 12512230 as of).
- “Requirements to format and content of occupational exposure personal cards” approved under the order N 47-N issued by the ANRA Chairman on 5 March 2013 (registered by the Ministry of Justice of RA on 25 March 2013 under the state registration № 12513109).

The complete list of ministerial acts is provided in the Annex 3.

2.2.2. System of Licensing

The overview of the licensing system, covering the procedure of licensing different types of practices in nuclear energy field, provisions for license termination, revocation and extension, involvement of public and concerned parties is provided in the 5th National Report of the Republic of Armenia.

2.2.3. System of Regulatory Inspection and Assessment

The information required under this Article is provided in the 5th national report.

2.2.4. Enforcement of Applicable Regulations and Terms of Licences

Overview of power of legal actions, enforcement measures of the regulatory authority and other information required under this article is provided in the 5th national report of the RA.

2.3 REGULATORY AUTHORITY

Article 8. Regulatory Body

- 1. Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.*
- 2. Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.*

2.3.1 Establishment of the Regulatory Body

The information required under this article is provided in the in the 5th national report of the RA.

2.3.2 Status of the Regulatory Body

The information required under this article is provided in the 5th national report of the RA.

2.4 RESPONSIBILITY OF LICENCE HOLDER

Article 9. Responsibility of the Licence Holder

Each Contracting Party shall ensure that prime responsibility for the safety of a nuclear installation rests with the holder of the relevant licence and shall take the appropriate steps to ensure that each such licence holder meets its responsibility.

The information required under this article is provided in the in the 5th national report of the RA.

3. GENERAL SAFETY CONSIDERATIONS

3.1 PRIORITY TO SAFETY

Article 10 Priority to Safety

Each Contracting Party shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

In accordance with the Article 5 of the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes, the RA shall implement such a policy in the atomic energy utilization field where priority is given to safety. In accordance with the Article 19, paragraph 2 of the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes and the Statute of the Armenian NPP the prime responsibility for safe operation of the Armenian NPP rests with the operating organization.

Realizing the role and responsibility of the operating organization for safety, in 2004 the Armenian NPP management adopted the declaration on safety policy and quality, where the priority to safety is expressed as follows: “The highest priority of our activity, dominating even the factor of production itself, is the safety of the Armenian NPP and the personnel...”

To enhance the safety culture the Armenian NPP periodically performs self-assessments of the safety culture and the safety management system. Such self-assessments are performed once in three years in accordance with the approved guideline on self-assessment. The guideline specifies the procedure on organization and performance of self-assessments and their frequency. The guideline contains description of the assessment model and indicators/criteria according to which the assessment is to be performed. In addition to the guideline, methodologies of performing assessment are developed and the self-assessment team members are relevantly trained before starting the assessment.

The assessment model is based the elements of the safety management system described in INSAG-13 (INSAG-13 “Management of Operational Safety in Nuclear Power Plants”), which allows to identify weaknesses of the safety management system. In its turn, the total number of indicators/criteria of the assessment exceeds 150 and includes the indicators proposed in INSAG-4 “Safety Culture” and INSAG-15 “Key Practical Issues in Strengthening Safety Culture”, in Safety Reports Series No. 11 “Developing Safety Culture in Nuclear Activities” and Safety Reports Series No. 42 “Safety Culture in the Maintenance of Nuclear Power Plants” and in IAEA TECDOC-1141 “Operational Safety Performance Indicators for Nuclear Power Plants”, the WANO indicators, indicators used in Great Britain, Canada and other countries, as well as own specific indicators. Such a set of indicators enables to get a snap – shot of the safety culture and to define measures on further improvement of the safety culture. The results of these self–assessments make basis for “Operational Safety Enhancement Program” of the Armenian NPP.

The Nuclear Energy Safety Council under the President of the Republic of Armenia has been established to advice on strengthening of the Armenian NPP safety.

More detailed information is provided in the 5th national report of the Republic of Armenia.

Within the period 2010-2011 the Armenian NPP developed the guidelines intended for safety monitoring and self assessment, in particular:

- Guideline on “Periodic internal safety reviews and analyses”,
- Guideline on “Self-Assessment of Safety and Reliability Management”,
- Guideline on “Internal Commission Review of Armenian NPP Nuclear Safety Condition”,
- Guideline on “Structure and Content of Annual Report on Assessment of Condition of Armenian NPP Unit №2 Operational Safety”.

In accordance with the requirements of the Guideline on “Periodic internal safety reviews and analyses”, review of “Safety Analysis Report of the Armenian NPP Unit №2” has been initiated. The review is envisaged to be completed within this year.

In accordance with the requirements of the Guideline on “Self-Assessment of Safety and Reliability Management”, the self-assessment schedule covering 15 safety-related areas has been developed by the Armenian NPP.

Activities on self-assessment have been performed since 2010. For implementation of the guideline on “Review of Armenian NPP Nuclear Safety Condition by the Internal Commission”, the program of nuclear safety condition review is being developed (is at stage of agreement) by the internal commission. The review is envisaged to be performed in IV quarter of 2013.

With respect to the Guideline on “Structure and Content of Annual Report on Assessment of Condition of Armenian NPP Unit №2 Operational Safety” activities have performed since 2010. The annual reports are submitted to the ANRA. The proposed measures aimed at elimination of specified deficiencies that are assigned to respective departments following the order issued by the General Director of the Armenian NPP to ensure their implementation within specified dates and under personal responsibility of the Armenian NPP managers.

At the request of the Government of the RA, an IAEA Operational Safety Review Team (OSART) of international experts visited Armenian NPP from 16 May to 2 June 2011. The purpose of the mission was to review operating practices in the areas of Management organization and administration; Training and qualification; Operations; Maintenance; Technical support; Operating Experience Feedback, Radiation protection; and Preparedness for Transition from Operations to Decommissioning. In addition, an exchange of technical experience and knowledge took place between the experts and their plant counterparts on how the common goal of excellence in operational safety could be further pursued.

The IAEA OSART Follow-up team visited Armenian NPP from 2 to 7 June 2013. Of the 26 issues identified at the OSART mission, it was evaluated by the follow-up team that 3 of these issues have been resolved, 19 issues have made satisfactory progress to date and there were 4 issues, where insufficient progress has been made. The follow-up team concluded that the plant made a significant effort to resolve the issues identified in 2011.

As it has been mentioned above the list of safety upgrading measures for the Armenian NPP Unit №2 is regularly reviewed with regard to the measures implemented and the recommendations made.

For detailed information please refer to the 5th national report of the Republic of Armenia.

3.2 FINANCIAL AND HUMAN RESOURCES

Article 11 Financial and human resources

- 1. Each Contracting Party shall take the appropriate steps to ensure that adequate financial resources are available to support the safety of each nuclear installation throughout its life.***

2. *Each Contracting Party shall take the appropriate steps to ensure that sufficient numbers of qualified staff with appropriate education, training and retraining are available for all safety-related activities in or for each nuclear installation, throughout its life.*

3.2.1 Financial Resources

In accordance with the Article 19¹ of the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes the operating organization from consumption of energy (services rendered) shall allocate financial resources for nuclear, radiation, and technical safety, fire protection, physical protection, nuclear material account and control, implementation of safety upgrades, scientific and technical support, as well as securities needed for storage of spent nuclear fuel and for decommissioning. Financial securities for decommissioning of nuclear installations are accumulated on a special account of the Ministry of Finance and Economy of the RA. The use of these financial means in other purposes is prohibited. the RA Government adopted decree №1637-N as of 12 October 2006 on opening a special account for decommissioning of the Armenian NPP that establishes the procedure of servicing and transfer of amounts to the account and reporting.

The safety upgrades are financed also from the own resources of Armenia, as well as under EC, RF, Czech Republic and US DOE assistance programs.

3.2.2. Human Resources

Selection, training, examination and permit to work for Armenian NPP personnel is arranged in compliance with “Administrative Control Program. Armenian NPP personnel development”.

The Armenian NPP has established internal procedures addressing staff selection, training, probation and qualification based on the relevant IAEA documents.

The list of positions implementing safety important activities have established by the Government of the RA. Qualification of persons holding position included into this list is verified in compliance with procedure established by the ANRA.

In frame of the IAEA and US DOE Projects on providing assistance to the Armenian NPP, activities on implementation of systematic approach to training (SAT) are being performed, and for this purpose guidelines, regulations and procedures were developed and implemented. These documents regulate methods of developing training materials and conduct of training.

Analysis of requirements to knowledge and training is based on the method of analyzing specifics of work and tasks of certain positions and of the Armenian NPP on the whole.

Training and maintaining qualification of the Armenian NPP personnel are conducted in accordance with the approved standard and individual programs which specify types of training and sequence, as well as simulator training are specified (the need for simulator training is established in the training program).

The staff centralized general training, theoretical training during primary training, maintaining qualification and training on simulator are conducted in the Training Center of the Armenian NPP.

From 2001 the Armenian NPP uses multifunctional simulator to train and maintain qualification of the MCR operating staff.

The process modes simulated on multifunctional simulator correspond to operating modes of the Armenian NPP Unit №2. The scope of the Armenian NPP operation modes simulated on MFS enables to ensure MCR staff training and qualification maintaining.

In case of modifications of the Armenian NPP Unit №2 (implementation of new equipment) during annual outage and refueling and etc., the similar changes are made also to the multifunctional simulator in order to bring it in line with the Armenian NPP Unit №2 configuration.

At present a full-scope simulator from Bohunice NPP (Slovakia) is installed at the Armenian NPP with adaptation to the operating Armenian NPP Unit №2 (reactor part).

Under the US DOE support activities, the development of the emergency operating procedures, severe accident management guidelines are initiated and performed with their further validation on multifunctional simulator and full-scope simulator (after putting full-scope simulator into operation). Appropriate training is being performed by the experts of US DOE group with the Armenian NPP and contractor personnel involved in the mentioned activities.

According to the work plan on improvement of the Armenian NPP personnel training system and under the US DOE and the IAEA assistance projects, regular training (theoretical part) activities for maintenance personnel and engineering technical personnel are initiated in the NPP training center. The practical training of the mentioned personnel is performed in the work places of the structural departments.

The training programmes are periodically revised and corrected taking into account training analysis, feedback of departments, comments and suggestions of trainees .

“Self-assessment of personnel training system efficiency” and “Needs analysis for personnel training system improvement” have been performed at the Armenian NPP. According to the results of activities performed, the appropriate recommendations and action plans for their implementation were developed, including the training programme improvement.

Information of the IAEA, WANO, Armenian NPP and other information systems in relation to operational events is carefully studied and covered in the training programs of the Armenian NPP personnel.

Training of the relevant Armenian NPP personnel on equipment and system modernization also on activities performed during outages, is carried out.

The sufficiency of the Armenian NPP personnel is established by the standard number and the staff list (to be approved by the Board of Directors) taking into account the scope and complexity of the servicing equipment that ensure plant safe operation, as well as by the regular leaves provided to employees and the time allocated to training. For positions important from the point of view of safety the method of personnel number redundancy is additionally applied.

Nuclear safety related activities are performed by the Armenian NPP personnel authorized to perform these types of activities. Specific activities related to nuclear safety are performed by organizations involved in implementation of nuclear safety related practices and having certificates accepted by the ANRA. All activities are performed by the trained personnel according to the developed and approved procedures.

Qualification of contractor personnel is examined before the contract is concluded according to the service purchase procedure.

The Armenian NPP is not responsible for the contractor personnel training. But the contractors' personnel, if needed, participate in workshops or training courses conducted at the Armenian NPP in order to perform certain activities at the Armenian NPP in the established order.

The ANRA carries out inspections on sufficiency of human resources at the Armenian NPP in accordance with the inspection program.

Based on the inspections results ANRA develops the enforcement report indicating the results of inspection, identified deficiencies and the date of their elimination and transmits it to the Armenian NPP.

The Armenian NPP in the established order informs the ANRA about measures undertaken to eliminate deficiencies identified.

3.3 HUMAN FACTORS

Article 12. Human Factors

Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

The information required under this article is provided in the 5th national report of the Republic of Armenia.

All activities on the safety systems are implemented in accordance with the programs approved by the Chief Engineer of the Armenian NPP.

Functions connected with human and organizational factors management in the operating organization are distributed among the divisions. In particular, aspects concerned with investigation and analysis of event connected with human and organizational factors are assigned to the Operating Experience Department, aspects connected with organizational factor management are assigned to the Quality Assurance Department, training aspects and activity motivation are assigned to the Training Center, and aspects connected with “man-machine” interface are assigned to the Engineering Support Department.

The whole activity in the above mentioned areas is aimed at improvement of the procedures taking into consideration human factor, improvement of issues concerned with ergonomics and “man-machine” interface and improvement of personnel activity with application of different means for error reduction on the level of executor, manager and organization.

Analysis of the events connected with human activity and organizational factors, shows the following main typical causes of errors:

- Incorrect, non-appropriate implementation of technological operations (errors at making switches);
- Uncoordinated actions;
- Departure from work programs, procedures and other documents;
- Poor maintenance, violation of maintenance technology;
- Poor assembling (unreliable tightening, reduction of detachable parts, sealings);
- Deficiencies in information exchange and records keeping on the work results.

The self-assessment program that covers various levels of organization is implemented for assessment of managerial and organizational issues at the Armenian NPP.

The program envisages implementation of regular self- assessments on:

- Corporate level;
- Level of separate areas of activity;
- Level of structural divisions;
- Individual level of personnel.

The purpose of self-assessments on different levels is to determine the effectiveness of the management system on the given level, to detect deficiencies connected with managerial and organizational issues, as well as to comply with requirements of the international standards and good practice.

The standard guideline was developed on organization and performance of self-assessments to ensure the structural approach at self-assessments in different areas of activities and in different divisions. By now, self-assessments of the personnel training system, maintenance and repair,

radiation safety and of the activity of the maintenance planning and implementation department have been performed.

The ANRA implements the regulatory control over human factor and associated organizational measures of the operating organization through inspections. In case of events important to safety the ANRA within its jurisdictions when necessary conducts independent investigation, detects root causes of personnel errors, impose enforcement actions.

At review and granting permission on modification the ANRA verifies availability of systematic ergonomic analysis of this modification from the point of view of safety, reliability and usefulness for the Armenian NPP, and also preparedness of the personnel to operate under new conditions. –

3.4 QUALITY ASSURANCE

Article 13 Quality Assurance

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

The information required under this article is provided in the 5th national report of the Republic of Armenia.

3.5. ASSESSMENT AND VERIFICATION OF SAFETY

Article 14 Assessment and Verification of Safety

Each Contracting Party shall take the appropriate steps to ensure that:

- (i) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating experience and significant new safety information, and reviewed under the authority of the regulatory body;*
- (ii) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.*

3.5.1 Assessment of Safety

The Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes establishes, in particular:

- Commitments and responsibilities of the operating organization to submit to the regulatory authority the annual reports on current safety state of the unit and its compliance with the existing in the RA rules and standards;
- Commitments and responsibilities of the operating organizations to submit periodical safety assessments and analysis on safety state of the unit with respect to its compliance with the newly adopted regulatory rules and standards.

The Law of the RA on Licensing establishes types of practices subject to licensing in the atomic energy utilization field. The licensing procedures establishing rights, responsibilities, order, content and form of application documents supporting documents for obtaining a license for a specific practice (see Annex 2) have been adopted under the RA Government decrees.

At present in accordance with the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes and the legal acts the NPP licensing consists of 5 stages:

- Site selection;
- Design;
- Construction;
- Operation;
- Decommissioning.

On the stage of licensing of site selection in accordance with the RA Government Decree № 609-N as of 12.05.2005 the operating organization among the others should submit the following documentation in support to the licence application:

- General description of the design of the facility to be constructed on the particular site;
- The quality assurance program of the site selection for the facility;
- Results of public hearing in relation to site selection for the facility.

On the stage of licensing of NPP construction in accordance with the RA Government Decree № 649-N as of 12.05.2005 the operating organization among the others should submit the following documentation in support to the licence application:

- Preliminary safety analysis report;
- NPP environmental impact assessment report and conclusion;
- PSA Report;
- Results of public hearing.

On the stage of licensing of NPP operation in accordance with the RA Government Decree № 400-N as of 24.03.2005 the operating organization should among the others submit the following documentation in support to the licence application:

- Final safety analysis report;
- PSA report;
- Safety systems classification;
- Emergency response plan;
- Technological specification and instruction on NPP systems operation;
- Plan of fire protection measures.

On the stage of licensing of NPP decommissioning the RA Government Decree № 707-N as of 01.06.2005 the operating organization should among the others submit the following documentation in support to the licence application:

- Decommissioning program;
- Safety analysis report at NPP decommissioning;
- Program on management of radioactive wastes generated during operation;
- Plan on emergency response at decommissioning.

In connection with the RA Government Decree on construction of new NPP unit(s) in the RA, measures are undertaken for updating the above mentioned regulations and guides with the purpose to harmonize it with the modern approaches applied in this area. In particular, detailed requirements to assessment of NPP site and the requirements to NPP design have been developed and enforced.

After adoption of the Government decree on NPP restart in 1993, a comprehensive safety review with involvement of foreign and Armenian experts, was initiated aimed at identifying design and operational weaknesses. New set of deterministic analyses were performed. Experts from the IAEA

and organizations of EC and USA participated in engineering assessment for detection of deficiencies in the design safety of the Armenian NPP unit № 2. Based on the assessment results the program of measures aimed at improving the Armenian NPP Unit №2 safety, reliability and safety culture was developed for elimination of deficiencies by priorities in the below mentioned sequence:

- 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 program was approved by the Ministry of Energy of the RA and agreed with the ANRA.

The ANRA established requirements to contents and format of the Armenian NPP Unit №2 SAR enforced under the RA Government Decree № 2013-N as of 21.11.2001. In accordance with the mentioned decree the Armenian NPP developed the safety analysis report. The activities were implemented in close cooperation with the national laboratories of the USA (Argonne National Laboratory) in frame of US DOE assistance projects. The US DOE assistance consisted of training and retraining of the specialist for establishment of the analytical group, collection of information, establishment of database for SAR development, analysis of systems and so on.

In the period 2004-2006 the specialists of the NRSC and Armenian NPP developed the new revision of improved and the detailed model of the PSA in accordance with the international standards (based on the IAEA and US NRC documents). The scope of current PSA model includes:

- Internal initiating events;
- Regimes with both turbines in operation;
- Reactor core damage is considered as undesired event.

Afterwards the seismic hazard was also integrated in the 2-nd iteration PSA model.

In 2007 the IAEA IPSART mission and Risk Engineering company (Bulgaria) conducted expertise of the internal initiating events PSA model. Also the internal PSA review was made by the NRSC.

Recent activities in this field were aimed to resolve comments raised by external (IPSART + Risk Engineering) and internal (NRSC) reviews. All mentioned comments have been addressed in 3rd iteration of PSA model and corresponding documentation.

The PSA has been reviewed with support the ANL experts in frame of technical assistance provided by the US DOE. The PSA is brought in compliance with the situation for the end of 2012. The model incorporates capabilities for transition to the PSA Level 2. The detailed analysis of all human errors probability factors have been performed to include risk-informed decision making in the model. Additional thermal hydraulic calculations have been performed with the purpose to calculate the success criteria. The PSA review has been completed and transmitted for expertise of the NRSC. In accordance with the calculation the core damage frequency factor is $5.33 \cdot 10^{-5}$ 1/year (before the review the core damage frequency factor was $7.58 \cdot 10^{-5}$ 1/year). Contributions to the core damage from different initiating events became more realistic which allows application of the PSA for the risk-informed decision making.

Development of the PSA at hot zero power operation and in shut down condition has been initiated. Approximately 20% of the work has been performed. The PSA for the unit operation at hot zero power and in shutdown condition is planned to complete in the quarter 1 2014.

In parallel the development of the PSA level II is started in 2008 with support of the Argonne National Laboratory, USA. The Armenian NPP model for MELCOR has been revised. The preliminary list of the analyzed scenario has been developed and the thermal hydraulic calculation for definitions of finite conditions has been performed. The thermal hydraulic calculations of the preliminary 58 scenario were distributed among three organizations: Atomatom (Armenia), ET&D Ukraine and Armenian NPP. The PSA Level II is planned to complete in the Quarter I 2014.

The Fire PSA was performed by the NRSC during 2011-2012, and the review has been completed. The core damage frequency due to fire is $1,85 \cdot 10^{-5}$ [1/year]. The fire risk in 17 out of 102 reviewed sections is approximately 90% from the total core damage frequency due to fire. The main contributors to the risk are:

- Premises of control switchboard (E105, E119 and other);
- Containment (A-013/2);
- Reactor hall;
- Control room;
- Protection relays board (E-314/2).

Currently external hazards risk integration in 3rd iteration PSA model is in process (see details in 4.1).

Current status of PSA models and results for the Armenian NPP is provided in Table 1.

Table 1. PSA models status and results.

№	Hazard type	PSA model iteration	CDF [1/y]
1	Internal initiating events	3rd iteration	5.33E-05
2	Internal fires	3rd iteration	1.85E-05
3	Seismic hazard	2nd iteration	1.06E-04
4	External hazards (excluding seismic)	1st iteration	2.00E-05

There have been made calculations for accident included in the list of design and beyond design accidents.

The Armenian NPP with the IAEA support initiated a project to develop Comprehensive Safety Upgrading programme with regard to the safety goals and criteria, agreed with the ANRA and including LOCA200 as design basis accident and address safety issues identified at the Armenian NPP by several IAEA missions and provide solution for the unresolved issues with high ranking.

The ANRA uses its TSO for assessment of certain aspects of safety of the Armenian NPP. In the reporting period the following activities were carried out for the regulatory decision making:

- Assessment of the reactor core performance loaded with new type of fuel;
- Spent fuel storage assessment with regard to new fuel;
- Hydrogen safety assessment in case of BDA and BDBA;
- Confinement behavior assessment during LOCA accidents;
- Certain aspects of DBA and BDBA analyses e.g. ECCS behavior during larg LOCAs;
- Radiological consequence analysis.

In accordance with the RA Government Decree №1085-N, the operating organization performs safety and resource assessment for the operation life time extension of the Armenian NPP.

In accordance with the procedure on modifications, the ANRA performs assessment and licensing of the safety and safety important modifications.

3.5.2. Verification of Safety

The main programmes used for verification of the state of the Armenian NPP are:

- Periodic testing —of the safety important systems according to the operational limits and conditions;
- Preventive and predictive maintenance programme;
- In-service inspection programme;
- Periodic inspections of pressure equipment and piping;
- Surveillance programme of reactor pressure vessel material;
- Programmes for evaluating the ageing of components and materials.

Activities for verification of the physical state of the NPP are carried out in connection with normal daily routines and with scheduled inspections, testing, preventive maintenance etc. Activities are performed by the licensee and in the case of certain inspections by contractors approved separately. Detailed programmes and procedures are established and approved by the licensee. They are also reviewed and approved by the ANRA. The results of tests and inspections are documented, provided to the ANRA and used through a feedback process for further activities. The operational limits and conditions are approved by the ANRA.

The ANRA on regular basis performs assessment and control over the current level of the Armenian NPP Unit №2 safety through:

- Annual reports on safety assessment of the Armenian NPP Unit №2 operation;
- Regular inspections on assessment of the safety level in accordance with the annual schedule of the ANRA;
- Regular inspections organized jointly with the external organizations in frame of EC projects;
- Inspections organized jointly with the IAEA on design safety level assessment.

3.6. RADIATION PROTECTION

Article 15 Radiation Protection

Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

The list of legal acts that specify regulatory requirements concerning the radiation protection of nuclear installation is provided in the Annex 2.

The Chapters III and V of the “Radiation safety standards” specify the dose limits for workers and public. Limits for workers occupationally exposed to ionizing radiation are:

For category “A” personnel:

- An effective dose of up to 20 mSv per year averaged over 60 consecutive months (5 years), but not more than an effective dose of 50 mSv in any single year (consecutive 12 months),
- An equivalent dose to the lens of the eye of up to 150 mSv per year (consecutive 12 months),
- A equivalent dose to the extremities (hands and feet) or the skin of 500 mSv in a year (consecutive 12 months).

For category “B” personnel:

- An effective dose up to 5 mSv in any single year;
- An equivalent dose to the lens of the eye of up to 50 mSv in a year;
- An equivalent dose to the extremities (hands or feet) or the skin of up to 150 mSv in a year.

The following dose limits are specified for public:

- An effective dose of up to 1 mSv averaged for the consecutive 60 months (5 years), but not exceeding effective dose of up to 5 mSv in a single year (consecutive 12 months);
- An equivalent dose to the lens of the eye of up to 15 mSv in a year (for consecutive 12 months);
- An equivalent dose to the extremities (hands and feet) or the skin of up to 50 mSv in a year (for consecutive 12 months).

The effective dose to the individual members of public should not exceed 70 mSv during life (70 year).

Dose constraints are established for limitation of public exposure from separate man-made sources. Chapter II of the “Radiation safety standards” defines the individual lifetime risk criteria of stochastic effects due to exposure at normal operating conditions, as $1.0 \times 10^{-3} \text{ year}^{-1}$ for workers and 5.0×10^{-5} for public.

Chapters XIII and XIV of the “Radiation safety rules” specify the regulatory requirements to the facilities (including Armenian NPP) radiation safety procedure and program and also the requirements to occupational radiation protection and public exposure. It is stated, that the “Radiation protection program” shall clearly describe the categorization of workers and areas, responsibility of workers and management staff, categories of workers to be monitored, types of occupational exposure monitoring (external, internal, workplace contamination monitoring, etc.), registration of doses, workers protective means, monitoring frequency, medical examination frequency, record keeping system (retaining period of dose register is 50 years), monitoring of technological environments, airborne and liquid releases and etc.

Chapter II of the “Radiation safety standards” specifies the requirements to implementation the optimization principle (ALARA).

The regulation “Radiation Safety Rules for NPP Design and Operation-2003” specifies the dose constraint as 250 $\mu\text{Sv}/\text{year}$, which is considered as the upper boundary of public dose optimization during the normal operation of the NPP. The lower level of optimization is 20 $\mu\text{Sv}/\text{year}$, from which the public dose conditioned by the airborne releases should not exceed 10 $\mu\text{Sv}/\text{year}$ limiting value, the rest 10 $\mu\text{Sv}/\text{year}$ dose should be conditioned by the liquid releases.

For the new constructed NPPs the dose constraint should not exceed 100 $\mu\text{Sv}/\text{year}$.

The “Radiation Safety Rules for NPP Design and Operation-2003” states also the annual allowable and investigation levels of released radionuclides (Table 1,2 Annex 5.)

On the bases of above mentioned documents the Armenian NPP has developed the technical specifications, procedures and the programs on radiation protection and safety.

Implementation of Radiation Protection Programmes by the License Holder

The Armenian NPP management adheres to the policy of absolute safety priority over other concerns and considers the dose optimization principle as the most important means to decrease exposure of personnel working in conditions of ionizing radiation as stated in “Armenian NPP Management Declaration about the Policy in the Area of Radiation Safety”.

Objectives, criteria, procedures, administrative limitations in the part of radiation safety are being set taking into consideration:

- Requirements of standard documents;
- International practice in the area of radiation safety;
- Available operational experience of the Armenian NPP and other NPPs;
- Need for maximum possible decrease of NPP impact on environment;

The efficiency of the Armenian NPP radiation safety is evaluated with the following indicators:

- Maximum individual dose;
- Personnel collective dose;
- Amount of radioactive substances in airborne release;
- Amount of liquid radioactive substances in effluents;
- Number of personnel radiation contamination cases;
- Number of radiation incidents subject to reporting.

When assessing the radiation safety efficiency the above mentioned indicators and corresponding standards ratio, dynamics of indicators, their comparison with the similar values, characterizing radiation safety condition at other similar NPPs, are considered.

For the practical implementation of the radiation protection optimization at the Armenian NPP the ALARA Committee and ALARA Engineering group are formed. The ALARA Committee and the ALARA Engineering group work on continual basis in close contact with all the ANPP departments participating in activities with ionizing radiation sources, and implement activities on the Armenian NPP radiation protection optimization according to the requirements of the “Armenian NPP radiation protection management optimization according to ALARA principle” programme. Based on the results of the ALARA Committee activity report is prepared annually, which is the part of the Armenian NPP industrial activity annual report.

With the purpose of the ALARA principle further implementation at the Armenian NPP the “Program of the Armenian NPP Radiation protection for 2012” was developed which sets the objectives and tasks for minimization of the radiation impact and ensuring the effective radiation protection for the Armenian NPP personnel. It is aimed at maintaining the annual personnel collective dose rate as low as reasonably achievable.

The tasks were the following:

- Non exceeding of annual personnel collective dose above 1,0 man*Sv;
- Non exceeding of personnel collective dose during outage above 0,87 man*Sv;
- Non exceeding annual individual dose above 18 mSv;
- Maintaining radioactive materials gasoerosolic release value lower than the administrative levels:
 - Noble radioactive gas – $40 \cdot 10^{12}$ Bq/year;
 - Long-lived nuclides – $80 \cdot 10^6$ Bq/year;
 - Iodine – $30 \cdot 10^6$ Bq/year.
- Maintaining the amount of liquid radioactive materials effluence below the administrative levels - $\Sigma\beta_{act} = 3,7$ Bq/l;
- Reducing the number of contaminated people.

The annual collective dose for ANPP staff is 0.89 man*Sv, and the individual maximal effective doses is 17.9 mSv. The collective dose of contractors is 0.033 man*Sv.

The maximum individual committed dose for ANPP staff from intake in lung is 0.073 mSv, and the collective dose for intake is 0.0003 man*Sv.

The collective and individual maximal dose trends at the Armenian NPP are demonstrated on the figures 1-2 of Annex 4.

During the scheduled outage and refueling of 2012 the personnel dose loads were planned as 1187 man*Sv. During the annual outage and refueling in 2012 the Armenian NPP personnel actual dose was 794.3 man*Sv.

The majority of the personnel annual effective dose consists of the doses received by the personnel implementing radiation hazard operations during the annual outage and refueling: non-destructive testing, decontamination works, repair works on systems and components. These activities are mainly performed by the Armenian NPP personnel and this explains the difference in doses received by the personnel and contractors.

Airborne and liquid releases from the Armenian NPP

In accordance with the “Technical specification of Armenian NPP radiation control» which specifies the conditions and limits of radioactive releases and effluents (source term), the radiation monitoring is implemented.

The airborne releases from the Armenian NPP are controlled by the measurement devices located on the ventilation stack (150m height), and the liquid effluents are controlled by taking samples from the bore-halls located in outside of boundary of the Armenian NPP rainwater and sewerage systems. The measurement frequency is described in the technical specification for radiation control.

The airborne releases volumetric beta activity trends, which are 100 times lower than the authorized levels of releases from the Armenian NPP are demonstrated on the tables 1 and 2 of Annex 4. The annual activity of liquid discharges from the Armenian NPP are demonstrated on Figure 4 of Annex 5. They are lower than the authorized levels.

The main contribution to releases is made by the following radionuclides: ⁶⁰Co (21.9%), ¹³⁷Cs (0.02%), ⁹⁰Sr (0.06%), ¹³¹I (2.2%) ⁵⁸Co (4.1%), ¹³⁴Cs (0.08%), ^{110m}Ag(33.3%), ⁵¹Cr(20.3%), ⁵⁹Fe(0.98%), ⁶⁵Zn(0.63%), ⁵⁴Mn(1.58%) and ⁹⁵Zr(4.63%). The ⁶⁰Co, ⁵⁸Co, ^{110m}Ag, ⁵⁴Mn, ⁵¹Cr, ⁵⁹Fe and ⁶⁵Zn are corrosion radionuclides and the ^{137,134}Cs, ¹³¹I and ⁹⁰Sr fission radionuclides: The analysis of radioactive releases into the atmosphere in 2012 showed that they were on the level of the previous years and lower than the average level of all the operating period. ^{60,58}Co and ^{110m}Ag, ⁵¹Cr and other corrosion radionuclides (excluding radioactive noble gases) make the main contribution to the quantity of the releases. The release of noble gases for 2012 were 19.3 TBq (the permissible level is 690 TBq). The annual releases of long-lived radionuclides is provided on the Figure 3 of Annex 5.

The low levels of releases from the Armenian NPP are conditioned with reliability of the first barriers of defense in dept.

At present, measures are undertaken at the Armenian NPP on modernization of the radiation monitoring system including release control systems and environmental radiation monitoring control system. The purpose of the modernization is to control and assess the dose loads for public.

Environment Radiation Impact from Armenian NPP

With the purpose of monitoring of the Armenian NPP environmental radiation impact, the estimation of quantities of radioactive substances in the air, atmospheric precipitation, open waters,

soil, vegetation, and locally produced food in the (agricultural plants, milk, etc.) in the Armenian NPP control area (10 km radius) has been made.

The environmental radiation monitoring of facilities in the Armenian NPP supervised area and methods of distribution of areas for taking samples are determined taking into account the climatic, geographic, economic, demographic and other factors of the Armenian NPP location area.

The population external exposure control in the Armenian NPP supervised area is performed by the regular dosimetric measurements in the supervised area. In accordance with the periodical measurements results the gamma dose rate in the supervised area (external exposure) varied within 0.097 $\mu\text{Sv}/\text{hour}$ - 0.13 $\mu\text{Sv}/\text{hour}$ (open areas), which is almost the same as mentioned in the report on radiation situation surveillance dated 1976 before the Armenian NPP commissioning (0.1-0.12 $\mu\text{Sv}/\text{hour}$).

On the territory of the Armenian NPP the gamma dose rate was 0.10 - 0.63 $\mu\text{Sv}/\text{hours}$.

The results of environmental radiation monitoring for 2012 are provided in the tables 1-3 of the Annex 5.

Regulatory review and control activities

The regulatory reviews are based on the monthly and annual reports from the Armenian NPP on radiation situation on the Armenian NPP site and its supervised area and on the results of inspection performed at the Armenian NPP covering the following topics:

- Implementation of radiation protection activities included in the safety upgrading measures program of Armenian NPP;
- The QA programme for the measures implemented in the controlled area;
- The limits and conditions of radiation protection and safety in accordance with radiation control Technical Specification;
- Occupational radiation protection program and implementation of the ALARA principle;
- ALARA implementation measures during the airborne and liquid releases from the Armenian NPP into the environment and the system of environmental radiation monitoring and public dose control.

In the reporting period the Armenian NPP individual maximum and collective dose values (see diagrams 1, 2 of the Annex 5) did not have tendency for reducing (due to limited number of repair personnel in the NPP), it still remains below the dose values specified in the standards and are considered acceptable.

In 2012 In frame of the joint IAEA and the Slovak VUJE project, the Armenian NPP estimated the annual doses received for the Metsamor (located in 5 km from the Armenian NPP) population critical groups (0-1 years, 1-2 years, 2 -7 years, 7-12 years and 12-17 years old children and adults) based on the Armenian NPP releases and discharges, as well as the measurement results of the environmental sampling. The calculations demonstrated that the population critical group (adult) dose received within 1 year is $27.6 * 10^{-6}$ mSv (0.028 μSv), which is by several digits lower the limit of the radiation doses constraints (the "Radiation Safety Rules for NPP Design and Operation-2003, paragraph 5.10). In this case, the radiation risk (the risk for stochastic effects) is $<1 * 10^{-6}$ year⁻¹ (standard is $5 * 10^{-5}$ year⁻¹ ("Radiation safety standards," paragraph 12), and is considered to be acceptable.

The data provided in the Tables 1-3 of the Annex 5 indicate that the radioactive releases and discharges from the Armenian NPP did not result in contamination of air, surrounding areas, land, water, algae, river depositions and contamination of vegetation and local food.

Though the winds blowing from the north-east-east sector prevail in the Armenian NPP supervised area, which in case of higher releases could have led to radioactivity increase in the control points

distributed in the relevant sectors, the environmental sampling data demonstrates that the radiation characteristics (dose rates, radioactivity concentration, surface contamination) in all territories of the Armenian NPP supervised area differ from each other within the allowable error rate of the measurements. The comparison of the measurements data with the ones made before the Armenian NPP operation ("zero-background measurement") demonstrate that the Armenian NPP operation have not led to radioactive contamination of the environment.

3.7. EMERGENCY PREPAREDNESS

ARTICLE 16. Emergency preparedness

- 1. Each Contracting Party shall take the appropriate steps to ensure that there are on-site and off-site emergency plans that are routinely tested for nuclear installations and cover the activities to be carried out in the event of an emergency. For any new nuclear installation, such plans shall be prepared and tested before it commences operation above a low power level agreed by the regulatory body.*
- 2. Each Contracting Party shall take the appropriate steps to ensure that, insofar as they are likely to be affected by a radiological emergency, its own population and the competent authorities of the States in the vicinity of the nuclear installation are provided with appropriate information for emergency planning and response.*
- 3. Contracting Parties which do not have a nuclear installation on their territory, insofar as they are likely to be affected in the event of a radiological emergency at a nuclear installation in the vicinity, shall take the appropriate steps for the preparation and testing of emergency plans for their territory that cover the activities to be carried out in the event of such an emergency.*

Legislative Framework

In Armenia the main legal act settling relations concerned with response to nuclear and radiation emergencies are:

- Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes;
- Law of the RA on Population Protection During Emergencies;
- Plan on Protection of Population in case of Nuclear and Radiation Emergencies at Armenian NPP (off-site emergency plan of Armenian NPP) approved under the Government Decree № 2328 as of 22.12.2005 as amended in 2008, 2009;
- "Armenian NPP emergency response plan to nuclear and/or radiation emergencies (On-site plan of the Armenian NPP);
- Basic requirements to emergency planning and response at nuclear and radiation emergencies;
- Government Decree № 1219-N as of 18.08.2006 on approval of radiation safety norms;
- Government Decree № 1489-N as of 18.08.2006 on approval of radiation safety rules.

The basic framework for preparedness and response to nuclear and radiation emergencies in Armenia is established in above mentioned legal acts, which assign the main role to state authorities and other organizations and regulate issues related to different aspects of the emergency preparedness and response. The "Radiation safety standards" stipulate the generic optimized intervention levels for taking urgent protective actions for sheltering, evacuation, iodine prophylactic and permanent resettlement, as well as the dose criteria for emergency workers.

Besides the above mentioned there are a number of legal acts that regulate separate issues

concerned with the emergency preparedness (notification, organization and implementation of evacuation, transportation, emergency radiation monitoring, medical response, agricultural countermeasures and so on).

Structure of the National Emergency Response System

The National Population Protection Plan in case of a nuclear and radiation emergencies provides with the detailed assessment of organizational measures and allocation of the functions and responsibilities of the operator and national and local authorities implementing response measures in case emergencies at the Armenian NPP (Government Decree №2328-N as of 22 December 2005, amended in 2008 and 2010 respectively). This plan had been developed with account taken to requirements of the IAEA GS-R-2, GS-G-2.1 and EPR-METHOD-2003.

According to the National Population Protection Plan:

- The Armenian NPP is responsible for classification of emergency situation at NPP, prompt notification on emergency situation, bringing the reactor in safe condition and NPP personnel protection,
- The Ministry of Emergency Situations of the Republic of Armenia (MES) is responsible for warning of national response organizations and population, coordination of population protection measures, organization of emergency radiological monitoring and performing rescue actions in emergency situations. From 2008 the Armenian Rescue Service (ARS) functions within the MES. The Rescue Service of Armenia functions as the national coordinator in organization and implementation of population protection measures. To cope with this task there was established the Crisis Management Centre of the MES equipped with new equipment and communication means. The MES is the competent authority and the contact point under the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency. The Ministry for Emergency Situation transmits radiation monitoring data in area where emergency took place and in adjacent to its territories to the ANRA ERC;
- The ANRA is the national advisor in organization of response and also the National Warning Point under the Convention on Early Notification about Nuclear Accident. In case of threat to population notifies the Ministry for Emergency Situations on the emerged situation, provides with information on situation in the area where emergency took place.
- The Hydrometeorological Service provides the ANRA ERC and the Ministry for Emergency Situations with the information on meteorological situation in the area where emergency took place and prognosis.
- The Ministry of Foreign Affairs of the RA is responsible for providing information received from the ANRA ERC on emergency to the foreign representative offices and RA embassies in other countries.
- The Ministry of Health of the RA is responsible for provision of medical aid to the affected population, coordination of the evacuation of injured persons from the contaminated zone and participation in organization of decontamination of the evacuees;
- The Ministry of Defense of the RA is responsible for conducting emergency radiological monitoring, deployment of forces and resources necessary for rescue operations and deployment of decontamination and special treatment units;
- The Police of the RA is responsible for warning and notification of the population, protection of the property and assets of the settlements in the contaminated zone and maintaining public order in settlements, organizations, evacuation points, and transportation routes;
- The Ministry of Agriculture of the RA is responsible for providing support to the regional administrations and local self-governing bodies in the evacuation of live stock and providing of agricultural countermeasures and implementation of the continuous monitoring of the

radiological situation.

- The Ministry of Transport and Communication of the RA is responsible for provision of the necessary means of transportation for evacuation of the population and provision of communication during the implementation of protective measures.

The responsibilities of the local authorities on the regional and local levels over the territory included in PAZ or UPZ areas are indicated in the off-site emergency plan of the Armenian NPP. The local authorities carry out the displacement, reception and the distribution of the displaced people, sheltering and provision of individual protection for the population.

The organizational chart of the population protection planning system is given in the Annex 8.

To cope with this task the ANRA operates the appropriately equipped Emergency Response Center (ERC) and has relevantly trained emergency personnel. The functions of the ANRA ERC groups are:

- The Emergency Commission – management of the ERC operations;
- The NPP technological assessment group – assessment of nuclear reactor condition, prognosis on possible changes of the reactor condition, estimation of radioactive releases and discharges and conditions;
- The Radiation Situation Assessment and Prognoses Group – assessment of situation at the facility or place where accident took place, prognosis on possible changes of situation, development of recommendations on protective measures;
- The Information and Public Relations Group – receiving from and sending to information of the emergency commission, communication with public and mass media.

There are relevant emergency procedures established to ensure functioning of the ANRA ERC groups. Among the others there are procedures established that specify sequence of implementation of reactor condition and source term assessment, assessment of radiological situation of the Armenian NPP and adjacent territories, prognosis on situation change, development recommendations on radiation protection of Armenian NPP personnel, emergency personnel and population and other.

These procedures are periodically revised during/after the regular table top exercises within the ANRA. The Emergency Response Structure of the ANRA is provided in the Annex 6.

The MES of RA periodically conducts exercises and drills in relation to the Armenian NPP which are aimed at testing the capabilities and skills of the state and local authorities on various level. In particular the following exercises were conducted:

- 22 April 2011 – Organization of population protection arrangements in case of nuclear and radiation accident at the Armenian NPP. Staff exercise was conducted in the Armavir region,
- 29 June 2011 – the MES RA rescue service actions in case of nuclear and radiation accident at the Armenian NPP. Staff exercise was conducted at the MES ARS,
- 10 October 2011 – Admission and allocation of evacuees in case of accident at the Armenian NPP. Staff exercise was conducted in Kotayk region,
- Joint MES-USA Embassy exercise was conducted in July 2013.

In relation to the emergency preparedness the Armenian NPP functional commitments are:

- Classification of accidents;
- Implementation of activities aimed at mitigation of accidents consequences;
- Notification;

- Protection of the personnel;
- Organization of radiation monitoring on the Armenian NPP site.

Besides the RA organizations, the Armenian NPP also cooperates with WANO MC Regional Crisis Center (RCC) for NPP-s with WWER type reactor facilities on the basis of "ROSENERGOATOM" OJSC Crisis Center. The WANO MC Regional Crisis Center assists the Armenian NPP in the following issues:

- Analysis of emergency situation and prognosis of its progression;
- Development of recommendations related to emergency situation management, localization, minimization of its consequences and recovery of safe condition at the NPP;
- Development of recommendations on protective measures for personnel and public;
- Providing the Armenian NPP with advises on nuclear safety, fire safety; engineering, radiation and chemical protection issues and on design-engineering characteristics of NPP units;
- Preparation of conclusions on accidents progression at the Armenian NPP and on necessity of taking measures on the state (national) level;
- Providing the Armenian NPP with inventory assistance.

Classification of Accidents

The guideline "Classification of Emergency Situations at ANPP" was developed to evaluate accident conditions at the Armenian NPP. The guideline covers also natural disasters and human illegal actions that may lead to nuclear or radiation accident.

Implementation of Activities on Accidents Consequences Mitigation

For the accident management and prevention of its progression into the beyond design accident and in case of design accident – for elimination of its consequences on personnel and environment, in accordance with the requirements specified in the main rules on NPP safety, the Armenian NPP developed and enforced the instructions on mitigation of design and beyond design accidents. At present these instructions are revised based on the IAEA symptom-oriented approach.

Notification

The Instruction on "Organization of notification and communication in case of emergency situations at ANPP" (hereafter referred to as the instruction) establishes the order of organizing notification and communication of information from the moment when "Preparedness", "Local accident" and "General accident" situations are declared at the Armenian NPP.

Notification is organized according to the Notification Chart provided in the Annex 7.

Permanent duty in the Crisis Management Centre (CMC) of the MES ensures prompt response to emergency situations.

Personnel Protection

When "Nuclear and/or Radiation Accidents Response Plan" (on-site plan) of the Armenian NPP is activated up to completion of actions, the radiation and medical protection of the personnel is provided, including radioactivity examination, radiation monitoring at the Armenian NPP, radiation monitoring of personnel involved in the accident management and other personnel, individual dosimetry control, control over the personnel overexposure, decontamination of equipment and

personnel, evacuation and sheltering, use of individual protection tools, including iodine tabs, decontamination means and other.

Site Emergency Response Plan

The on-site plan of the Armenian NPP is the principal document that regulates organization and order of responding to nuclear and radiation accidents at the Armenian NPP, interrelations entities involved in the emergency activities.

Currently, the “Nuclear and Radiation Accidents Response Plan of Armenian NPP” (on-site plan) is being reviewed with respect to the requirements specified in the IAEA document “Methodology of Developing Activities in Response to Nuclear and Radiological Emergency Situations” (EPR – methodology - 2003).

Training and Exercises, Evaluation Activities and Main Results of Performed Exercises

A systematic training of the personnel on emergency preparedness and response related issues is conducted at the Armenian NPP.

The “Program for maintaining qualification of the personnel involved in Armenian NPP emergency response system” for 2012-2014 was developed. Based on this program, the schedules for organization of training and drills and practical lessons on emergency response were prepared.

Sixteen standard training programs for the personnel involved into the Armenian NPP emergency response system have been developed. Several standard programs for the personnel training, some training materials and drills programs are under development.

Trainings and drills based on ad hoc prepared scenarios and requiring participation of all the employees who are responsible for response critical tasks are conducted periodically in order to verify the emergency preparedness system of the Armenian NPP.

Drills and exercises are evaluated, and based on the evaluation results, the emergency procedures are relevantly updated. The exercises on the following scenario have been conducted with participation of the relevant state authorities and organizations:

- Total loss of power at the Armenian NPP, LOCA200;
- Fire on TG-3. Break of heat-exchanger tubes of SG;
- Earthquake in protective action zone. Total loss of power at the Armenian NPP;
- First aid for injuries and evacuation of injured persons;
- Failure of emergency make-up system at LOCA32;
- Organization of notification during radiation emergencies at the Armenian NPP.

Regulatory review and control activities

The ANRA conducted inspections to verify implementation of the Armenian NPP on-site plan as it is provided for in the license terms and conditions. The following points have been inspected:

- Armenian NPP on-site plan;
- Armenian NPP personnel evacuation plan;
- Organization of medical protection of the Armenian NPP personnel during emergency situations;

- Organization and implementation of emergency and rescue works during emergency situations;
- Organization of communication and notification during emergency situations;
- Instruction on organization of evacuation measures during emergency situations;
- Instruction for technical support group;
- Radiation monitoring program during nuclear and radiation emergencies;
- Manual on classification of emergency situations at the Armenian NPP;
- Armenian NPP personnel and management preparedness programs.

The requirements specified in the enforcement report made as a result of inspection are in progress of implementation.

The IAEA EPREV mission was hosted from 15 to 25 October 2012 at the ANRA's request. The objective of the mission was to provide an assessment of arrangements and capabilities to respond to nuclear or radiological emergencies, to assess whether Armenia resides with regard to international standards and to prepare the recommendations in the areas of arrangements, decrees, equipment, staff, and related functional areas.

The end-of-mission report indicates that the National Emergency Response Plan clearly names and delegates the appropriate set of responsibilities to all state governing bodies, local self-governing bodies and organizations of the Republic of Armenia that play roles in the protection of the population from the dangerous impact of ionizing radiation in case of a nuclear and (or) radiological accident at the Armenian NPP and set up specific requirements for all response organizations.

The legal arrangements listed in the National Emergency Response Plan (the international agreements, the laws of RA, decisions of the Government, and other legal acts) establish the sound emergency management and operation system of the Republic of Armenia.

However, based on the IAEA's new standards, the mission also issued a number of recommendations and advises on revision and implementation of on-site and off-site emergency plan of Armenian NPP.

Based on the recommendations of the IAEA EPREV mission, the ANRA has prepared the list of those emergency response regulations that, based on the IAEA requirements specified in the new standards (GSR Part 3, GSG-2), should be reviewed and then introduced in the National Emergency Response Plan. At the same time the schedule on amendments to the emergency response plans of the state and regional authorities involved in the National Emergency Response Plan is being developed.

Information of the public and neighboring states

The responsibilities for notification about nuclear and radiation emergencies at the Armenian NPP are specified in the basic requirements to planning and response to nuclear and radiation emergencies and fixed in emergency response plans.

According to the above mentioned regulation the responsibilities for notification rest with:

- The Armenian NPP – notification of population residing in the preventive actions zone;
- The MES – notification of population residing in the urgent protective actions zone, and if necessary also population of other settlement;
- The ANRA – international notification about nuclear and radiation emergencies at the Armenian NPP, and for receiving information about emergencies occurred in nuclear installations of other countries through the IAEA ERC.

International Cooperation

The Republic of Armenia is a party to a number of international treaties and conventions on emergency response and planning related issues (the Annex 1).

The Republic of Armenia participates in the IAEA Convex exercises organized in accordance with the IAEA annual schedule.

Armenian organizations and authorities cooperate with the IAEA (in frame of technical cooperation projects), USA, United Kingdom and EC (in frame of INSC) on different issues related to the emergency response and planning.

4. SAFETY OF INSTALLATIONS

4.1 NPP SITING

Article 17 Siting

Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

- (i) for evaluating all relevant site-related factors likely to affect the safety of a nuclear installation for its projected lifetime;*
- (ii) for evaluating the likely safety impact of a proposed nuclear installation on individuals, society and the environment;*
- (iii) for re-evaluating as necessary all relevant factors referred to in sub-paragraphs (i) and (ii) so as to ensure the continued safety acceptability of the nuclear installation;*
- (iv) for consulting Contracting Parties in the vicinity of a proposed nuclear installation, insofar as they are likely to be affected by that installation and, upon request providing the necessary information to such Contracting Parties, in order to enable them to evaluate and make their own assessment of the likely safety impact on their own territory of the nuclear installation.*

4.1.1 Evaluation of Site Related Factors

The information required under this article is provided in the 5th National Report of the Republic of Armenia.

4.1.2. Impact of the Installation on Individuals, Society and Environment

The information required under this article is provided in the 5th National Report of the Republic of Armenia and in the chapter 3.6 of this report.

4.1.3. Re-evaluation of Site Related Factors

In the reported period the activities on seismic safety upgrading were implemented in compliance with the Technical Guidelines, Programme for the Seismic Re-evaluation of the Armenian NPP Unit №2 developed with the IAEA assistance. In 2011 with the purpose to complete the seismic reevaluation program the Armenian NPP seismic qualification was implemented in frame of the IAEA ARM9022 project. In frame of the project 109 components were reviewed with specification of activity types: analyses or tests, development of design enforcements, expertise of all implemented enforcements.

In frame of the project the analysis of boundary seismic stability (HCLPE) of all SSC included in the SSEL was performed:

- Pipelines of 11 systems (including penetrations);
- Control rods drives,
- Support structures of pumps, tanks and specific sensors of I&C;

Also the board panels of RDGS and TD were tested on shake table.

Based on the implemented analyses there were developed design and technical solutions for seismic enforcements (installation of additional supports and vibration snubbers – 17 pieces, and dampers – 27 pieces).

All submitted design and technical solutions were completely implemented during 2012 outage. Thus, it could be stated that all components of the Armenian NPP Unit №2 are adequate to the RLE (PGA=0,35g).

Results of recent reassessment activities

In the frame of activities on seismic hazard assessment of construction site for the new NPP unit in 2009-2011 the integrated activities (including field ones) were implemented in compliance with the IAEA NSS-G-9. These activities were performed the consortium involving local and external organizations and invited experts.

In 2012, in the frame of the Armenian NPP stress-tests program implementation the PGA=0,47g value was assumed as a beyond design basis earthquake (BDBE), which corresponded to the annual probability 10^{-5} on median curve of seismic hazard being higher than PGA=0,42g with 10^{-4} probability and 84% confidence.

Additional HCLPF calculations were performed for specific buildings, not included in the SSEL (dry spent fuel storage facility, reactor auxiliary building, ventilation stack, water receiver №2 rooms); the seismic walkdown also was performed aimed at qualification of the Armenian NPP Unit №1 spent fuel storage pool system components.

As it was mentioned above, in frame of the Armenian NPP Unit №2 seismic reevaluation program the HCLPF analyses for the PGA=0,35g RLE was performed for the main components included in the SSEL. For the elements that were qualified based on verification or tests the specific values of HCLPF were received with application of CDFM procedure. For the elements that were qualified with application of indirect methods the HCLPF value was assessed as HCLPF>ASL, where the ASL=0.35g is the level of PCA assumed for the screening procedure in frame of the conservative methodology GIP-WWER used during the seismic walkdowns. In frame of the Armenian NPP stress-tests assessments, according to the Armenian NPP technical guide, for several classes of equipment, the seismic adequacy check (screening level) could be used until ASL=0.5g, taking into account the equipment installed at the Armenian NPP with the correct anchorage (especially, on top), is rather strong, and activities on seismic upgrades were regularly performed at the Armenian NPP.

The results of the Armenian NPP HCLPF in frame of stress-tests allow making the following conclusions:

- The analysis of seismic response of components included in the SSEL demonstrated lack of any cliff-edge effects.
- The minimum value of HCLPF for the confinement system is 0.49g. This value corresponds to the strength of pipeline penetrations from the confinement. At the same time, the reactor shaft has the value HCLPF=0,98g. Thus, at 10% failure probability the minimum seismic stability level of the Armenian NPP structures providing integrity of confinement is ~ 0,74g.

Thus, based on the abovementioned, it could be stated that for the Armenian NPP the sufficient seismic margin was confirmed (the NPP seismic stability as a whole) for stress-test level earthquakes with PGA 0,47g.

4.1.4. Consultation with other Contracting Parties likely to be affected by the installation

The list of international treaties ratified by the Republic of Armenia is provided in the Annex 1 of this report.

The Republic of Armenia has no bilateral arrangements with the neighboring states.

4.2 DESIGN AND CONSTRUCTION

Article 18. Design and Construction

Each Contracting Party shall take the appropriate steps to ensure that:

- (i) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defense in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;*
- (ii) the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;*
- (iii) the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.*

4.2.1. Implementation of Defense in Depth

The Armenian NPP design was developed with respect to the defense- in-depth principle. In accordance with this principle the Armenian NPP design includes five levels of defense and four main barriers to prevent release of radioactive materials into the atmosphere.

All five levels of defense in depth are implemented at the Armenian NPP. Deficiencies of safety related to the implementation of defense levels are documented and upgrading measures are planned in the Comprehensive safety upgrading programme.

The many years experience of successful operation of WWER-440 reactors demonstrated the validity and reliability of the accepted design solutions. The positive features of WWER-440 reactor facility are: comparatively low power rating of core, availability of specific volume of the primary coolant and cooling water reserve in the SGs of the secondary side and features of the primary side contributing to the coolant natural circulation that enables passive core cooling in natural circulation modes at accidents during long time and reduces dependency on earlier operator actions.

At designing of the Armenian NPP that was supposed to be operated in seismic areas it was accepted that systems, structures and components ensuring safety of personnel and population and also protection of environment against contamination above the allowable limits should remain operable to certain degree at any seismic impacts possible at the NPP site.

To prevent escalation of design bases accident into beyond design basis accidents and also to reduce radiological consequences at beyond design accidents the following upgrades have been implemented at the Armenian NPP:

- Upgrade of the primary circuit protection system against pressure rise. In particular, installation of PRZ impulse safety valves certified to be operated in water media;
- Upgrade of secondary circuit protection system against pressure rise. In particular, installation of PRZ impulse safety valves certified to be operated in water media;
- Upgrade of steamline system. In particular, installation of fast acting valves;
- Upgrade of automatic DG start-up system. This upgrade enables actuation of 2 pumps in each safety channel of the emergency core cooling system at the total power loss at the Armenian NPP;

- Implementation of a completely independent essential service water system;
- Upgrade of the emergency core cooling system actuation logic;
- Confinement tightness is regularly increased;
- The system for additional make-up of SG with installation of diesel pump was implemented;
- Partial separation of channels of electric power supply and I&C; Implementation of the system for the reactor vessel protection against cold overpressurisation;
- Implementation of Leak Before Break concept and installation of leak detection systems;
- Assessment of high energy piping and implementation of corresponding measures;
- Installation of filters against clogging of confinement sump;
- MCR habitability improvement;
- Installation of PAMS and Backup control panel;
- Installation of restraints against pipe whip on main steam lines.

The following upgrades are planned to be implemented:

- Upgrade of the emergency core cooling system (considering new LOCA definition, redundancy and separation, etc.);
- Upgrade of the spray system. In particular, upgrade is aimed to separate systems into two independent channels and increase of water flow rate supplied by the spray system into the confinement;
- Implementation of post accident monitoring system (partly implemented);
- Implementation of passive autocatalytic recombiners to prevent accumulation of explosive hydrogen concentration in the confinement;
- Reactor cover gas removal system;
- Separation of the reactor protection system into two independent channels;
- Establishment of emergency control room (partly);
- Installation of full-scale simulator.

In addition several safety upgrades have been recommended to the Armenian NPP as a result of comprehensive safety assessment project performed by the international consortium in co-operation with the IAEA. Based on the result of performed comprehensive safety analysis the list of safety upgrades for the Armenian NPP Unit №2 had been revised. See below list of additional important upgrades recommended:

- Verification of integrity of confinement structures and flaps functions;
- Analysis of heat removal capability of service water system (considering new LOCA definition);
- Improvement of plant fire safety (verification of cable routing information, modeling of fire propagation and fire control possibilities, etc.);
- Completion of PSA Level 1 (expand considered regimes, scope of initiators etc.);
- Conducting of new and supplementing of existing accident and transient analysis, including confinement analysis and radiological consequences;
- In core monitoring system upgrade (considering requirements for its reliability and redundancy).

The ANRA implements regulatory control through:

- Regular inspections in accordance with the annual schedule of the ANRA;
- Inspections organized with involvement of external organizations in frame of EC projects;
- Joint assessment on design safety level assessment in frame of the IAEA expert missions.

4.2.2. Incorporation of Proven Technologies

The information required under this article is provided in the 5th national report of the Republic of Armenia.

4.2.3. Design for Reliable, Stable and Manageable Operation

The information requested under this article is provided in the 5th national report of the Republic of Armenia.

4.3. OPERATION

Article 19 Operation

Each Contracting Party shall take the appropriate steps to ensure that:

- (i) the initial authorization to operate a nuclear installation is based upon an appropriate safety analysis and a commissioning programme demonstrating that the installation, as constructed, is consistent with design and safety requirements;*
- (ii) operational limits and conditions derived from the safety analysis, tests and operational experience are defined and revised as necessary for identifying safe boundaries for operation;*
- (iii) operation, maintenance, inspection and testing of a nuclear installation are conducted in accordance with approved procedures;*
- (iv) procedures are established for responding to anticipated operational occurrences and to accidents;*
- (v) necessary engineering and technical support in all safety-related fields is available throughout the lifetime of a nuclear installation;*
- (vi) incidents significant to safety are reported in a timely manner by the holder of the relevant licence to the regulatory body;*
- (vii) programmes to collect and analyse operating experience are established, the results obtained and the conclusions drawn are acted upon and that existing mechanisms are used to share important experience with international bodies and with other operating organizations and regulatory bodies;*
- (viii) the generation of radioactive waste resulting from the operation of a nuclear installation is kept to the minimum practicable for the process concerned, both in activity and in volume, and any necessary treatment and storage of spent fuel and waste directly related to the operation and on the same site as that of the nuclear installation take into consideration conditioning and disposal.*

4.3.1. Initial Authorization

The information required under this article is provided in the 5th national report of the Republic of Armenia.

4.3.2. Operational Limits and Conditions

The operational limits and conditions of the Armenian NPP are brought in compliance with the technical standards set in the Armenian NPP design. The set of safe and normal operation limits and conditions is specified in the Technical Specification of the Armenian NPP unit №2 operation with WWER-440 (V-270) type reactor. The ANRA verifies safety management, maintenance and repair and control through inspections. The ANRA identified progress on the side of operating organization in relation to establishment of the programs on testing of safety systems and success criteria. The Armenian NPP initiated development of new administrative procedures. Recommendations on improvement of the procedures for maintenance and repair have been made.

It is planned to enforce the new technological specification which is developed with respect to implemented upgrades.

4.3.3. Procedures for Operation, Maintenance, Inspection and Testing

The operation, maintenance, inspection and testing procedures established at the Armenian NPP with respect to the with the requirements of the rules and standards, are revised in accordance with the established frequency as well as implementation of modifications, upgrades and operational experience feedback.

Through inspections and tests, maintenance and repair, the safety systems are maintained in operable condition to fulfill functions attributed by the design. In compliance with the administrative management procedures the operating personnel is provided with all the required documentation, procedures at their work places and receive training according to the training program.

A complete set of operational documents for ANPP systems and equipment is being developed at the Armenian NPP for enhancement of the Armenian NPP operational safety. The complete set of operational and technical documentation includes normal operating procedures, technical descriptions, emergency response procedures and programs for checking operability and testing. The Armenian NPP has established a procedure for making changes and revising the administrative and operating procedures. Before implementation the complete set of operational and technical documentation is verified and validated by the relevant Armenian NPP personnel having significant work experience and high qualification.

The responsibility has been defined for completeness and safety of the complete sets of operating procedures available at the work places of the operating personnel according to the approved distribution list. The copies of the complete set of operating procedures available at work places of Armenian NPP personnel are intended for information, training and drills. The administrative and operating procedures are revised according to the procedure established at the Armenian NPP.

All the administrative and operating procedures (having an impact on safety) are subject to the ANRA's approval. Before implementation the complete set of administrative and operating procedures is verified and validated by the relevant Armenian NPP personnel having significant experience and high qualification.

4.3.4. Procedures for Responding to Operational Occurrences and Accidents

Through inspections and tests, maintenance and repair the safety systems are maintained in operable state which is a guarantee implementation of the safety functions. The operating personnel, in compliance with the procedures of administrative management is provided with all the necessary documents, procedures in their work places and are trained according to training programme.

In frame of the US DOE and National Argonne Laboratory assistance project for the Armenian NPP instead of old EOPs new symptom-oriented emergency operating procedures (SOEOP) are being developed for the reactor on hot full power and SOEOP are being developed for shutdown reactor; the severe accident management program is being developed as well.

Complete sets of SOEOP cover all the reactor operation conditions – SOEOP of the first two complete sets are intended for identification and elimination of emergency situations, design basis accidents, beyond the design basis accidents when the reactor facility is operated on “hot full power”, “zero power”, “semihot shutdown”, “hot shutdown” if the average temperature is above 156°C. The SOEOP of third complete set is intended for identification and elimination of emergency situations and accidents when the reactor facility is operated in “cold shutdown”, “refueling”, “hot shutdown” if the average temperature is below 156°C.

- EOP under development take into account the following:
 - Modernizations implemented at Armenian NPP;
 - Accidents and incidents initiated in the process of shutdown and startup;
 - Include the aspect of accidents consequences elimination;
 - The mode of shutdown reactor when the confinement and reactor vessel are open and there are no physical barriers between fuel assemblies and environment;
 - Accidents occurring in spent fuel pools of Units №1,2 and the DSFS.
- EOP is being developed for the reactor cooling, if in case of emergency evacuation from MCR is needed.

All procedures existing at the ANPP will be revised with regard to results of Stress Test of the Armenian NPP.

4.3.5. Engineering and Technical Support

At present functions of the operating organization are assigned to the Armenian NPP. The following departments have been established within the structure of the plant to provide the internal technical support in the safety improvement area:

- Nuclear safety and reliability department;
- Engineering and technical support department;
- Workshop for thermal automatics and measurement;
- Technical department of planning and operation;
- Technical inspection.

Besides there are also external technical support organizations in Armenia, in particular:

- Armatom institute CJS;
- Atomservice CJS;
- Institute of Energy CJS.

The technical support is received also from foreign organizations in frame of international assistance programs (IAEA, EC, USA).

The responsibility for coordination of activities with the external support organizations in Armenia rests with the operating organization.

Engineering and Technical Support is provided mainly for the safety upgrades of the Armenian NPP that cover all safety aspects.

4.3.6. Reporting of Incidents Significant to Safety

In accordance with the Article 20 of the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes the operating organization should investigate accidents and incidents occurred during operation of nuclear installations. In accordance with the Basic requirements to NPP safety the operating organization should provide the ANRA the information on operational events in the established order. Criteria of selection of events to be reported to the regulatory body, are described Procedure on investigation and account of operational events at the NPPs. Issues related to notification, account, investigation and reports on operational events is specified in the Procedure on investigation and account of operational events at the NPPs. The procedure establishes:

- Categories of operational events;
- Procedure of accounting and notification of events;
- Procedure on investigation of events.

Events, detected during implementation of operational and maintenance activities, walkdowns, inspections, audits etc. at the Armenian NPP should be reported. Any unfavorable, unforeseen action that resulted in deviation from the established requirements and standards should be also reported to the ANRA. Events to be reported to the ANRA are classified by the INES scale in accordance with “International Nuclear and Radiological Event Scale (INES)”, 2008 Edition. At the request of the ANRA the assigned event level can be changed.

In accordance with the established procedure a preliminary event report is prepared within 24 hours and sent to the ANRA after an operational event is detected. A 15-days period is specified to investigate causes of event and to submit the event investigation report to the ANRA.

The reports on investigation of operational events is analyzed by the ANRA. If the root cause is not detected or the corrective measures do not fully cover and prevent reoccurrence of event the ANRA may require additional investigation. The ANRA can conduct inspection of corrective measures implemented at the Armenian NPP.

The ANRA has established a data base of operational events. The database contains the following information: the date of event, summary description of event, number of report on investigation, description of direct and root cause, corrective measures and deadlines for implementation, as well as the electronic version of complete report on investigation.

For the last three years, 9 operating events have taken place: 8 events are classified at the INES Level «0» (under the scale, deviation), and one event are classified at Level «1» - important to safety (anomaly). The events occurred didn't result in violation of the safe operation limits and conditions. Corrective measures for all the violations were developed and implemented.

Information to the International Reporting System (IRS) is regularly provided. Data from the IRS database are analyzed and provided to the concerned authorities for use.

Reports on the events occurred at Armenian NPP is periodically presented at the Nuclear Energy Safety Council under the RA President and to WANO.

4.3.7. Operational Experience Feedback

A formalized program of operational experience (OE) was developed based on the IAEA PROSPER mission recommendations.

The Armenian NPP operational experience department (OED) is responsible for the OE program.

The management policy and expectations have been established for reporting on events (including low-level events with near-misses), threats, errors and organizational deficiencies.

A full set of 20 documents, formalizing the OE complete process, has been developed and implemented.

Training materials on new processes and methods have been elaborated, and training of both OED personnel (on event review methodologies – ASSET, HPES), and of the rest of the NPP personnel has been performed.

The IAEA safety standards, WANO documentation, good practice of the other NPPs have been used during implementation of the OE program at the Armenian NPP.

Review of events occurred at the plant, is performed in accordance with “The event direct and root causes determination” guideline.

The event investigation is performed with application of ASSET (Assessment of Safety Significant Events) and HPES (Human Performance Evaluation System) methodologies.

The ASSET methodology is applied to investigate the safety important events. The HPES methodology, which includes several methods (change review, protective barriers review, task review), is used to review the events, connected with human actions.

The criteria for evaluation external events by degree of importance of their analysis and application as well as the procedure for development and implementation of corrective measures are established.

Three categories of external events by degree of their importance for the Armenian NPP are established.

1. **High priority:** the Armenian NPP management should immediately get familiar with the information. This category is attributed to the information on the events directly affecting nuclear safety, personnel safety and the NPP reliability.

The category is attributed on the basis of one or several of the following features:

- The event is classified as Level 3 or higher by the INES scale;
- The event reporting is of SOER or SER type;
- The event occurred at the NPP with similar design and there is a possibility of its recurrence at the Armenian NPP, if safety measures are not undertaken;
- The event is important and requires particular attention and respective measures to be undertaken from the point of view of the ANRA.

2. **Average priority:** the category is attributed if information meets the following criteria:

- The event is classified as Level 1 or 2 by the INES scale;
- Information is of EAR or ENR reporting type.

3. **For the information:** information does not have high or average priority but it meets application criteria and is distributed among the divisions to get familiarized with. Following the assessment of event importance to the Armenian NPP the information is received by respective subdivisions to review and develop proposals on corrective measures. The review is performed based on “How can this event occur at our NPP?” principle. The event review is performed with application of the following approach:

- How could the plant become vulnerable in regard to the event under consideration (why could such an event occur)?
- Are there any barriers designed to prevent such event at the Armenian NPP and what are the additional barriers required?
- Are reported corrective measures acceptable for the Armenian NPP?
- What are the additional corrective measures to be undertaken?

The information on event and undertaken corrective measures are entered into the Event Data Base. As a rule the corrective measures are registered in an administrative document and they are not

limited by implementation of purely technical measures. The lessons learned from external event analysis are also implemented with the following methods:

- Use of information on external events in personnel training;
- Personnel acknowledgement with information about events by means of booklets.

In the framework of co-operation with WANO event (internal and external) information is exchanged within Information Exchange on Operating Experience program.

The following processes are used as a feedback of important events occurred at other NPPs and implementation of correcting actions:

- Use of information on external events at the Armenian NPP is reported at annual meetings of WANO contact persons;
- Use of event information is also included in the Armenian NPP report presented at annual meetings of WANO-MC Governors' Board (the Armenian NPP is represented by the Armenian NPP General Director);
- Before external reviews are carried out a report on operating experience use (in particular to respond important event reports) and implementation of correcting actions is prepared and submitted to the organization that carries out the review (WANO, IAEA, etc.).

International organizations WANO and IAEA regularly hold workshops/meetings on operating experience issues presenting important industry events. It is used at these meetings to present lessons learned by the Armenian NPP from the occurred important events.

Application of industrial operating experience (except for events) by the Armenian NPP operating organization is regulated by Guideline "Use of industry operating experience". A procedure is established for analysis of industry operating experience and its use aimed at the Armenian NPP operation safety and reliability upgrading.

The following information sources for industry operating experience are used at the Armenian NPP:

- Materials of international workshops, reports of IAEA and WANO missions;
- Information from NPPs and international organizations in the framework of bilateral and international co-operation;
- Information from design organizations and equipment suppliers;
- Materials of meetings (twice per year) of Russia, Armenia and Ukraine NPPs managers;
- Materials of workshops held by IAEA and WANO.

When considering industry operating experience information the principle of maximum learning is used for the lessons that would allow the plant to avoid problems.

Assessment of information on industry experience includes answers to the following questions:

- What are the lessons that could be learned from information?
- What specific actions shall be undertaken at the Armenian NPP to implement good practice or avoid similar problems?

The analysis results are registered in industry operating experience feedback form including recommendations (lessons learned to implement) to use them at the Armenian NPP.

If a need in additional information arises a corresponding organization is requested.

The plant annually sends hundreds of requests to various organizations (operating organizations, NPPs, design organizations and manufacturers) for information concerning improvement of various activity aspects and experience exchange to solve arising problems.

Good practice of other NPPs is used through acknowledgement with results of past international missions (WANO Peer Reviews and IAEA OSART Missions), and active participation of personnel and management in international meetings and conferences.

Good practice of the plant in various activity areas is learned by international missions invited to the Armenian NPP to carry out Peer Review of activity.

We have close relationships with Russian and Eastern European NPPs which have similar design specifications.

Main experience exchange areas include issues of design safety upgrading and improvement of operational safety. In regard to different implementation stages of their modernization and operational safety programs the experience exchange and learning of lessons is the most effective method to correct programs and implement good practice.

In 2005 the operating organization developed Event Data Base. The existing database was developed in regard to all requirements of IAEA guiding documents in the area of operating experience and best practice of the world's NPPs in that area.

All information on the events occurred at the plant is entered into the database.

Each event in the database is specified with a set of more than 40 parameters including equipment safety class, the event impact on the unit operating conditions, event consequences, way of event identification, involved personnel, direct and root causes, correcting actions, INES level, etc.

The event data base was installed in the plant network and allows on-line event reporting by all users, receipt of information about the occurred events, status of investigation, correcting actions, etc.

Use of coding system for event parameters in the database allows performing selection by any event parameters. In addition the database allows receiving more than 85 standard statistic requests, such as:

- Event by failure type;
- Event by direct causes;
- Event by root causes;
- Event by for safety class of the failed equipment;
- By categories of insignificant events;
- By problem of insignificant event.

The ANRA regulatory reviews and controls activities for licence holder programmes and procedures. The ANRA also uses the information received from the WWER Regulators Forum.

At present the operational experience database of the Armenian NPP contains detailed information about more than 8000 plant events and information about more than 3300 events occurred at the NPPs in the world.

4.3.8. Management of Spent Fuel and Radioactive Waste on the Site

The “Concept on safe management of radioactive waste and spent nuclear fuel in RA” has been developed, discussed with the concerned authorities and approved under the RA Government protocol decision №43 on 4 November 2010. In this document the objectives of the National Policy were outlined to define safe and sustainable management of radioactive waste and spent nuclear fuel in RA. In order to implement the Policy and to specify the ways for achieving the goals identified in the Policy, the activities on development of radioactive waste and spent nuclear fuel management strategy were initiated in 2011. Within the frame of EC Development and Cooperation

(DEVCO) Programme, the development of “National Strategy on Radioactive Waste and Spent Fuel Management” is planned to start in September 2013.

In 2011 the IAEA Operational Safety Review Team (OSART) mission was conducted at the Armenian NPP and 2 recommendations related to the safety improvements of low and intermediate level radioactive waste storages were made in the area of transition from operation to decommissioning.

It is planned to perform the decommissioning planning and licensing development activities at Armenian NPP and Pilot Decommissioning Project for Unit №1 of the Armenian NPP in frame of the EC INSC Programme.

On-site storage of spent fuel

Spent fuel of the Armenian NPP is stored in the spent fuel ponds. After five years of storage the spent fuel is placed into the dry shield canister (DSC) of NUHOMS-56M type and placed into horizontal storage modules (HSM) of the dry spent fuel storage facility. There are two buildings of the HSM built on the Armenian NPP site. The first building (11 modules) is completely full and in the second one only 10 out of 12 modules are full.

Implementation of on-site treatment, conditioning and storage of radioactive waste

Radioactive waste is an unavoidable by-product of the operation of NPP and arises from routine NPP maintenance and operations. Radioactive wastes are divided according to the aggregate state into solid (SRW), liquid (LRW) and gaseous and to their activity content into low level, intermediate level and high level. The need for harmonization of radioactive waste current classification with the IAEA proposed one was stated in the “Concept on safe management of radioactive waste and spent nuclear fuel in RA”. Radioactive waste new classification is developed by the ANRA and will be submitted to the RA Government for approval after review with the concerned authorities.

Solid radioactive wastes at the Armenian NPP undergo pre-treatment before transportation to the appropriate storage facility. No treatment or conditioning technologies for SRW processing are implemented at the Armenian NPP.

All liquids from the Armenian NPP controlled area are collected and evaporated continuously, therefore low level liquid radioactive waste storage facilities at the Armenian NPP are empty. The generated evaporator concentrate, that is intermediate level liquid radioactive waste, subsequently undergoes treatment at deep evaporation facility (DEF) and the resulting alloy (“salt cake”) is packed in metal containers, where it is solidified and placed for storage in the DEF containers temporary storage site. The temporary storage site is currently full and as an interim solution for storing the DEF containers the solid intermediate level waste storage facility was decided. At present the Armenian NPP considers the options for safe management of the accumulated DEF containers.

Due to the continuous purification of technological blow-off through the system of special gas purification there is no gaseous radioactive waste at the Armenian NPP.

The current situation related to the fullness of radioactive waste storage facilities at the Armenian NPP as of 31.12.2012 is provided on the Figure 1 of the Annex 9.

The Armenian NPP should implement measures on minimization of radioactive waste generation.

The ratio of design and actual annual SRW streams at the Armenian NPP with the result of actions undertaken to minimize waste streams is provided on the Figure 2 of the Annex 9.

Levels for exemption/clearance of moderate amounts of material are established in the RA Government Decree №1219 as of 18 August 2006 on approval of the Radiation Safety Standards”.

Based on the quarterly and annual reports from the Armenian NPP on radioactive waste, as well as documents submitted for the ANRA review and approval and the periodical inspections organized by the ANRA, during which the following issues have been inspected:

- Fulfillments of radiation protection requirements during the radioactive waste management;
- Ensure the Armenian NPP Waste Acceptance Criteria's and clearance criteria's;
- The Armenian NPP storage facilities and the safety assessment measures.

ANNEX 1. THE INTERNATIONAL TREATIES RATIFIED BY THE REPUBLIC OF ARMENIA

- Convention on Early Notification about Nuclear Accident ratified on 22.06.1993
- Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency ratified on 22.06.1993
- Vienna Convention on Civil Liability for Nuclear Damage ratified on 22.06.1993
- Convention on Physical Protection of a Nuclear Material ratified on 22.06.1993
- CTBT Comprehensive Nuclear-Test-Ban Treaty ratified on 21.12.1993
- Convention on Nuclear Safety ratified on 24.09.1997
- Treaty on the Non-Proliferation of Nuclear Weapons ratified on 24.09.1991
- 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
- 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 on 28.06 2004
- Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the International Atomic Energy Agency to the Government of the Republic of Armenia ratified on 04.06 2003
- Amendment to the Convention on Physical Protection of Nuclear Material ratified on 18.03.2013
- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management ratified on 21.03.2013

ANNEX 2. GOVERNMENT DECREES ADOPTED IN ATOMIC ENERGY UTILIZATION FIELD

- Government Decree № 573 as of 16.11.1993 on establishment of the state authority under the government of the RA on regulation of nuclear and radiation safety for atomic energy utilization (Armenian Nuclear Regulatory Authority)
- Government Decree № 768 as of 22.12.1999 on approval of the list of activities and positions of authority important for safety in atomic energy utilization
- Government Decree № 342 as of 25.04.2001 on establishment of the scientific and technical center on Nuclear and Radiation Safety, CJS
- Government Decree № 452 as of 24.05.2001 on transfer of responsibilities for regulation of safety of ionizing radiation sources and protection against ionizing radiation in the Republic of Armenia to ANRA
- Government Decree № 640 as of 12.07.2001 on approval of the procedure for organization and conduct of safety expertise in the atomic energy utilization field
- Government Decree № 765 as of 16.08.2001 on approval of the procedure for registration of ionizing radiation sources
- Government Decree № 1263 as of 24.12.2001 on approval of the special rules on transport of nuclear and radioactive materials
- Government Decree № 931-N as of 27.06.2002 on approval of the procedure for safe transport of nuclear and radioactive materials
- Government decree № 1231-N as of 11.09.2003 on approval of the concept of physical protection and security of Armenian NPP and nuclear materials and rules on physical protection of nuclear installations and nuclear materials
- Government Decree № 2013-N as of 21.11.2002 on approval of the requirements to form and contents of the Safety Analysis Report of the Armenian NPP Unit №2
- Government Decree № 1597-N as of 26.10.2004 on fulfilment of obligations undertaken under the Protocol Additional to the Agreement between the Republic of Armenia and the International Atomic Energy Agency for "The Application of Safeguards in Connection with Treaty on the Non-Proliferation of Nuclear Weapons"
- Government Decree № 1751-N as of 09.12. 2004 on approval of the licensing procedure and licence form for use of radioactive materials, devices containing radioactive materials, or radiation generators
- Government Decree № 1790-N as of 09.12. 2004 on approval of the licensing procedure, licence and application form for import and export of radioactive materials, devices containing radioactive materials, or radiation generators
- Government Decree № 1791-N as of 09.02. 2005 on approval of the licensing procedure and licence form for storage of radioactive materials, devices containing radioactive materials, or radiation generators
- Government Decree № 1792-N as of 09.02. 2005 on approval of the licensing procedure for transport of radioactive materials, devices containing radioactive materials, or radiation generators
- Government Decree № 257-N as of 10.02. 2005 on approval of the licensing procedure and licence form for designing of systems, structures and components important to safety of atomic energy utilization installation

- Government Decree № 258-N as of 10.02. 2005 on approval of the licensing procedure and licence form for manufacture of systems, structures and components important to safety of atomic energy utilization installation
- Government Decree № 259-N as of 10.02. 2005 on approval of the licensing procedure and licence form for repair of radioactive materials, devices containing radioactive materials, or radiation generators
- Government Decree № 260-N as of 10.02. 2005 on approval of the licensing procedure and licence form for installation and calibration of radioactive materials, devices containing radioactive materials, or radiation generators
- Government Decree № 345-N as of 24.03.2005 on approval of the licensing procedure and licence form for expertise of atomic energy utilization installations, their designs and other documents
- Government Decree № 375-N as of 24.03.2005 on approval of the licensing procedure and licence form for import and export of radioactive wastes
- Government Decree № 400-N as of 24.03. 2005 on approval of the licensing procedure and licence form for operation of nuclear installations
- Government Decree № 401-N as of 31.03. 2005 on approval of the licensing procedure and licence form for implementation of physical protection of nuclear installations and nuclear materials
- Government Decree № 416-N as of 31.03. 2005 on approval of the licensing procedure and licence form for construction of radioactive waste storage facility
- Government Decree № 417-N as of 31.03. 2005 on approval of the licensing procedure and licence form for construction of radioactive waste disposal facility
- Government Decree № 608-N as of 12.05. 2005 on approval of the licensing procedure and licence form for designing of nuclear installations
- Government Decree № 609-N as of 12.05. 2005 on approval of the licensing procedure and licence form for site selection of nuclear installations
- Government Decree № 647-N as of 05.05.2005 on approval of the licensing procedure and licence form for storage of radioactive wastes
- Government Decree № 649-N as of 12.05. 2005 on approval of the licensing procedure and licence form for construction of nuclear installations
- Government Decree № 652-N as of 19.05. 2005 on approval of the licensing procedure and licence form for operation of radioactive waste disposal facility
- Government Decree № 702-N as of 19.05. 2005 on approval of the licensing procedure and licence form for operation of radioactive waste storage facility
- Government Decree № 703-N as of 19.05. 2005 on approval of the licensing procedure and licence form for reprocessing of radioactive wastes
- Government Decree № 707-N as of 01.06. 2005 on approval of the licensing procedure and licence form for decommissioning of nuclear installations
- Government Decree № 745-N as of 09.06.2005 on approval of the licensing procedure and licence form for storage of nuclear materials
- Government Decree № 746-N as of 09.06.2005 on approval of the licensing procedure and licence form for transport of nuclear materials

- Government Decree № 762-N as of 09.06. 2005 on approval of the licensing procedure and licence form for use of nuclear materials
- Government Decree № 985-N as of 07.07. 2005 on approval of the licensing procedure and licence form for designing of radioactive waste storage facility
- Government Decree № 986-N as of 07.07. 2005 on approval of the licensing procedure and licence form for designing of radioactive waste disposal facility
- Government Decree № 1204-N as of 11.08. 2005 on approval of the licensing procedure and licence form for site selection of radioactive waste disposal facility
- Government Decree № 2129-N as of 01.12. 2005 on approval of the licensing procedure and licence form for decommissioning of radioactive waste disposal facility
- Government Decree № 2140-N as of 01.12. 2005 on approval of the licensing procedure and licence form for manufacture of radioactive materials, equipment containing radioactive materials, or radiation generators
- Government Decree № 2141-N as of 01.12. 2005 on approval of the licensing procedure and licence form for decommissioning of radioactive waste storage facility
- Government Decree № 1219-N as of 18.08.2006 on approval of radiation safety norms
- Government Decree № 1489-N as of 18.08.2006 on approval of radiation safety rules
- Government Decree № 1858-N as of 14.12.2006 on approval of the licensing procedure, license and application forms and qualification check of individuals implementing practices and holding positions important for safety of atomic energy utilization field
- Government Decree № 1859-N as of 14.12.2006 on approval of amendments to RA Government Decree № 768 as of 22.12.1999
- Government Decree № 553-N as of 03.05.2007 on approval of procedure on detection and isolation of radioactive materials
- Government Decree № 1267-N as of 25.10.2007 on approval of amendments to a number of RA Government Decrees
- Ordinance of RA President № 121-N as of 20.02.2008 of reorganization of Armenian Nuclear Regulatory Authority (ANRA) under Ministry for Nature Protection of RA into State Committee under Government of RA on nuclear safety regulation and amendment of RA President Ordinance № NH-1063 adopted on 16 March 2002
- Government decree № 866-N as of 17 July on establishment of the State Committee under the Government of the RA on Nuclear Safety Regulation, approval of the statute and organizational structure, content and size of property of the State Committee under the Government of the RA on Nuclear Safety Regulation
- Government Decree №631-N as of 04.06.2009 on approval of the procedure on radioactive waste management
- Government Protocol Decision №43 as of 04.11.2010 on approval of the concept on radioactive waste and spent fuel safe management in the RA
- Government Decree № 418-N as of 05.04.2012 on approval of procedure on investigation of NPP operational events
- Government Decree № 461-N as of 19.04.2012 on approval of extension of design lifetime of Armenian NPP Unit No2
- Government Decree № 1085-N as of 23.08.2012 on approval of the requirements to extension of design lifetime for Armenian NPP Unit No2 operation

- Government Decree № 1411-N as of 08.11.2012 on approval of Design Safety Requirements to New NPP Unit(s)
- Government Decree № 1546-N as of 13.12.2012 on approval of Method on Seismic Hazard Assessment for New Nuclear Unit Site
- Government Decree № 708-N as of 04.07.2013 on approval of Site Safety Requirements to New NPP Unit(s)
- Government Decree № 709-N as of 04.07.2013 on approval of List of Internal Legal Acts Applied in Atomic Energy Utilization Field in Russian and in English

ANNEX 4. MINISTERIAL ACTS IN ATOMIC ENERGY UTILIZATION FIELD

- Requirements to format and content of conclusion on safety expertise in atomic energy utilization field (Registered by the Ministry of Justice of RA. Registration № 10503349 as of 12.11.2003)
-
- Establishment of Armenian NPP emergency planning zones (Registered by the Ministry of Justice of RA. Registration № 12506129 as of 04.05.2006)
- Statute and procedure on formation of commission on qualification check of physical persons holding positions and implementing practices important to safety in atomic energy utilization field (Registered by the Ministry of Justice of RA. Registration № 12507398 as of 21.11.2007)
- Requirements to content and form of program on decommissioning of nuclear installations (Registered by the Ministry of Justice of RA. Registration № 12511432 as of 27.09.2011)
- Requirements on accounting of radioisotopic and ionizing radiation sources at atomic energy utilization installations (Registered by the Ministry of Justice of RA. Registration № 12512188 as of 11.04.2012)
- Requirements to content and form of program on decommissioning of nuclear installations” (Registered by the Ministry of Justice of RA. Registration № 12511432 as of 27.09.2011)
- “Requirements to format and content of environmental radiation monitoring system of nuclear energy utilization installation” (registered by the Ministry of Justice of RA. Registration № 12512230 as of 31.05.2012).
- “Requirements to format and content of occupational exposure personal cards” (Registered by the Ministry of Justice of RA. Registration № 12513109 as of 25.05.2013).

ANNEX 5. RADIATION PROTECTION

Table 1. Annual Allowable Release of Radioactive Gases and Airborne into the Atmosphere

Radionuclide	WWER NPP
Noble gases [TBq]	690
¹³¹ I [GBq] (gas and airborne)	18
⁶⁰ Co [GBq]	7.4
¹³⁴ Cs [GBq]	0.9
¹³⁷ Cs [GBq]	2.0

Table 2. Control Levels for Release of Radioactive Gases and Airborne into the Atmosphere per Month

Radionuclides	WWER NPP
Nobel gases [TBq]	57
¹³¹ I [GBq] (gas and aerosols)	1.5
⁶⁰ Co [MBq]	620
¹³⁴ Cs [MBq]	75
¹³⁷ Cs [MBq]	170

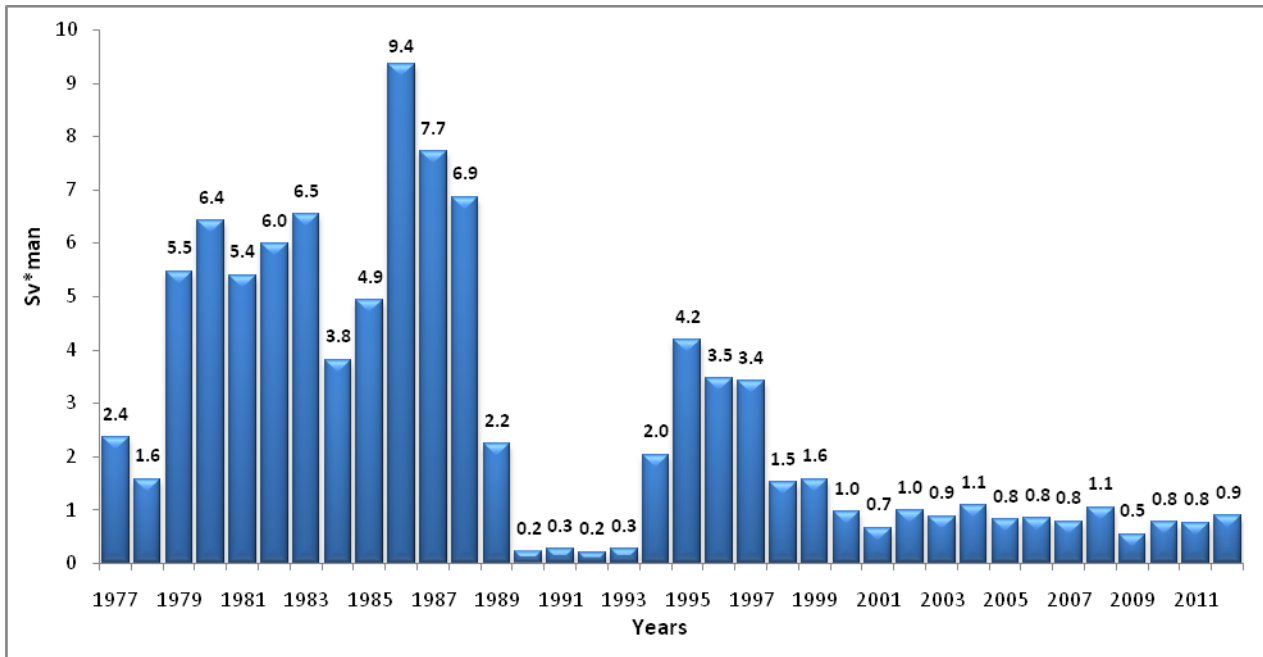


Figure 1. Annual Collective Equivalent Exposure Dose of Armenian NPP Personnel

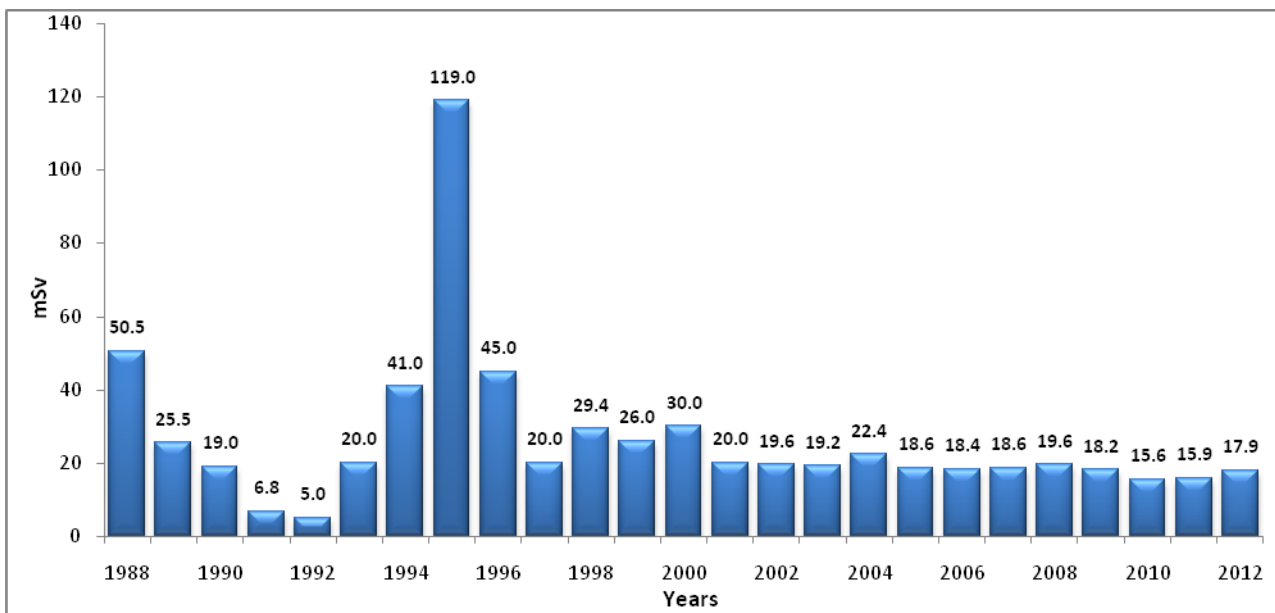


Figure 2. Individual Equivalent Annual Maximum Exposure Dose of Armenian NPP Personnel for the period 1988-2012

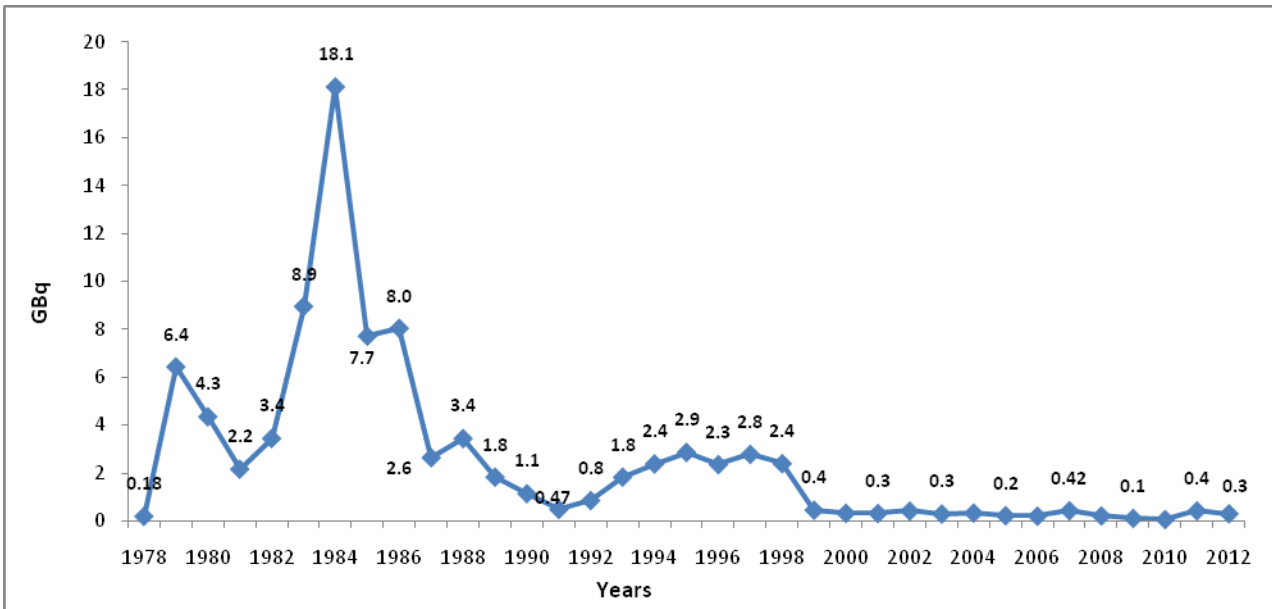


Figure 3. Annual Releases of Long-Lived Radionuclides (T1/2 more 24 hours) for the period of the Armenian NPP operation

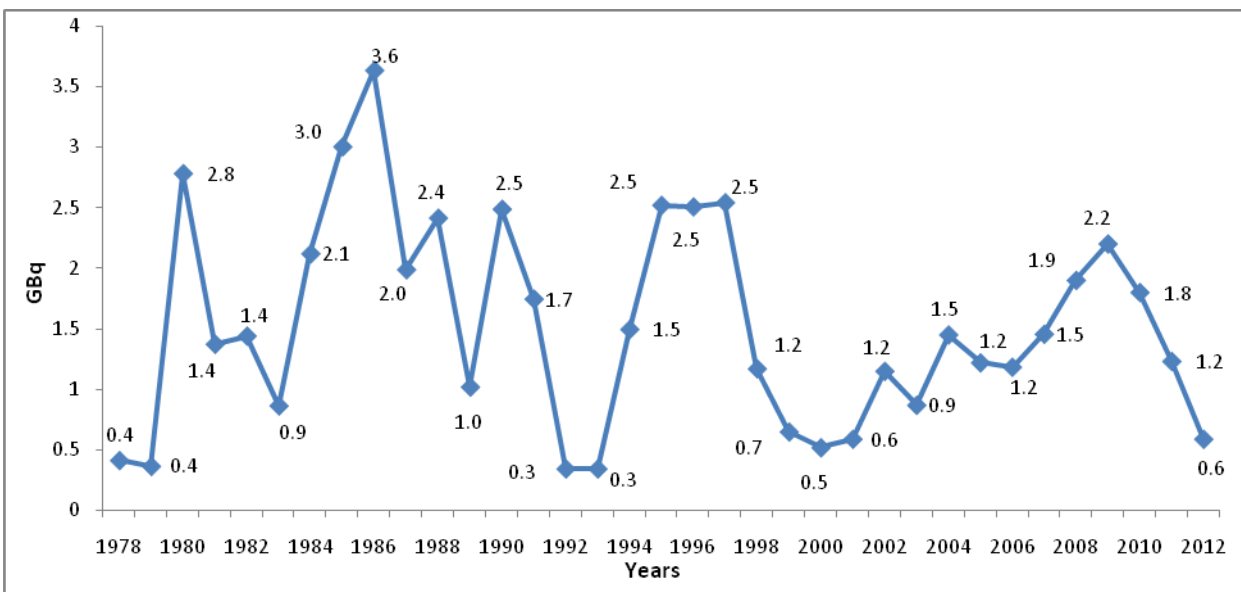


Figure 4. Annual Discharges of Long-Lived Radionuclides (Sr+Cs) from Armenian NPP in the period of operation

The Results of Environmental Radiation Monitoring for 2012

Table 1. The contamination of atmosphere* in the Armenian NPP supervised area in 2012 [10^{-4} Bq/m³]

Name of location	Summary beta activity	¹³⁷ Cs	⁹⁰ Sr	⁷ Be**
Armenian NPP - 1 km	1.21	0.011	0.007	3.31
Metsamor town - 5 km	1.02	0.009	0.005	3.22
Water purification system of Armenian NPP - 6-7km	1.12	0.007	0.004	2.84
Yerevan city – 30 sm (clean area for comparison of data)	0.62	0.011	0.004	1.57

*) Boundary limit values of ¹³⁷Cs in atmosphere equals 27 Bq/m³, ⁹⁰Sr - 2.7 Bq/m³, ⁷Be - 1,900 kBq/m³ (Radiation safety standards, table 3)

**) ⁷Be is a radioactive isotope of cosmic origin.

Table 2. Contamination of soil in the Armenian NPP supervised are in 2012 [Bq/kg]

Name of location	Cs-134	Co-60	Ag-110m	Cs-137	Sr- 90
Armenian NPP	-	-	-	2.5	1.70
Territory with 3-6 km radius	-	-	-	2.94	1.8
Territory with 8-12 radius	-	-	-	3.50	1.35
Territory with 14-18 radius	-	-	-	2.40	1.25
Yerevan city – 30 sm (clean area for comparison of data)	-	-	-	3.40	1.70

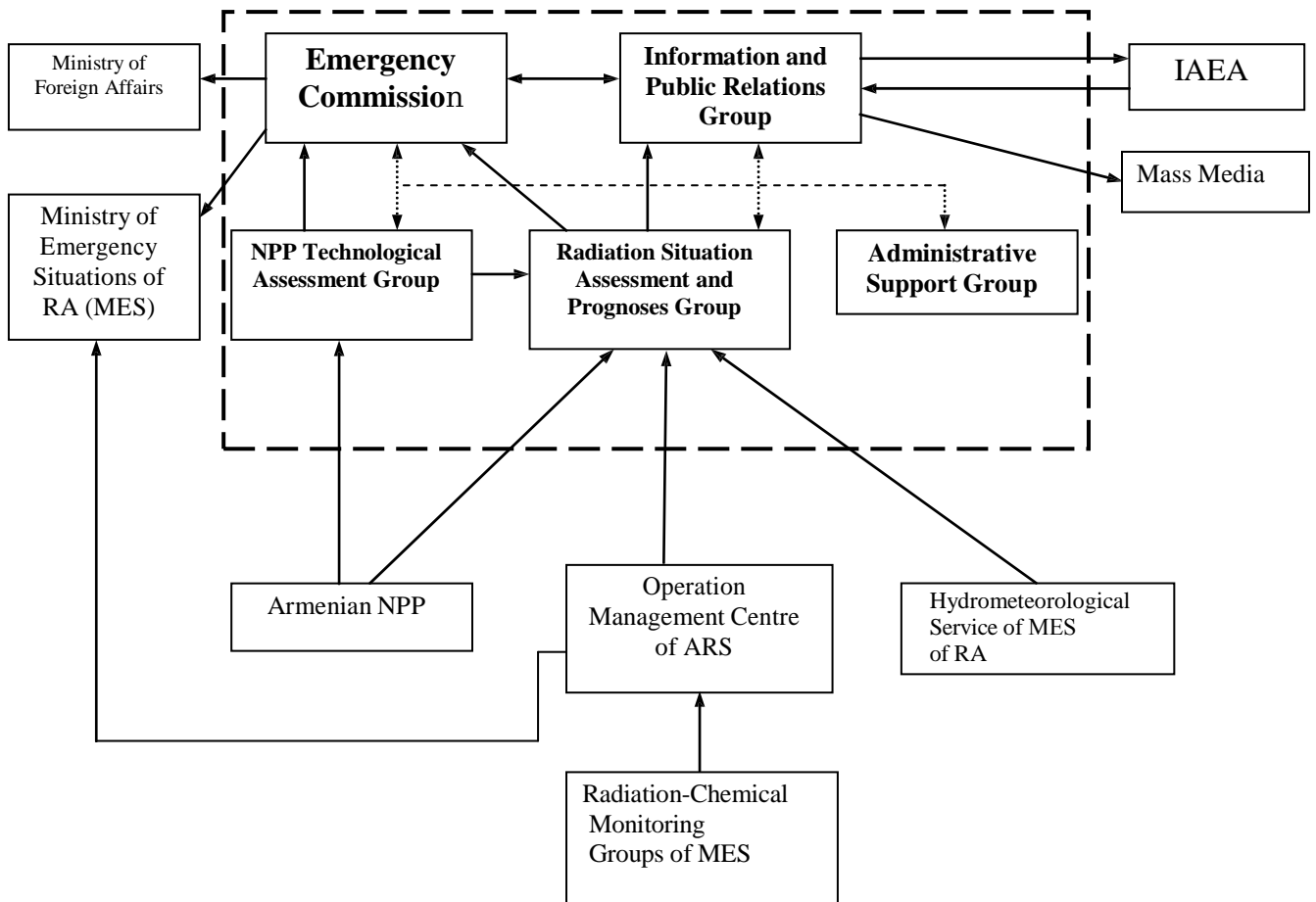
No radioactive isotopes generated due to operation of the Armenian NPP are available in the soil and vegetation of the Armenian NPP supervised area.

Table 9. Quantity of ¹³⁷Cs u ⁹⁰Sr radioisotopes in open reservoir of the Armenian NPP supervised area in 2012 [Bq/m³]

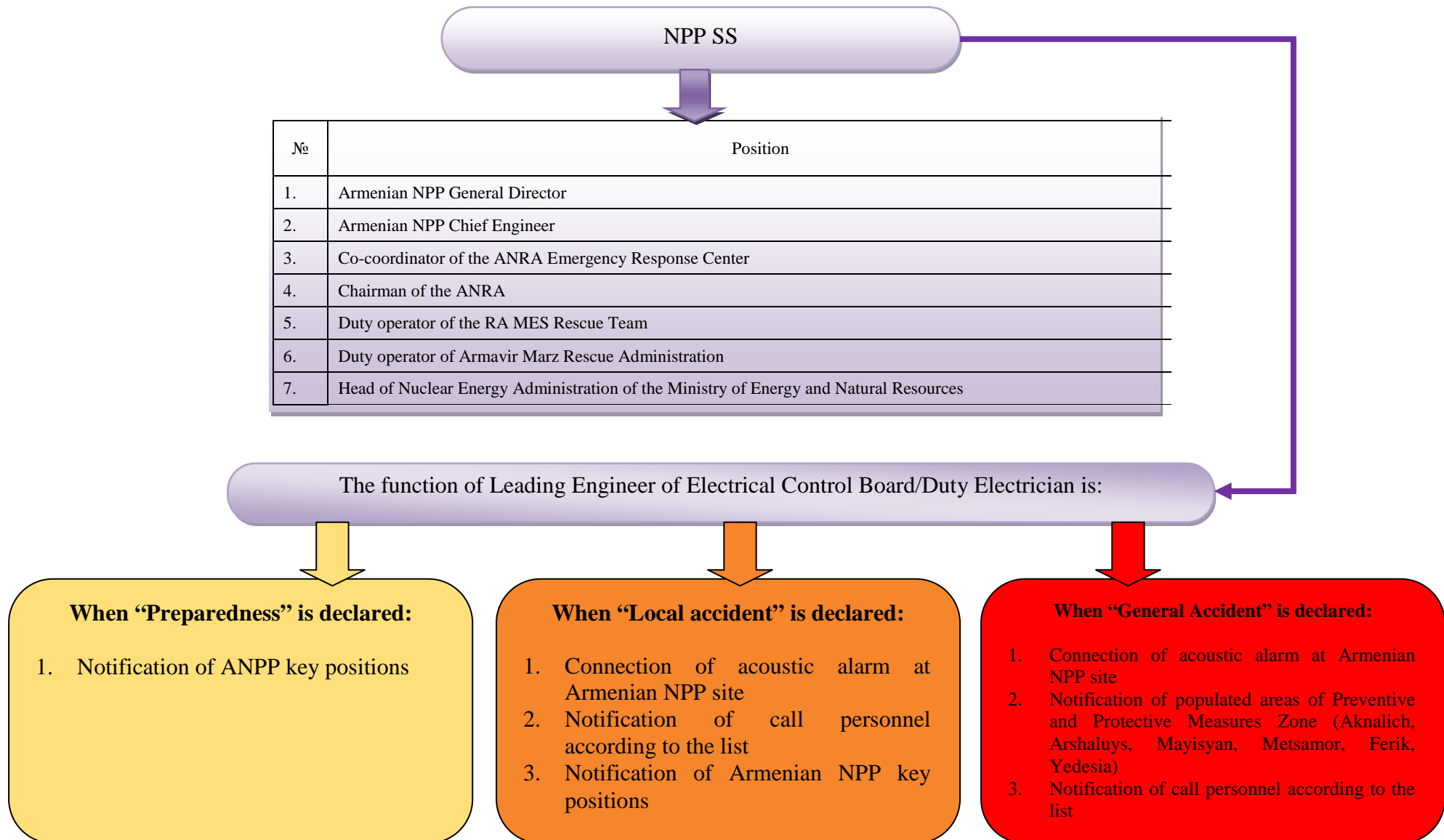
Name of open reservoir	Radioactive isotopes	
	¹³⁷ Cs	⁹⁰ Sr
Lake Aknalich	100.0	25.0
Fishery Facility	95.0	25.0
Service Water Supply Pump Facility	95.0	15
Drinking Water Sampling for Metsamor	80.0	19.5
Drinking Water Sampling for Armavir	95.0	71.5
Sanitary Sewage Discharge Point	70.0	21.5
Site Rainwater Sewage Discharge Point	85.0	26.5
Big reservoir of Armavir	Dry water	Dry water

The limiting value of ¹³⁷Cs in open reservoirs is $11 \cdot 10^3$ Bq/m³, and the limiting value of ⁹⁰Sr is $5 \cdot 10^3$ Bq/m³, (Radiation safety standards, table 3)

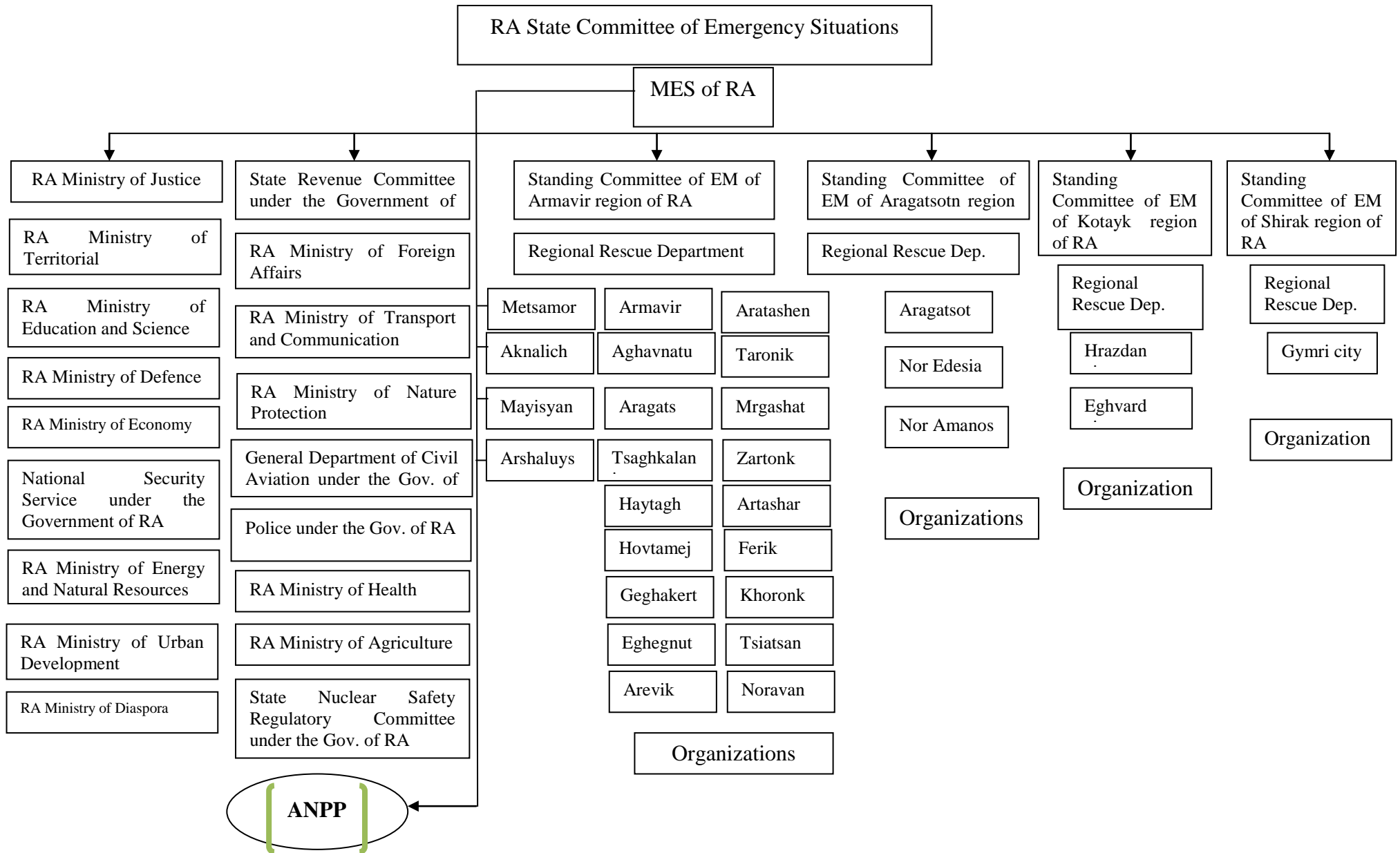
ANNEX 6. SCHEME OF ANRA EMERGENCY RESPONSE AND INTERACTION WITH EXTERNAL ORGANIZATIONS



ANNEX 7. ARMENIAN NPP NOTIFICATION SCHEME



ANNEX 8. ORGANIZATIONAL CHART OF POPULATION PROTECTION PLANNING SYSTEM



ANNEX 9. RADIOACTIVE WASTE MANAGEMENT

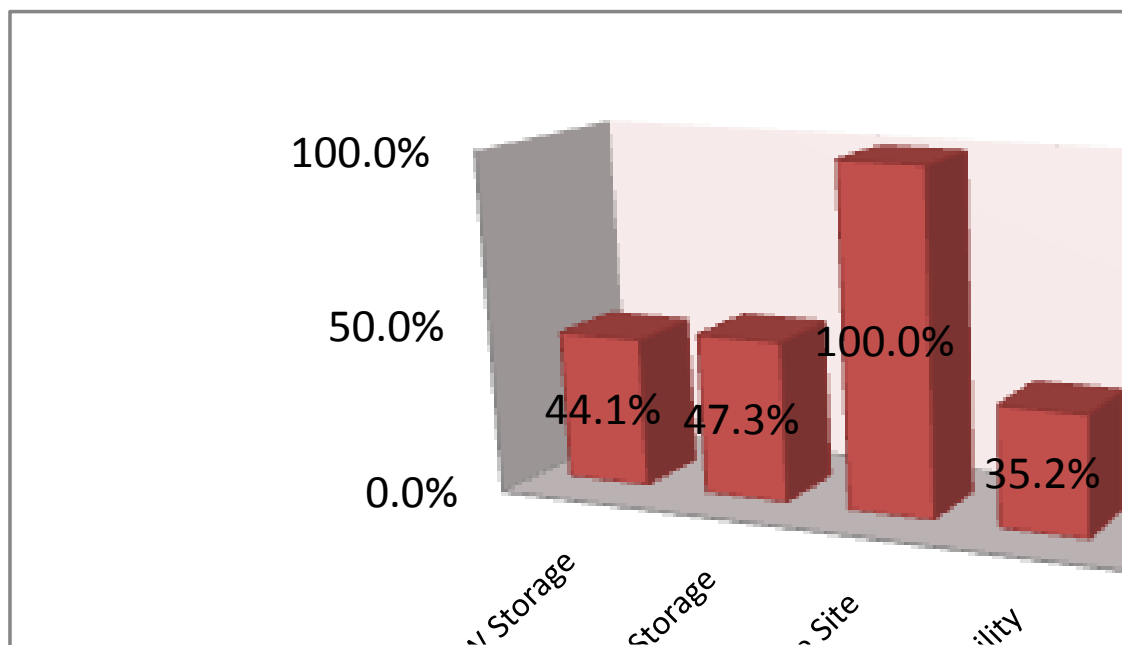


Figure 1. Fullness of radioactive waste storage facilities at Armenian NPP as of 31.12.2012

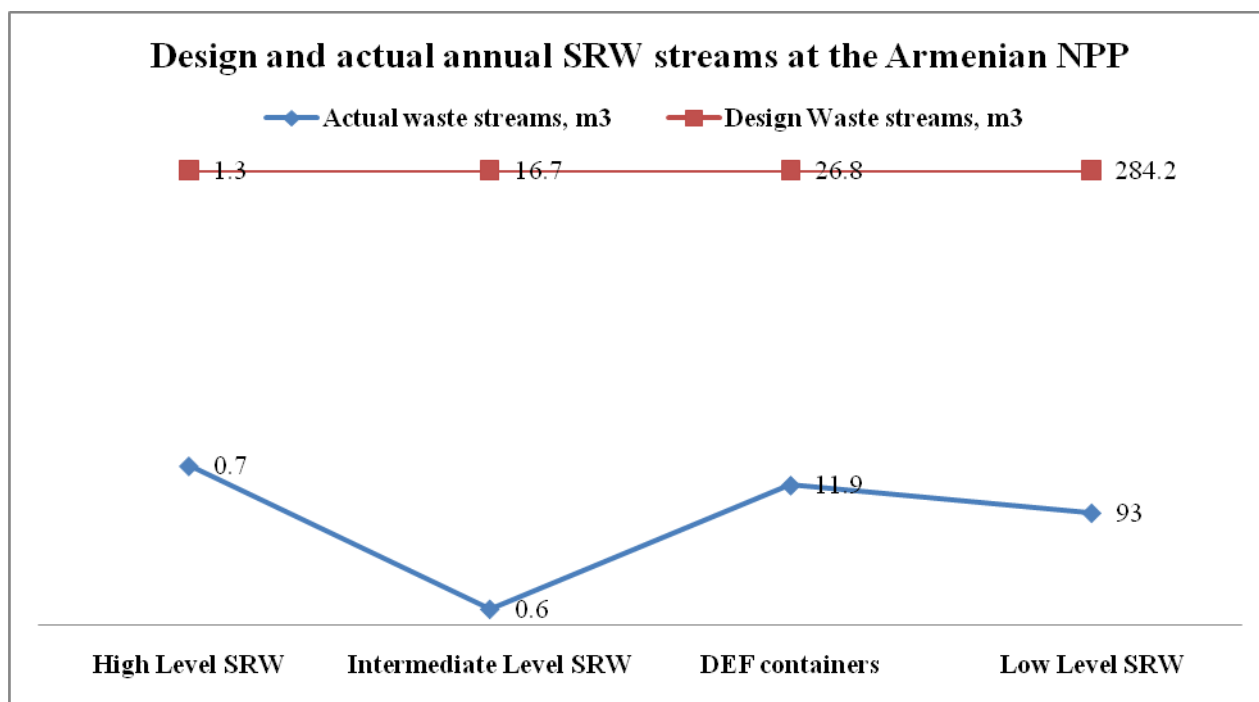


Figure 2. Design and actual annual SRW streams at the Armenian NPP

ANNEX 10. LIST OF ABBREVIATIONS

ALARA	As Low as Reasonably Achievable
ANL	Argon National Laboratory
ANRA	Armenian Nuclear Regulatory Authority
ARS	Armenian Rescue Service
ASSET	Assessment of Safety Significant Events
ASL	Accelerated Screening Level
ATWS	Anticipated Transient Without Scram
BDBA	Beyond Design Basis Accident
DBA	Design Basis Accident
CES	Commission on Emergency Situations
CDF	Core Damage Frequency
CMC	Crisis Management Centre
DE	Design Earthquake
DEF	Deep Evaporation Facility
DG	Diesel Generator
DGS	Diesel Generator Station
DSC	Dry Shielding Container
DSFS	Dry Spent Fuel Storage Facility
EAR	Event Analysis Report
ESP	Emergency Shutdown Panel
ECCS	Emergency Core Cooling System
ENR	Event Notification Report
EOP	Emergency Operating Procedure
EPREV	Emergency Preparedness Review Service
ERC	Emergency Response Center
HCLPE	High Confidence Low Probability Event
HPES	Human Performance Evaluation System
HSM	Horizontal Storage Modules
INES	International Nuclear Event Scale Information Service
INSC	Instrument for Nuclear Safety Cooperation
IPSART	International Probabilistic Safety Analysis Review Team
IRDP	International Regulatory Development Partnership
IRS	Incident Reporting System
I&C	Instrumentation and Control
LRW	Liquid Radioactive Wastes

LOCA	Loss of Coolant Accident
MCR	Main Control Room
MDE	Maximum Design Earthquake
MES	Ministry of Emergency Situations
MFS	Multi-functional Simulator
ND	Nominal Diameter
NRSC	Nuclear and Radiation Safety Center
OE	Operational Experience
OSART	Operational Safety Review Team
OED	Operational Experience Department
PAMS	Post-Accident Monitoring System
PAZ	Protective Actions zone
PGA	Peak Ground Acceleration
PSA	Probabilistic Safety Assessment
PROSPER	Peer review of the Effectiveness of the Operational Safety Performance Experience Review
PRZ	Pressurizer
SOEOP	Symptom-oriented emergency operating procedures
QMS	Quality Management System
RA	Republic of Armenia
RF	Russian Federation
RLE	Reviewed Level Earthquake
SSC	Systems, Structures and Components
QA	Quality Assurance
RDGS	Redundant Diesel Generator Station
SAR	Safety Analysis Report
SAT	Systematic Approach to Training
SER	Significant Event Report
SG	Steam Generator
SOER	Significant Operating Experience Report
SRW	Solid Radioactive Waste
SSEL	Safe Shutdown Equipment List
TG	Turbine Generator
US NRC	United States Nuclear Regulatory Commission
US DOE	United States Department of Energy
UPZ	Urgent protective actions zone

WANO
WENRA

World Association of Nuclear Operators
Western European Nuclear Regulators Association