CONVENTION ON NUCLEAR SAFETY

7th NATIONAL REPORT

Prepared by Government of Republic of Armenia for Seventh Review Meeting in March/April 2017

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Contents

A. INTRODUCTION

The seventh 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 (hereinafter referred to as the Armenian NPP) and development of efforts to ensure the country's energy security and independence.

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

B. 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 put to improve the nuclear safety by enhancing the national arrangements and developing the international cooperation to meet the obligations under the Convention on Nuclear Safety.

The RA operates one nuclear power plant – the Armenian NPP Unit № 2. The Armenian NPP Unit № 2 is operated in accordance with the license issued by the Armenian Nuclear Regulatory Authority (ANRA) on 1 April 2011. The Armenian NPP provides in average 45% of the electricity consumed in the country and is a very important component of the national economy that ensures the energy security of the country. The safety upgrades as specified in the List of the Armenian NPP Safety Improvement Measures are continuously implemented to improve the safety level of the Armenian NPP.

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 RA Government decided to initiate the construction of a new nuclear power unit(s), at the same time it undertakes necessary actions on the design lifetime extension of the Armenian NPP Unit № 2. In this regard, on 19.04.2012 the RA Government adopted the Decree № 461-N on approval of the design lifetime extension of the Armenian NPP Unit №2 and on 23.08.2012 the Decree №1085-N on approval of the requirements to extension of design lifetime for the Armenian NPP Unit №2 operation.

International peer review missions hosted by the Republic of Armenia in the reporting period

IAEA Pre-SALTO Mission at Armenian NPP (limited scope)

The peer review service on Safe Long-Term Operation (SALTO) at the Armenian NPP was performed from 15 to 23 April 2013. The terms and conditions of the operation license, issued by the ANRA in 2011 to the Armenian NPP stipulate that the plant must demonstrate the preparedness to operate beyond its design lifetime - 31 August 2016. Thus, the IAEA pre-SALTO mission reviewed the completed, in-progress and planned plant activities related to the LTO including activities related to the ageing management of systems, structures and components (SSC) important to safety. Based on the observations the peer review team concluded that the plant has yet to complete a significant part of activities important for the safe long-term operation and encouraged to continue the on-going activities and to prioritize the LTO activities to fulfill the action plan successfully and in a timely manner.

At the request of the Armenian NPP another pre-SALTO peer review mission will be organized from 28 November to 7 December 2016; the SALTO peer review mission is scheduled for 2017.

IPSART mission

At the request of the Government of the Republic of Armenia the IAEA conducted the International Probabilistic Safety Assessment Review Team (IPSART) mission from 13 to 22 October 2014. The objective of the mission was to review the Level 1 of the Probabilistic Safety Assessment (PSA) for Armenian NPP Unit №2. The review of the Level 1 PSA showed that in general the PSA for the Armenian NPP has a potential for a good level of quality. However it was recommended to resolve issues identified during the review before further development of the PSA models and documentation aimed to increase the scope of the PSA to Level 2 PSA.

IPPAS mission

From 1 to 12 December, 2014 the IAEA conducted IPPAS mission at the request of Armenia's Government. The mission reviewed the country's nuclear security-related legislative and regulatory framework for nuclear and other radioactive materials and associated facilities and activities, as well as security arrangements applied to the transport of radioactive sources. The team also reviewed the physical protection systems at the Armenian NPP and at three facilities where high activity sources are used or stored. The IPPAS team concluded that Armenia's nuclear security is robust and that important progress has been made in enhancing the nuclear security since the previous IPPAS mission in 2003. The team also identified several good practices in the national nuclear security regime and at the visited facilities. At the same time, it made recommendations and suggestions for further improvements in the nuclear security. The IPPAS mission findings consisted of 25 recommendations, 39 suggestions and 8 good practices.

IRRS mission

From 1 to 12 June, 2015 the IAEA conducted the Integrated Regulatory Review Services (IRRS) mission in Armenia. The purpose of the mission was to discuss the compliance of Armenia's nuclear safety regulatory infrastructure with the IAEA safety standards. The IRRS team found that the Armenia's nuclear safety regulation infrastructure complies with the IAEA safety standards that is reflected in developing and adopting legal acts in the nuclear area and in application of the IAEA safety standards. The IRRS mission findings consisted of 35 recommendations, 27 suggestions and 4 good practices. The ANRA developed action plans with the clearly established time frames for implementation of the recommendations and suggestions of the IPPAS and the IRRS respectively.

Armenian NPP Stress-Test Peer Review

Following the accident in 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 the stress tests. Thus, on August 2015 the ANRA, based on the Armenian NPP self-assessment report, submitted the National Report on Stress Test for Armenian Nuclear Power Plant, developed in accordance with the ENSREG technical specifications, to the European Commission for peer review. The National Report was posted on the ENSREG webpage and also on the ANRA webpage. The desktop review of the Armenian National Report on Stress Tests by the ENSREG Members and the EC took place from 15 February to 31 March 2016. As a result 196 questions were posed to the national report by the EC and the ENSREG Members and sent to the ANRA by 29 April 2016. The answers to the questions posed were prepared by the ANRA, the Nuclear and Radiation Safety Center and the Armenian NPP and were provided to the EC by 31 May 2016. The EC Peer Review Mission to Armenia took place from 20 to 24 June 2016. The EC peer review team (PRT) composed of 10 EU experts (8 from EU Member states who had been nominated by the ENSREG members and 2 from the European Commission). The conclusions of the EC experts to the Armenian NPP "stress test" are summarized the PRT report, based on which a national action plan will be developed.

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 - 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 MW, and the design lifetime is 30 years. The Armenian NPP was shutdown shortly after the Spitak earthquake on 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 remained in operation, the USSR Board of Ministers adopted decree to shutdown the Armenian NPP. Thus, the Unit №1 was shutdown on 25.02.1989 and the Unit №2 was shutdown on 18.03.1989. Both units were in long-term shutdown condition, but not decommissioned. To overcome the energy crisis on 07.04.1993 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 improvement measures, which is periodically revised and updated taking into account the operation experience of the Armenian NPP and of other countries operating similar NPPs, new IAEA safety standards, recommendations and suggestions made by the expert and peer review missions organized in frame of the international and technical cooperation projects with the IAEA, EC and other countries and international organizations.

The following safety related measures have been performed in the reporting period covering 2013-2016:

- Improvement of the main control room (MCR) conditioning, filtration and air cleaning system, installation of the emergency filtration system in the MCR;
- Implementation of the Emergency Shutdown Panel (ESP) and the Post-Accident Monitoring System (PAMS);
- 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;
- Replacement of nickel sealing gaskets of the power release channel and the technological channel by extended graphite ones.
- Replacement of composite welds of 2SG-5 and 2SG-6.

The licensing plan of the Armenian NPP design lifetime extension has been established following the Government Decree № 1085-N as of 23.08.2012 on approval of the requirements to extension of design lifetime for Armenian NPP Unit №2 operation. The licensing plan of the Armenian NPP design lifetime extension has been approved by the ANRA on 14.07.2015.

The following the safety related measures covered in the licensing plan are in process of implementation:

- Modification of the Emergency Core Cooling System;
- Modification of the Sprinkler System.
- Measures aimed to establish LOCA-200 as design basis accident.

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.

2.1 LEGISLATIVE AND REGULATORY FRAMEWORK OF THE REPUBLIC OF ARMENIA

The Constitution of the RA has the highest legal force and its provisions are directly applied.

Laws that should comply with the Constitution belong to the first level of legislative framework on the nuclear safety regulation.

Ordinances of the RA President, decrees of the RA Government and the RA Prime Minister belong to the second level of the legislative framework.

Regulations approved by the ANRA Chairman, registered by the Ministry of Justice of the RA and named “ministerial normative legal acts” belong to the third level of the legislative framework.

Guides, methodologies, industrial standards and so on belong to the forth level of the legislative framework.

The intentional treaties of the RA are integral part of the legislative framework and also belong to the first level. If the international treaties ratified by the National Assembly of the RA stipulate provisions other than the ones stipulated in the laws, the provisions of the ratified international treaties are applied. The list of international treaties ratified by the RA is provided in the Annex 1.

2.2 NATIONAL SAFETY REQUIREMENTS AND REGULATIONS

The following laws directly pertain to the nuclear safety and belong to the first level of the legislative framework:

- The Code of the RA on Administrative Offenses, as amended in 1996. The amendments empower the ANRA to impose sanctions (warnings and fines**)** to offender of the legislation in the field of atomic energy utilization;

- The Law of the RA on Environmental Impact Expertise as of 20.11.1995;
- The Law of the RA on Population Protection in Emergencies (№ N-265 as of 09.12.1998) that establishes organization of population protection in emergency situations, rights and responsibilities of the state and local authorities, entities, officials and citizens involved in the national emergency response system;
- The Law of the RA on organization and conduct of inspections (№ HO-172 as of 17.05.2000) that settles relations concerned with organization and conduct of inspections and examinations of practices of entities as well as of individual entrepreneurs;
- On May 30, 2001 (with further amendments as of 16 March 2004) the National Assembly (Parliament) of the Republic of Armenia adopted the Law on Licensing that establishes types of practices subject to licensing in the atomic energy utilization field and settles relations related to licensing;
- On March 1, 1999 the National Assembly (Parliament) of the Republic of Armenia adopted the Law on Safe Utilization of Atomic Energy for Peaceful Purposes, which is the basic legal document for settling relations in the field of the atomic energy utilization and is called to ensure fulfillment of obligations of the RA under the international treaties in the field of atomic energy utilization;
- On April 18, 2003 the National Assembly (Parliament) of the Republic of Armenia adopted the Criminal Code of the RA that specifies the types of crimes and liabilities in the field of atomic energy utilization.

Ordinances of the RA President, decrees of the RA Government and the Prime Minister belonging to the second level of the legislative framework settle down specific relations.

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

The list of legal acts belonging to the second level of the legislative framework is provided in the Annex 2.

Legal acts, that are approved by the ANRA and registered by the Ministry of Justice of the RA (and that are binding), are adopted in accordance with the legal acts having higher legal force. These legal acts belong to the third level of the legislative framework, are named ministerial normative legal acts and settle down specific issues.

The list of ministerial normative legal acts adopted by the ANRA is provided in the Annex 3.

The relations concerned with development, agreement and approval of legal acts are settled down in the Law of the RA on Legal Acts and the Ordinance of the RA President. Thus, in accordance with the procedure established, a draft legal act developed by the ANRA prior to submission to the RA Government for adoption (in case of laws - for approval) should be submitted to the concerned authorities (ministries, state authorities under the RA Government) for consent and also posted on the ANRA web site.

In accordance with the Law of the RA on Legal Acts and the Ordinance of the RA President the following documents should be submitted in support to a draft legal act:

- Justification for adoption of legal act;
- Drafts legal acts concerned with adoption of legal act or a note on absence a need to adopt them;
- A note on changes in the state budget concerned with adoption of legal act.

The ministries and state authorities make their comments and proposals to submitted draft legal acts. Based on these comments and proposals the ANRA makes corrections and adjustments to draft legal act, as necessary, and submits it to the RA Government. If the concerned ministries and state authorities make comments and proposals, the ANRA submits a note with justification of accepted

comments and proposals as well as justification on the reasons for non-acceptance of proposals or comments made.

The same procedure is applied also to the process of amendment or supplement of the adopted legal acts.

The legal acts were adopted in the reporting period

Laws

The Law on Safe Utilization of Atomic Energy for Peaceful Purposes was amended and supplemented twice in the reporting period: in November 2013 and June 2016. The amendments enforced since November 2013 complemented the Law with the 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 amendments made in June 2016 were aimed to bring the provisions on organization and conduct of the regulatory inspections stipulated in the Law in compliance with the IAEA Safety Standards.

Government Decrees

The RA Government Decree № 631-N as of 04.06.2009 on approval of the procedure on radioactive waste management was amended and supplemented under the RA Government Decree №1291 as of 19 November 2014. The amendments are aimed to harmonize the existing radioactive waste classification in Armenia with the IAEA proposed ones established in the General Safety Guide №GSG-1 “Classification of Radioactive Waste” in order to launch the back-end driven approach in the field of radioactive waste management.

The RA Government Decree № 1219-N as of 18.08.2006 on approval of radiation safety norms was amended and supplemented under the RA Government Decree №1367 as of 27 November 2014. The amendments were aimed to bring the provisions established in the radiation safety norms and rules in line with the IAEA safety standards.

The RA 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 was amended and supplemented under the RA Government Decree №1479-N as of 17.12.2015. The amendments stipulated that radioactive materials can be imported/exported only by the legal entities. The relations concerned with import and export were brought in line with IAEA Code of Conduct on the Safety and Security of Radioactive Sources.

The RA Government Decree №11-N as of 14 January 2016 on approval of the physical protection rules of radioactive materials and devices containing radioactive materials. The decree establishes the requirements to the physical protection system of radioactive materials and devices containing radioactive materials, the physical protection levels according to the assessment of design basis threat and other issues concerned with response to and regulation of associated events, as well as the requirements to prevent illicit trafficking of radioactive materials, to reduce possible threats concerned with their theft or other illegal possession.

The ANRA submitted a draft of the RA Government Decree on amendments and supplements to the Government Decree № 1263 as of 24.12.2001 on approval of the special rules on transport of nuclear and radioactive materials to the concerned ministries for comments and to the RA Government for approval. The amendments are aimed to bring the special rules on transport of nuclear and radioactive materials in line with the IAEA safety standards.

Ministerial Acts

- "Requirements to content and form of the complex survey report" approved under the ANRA's order №9-N as of 19 January 2016 (registered at the RA Ministry of Justice under № 12516039 on 04 February 2016);
- "Methodology on analysis of deviations of Armenian NPP design and actual state from the legal acts applied in the nuclear energy utilization field" approved under the ANRA's order №98-A as of 22 April 2016.

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

2.3 SYSTEM OF LICENSING

The licensing related relations are settled down under the Law of the RA on Licensing, the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes and the relevant licensing procedures approved by the RA Government.

The following practices in atomic energy utilization field are subject to licensing:

- Site selection, design, construction, operation, and decommissioning of nuclear installations;
- Use, transport and storage of nuclear materials;
- Physical protection of nuclear installations and nuclear materials;
- Expertise of designs and other documents of nuclear installations,
- Physical persons implementing practices and holding positions important to safety in atomic energy field and other.

The licensing is implemented in accordance with the complex procedure: licensing of specific type of practice is specified in respective licensing procedures (approved under the RA Government Decree). For instance, the RA Government Decree № 400-N as of 24.03.2005 on approval of the licensing procedure for operation of nuclear installations specifies the requirements to licensing operation of nuclear installations, the list of application supporting documents, the requirements mandatory for obtaining a license, the provisions related to review of application supporting documents, rejection of license application and other issues.

In accordance with the established procedure the ANRA reviews application for obtaining licence for construction, operation and decommissioning of nuclear installations within 30 days after receiving all documents stipulated in the law, and grants or rejects licence within 180 days after all documents are submitted. The Law of the RA on Licensing specifies also provisions for extension of licence validity period.

Thus, the ANRA establishes a licensing commission to make conclusions on granting, termination or revocation of license; the statute of the licensing commission is approved by the ANRA. The licensing commission organizes sessions to review licence applications. Applicant is duly notified about review not later that in 7 days in advance with indication of venue (address) where review takes place, date and time. Non-participation of applicant in review is not the basis for non-review or rejection of licence application if other date for review is requested by applicant. This request of applicant can be met if he cannot participate in review by reasoned justifications and if postponement of review will not result in violation of terms specified in the legislation. Applicant has the right to involve specialist, expert, auditor, lawyer or interpreter in review. Applicant or his counselors have right to make speeches, answer questions posed by the commission members, request arbitration. Reviews are conducted with open doors. Reviews involving state, official and banking confidential information are conducted with the closed doors. At applicant's request reviews can be conducted with the closed doors if commercial confidential information will be discussed during review. Journalists, specialists, officials and other persons can be involved in

reviews made with the closed doors. The closed-door review process can be audio and video recorded.

Provisions related to the public involvement and awareness of nuclear installation construction are specified in the Law of the RA on Environmental Impact Expertise (Articles 4,5), the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes (Article 10) and the Law of the RA on Construction of New NPP Unit (s) (Article 4). According to the latter, in the process of new NPP unit(s) construction the RA Government in the established order shall, regularly but not later than once in a half a year, inform public and environmental organizations about the progress with implementation of the program on construction of new NPP unit(s).

In accordance with the Law of the RA on Construction of New NPP Unit(s), the RA Government under its Decree № 604-N as of 20 May 2010 on provision of information on implementation of the program on construction of new NPP unit(s) to public and environmental organizations, has established that with the purpose to provide information on implementation the program on construction of new NPP unit(s) the Ministry for Energy and Natural Resources shall cooperate with environmental organizations, as well as mass media in compliance with the Law of the RA on Freedom of Information.

The Ministry for Energy and Natural Resources of the RA makes public the information on progress of new NPP unit(s) construction through mass media sources, internet, and other means specified in the RA legislation:

a. Not later than once in each six months, through press reports or press releases informs public and environmental organizations about the progress with implementation of new NPP unit(s) construction program;

b. As necessary, organizes press conferences as well as meetings of journalists and representatives of environmental organizations with persons involved in new NPP unit(s) construction program;

c. In two days before a press conference makes relevant announcements to mass media and environmental organizations that are accredited in advance to participate in the press conference. Announcement about press conference should be posted on the web site of the ministry. The announcement can be disseminated also via newspapers and e-mailed to mass media and environmental organizations;

d. As necessary, requests the persons responsible for new NPP unit(s) construction process to prepare publications and expert analysis related to the program;

e. During presentations organized on different stages of new NPP(s) construction program, as necessary, organizes visit of journalists and environmental organizations to the new NPP unit site and provides also with press releases and transportation.

In accordance with the Code of the RA on Administrative Offences a legal entity has no right to implement practices subject to licensing without license, otherwise administrative or criminal liabilities shall be applied. In accordance with the Article 169 of the Code of the RA on Administrative Offences, the implementation of a practice without licence is subject to a fine at the rates specified in the legislation. The Article 188 of the Criminal Code of the RA stipulates the provisions related to implementation of activities without special permit (license), causing losses to public or commercial organizations and other as well as enforcement actions to be imposed for each offence.

The right of the ANRA to impose enforcement actions is established in the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes, the Law of the RA on Licensing and the Code of the RA on Administrative Offences.

2.4 SYSTEM OF REGULATORY INSPECTION AND ASSESSMENT

The inspection is one of the major functions of the ANRA to satisfy itself that the Armenian NPP fulfills the terms and conditions set out in the authorizations and the regulatory requirements. The ANRA's inspections are organized and conducted in accordance with the Law on Safe Utilization of Atomic Energy for Peaceful Purposes, the ANRA Statute and the Instruction on organization and conduct of inspections at the NPP.

The inspections are performed in accordance with the schedule approved in frame of the ANRA's annual plan on preliminarily determined topics. It is based on the 3-years baseline periodic inspection program developed by the ANRA.

The ANRA performs the following inspections at the Armenian NPP in accordance with its periodic inspection plan:

- Compliance with the requirements of safety rules and regulations in the nuclear energy field;
- Compliance with the license terms and conditions;
- Implementation of QA programs;
- Implementation of ANRArogramserms and conditions and regulations in;
- Organizational structure of NPP;
- Implementation of NPP safety upgrades, modifications of systems and elements important to NPP safety;
- Implementation of periodical examinations of systems and elements important to NPP safety;
- Ageing management system of elements and systems important to NPP safety;
- Organization of maintenance and repair of elements and systems important to NPP safety;
- Personnel training system;
- Technical and operational documentation system;
- Compliance with the requirements of the technological specifications and instructions on NPP operation;
- Radiation safety and environmental control;
- NPP emergency preparedness;
- Radioactive waste management;
- Fresh and spent nuclear fuel management;
- Nuclear materials accounting system;
- Physical protection system;
- Organization of housekeeping;
- System on investigation of NPP event causes;
- Fire protection system.

The design life time extension of the Armenian NPP is also included in the ANRA's inspection plan.

In accordance with the chapter 2 point 7 of the Procedure on conduct of inspections, the ANRA undertakes planned and reactive inspections at the Armenian NPP that in its turn can be announced and unannounced.

Planned inspections are performed in accordance with the ANRA's work plan. Reactive inspections are performed in connection with accidents and events at the NPP or in accordance with the decision of the ANRA management.

In case of announced inspections the operating organization is notified by the ANRA not later than in 10 days before inspection. Unannounced inspections are performed without advance notification of the operating organization.

The regulatory inspectors use the following methods of inspections:

- Monitoring and direct observation;
- Discussions and interviews with personnel;
- Review and verification of instructions, procedures, records and other documents on ensuring and justification of safety.

The inspection team collects the following information prior to an inspection:

- Safety norms and rules related to the inspected area;
- Documents related to the organizational structure of the operating organization, quality assurance program for practices implemented by the NPP and related to the inspected area and relevant operational procedures and programmes;
- Terms and conditions of licenses/permits issued by the ANRA to the operating organization;
- Information from annual reports and/or safety submittals;
- Information on enforcement actions imposed by the ANRA earlier and information on their implementation, and also reporting documents developed based on results of earlier performed inspections;
- Other available information related to the inspection.

Deficiencies detected during inspections are recorded and discussed at the final meeting with the management and responsible employees of the NPP.

In accordance with the chapter 5 of the Procedure on conduct of inspection, results are documented in act (report) if no non-compliance has been detected or act-enforcement if non-compliances have been detected with indication of necessary corrective measures and deadlines. The following is indicated in the act-enforcement:

1. Fact of non-compliance with NPP safety requirement;
2. Points of articles with indication of legal acts, norms and rules in atomic energy utilization field non-complied with;
3. Requirements to eliminate deficiency detected;
4. Deadline for elimination of deficiency.

Act and act-enforcement are signed by the leader of inspection team, all members of the inspection team and transmitted for signature to the NPP Director General.

Routine inspections are conducted by the resident inspector. When detecting non-compliances with the NPP safety requirements the resident inspector issues enforcement to the NPP Director General and informs the ANRA about it.

The ANRA controls over fulfillment of its act-enforcements and enforcements through:

1. Receiving and review of information on fulfillment of requirements of act-enforcements and enforcements and control over timeliness of its submission;
2. Verification of fulfillment of act-enforcements and enforcements.

The ANRA performs accounting and control over implementation of the enforcement actions applied.

2.5 ENFORCEMENT OF APPLICABLE REGULATIONS AND TERMS OF LICENCES

The right of the ANRA to impose enforcement actions is established in the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes, the Law of the RA on Licensing and the Code of the RA on Administrative Offences.

The Articles 36 and 37 of the Law of the RA on Licensing specify the cases for suspension and termination when the ANRA has right to suspend and terminate licence.

The Code of the RA on Administrative Offences (Articles 97-97[6]) specifies the types of administrative offences in the atomic energy utilization field and the types of enforcement actions (fines) applied by the ANRA.

The process of application of enforcement actions starts with drawing up a protocol on administrative offence. The protocol should indicate date and venue, name and surname of person drawing up the protocol, information about person committed an offence, time and venue where the offence was committed, subject-matter of offence, the normative document which establishes liability for the present offence, explanatory note of the offender, other information related to the case. The protocol is signed by the person drawn up the protocol and by the person committed the offence (offender). If the offender refuses to sign the protocol, the indication on that should be appropriately made. The offender has right to give explanations and comments to the protocol content which are to be attached to the protocol, as well as to express in writing reasons of his refusal to sign the protocol. While drawing a protocol the offender is notified of his rights and responsibilities and this is relevantly indicated in the protocol. The protocol is the basis for investigation of a case with offence. Authority (official) investigating the case when detecting causes and conditions resulting in administrative offence, makes relevant proposals on undertaking measures intended to eliminate those causes and conditions.

Having investigated the case on administrative offences the official makes one of the following decisions:

- Impose administrative penalty;
- Withdraw the case.

Decision on administrative offence is mandatory for implementation by state and public authorities, entities, officials and citizens. Decision on the case on administrative offence can be appealed in court by person to whom it was applied as well as by aggrieved party.

In the reporting period 9 administrative offences (fines) were applied to the Armenian NPP management.

Thus, the RA has established and maintains the legislative and regulatory framework for nuclear installations safety that includes:

- Establishment of relevant national requirements and regulations on safety;
- System for licensing of nuclear installations and prohibiting to operate nuclear installations without licence;
- System of regulatory inspections and assessment to confirm the compliance with the requirements specified in the regulations and licence terms;
- Enforcement of requirements specified in the applied regulations and licence terms, including suspension, modification and termination of licence.

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 fulfill 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.***

3.1 ESTABLISHMENT OF THE REGULATORY BODY

The Armenian Nuclear Regulatory Authority was established under the RA Government Decree № 573 as of 16 November 1993 as a state authority under the RA Government empowered to regulate the nuclear and radiation safety in the atomic energy utilization field. In the period 2002-2008 the ANRA functioned within the Ministry for Nature Protection of the RA in the status of the inspectorate; in May 2008 under the Ordinance issued by the RA President the inspectorate was reorganized into the State Committee under the Government of the RA on Nuclear Safety Regulation (it was decided to retain the acronym "ANRA"). The statute and the organizational chart of the ANRA were approved under the RA Government Decree № 866 as of 17 June 2008.

The ANRA is the republican body of the executive power implementing the state regulation of the atomic energy utilization field aimed to ensure the safety of population and personnel, environmental safety and to defend safety interests of the Republic of Armenia. The ANRA Chairman is appointed and dismissed by the RA Prime Minister. The ANRA Chairman reports to the RA President, RA Government and RA Prime Minister. The ANRA does not report to any other authority or ministry. The ANRA is independent from the agencies responsible for promotion of nuclear energy, has its independent budget (is directly financed from the state budget); the ANRA's jurisdictions are established in the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes (Articles 17, 17^1) and its Statute.

In accordance with the above mentioned legal acts the ANRA's jurisdictions are:

a. Organization of development, development and submission of drafts of safety norms and rules, legal acts related to the atomic energy utilization field to the RA Government in accordance with the established procedure;
b. Licensing of practices and physical persons implementing practices and holding positions important in terms of safety in the atomic energy utilization field;
c. Suspension or termination of license in accordance with the requirements of the international treaties and the RA legislation when non-compliance by a licensee with license terms and conditions is detected;
d. Safety assessment, organization and conduct of expertise of practices, installations and equipment in the atomic energy utilization field;
e. Organization and conduct of researches for safety strengthening purposes in the atomic energy utilization field;
f. Control over compliance with requirements of the RA laws related to the atomic energy utilization field as well as terms and conditions of issued licenses by legal entities and physical persons;
g. Verification of QA programs of contractors implementing safety important activities and rendering services to licensees in the atomic energy utilization field;

h. Control on preparedness of licensees to possible emergency situations;

i. In case of emergencies, assessment of situation and on the basis of prognosis on its possible changes submission of proposals on implementation of necessary protective actions to the state authority of the RA empowered with the responsibility for emergency situation related issues;

j. Jointly with the authority empowered with responsibilities for foreign affairs within its jurisdictions control over fulfillment of the RA of commitments undertaken under the international treaties of the RA in the atomic energy utilization field;

k. Control over safeguards implementation;

l. Imposing sanctions to licensees binding for implementation when non-compliance with requirements specified in the RA legislation related to the atomic energy utilization field and with terms and conditions of issued licenses is detected, and issuing order for termination of activities being implemented in case of threat to the human health and the environment;

m. The right to stop immediately the operation of the Armenian NPP rests with the ANRA Chairman, his relevant deputy and the resident inspector;

n. In accordance with the RA legislation, imposing administrative offences to licensees breaching the RA laws related to the atomic energy utilization field, safety norms and rules, requirements of sanctions imposed, and in the order established in the law, transmission of the materials related to breach to the law enforcement authorities;

o. With the purpose to determine the condition of nuclear and radiation safety, inspection of atomic energy utilization installations and of activities carried out there freely, using the necessary measurement and registration instruments, including audio and video recorders, entering industrial sites of atomic energy utilization objects freely, taking needed samples and obtaining data, installing necessary devices;

p. Involving in the established order specialists from the RA ministries, other state authorities, organizations as well as international organizations in inspection practices;

q. Assessment of investigations conducted by operating organization in relation to nuclear and radiological emergencies taken place during operation of atomic energy utilization installations and implementation of additional investigation, as necessary, in accordance with the procedure established by the RA Government and development of database of deficiencies;

r. State registration of nuclear materials, ionizing radiation sources and radioactive waste;

s. Providing information to state and local authorities, physical persons and mass media on nuclear and radiation safety in accordance with the procedure established in the RA legislation;

t. Cooperation with international and foreign competent organizations on issues related to safety regulation;

u. Coordination of the RA national and regional projects in frame of technical cooperation with the IAEA;

v. Making early international notification on an emergency, in accordance with to the provisions of the Convention on Early Notification in case emergencies at the atomic energy utilization installation or in activities implementing there;

w. Once a year submitting a report to the RA Government on nuclear and radiation safety situation in the RA, its separate regions or separate atomic energy utilization installations;

x. State regulation (within its jurisdictions) of physical protection of nuclear and radioactive materials and atomic energy utilization installations jointly with the RA police and state authority empowered with national security related issues;

y. Obtaining information necessary for nuclear and radiation safety assessment from state authorities and organizations in accordance with the procedure established in the RA legislation;

z. Adopting ministerial acts;

aa. Monitoring and controlling exposure to environmental radiation.

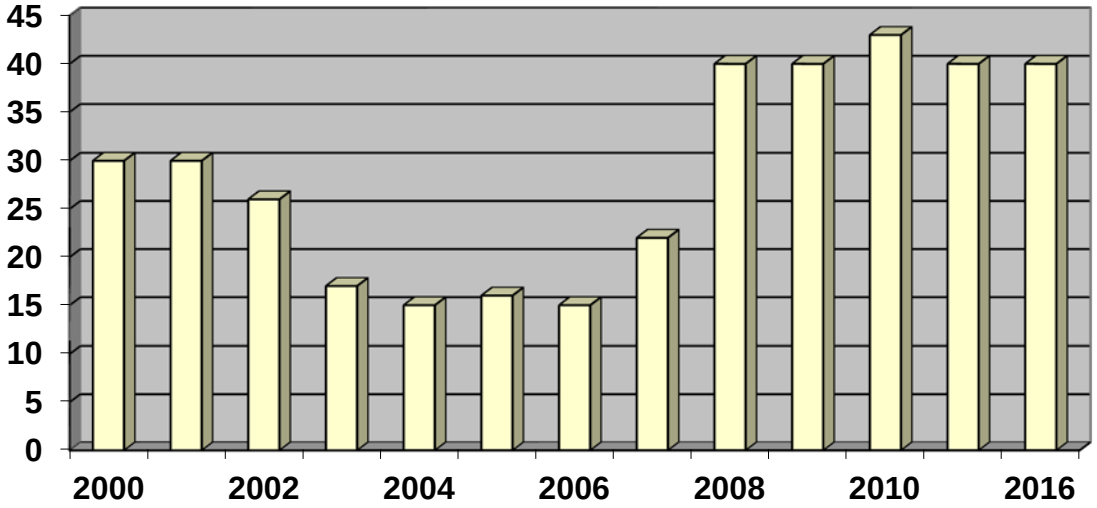
The organizational structure of the ANRA is provided in the Annex 4.

ANRA Human Resources

The ANRA staff list as of 01.01.2010 includes 43 positions. At present 40 out of 43 positions are occupied at the ANRA; 27 out of 37 are the professional staff, 4 out of 27 have PhD, 15 have more than 10 years experience in the atomic energy utilization field and 6 out of those 15 have 5-years work experience at the Armenian NPP.

The ANRA organizes training of new staff in accordance with the individual programs consisting of theoretical (on the jog self-training) and practical trainings. The resources of the IAEA, US NRC and EC cooperation programs are used for implementation of separate tasks concerned with training, improvement and maintaining of the personnel qualification.

Dynamics of ANRA Staffing



The ANRA is financed from the State Budget of the RA. The budget for 2016 is 257,973,600.0 Armenian Drams (AD) (approximately 543,102.0 USD), which is approximately for 52 million AD more than in 2013. 67,798.275 AD (approximately 142,733.0 USD) is intended for funding the technical support organization of the ANRA – the Nuclear and Radiation Safety Center.

To function effectively and to continually improve the regulatory performance the ANRA has established a process oriented quality management system. The ANRA QMS is represented in the management handbook. The ANRA QMS is a set of interrelated or interacting processes that establish policies and objectives and which enables those objectives to be achieved in safe, efficient and effective manner. It is planned to revise the ANRA QMS and bring it in compliance with the IAEA GS-R-3.

To improve safety and physical protection of nuclear facilities and nuclear materials, to promote non-proliferation and to prevent illicit trafficking of nuclear materials the ANRA cooperates with the international organizations and regulatory authorities of other countries to harmonize Armenia's policy in the atomic energy utilization field.

The ANRA has cooperation agreements with the following regulatory authorities:

- United States Nuclear Regulatory Commission (US NRC) in frame of the Arrangement between the Nuclear Regulatory Authority of the Republic of Armenia and The United States Nuclear Regulatory Commission on the Exchange of Technical Information and Cooperation in Nuclear Safety Matters (signed on 13 March 2012);
- Rostekhnadzor in frame of the Agreement between the Federal Authority of Russia on Nuclear and Radiation Safety and the State Authority of Armenia on Nuclear and Radiation Safety (23 May 1994);
- Department of Nuclear and Radiation Safety of the Ministry of Emergency Situations of the Belarus Republic in frame of the agreement between the Government of the Republic of Armenia and the Government of the Republic of Belarus on cooperation for exchange of information and on nuclear safety and radiation protection (signed in May 2012);
- The agreement between the State Nuclear Regulatory Inspectorate of Ukraine and the Armenian Nuclear Regulatory Authority on cooperation in the fields of nuclear safety and radiation protection is in process of preparation to signature.

In frame of EC INSC, IAEA technical cooperation projects the ANRA cooperates with:

- Bel V, (a subsidiary of the Federal Agency for Nuclear Control), Belgium;
- Bulgarian Nuclear Regulatory Authority (BNRA), Bulgaria;
- Gesellschaft für Anlagen- und Reaktorsicherheit (GRS), Germany;
- Institut de Radioprotection et de Sûreté Nucléaire (IRSN), France;
- Nuclear Research Institute Řež plc (NRI Řež), Czech Republic;
- Radiation and Nuclear Safety Authority of Finland (STUK);
- Slovak Nuclear Regulatory Authority (UJD SR);
- State Office for Nuclear Safety (SUJB), Czech Republic.
- And other.

The ANRA has no advisory committees. The Nuclear Energy Safety Council under the RA President was established under the Ordinance NH-606 issued by the RA President on 3 July 1996 (the statute was approved under the President Ordinance NH-679 as of December 19, 1996). The main tasks of the Council are:

- Formulation of trends in the nuclear safety area and its development priorities, development of instructions and proposals on principal tasks,
- Analysis and expertise of legal acts on safe and peaceful use of atomic energy submitted to the RA President.

The Council implements its activities through meetings. The meetings are convened at the initiative of the RA President or members of the council in agreement with the RA President not less that once a year. The Council is composed of world authorities in nuclear science and engineering.

The state republican authorities are the ministries of the RA, state authorities under the RA Government. The RA Government structure and the position of the ANRA within the structure are provided in the Annex 5.

In accordance with the Article 17 (j) and its statute the ANRA submits annual report to the RA Government on nuclear and radiation safety of the RA, its certain territories and nuclear installations.

Thus, the regulatory authority for nuclear safety regulation has been established at the RA; it is provided with relevant jurisdictions, human and financial resources and there is an effective separation between the functions of the ANRA from the agencies responsible for promotion of nuclear energy.

Technical support to the ANRA is provided by the Nuclear and Radiation Safety Center (NRSC), which is a scientific and technical company established under the Government Decree №342 as of 25.04.2001.

The NRSC hires staff on the contractual basis and currently employs about 30 specialists (with an average age of 35 years), including:

- PhD holders - 7;
- PhD students – 2;
- Engineers & physicists - 17;
- IT specialists - 4;
- Management & Administration - 9.

The NRSC provides technical and expert support to the ANRA in the following areas:

- Expertise of technical solutions and documents on safety justification in frame of licensing the Armenian NPP safety upgrades;
- Technical review of the revised SAR of the Armenian NPP Unit №2;
- Technical review of the SAR of the spent fuel storage facility;
- Technical support to licensing of ionizing radiation sources;
- Technical support to inspection activities in nuclear facilities, ionizing radiation sources, radioactive waste storage and disposal facilities;
- Development of drafts regulations related to nuclear and radiation safety, radioactive waste management;
- Development and application of analytical models (including the PSA Level 1 models) for safety analyses and application of models to support the regulatory decision making process;
- Development of procedures for the ANRA ERC and involvement in the emergency response teams of the ANRA;
- Participation in regulatory actions for strengthening control over radiation sources.

The technical and expert support of the NRSC allows the ANRA to make decision on nuclear and radiation safety regulation with better quality and in a timely manner. With the NRSC's support the ANRA organizes training and retraining of its personnel, including on-the-job training and training in the international courses.

3.2 STATUS OF THE REGULATORY BODY

The position of the ANRA in the RA government structure is demonstrated in the Annex 5. The organizational structure of the ANRA is provided in the Annex 4. The information on status, jurisdictions, responsibilities, reporting obligations of the ANRA is provided in the section 3.1-Establishment of the Regulatory Body.

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.

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 (point 1.2.1.6) of the Armenian NPP the prime

responsibility for safe operation of safety important installation rests with the operating organization.

In accordance with the Article 20 of the Law the operating organization:

a. Develops and implements safety measures in the atomic energy utilisation object;
b. Ensures that a safety culture is maintained;
c. In the manner prescribed periodically submits reports on the safety of the facility to the regulatory authority;
d. Ensures that nuclear, radioactive and special materials, special equipment and technologies are put to useful purposes;
e. Ensures the physical protection of atomic energy utilisation installation, nuclear, radioactive and special materials, special equipment and technologies;
f. Develops the quality assurance programme for each stage in the lifetime of the atomic energy utilisation installation (site selection, design, construction, commissioning, operation, decommissioning) and ensures its implementation;
g. Organises the control of dose limits amongst personnel in the manner prescribed;
h. Organises the accounting and control of nuclear, radioactive and special materials and radioactive waste;
i. Organises and conducts investigations in the manner prescribed into incidents and accidents occurring during the operation of atomic energy utilisation installations;
j. In the manner prescribed develops the response plan for emergencies occurring in the atomic energy utilisation installation and ensures the preparedness of personnel and the necessary resources for its implementation;
k. Develops the programme of activities for protection against fire in the atomic energy utilisation installation and ensures its implementation;
l. Organises the recruitment and training of skilled personnel to work in the atomic energy utilisation object, or with nuclear and radioactive materials;
m. Ensures that the health and social conditions governing the personnel of the atomic energy utilisation installation are in accordance with the current regulations;
n. Carries out periodical safety assessments of the installation to ascertain its compatibility with the most recent safety requirements;
o. Performs other authorities determined by this Law and other legislative and legal acts of the Republic of Armenia.

The operating organisation of the atomic energy utilisation installation carries out the following tasks important in terms of safety:

a. Establishes the services that control the nuclear and radiation safety;
b. Organises the permanent control over the radiation situation in the controlled and supervised areas of the atomic energy utilisation installation;
c. Provides periodically the governor (mayor of Yerevan) of the territory included in the supervised area of the atomic energy utilisation installation with information in the established order on the radiation situation in the supervised area.

The ANRA ensures that the operator discharges its prime responsibility for safety by establishment of safety requirements and regulations, inspections and assessment, control over compliance with the legislation as well as with the licence terms and conditions, and imposing enforcement actions and in case of detecting violation of licence terms and conditions up to suspension and termination of license.

5 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.

The state policy in the area of nuclear energy is formed by the RA National Safety Council, and the RA Government is responsible for implementation of that policy.

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

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 in 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 snapshot 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.

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 been performed since 2010. The annual reports are submitted to the ANRA. The proposed measures aimed at elimination of specified deficiencies that are assigned to the 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.

In 2013 the WANO MC performed Peer Review (PR) at the Armenian NPP in the following areas of productive activity and company's activity on a whole, correspondingly:

a. Management organization and administration;
b. Operations;
c. Maintenance;
d. Technical support;
e. Radiation protection;
f. Operating experience feedback;
g. Chemistry;
h. Personnel training and qualification;
i. Fire protection;
j. Emergency preparedness.

In 2013 the WANO MC also performed Corporate Peer Review (CPR) at the Armenian NPP in the following areas of productive activity and company's activity on a whole, correspondingly:

a. Corporate management and administration;
b. Corporate surveillance and control;
c. Corporate support;
d. Human resources;
e. Interfaces.

The corrective actions were developed based on the results of both peer reviews. The PR follow-up was performed in 2015. The results were assessed as positive on a whole. The CPR follow-up will be performed in 2016.

Following the nuclear accident at the Fukushima nuclear power plant on 11 March 2011, the Armenian Government emphasized the need for urgent actions to reassess the preparedness of Armenian NPP to respond to emergencies. In June 2011, ANRA required the Armenian NPP to perform in-depth reassessment of the Armenian NPP safety in the light of Fukushima accident (stress-tests), which should be in conformity with the methodology adopted by the ENSREG and the EC.

In this initiative the Armenian NPP was supported by the EC under the dedicated project to implement the self-assessment and prepare the report. The Armenian NPP self-assessment covered Unit №2 and the wet spent fuel pools of Unit № 1 and Unit №2. The plant data and reassessment provided in report are as of July 2012.

The national stress-test report has been prepared on the basis of self-assessment report of the Armenian NPP. The first part of the report provides the main data for the site and the Armenian NPP with special emphasis being made on its characteristics. The design bases of the Armenian NPP, reassessment of safety margins and cliff edge effects are provided in the chapters 2-6; each chapter summarizes the proposed measures to improve the plant robustness to extreme natural phenomena. In the chapter 7 conclusions and recommendations are summarized. The national stress-test report has been sent to the ENSREG group in August 2015. The EC peer review was performed on 20-24 June 2016 in Yerevan, Armenia. The recommendation of the EC experts to the Armenian NPP "stress test" are summarized the PRT report (the final version is expected to be provided by the EC in August 2016), based on which a national action plan will be developed.

6 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.***

6.1 FINANCIAL RESOURCES

In accordance with the Article 19[1] 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. The financial securities for decommissioning of nuclear installations are accumulated on a special account of the Ministry of Finance the RA. The use of these financial means in other purposes is prohibited. The RA Government adopted a 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.

6.2 HUMAN RESOURCES

Selection, training, examination and permit to work of the Armenian NPP personnel are arranged in compliance with the "Administrative Control Program. Armenian NPP personnel development".

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

The list of positions implementing safety important activities has been established by the RA Government. Qualification of persons holding position included into this list is verified in compliance with the 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 performed, and guidelines, regulations and procedures were developed and implemented for this purpose. These documents describe methods of developing training materials and conduct of training.

Analysis of the 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 the simulator training (the need for simulator training is established in the training program).

The 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 personnel.

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

In case of modifications to 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 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 implemented at the NPP training center. The practical training of the mentioned personnel is performed in the work places of the relevant structural departments.

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

The “Self-assessment of personnel training system efficiency” and the “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 in relation modernization of equipment and system also in relation to activities performed during outages is implemented.

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 the plant safe operation, as well as by the regular leaves provided to employees and the time allocated to training. For positions important from the safety point of view the method of personnel number redundancy is additionally applied.

The 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 the nuclear safety related practices and having certificates accepted by the ANRA. All activities are performed by the personnel trained according to the developed and approved procedures.

Qualification of the 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 implemented at the Armenian NPP in order to perform certain activities at the Armenian NPP in the established order.

The ANRA performs inspections to verify the sufficiency of human resources at the Armenian NPP in accordance with the inspection program.

Based on the inspections results the 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 during the regulatory inspections.

7 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 design of any modification takes into account the human factor with implementation of the "Operator non-interference" principle. The operators will not be able to interfere in the software operation within 10 minutes after violation of normal operation condition of the new system. In 10 minutes these systems provide the operators with information on possible and allowed actions.

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

The functions connected with human and organizational factors management in the operating organization are distributed among the divisions. In particular, the aspects concerned with investigation and analysis of event connected with the human and organizational factors are assigned to the Operating Experience Department, the aspects connected with the 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 the "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 account the human factor, improvement of issues concerned with ergonomics and the "man-machine" interface and improvement of personnel activity with application of different means for error reduction on the level of doer, 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, sealing);
- 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 practices.

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.

8 QUALITY ASSURANCE

Article 13 Quality Assurance

Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmers 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 Quality Assurance Program (QAP) of the Armenian NPP was developed in accordance with the requirements of the IAEA (Safety Series №50-C/SG-Q "Quality assurance for safety in Nuclear Power Plants and Other Nuclear Installations"); it was approved in 2004 and then revised in the established order.

The present QAP is developed for the Armenian NPP operation and covers the whole activity of the Armenian NPP. The QAP summarizes the management processes for 30 areas of activities and references. More detailed descriptions of the management processes on the level of sub-processes are provided in guidelines. Thus, the administrative management program with its set of guidelines for a specific activity provides a detailed and complete description of a process, including distribution of responsibilities of personnel and divisions.

A number of documents included in the management system have been developed and implemented over the last years at the Armenian NPP. The documents cover all safety aspects, such as nuclear safety, radiation safety, industrial safety, fire protection and seismic safety, as well as system of management and control of works performed by the Contractor.

With the aim of upgrading of the existing system up to the integrated one the processes of some activity areas management were reviewed in the reported period and, based on the existing documentation on the quality management system, the missing documents related to labor protection and also physical protection and regime activities were developed.

Besides, the Armenian NPP has a Quality Audit Program for systematic assessment of all types of activities. The Audit Program includes a document specifying requirements to organization and conduct of quality audits, training of auditors, as well as a three – years audit schedule, which is to be annually revised. The schedule contains tentative dates of audit for three years and includes audit of works and services of suppliers. Such approach allows ensuring auditing every field of activity important to safety at least once in 3-4 years. With this, unscheduled quality audits are foreseen at a separate request of the top management of the Armenian NPP.

As a result of quality audits, corrective measures are developed and registered in the form of order issued by the Director General of the Armenian NPP.

For the regulatory control over the quality assurance of the Armenian NPP the ANRA:

- Conducts planned and reactive inspections;
- Identifies the QA state and dynamics of its change;
- Verifies and assesses the preparedness of personnel and understanding of the quality policy adopted by the personnel;
- Verifies availability and quality of the QA programs;
- Assesses measures for detection of inconsistencies and implementation of corrective measures;
- Analyses self-assessment reports of all levels and audit results;
- Makes independent assessment of effectiveness of the quality management system;
- Assesses measures aimed for the quality management system improvement and makes recommendations and proposals;
- Imposes enforcement actions when deficiencies are detected and identifies deadlines for elimination of those deficiencies and controls over the implementation.

9 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.

9.1 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 the 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:

- The preliminary safety analysis report;
- The NPP environmental impact assessment report and conclusion;
- The PSA Report;
- The 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:

- The final safety analysis report;
- The PSA report;
- The Safety systems classification;
- The emergency response plan;
- The technological specification and instruction on NPP systems operation;
- The 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:

- The decommissioning program;
- The safety analysis report at NPP decommissioning;
- The program on management of radioactive wastes generated during operation;
- The plan on emergency response at decommissioning.

In connection with the Law 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 them with the modern approaches applied in this area. In particular, the following regulations were updated in 2015-2016 taking into account the lessons learned from the Fukushima accident:

- The design safety requirements;
- The requirements to the SAR content and structure;

- The site safety requirements.

After adoption of the RA Government Decree on the Armenian NPP restart in 1993, a comprehensive safety review with involvement of foreign and Armenian experts was undertaken aimed at identifying design and operational weaknesses. A new set of deterministic analyses were performed. Experts from the IAEA, 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 the operational license;
- Important, but not connected to the 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 the requirements to the 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 the US DOE assistance projects. The US DOE assistance consisted of the personnel training and retraining for establishment of the analytical group, collection of information, establishment of the database for SAR development, analysis of systems and so on.

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

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

Then, the seismic hazard was also integrated in the 2nd iteration of the PSA model. Recently the 3rd iteration of seismic hazard was integrated in the model which was performed by the Risk Engineering Company (Bulgaria).

In 2007 the IAEA IPSART mission and the Risk Engineering Company (Bulgaria) performed expertise of the internal initiating events in the PSA model. Besides, the internal PSA review was made by the NRSC.

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

In 2014 the IAEA IPSART mission was organized to review and comment on the improved 3rd iteration of the PSA model and associated documentation. The mission scope covered internal initiating events, external initiating events, internal fires and seismic PSA, as well as not completed low power and shutdown PSA.

The PSA has been reviewed with support of 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 the 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 to the NRSC for expertise. In accordance with the calculation the core damage frequency factor is 5.33 10^{-5} 1/year (before the review the core damage frequency factor was 7.58 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.

The development of the PSA in the hot zero power operation and in the shutdown condition has been initiated. Approximately 60% of the work has been performed. The IPSART mission comments and recommendation are considered. The PSA for the unit at the hot zero power operation and in the shutdown condition is planned to complete in the quarter 4, 2016 with account taken to all comments and recommendations made.

In parallel, the development of the PSA level 2 was initiated 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: Armatom (Armenia), ET&D Ukraine and Armenian NPP. The PSA Level 2 is planned to complete in the Quarter 4, 2016.

After the Fukushima accident the Armenian NPP together with the NRSC launched a project with the IAEA aimed to apply the fault sequence analysis (FSA) method for the Armenian NPP. The main objective of the project is to perform a complementary analysis of the plant robustness by assessing potential impact of external hazards and their credible combinations using the FSA method and the software Fault Sequence Tool for Extreme Events (FAST-EE) developed by the IAEA.

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 $1{,}85*10^{-5}$ [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).

The external hazards risk integration in 3rd iteration PSA model is currently in process which is planned to be completed in the quarter 4, 2016 (see the details in the section 4.1).

The current status of PSA models and the results for the Armenian NPP are provided in the 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	2nd iteration	1.85E-05
3	Seismic hazard	3rd iteration	1.39E-05
4	External hazards (excluding seismic)	1st iteration	2.00E-05

The calculations were performed for the accidents included in the list of design basis and beyond design basis accidents.

The Armenian NPP with the IAEA support initiated a project to develop a 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 the safety issues identified at the

Armenian NPP by several IAEA missions and to provide solution for the unresolved issues of high ranking.

Based on the results of the Comprehensive Safety Upgrading Programme, a list of safety measures was developed for the Armenian NPP.

In 2013 ÚJV Řež jointly with the NRSC performed assessment of selected scenarios with pressurized thermal shock for the Armenian NPP Unit № 2 in frame of the IAEA Project ARM/9/022.

The RA voluntarily jointed the initiative to perform the comprehensive risk and safety assessments ("stress tests"), taking into account the specifications agreed by the European Commission and the European Nuclear Safety Regulators Group (ENSREG) on 24 May 2011.

Based on the Armenian NPP self-assessment report the ANRA developed the National Stress Test Report of the Armenian NPP and submitted to the Directorate-General for Energy of the European Commission for peer review.

The peer review of the national report was conducted in the 3 steps: desktop review, topical review and country review. The country review of the National Stress Test Report of the Armenian NPP was performed on 20-24 June, 2016. The results of the stress test report are provided in "EU Peer Review Report of the Armenian Stress Tests".

The ANRA uses its TSO, i.e. the Nuclear and Radiation Safety Center, for assessment of certain aspects of the Armenian NPP safety. In the reporting period the following activities were performed by the NRSC for the regulatory decision making:

- Verification of the PARCS-PATHS coupled code for WWER-440 fuel cycle analysis;
- Safety assessment of spent fuel transport canister criticality;
- 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 large LOCAs;
- Radiological consequence analysis;
- Development of the Maintenance Effectiveness Monitoring;
- External hazard combination analysis using the RiskSpectrum tool;
- Sump filter clogging analysis;
- PTS study.

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.

9.2 VERIFICATION OF SAFETY

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

- The periodic testing of the safety important systems according to the operational limits and conditions;
- The preventive and predictive maintenance programme;
- The in-service inspection programme;
- The periodic inspections of the pressure equipment and piping;

- The surveillance programme of the reactor pressure vessel material;
- The programmes for evaluation of the components and materials ageing.

Activities for verification of the physical state of the NPP are performed in connection with normal daily routines and with scheduled inspections, testing, preventive maintenance etc. 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.

10 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 establish regulatory requirements to the radiation protection of nuclear installations is provided in the Annex 2.

The Chapters III-1 and III-3 of the "Radiation safety norms" 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 20 mSv per year (consecutive 12 months);
- An 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 5 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

years).

The dose constrains are established for limitation of public exposure from separate man-made sources. The Chapter II of the "Radiation safety norms" defines the individual lifetime risk criteria of stochastic effects due to exposure at normal operating conditions, as $1.0x10^{-3}$ $year^{-1}$ for workers and $5.0\ x10^{-5}$ for public.

The chapters XIII and XIV of the "Radiation safety rules" specify the regulatory requirements to procedure and program on radiation safety of facilities (including the Armenian NPP) and also the requirements to the 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 the dose register is 50 years), monitoring of technological environment, airborne and liquid releases and etc.

The Chapter II of the "Radiation safety norms" specifies the requirements to implementation the optimization principle (ALARA).

The "Radiation Safety Rules for NPP Design and Operation-2003" establish the dose constraint of NPPs as 250 μSv/year, which is considered to be the upper boundary of public dose optimization during the NPP normal operation. The lower level of optimization is 20 μSv/year, from which the public dose conditioned by the airborne releases should not exceed 10 μSv/year limiting value, the rest 10μSv/year dose should be conditioned by the liquid releases.

For the new constructed NPPs the dose constraint shall not exceed 100 μSv/year.

The "Radiation Safety Rules for NPP Design and Operation-2003" establish also the annual allowable and investigation levels of released radionuclides (Table 1,2 Annex 6).

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

The Armenian NPP management adheres to the policy of indisputable safety priority over other concerns and considers the dose optimization principles as the most important means for decreasing the exposure of personnel working in conditions of ionizing radiation stated in "The Armenian NPP management declaration about the policy in the area of radiation safety".

The objectives, criteria, procedures, administrative limitations on the radiation safety are 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;
- Amount of radioactive effluent;
- Number of personnel contamination cases;
- Number of radiation incidents subject to reporting.

The assessment of radiation safety efficiency requires consideration of the above mentioned indicators and corresponding standards ratio, dynamics of indicators, their comparison against similar values which specify radiation safety condition at other similar NPPs.

For practical implementation of the radiation protection optimization the ALARA Committee and the ALARA Engineering group were established at the Armenian NPP. The ALARA Committee and the ALARA Engineering group work regularly in close cooperation with all departments of the Armenian NPP involved in activities with ionizing radiation sources, and implement activity on the Armenian NPP radiation protection optimization according to the requirements of the program on the "Armenian NPP radiation protection management optimization according to ALARA principle".

Annual report is prepared based on the results of the ALARA Committee activity. The report makes a part of the Armenian NPP industrial activity annual report.

With the purpose of further implementation of the ALARA principle, the Armenian NPP developed the Radiation Protection Program for 2015 which establishes the objectives and goals for minimizing radiation impact and ensuring effective radiation protection of the Armenian NPP personnel. The objective of ALARA principle is to maintain the annual personnel collective dose rate at as low as reasonably achievable level, in particular:

- Non-exceeding of annual personnel collective dose, 911 man mSv;
- Non-exceeding of personnel collective dose during outage, 0,791 man mSv;
- Non-exceeding annual individual dose, 16 mSv;
- Maintaining radioactive gas and aerosol release value below the administrative levels:
  - Inert radioactive gas – $30*10^{12}$ Bq/year,
  - Long-lived nuclides – $55*10^{6}$ Bq/year,
  - Iodine – $20*10^{6}$ Bq/year;
- Maintaining the amount of radioactive effluent below the administrative levels - $\Sigma\beta act = 3,7$ Bq/l
- Reducing the number of contaminated people.

The individual external exposure is monitored once per month with the thermo luminescence dosimeter (TLD).

To control the exposure dose on a shift basis, in addition to the TLD, the personnel has electronic dosimeters with built-in alarm which activates when the threshold set both for the dose rate and the cumulative dose is exceeded. The personnel entry into the controlled area is allowed by the system only with both dosimeters. In case of approaching the dose limits set at the Armenian NPP, a failure to pass the test on radiation safety and negative results of medical examination, the system automatically prohibits the entry of the given employee into the controlled area.

During the scheduled outage and refueling of 2015 the planned personnel dose loads were 815 man*mSv. During the annual outage and refueling in 2015 the actual dose of the Armenian NPP personnel was 648. man*mSv.

In the reporting period:

- The maximum individual dose of external exposure was 17,326 mSv;
- The annual collective dose for the Armenian NPP personnel was 0.89 man*Sv;
- The collective dose of contractors was 0.033 man*Sv.

The maximum individual committed dose for the Armenian NPP personnel from intake in lung is 0.03 mSv. The collective and individual maximum dose trends at the Armenian NPP are demonstrated on the figures 1-2 of Annex 6.

The majority of the personnel annual effective dose consists of the doses received by the personnel implementing radiation hazard operations during 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

The radiation monitoring is implemented in accordance with the "Technical specification on radiation monitoring of Armenian NPP » which specifies the conditions and limits of radioactive releases and effluents (source term).

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-holes located outside of boundary of the Armenian NPP rainwater and sewerage systems. The measurement frequency is described in the technical specification for radiation monitoring.

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 6.

The main contribution to releases is made by the following radionulcides: ^{60}Co(25.2%), ^{137}C (8.2%), ^{90}Sr (0.5%), ^{131}I (20.0%), ^{58}Co (1.9%), ^{110}Ag(41.0%), ^{54}Mn(0.21%) and ^{103}Ru(2.1%). The ^{60}Co, ^{58}Co,^{110m}Ag, ^{54}Mn, are corrosion radionuclides and ^{137}Cs, ^{131}I and ^{90}Sr fission radionuclides. The analysis of radioactive releases into the atmosphere in 2015 showed that they were on the level of the previous years and lower than the average level of all the operating period. ^{60}Co, ^{58}Co and ^{110m}Ag, ^{51}Cr and other corrosion radionuclides make the main contribution to the quantity of releases. The release of noble gases for 2015 was 20.10 TBq (the permissible level is 690 TBq). The annual releases of long-lived radionuclides is provided on the Figure 3 of Annex 6.

The annual activities of liquid discharges from the Armenian NPP are demonstrated on the Figure 4 of Annex 6. They are lower than the authorized levels.

The amount of ^{3}T in the primary circuit is 486.0*E+7Bq/m^3 (annual average concentration).

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

At present, in the frame of the Armenian NPP life time extension the measures are undertaken on modernization of the radiation monitoring system including the release control systems and the 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 quantities of radioactive substances in the air, atmospheric precipitation, open waters, soil, vegetation, and locally produced food (agricultural plants, milk, etc.) in the Armenian NPP supervised area (10 km radius) has been estimated.

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 μSv/hour - 0.13 μSv/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 μSv/hour).

On the territory of the Armenian NPP the gamma dose rate in the reporting period was estimated to 0.10 - 0.63 μSv/hours.

The results of environmental radiation monitoring for 2015 are provided in the tables 1-3 of the Annex 6.

Regulatory review and control activities

The regulatory review and control activities cover the review of monthly and annual reports on radiation situation on the Armenian NPP site and its supervised area and on the results of inspections performed at the Armenian NPP covering the following topics:

- Implementation of radiation protection activities included in the program of Armenian NPP safety improvement measures;
- The QA programme for the measures implemented in the controlled area;
- The limits and conditions of radiation protection and safety in accordance with the technical specification on radiation monitoring;
- The occupational radiation protection program and implementation of the ALARA principle;
- The 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 reporting period the ANRA performed 9 inspections to verify the data contained in the Armenian NPP reports and to check the quality management system for occupational and public exposure control.

In the reporting period the Armenian NPP individual maximum and collective dose values (see diagrams 1, 2 of the Annex 6) did not have sufficient tendency for reducing (due to limited number of repair personnel in the NPP), but the doses still remain below the dose values specified in the standards and are considered acceptable.

In 2015 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 samples. The calculations demonstrated that the population critical group (adult) dose received within 1 year is 32.0*E-6 mSv (0.032 μSv), which is 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* E-6 $year^{-1}$ (standard is 5* E-5 $year^{-1}$ (“Radiation safety norms,” paragraph 12), and is considered to be acceptable.

The data provided in the Tables 1-3 of the Annex 6 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 demonstrate 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 the environmental contamination.

11 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.***

11.1 EMERGENCY PLANS AND PROGRAMS

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

- The Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes;
- The Law of the RA on Population Protection During Emergencies;
- The Population Protection Plan 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;
- The Government Protocol № 8 as of 03.03.2016 on approval of "National plan of civil protection in case of radiological and nuclear accidents in the territory of RA";
- The Government Decree № 943-N as of 18.05.2016 on approval of "Establishing of regime of implementing rescue works in the areas of radioactive contamination";
- The "Armenian NPP emergency response plan to nuclear and/or radiation emergencies (On-site plan of the Armenian NPP);
- The Basic Requirements to Emergency Planning and Response at Nuclear and Radiation Emergencies;
- The RA Government Decree № 1219-N as of 18.08.2006 on approval of radiation safety norms;
- The RA 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 the above mentioned legal acts, which assign the main role to the state authorities and other organizations and regulate issues related to different aspects of the

emergency preparedness and response. The "Radiation safety norms" 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 dealing with 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 Plan on Population Protection in case of a nuclear and radiological emergencies provides with the detailed assessment of organizational measures and allocation of the functions and responsibilities of the operator and the 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.

The plan is currently revised based on GSR part 7, GSG-2 and the new radiological intervention criteria established in GSR Part 3.

According to the National Plan on Population Protection (the off-site 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 the ANRA notifies the Ministry for Emergency Situations on 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 the meteorological prognosis;
- The Ministry of Foreign Affairs of the RA is responsible for providing information received from the ANRA ERC on emergency to the embassies, foreign representative offices and the 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 evacuation of injured persons from contaminated area and participation in organization of decontamination of 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 property and assets of the settlements in the contaminated area 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 authorities in the evacuation of livestock and implementing the agricultural countermeasures and the continuous monitoring of the radiological situation;
- The Ministry of Transport and Communication of the RA is responsible for provision with the necessary transport means for evacuation of the population and providing communication during the implementation of protective measures.

The responsibilities of the local authorities on the regional and local levels in the territory included in PAZ or UPZ are indicated in the off-site emergency plan of the Armenian NPP. The local authorities perform 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 provided in the Annex 9.

To cope with its 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, providing information to the IAEA, 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 the Armenian NPP personnel, emergency personnel, 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 7.

In May 3 2016 the ANRA conducted an emergency exercise in the renovated premises of its ERC. The exercise was organized and conducted in frame of the EC INSC project AR/RA/0506 “Institutional Building of Armenian Nuclear Regulatory Authority”. The objectives of the exercise were to test the procedures of alerting and management of alert, assessment of the thermal-hydraulics situation, evaluation of source-term and release calculations by the ANRA’s ERC staff, exchange of information with the ANPP, MES, IAEA, as well as the procedures on communication with public and media, also the teams’ shift rotation procedures, logistical support activities (e.g. registration of participants, registration of information, keeping logbooks) and so on. Based on the evaluation of the exercise the action plan for further improvement of the ANRA emergency response capabilities was developed and approved.

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

- In 2014 the exercise was conducted within 5km and 10km radius around the Armenian NPP on implementation of radiation monitoring;
- In 2013, 2014, 2015 the rescue service of the Armavir region of the MES conducted exercises on population protection in case of nuclear or radiological emergency at the Armenian NPP;
- In 2013 the MES jointly with the USA conducted the National Response Plan Workshop and Table Top Exercise.

Summary of activities related to the Armenian NPP emergency preparedness

The guideline "Classification of Emergency Situations at the Armenian NPP" was developed to evaluate accident conditions at the Armenian NPP. The guideline covers also natural disasters and human errors capable to result in nuclear or radiological emergency.

The existing emergency response system at the Armenian NPP is designed for prevention of emergency situations, prevention or limitation, mitigation of radioactive release impact, localization and timely mitigation of accident consequences.

The Armenian NPP emergency response is implemented by the emergency personnel in the frame of a specially established organizational structure of the emergency response system. The ERS management structure is a part of the general management structure of the Armenian NPP.

The manager of emergency activities, i.e. the General Director of the Armenian NPP, is in charge of the ERS.

The Armenian NPP ERS includes the following functional units:

- The manager of emergency activities;
- The Committee on Emergency Situations of the Armenian NPP;
- The Armenian NPP operating personnel;
- The Headquarters of Civil Defense & Emergency Situations;
- The coordinator of public and media relations;
- The ERS structural units;
- The personnel of the physical protection department;
- The RA Police military unit;
- The specialized brigade for the Armenian NPP fire protection.

The emergency response system of the Armenian NPP is coordinated by the Committee on Emergency Situations (CES). The chairman of the CES is the Armenian NPP Chief Engineer. The CES activity is implemented under the direction of the manager of emergency activities, i.e. the General Director of the Armenian NPP.

The headquarter, the Armenian NPP Civil Defense and Emergency Situations Service, is the executive authority of the CES.

In case of accidents at the Armenian NPP the key organizations are:

- The Armenian NPP;
- The ANRA;
- The RA Ministry of Emergency Situations.

The duties of the organizations involved in case of accidents at the Armenian NPP are settled down in the National Plan on Population Protection in Nuclear and/or Radiological Emergencies at the

Armenian NPP (off-site plan - the RA Government Decree №2328-N as of 22.12.2005). In addition, each organization has its own emergency plan with detailed description of functions and protective actions, and also forces and means needed for their implementation.

Besides the national organizations the Armenian NPP cooperates with WANO MC Regional Crisis Center for WWER type reactors on the basis of "ROSENERGOATOM" OJSC Crisis Center.

To ensure proper response, the Armenian NPP ERS is provided with the required material and technical means and support, and also with the emergency equipment and special premises.

The special premises are assigned which could be used at various stages of emergency response, such as:

- The emergency control board for the MCR operating personnel;
- The crisis center;
- The reserve crisis center (ToR developed);
- The shelters;
- The ERS property warehouse.

There are special systems and channels of emergency and regular communication and notification developed and implemented at the Armenian NPP.

Personnel training, exercises and drills

The Armenian NPP organizes systematic training under the relevant programs and in accordance with the approved schedules.

The topics of the emergency preparedness and response are annually included into the topical plans of the initial briefings for the personnel of structural units.

The issues of the emergency preparedness and response are included in the examination questionnaires of the Armenian NPP personnel.

The skills on appropriate accident response are maintained through periodical exercises and drills which follow specially prepared scenario and involve all officials who are responsible for critical emergency response objectives.

The exercises and drills are systematically assessed, and based on the results a plan of correcting measures is developed. Their timely and proper implementation is followed-up.

Notification

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

The notification is organized according to the Notification Scheme provided in the Annex 8.

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

On-Site Emergency Response Plan

The on-site plan of the Armenian NPP is the principal document that establishes organization and procedure of responding to nuclear and radiological emergencies at the Armenian NPP, settles down relations of entities involved in the emergency activities.

Currently, the "Plan on Response to Nuclear and radiological emergencies at the Armenian NPP" (on-site plan) is currently reviewed with respect to the requirements established in the IAEA document "Methodology of Developing Activities in Response to Nuclear and Radiological Emergency Situations" (EPR – methodology - 2003).

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 issues have been inspected:

- The Armenian NPP on-site plan;
- The Armenian NPP personnel evacuation plan;
- The organization of medical protection of the Armenian NPP personnel during emergency situations;
- The organization and implementation of emergency and rescue works during emergency situations;
- The organization of communication and notification during emergency situations;
- The instruction on organization of evacuation measures during emergency situations;
- The instruction for technical support group;
- The radiation monitoring program during nuclear and radiation emergencies;
- The manual on classification of emergency situations at the Armenian NPP;
- The Armenian NPP personnel and management preparedness programs;
- The training methodology and its implementation;
- The shelters, located at the Armenian NPP site and their habitability;
- The organization of iodine prophylactic and distribution.

The requirements specified in the act-enforcement prepared as a result of inspection are in progress of implementation.

The IAEA IRRS mission was hosted from 2 to 12 June 2015 at the ANRA's request. The end-of-mission report indicates that the ANRA Response Plan clearly names and delegates the appropriate set of responsibilities to all emergency response groups and makes specific recommendations for the ANRA such as:

- Development of criteria for termination of emergency and transition to long term recovery operations that follows the requirements of IAEA GS-R-2;
- Development of an internal methodology for evaluation of training and exercise programmes of all response groups.

11.2 INFORMATION OF THE PUBLIC AND NEIGHBORING STATES

The responsibilities for notification about nuclear and radiological emergencies at the Armenian NPP are established in the Basic Requirements to Planning and Response to Nuclear and Radiological Emergencies and in the emergency response plans.

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

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

According to the requirements of the RA administrative and regulatory documentation and the National Plan on Population Protection, the Armenian NPP bears responsibility for informing population in the preventive protective measures zone (PPMZ – 5km area around the Armenian NPP). Currently a project to update the PPMZ notification system is under development by the Armenian NPP. The notification of the population outside the PPMZ and the mass media is made by the RA MES. If necessary, the coordinator on relations with mass media and public, jointly with the ESC representatives prepare relevant and timely information for mass media about an accident, in order to provide correct and complete information on required protective measures and further progress.

Such information is distributed in the form of information cards, news releases, messages on official web pages of the response organizations, local radio and television, and also in the form of briefings and press conferences.

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

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

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

12 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.***

12.1 EVALUATION OF SITE RELATED FACTORS

The site selection of the Armenian NPP was made in 1968 in accordance with the normative documents existing at that period of time. Thus, practically the siting factors which can influence the NPP safety were taken into account:

- The NPP site is located on solid, crystal and basalt area;
- The geological conditions of the site are acceptable, steady;
- The ground waters deposited on the depth 85-90m;
- The volcanic hazard of the site is extremely small;
- Other natural events (flooding, tornado, landslides and so on) on the territory of the site are not observed.

Then, additional activities related to the site factor have been performed in accordance with:

- The Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes;
- Law of the RA on Licensing;
- The RA Government Decree № 609-N as of 12.05. 2005 on approval of the licensing procedure and licence form for site selection of nuclear installations;
- The IAEA Safety Standards.

The RA Government Decree № 609-N is currently revised; and the detailed requirements to the NPP site evaluation are developed.

After the Spitak earthquake in December 1988 and during the shutdown period of the plant the implementation of the seismic upgrading programme was continued.

Three important aspects were fulfilled:

- Verification of the geological stability of the site, (absence of any capable fault that can produce permanent ground displacement phenomena);
- Determination of the severity of seismic ground motion at the site, (seismic design related parameters, such as peak ground acceleration, ground response spectra, duration, time history accelerations, etc.);
- Establishment and development a complete programme for the re-evaluation of the seismic capacity of buildings, systems and components important to safety in accordance with new data, methods and criteria recognized in the international practice.

The seismic safety related issues of the Armenian NPP unit №2 are specified in the special program on the Armenian NPP Unit №2 seismic safety re-evaluation and improvement, where complex measures of analytical and engineering and technical nature and also the deadlines for their implementations are specified. In the first place, the systems, structures and components for the safe shutdown of the plant should be strengthened.

The ANRA has approved the Armenian NPP Unit №2 seismic safety re-evaluation and improvement program that envisages implementation of comprehensive measures of analytical, engineering-technical nature and implementation of modifications with the purpose to improve the seismic safety level of the Armenian NPP unit №2. The ANRA regulates also seismic safety related issues of the dry spent fuel storage facility.

The assessment of external events impact on the Armenian NPP safety was performed in frame of the PSA. Selection of external events important to the Armenian NPP site was made on the first stage of assessment. As a result, the following external events have been selected:

- Snow load;

- Wind load;
- Dust storm;
- Flooding due to accumulation of rain water;
- Explosion of pressure tanks;
- Extremely low temperature of air;
- Extremely high temperature of air;
- Aircraft crash.

Detailed analysis was performed for each of the selected events. The analysis demonstrated that the majority of selected initiating events with 10^{-6} [1/year] frequency do not result in damage of the systems, structures and components important to safety.

The ANRA with the NRSC support started development of regulations specifying processes of construction and site selection of a new NPP unit in Armenia, in particular:

- Guide on expertise of documents on new NPP seismic hazard assessment. The guide was revised by the experts from the US NRC and BNL. Comments are made to improve the format and contents of the guide.

In 2015 the ANRA requested the Armenian NPP to upgrade the level of maximum design basis accident with the ND 200mm coolant leak in any point of the MCP. The Armenian NPP plans to implement the ANRA's requirement in the framework of activities on preparation of the unit №2 for the extended operation.

12.2 IMPACT OF THE INSTALLATION ON INDIVIDUALS, SOCIETY AND ENVIRONMENT

The Radiation Safety Norms and Rules were developed by the ANRA and approved by the RA Government (see Annex 2) in 2006. The Radiation Safety Norms and Rules define the radiation protection principles, establish the dose limits for categories of personnel under normal and accident conditions, and establish the requirements for exposure of members of the public to man-made sources under normal conditions and due to natural radiation sources. The Radiation Safety Norms and Rules were developed in conformity with the international practice and the IAEA recommendations.

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

The maximum design accident was originally the primary leak with 32mm equivalent diameter. The ANRA required increasing of the maximum design accident and making relevant modifications aimed to raise the NPP safety level. The accident analyses were performed in frame of the SAR; the analysis demonstrated that the maximum design accident form the point of view of the core cooling has been increased to LOCA100mm. The ANRA requested the ANPP to revise the maximum design accident level to LOCA200mm. The ANPP undertook measures to implement this requirement in 2018.

The Armenian NPP in cooperation with the US DOE performs analysis of radiological consequences for selected initiating events.

The analysis of radiological consequences for design and beyond design accidents are performed with application of methodologies developed by the US NRC (RG -1.183 and RG -1.4).

The analysis results demonstrated that the population dose loads do not exceed the radiation safety norms adopted in the RA.

The monitoring of the Armenian NPP impact on environment and population in the Armenian NPP supervised area is performed by the Armenian NPP staff, and the associated reports are submitted to the ANRA on monthly and annual basis. The ANRA evaluates the reports and prepares monthly reports and annual reports to the RA Government. The analysis of environmental monitoring results and the evaluation of population exposure dose origination through food chain show that the exposure dose incurred by the population residing around the Armenian NPP was significantly lower than the dose limit mentioned in the section 10 of this report.

12.3 RE-EVALUATION OF SITE RELATED FACTORS

The measures on re-evaluation of the site related factors are aimed at ensuring continuous acceptability of the nuclear installation safety.

In 2012-2013 stress test was performed at the Armenian NPP.

The PGA=0,35g for the RLE was kept as the design basis earthquake, and the PGA=0,47g was established for the beyond design basis earthquake (BDBE) which corresponded to 10^{-5} annual probability on the median curve of seismic hazard.

According to the stress tests philosophy the list of SSC in the SSEL was extended with inclusion of the dry spent fuel storage facility, auxiliary building, ventilation stack, room of inlet water tank №2, the Armenian NPP Unit №1 spent fuel storage pool; and additional calculations of the boundary seismic stability of the mentioned buildings were made.

Based on the results of the implemented analyses, the pipelines and some components of the Unit №1 storage pool were reinforced; hydrants were installed on the demineralized water storage tanks. The opening of 0,5m height and 50m length was arranged on the lower level of the wall of outlet channel water scoop to prevent flooding of the RDGS structures.

It was confirmed that the Armenian NPP Unit №2 corresponds to the design basis earthquake (PGA=0,35g), and the minimum earthquake level (PGA=0,47g) was specified which the plant can withstand without the core damage and severe accidents.

Based on the stress tests results and in order to identify the components and systems, which require further modifications, the Armenian NPP was recommended to implement the seismic probabilistic safety analysis.

Also, it was recommended to implement the seismic margin assessment for the fire extinguishing system and install additional fuel tank for filling the DG reserve tanks. These measures were included in the schedule of measures to be implemented in 2016-2017 to fulfill the Stress Tests Recommendations.

Results of recent reassessment activities

Based on the 3rd iteration of PSA for internal initiating events the seismic PSA was developed by the Risk Engineering Company (Bulgaria) in 2014. The total core damage frequency due to seismic effect is 1.39E-05 1/y. The results of CDF for all intervals are demonstrated in the Table 1. The CDF distribution by specific intervals is demonstrated in the Figure 1. The conditional probability of the plant damage for separate intervals is demonstrated in the Figure 2.

Table 1

Interval	LVL0	LVL1	LVL2	LVL3	LVL4	LVL5	LVL6	LVL7
PGA, g	0.05-0.0.1	0.1-0.2	0.2-0.4	0.4-0.6	0.6-0.8	0.8-1	1-1.5	1.5 ≤
Seismic effect freq., 1/y	1.51E-02	2.42E-03	3.68E-04	3.48E-05	6.78E-06	1.81E-06	8.11E-07	1.00E-07
CCDP	5.06E-05	8.23E-05	4.24E-03	1.25E-01	6.71E-01	8.87E-01	9.77E-01	1.00E+00
CDF, 1/y	7.63E-07	1.99E-07	1.56E-06	4.36E-06	4.55E-06	1.60E-06	7.92E-07	1.00E-07

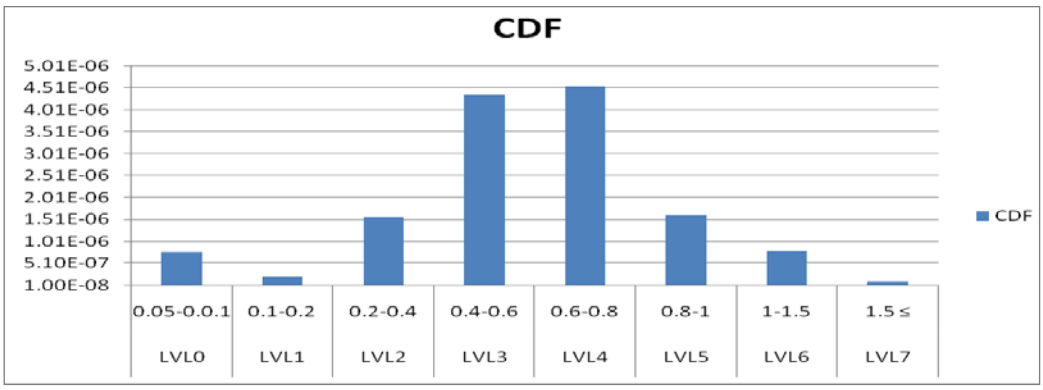


Figure 1. CDF by intervals

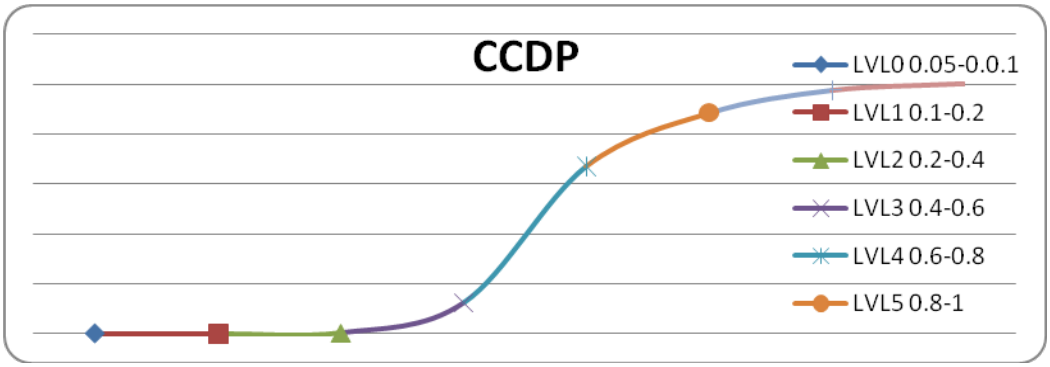


Figure 2. CCDP by intervals

In 2013 the "Armatom" Institute, based on the 3rd iteration of PSA for internal initiating events, developed the PSA for external initiating events. Total CDF due to external events is 5.47E-06 1/y (2.0E-05 1/y in the 2004 model). According to the results the dusty storm is the largest contributor in the Armenian NPP core damage risk (95%).

The core frequency damage factor is contributed by the following external events:

- Strong wind 3.89E-10;
- Dust storm 5.24E-06;
- Low air temperature 2.11E-07;
- Snow load 1.31E-08;
- Airplane crash 7.83·10-9/y.

In 2013-2015 the seismic PSA was reviewed based on the received in 2011 new seismic hazard curves (with 10^{-1} - 10^{-7} probability) and the corresponding response spectra were represented for

5%; 15%; 50%; 85% and 95% confidence. In frame of the seismic PSA a human factor was considered, and secondary consequences of earthquake, fire and flooding, were reviewed.

The fragility curves were received for 3300 components of the SSC (considerably exceeding the number of SSC in the previous PSA as of 2006).

As a result the total CDF value conditioned by the seismic effect reached 1.39E-051/y.

This result was received based on the analysis of 8 seismic intervals (from 0,1g to 1,5g) and 11 groups of the plant damage conditions.

It should be noted that there is no interval for which the CDF value is higher than 1.0E-51/y.

The IPSART mission reviewed the general PSA materials and, in parallel, the seismic PSA. The mission made a number of specific recommendations which were completely implemented and reflected in the final PSA as of 2015.

12.4 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.

On 2015 December 24, the Republic of Armenia and the Islamic Republic of Iran signed the Memorandum of Understanding. In the frame of that Memorandum are established the working group for coordination the cooperation on nuclear energy between Parties, as well as for exchange of information.

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

13 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.***

13.1 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. The safety deficiencies related to the implementation of defense levels are documented and the 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 the 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 the passive core cooling in the natural circulation modes during accidents for a long time and reduces dependency on earlier operator actions.

At designing of the Armenian NPP that was supposed to be operated in the seismic area it was accepted that systems, structures and components ensuring the safety of personnel and population and also protection of the 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 accident 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 the PRZ impulse safety valves certified to be operated in water media;
- Upgrade of the secondary circuit protection system against pressure rise. In particular, installation of the PRZ impulse safety valves certified to be operated in water media;
- Upgrade of the steamline system. In particular, installation of fast acting valves;
- Upgrade of the 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;
- The confinement tightness is regularly increased;
- The system for additional make-up of SG with installation of diesel pump was implemented;
- Partial separation of the electric power supply and I&C channels;
- Implementation of the system for the reactor vessel protection against cold overpressurisation;
- Implementation of the Leak Before Break concept and installation of the leak detection systems;
- Assessment of the high energy piping and implementation of associated measures;
- Installation of filters against clogging of the confinement sump;
- The MCR habitability improvement;
- Installation of the post accident monitoring system and the backup control panel;
- Installation of restraints against pipe whip on the main steamlines;
- Installation of the full-scale simulator;
- Separation of the reactor protection system into two independent channels;
- Establishment of the emergency control room;

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, the 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 passive autocatalytic recombiners to prevent accumulation of explosive hydrogen concentration in the confinement;
- The reactor cover gas removal system;

In addition several safety upgrades have been recommended to the Armenian NPP as a result of comprehensive safety assessment project implemented 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. The following additional important upgrades were recommended:

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

The Armenian NPP initiated activities related to the LTE. Based on the result of the Armenian NPP self-assessment report and the conclusions made by the EC peer-review team following the review of the national report on the Armenian NPP stress test, the list of safety upgrades for the Armenian NPP Unit №2 had been revised to cover:

- Reformulation of design basis flooding of the plant site in the SAR, based on the performed sewage system reevaluation;
- A number of activities to further strengthen the seismic robustness of the Armenian NPP, e.g. sufficiency of EDG building seismic protection, upgrade of the fire extinguishing means and etc;
- In cases of the station black-out or loss of ultimate heat sink, the graded approach exists, with measures which are pertinent in general to make the Armenian NPP relatively resistant in the case of these events. There are different actions planned to extend the available time for heat removal from the core and the spent fuel pool, without need for any external action or support;
- In respect to the power supply, the PRT recommends the implementation of the intended improvements of safety systems necessary to cope with postulated events. The PRT recommends especially strengthening the fuel supply for the EDGs. The PRT also recommends to consider addressing the lack of diversity of the EDGs and DAR DG (same type, same building, same age), the ability for recharging the batteries and the assurance for cooling the spent fuel pool of the Unit №2;
- Development of the plans to respond to potential volcanic activity at Mount Ararat and Mount Aragats and the Shamiram plateau, and establish a monitoring of these volcanoes in the framework of national civil protection programmes;
- Complementing the 2011 PSHA by a review of the maximum magnitude M_{max} values and detailed investigations of the active faults close to the site using integrated paleoseismological techniques;
- Regarding the SAMGs, the development and implementation of guidelines for shutdown states and SFP should be initiated and finalized;

- In respect to hardware modifications especially enhancements of the ECCS, containment tightness, and hydrogen monitoring and control as well as containment spray system should be treated in priority.

In 2015 the ANRA requested the Armenian NPP to upgrade the level of maximum design basis accident with the nominal diameter 200 mm coolant leaks in any point of the MCP. The Armenian NPP plans to implement the ANRA's requirement in the framework of activities for preparation to additional (extended) operation life of the unit.

The ANRA implements regulatory control through the regular inspections in accordance with the annual schedule of the ANRA.

13.2 INCORPORATION OF PROVEN TECHNOLOGIES

According to the paragraph 1.2.5 of the General Safety Regulations (OPB -88/97) "Technical and administrative decisions made to ensure NPP safety shall be well proven by the previous experience or tests, investigations, operating experience of prototypes and shall meet requirements of regulatory documents. Such approach shall be applied not only in development of equipment and design of the NPP but also in manufacture of equipment, construction and operation of the NPP, its backfitting and reconditioning of its systems (elements)".

The Armenian NPP and the ANRA follow this requirement in technical and administrative decisions making during NPP operation and review of safety submittals.

Besides, the ANRA with the technical support of the NRSC developed the document specifying the requirements to design of new NPP unit(s) in Armenia that was approved under the RA Governmental Decree №1411-N as of 08.11.2012. The content of the document includes:

- Safety goals;
- NPP main safety requirements;
- Proved engineering and technical practice;
- Safety assessments;
- Classification of safety equipment;
- Requirements to SSC safety.

The recommendations of the IAEA and the WENRA were taken into account during development of the document and relevant documents were studied.

The description of review and control activities of the ANRA is provided in detail in the section 9.1 of this report.

13.3 DESIGN FOR RELIABLE, STABLE AND MANAGEABLE OPERATION

The Armenian NPP is operated in accordance with the Technological Specification. The reliability of operation is provided through regular inspections, maintenance, testing and repair of the NPP technological systems having impact on safety. The information on verification of performance of safety important systems is provided to the ANRA.

The impact of human factor on safe operation is described in detail in the section 7 of this report. The quantitative assessment of human factor impact on safety was made in frame of the PSA.

The ANRA conducts regular inspections in accordance with the schedule to ensure regulator control over implementation of the safe operation requirements.

The description of the regulatory review and control activities is provided in detail in the section 9.1 of this report.

14 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.

14.1 INITIAL AUTHORIZATION

The analysis of the design safety was performed in 1995 before the Armenian NPP Unit №2 restart in accordance with the NPP restart concept.

The following analyses with application of the deterministic approach have been performed:

- The “Complex analysis of NPP design safety level based on deterministic and probabilistic approaches” Atomenergoproekt, 1994;
- The “Report on thermal hydraulic calculations to justify design operation conditions of the Armenian NPP unit №2”. Gidropress, 1995;
- The “Final safety analysis report of the Armenian NPP” Framatom, 1992;
- The “Report of Bechtel Corporation specialists”;
- The “Analysis of working conditions, materials and radiation resource of the Armenian NPP Unit №2 reactor vessel”. Gidropress, 1995;
- The “Re-evaluation of the Armenian NPP seismic conditions”, 1995.

Based on the safety analysis the ANRA issued annual permits for operation. Then, the ANRA developed the requirements to the SAR, based on which the operating organization prepared the documents for obtaining the operation license in accordance with the RA Government Decree №

400-N as of 24.03.2005 on approval of the licensing procedure and licence form for operation of nuclear installations.

14.2 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 for operation of the Armenian NPP unit №2 with WWER-440 (V-270) type reactor. The ANRA verifies the 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 the success criteria. The Armenian NPP initiated development of new administrative procedures. The recommendations on improvement of the procedures for maintenance and repair have been made.

The radiation protection and safety limits and conditions are specified in the Technical Specification on Radiation Monitoring and provided in the section 10 and in Annex 6 of this report.

14.3 PROCEDURES FOR OPERATION, MAINTENANCE, INSPECTION AND TESTING

The operation, maintenance, inspection and testing procedures established at the Armenian NPP with respect to 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 receives training according to the training program.

A complete set of operational documents for Armenian NPP 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 set 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 impact on the 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.

Development of a full set of EOPs (at full power and for shutdown modes) based on the Westinghouse Owners Group Emergency Response Guidelines (WOG ERG) is in process. The project is supported by the US Department of Energy with Pacific North National Laboratories and Argonne National Laboratories.

The EOPs for shutdown mode were completed and have been verified and validated in 2015. The EOPs for shutdown mode were submitted to the ANRA for review in 2015. By end of 2016 it is expected that the final ANRA decision will be made regarding the EOPs for shutdown mode. The

EOPs for were completed and have been verified and validated in April 2016. It is expected that Armenian NPP will submit EOPs for power mode to ANRA in August 2016.

The SAMGs for power mode are under development. The validation of SAMGs and issue of the final versions of the guidelines based on the results of validation is foreseen in August-September 2016. Currently the guidelines are reviewed based on the updated analytical justification documents provided by the Analytical Team recently. During July 2016 the final verification of the guidelines and their Technical Basis Documents (TBD) must be performed at the Armenian NPP.

The maintenance and testing procedures developed by the Armenian NPP are agreed with the ANRA. The results of testing of the safety systems are submitted to the ANRA in a due frequency as established in the requirements.

14.4 PROCEDURES FOR RESPONDING TO OPERATIONAL OCCURRENCES AND ACCIDENTS

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

The procedures for the Armenian NPP personnel response, protection, organization and implementation of the emergency radiation monitoring in case of operational accuracies and accidents are defined in the Armenian NPP on-site plan which are periodically exercised during exercises and drills organized at the Armenian NPP on a regular basis.

Development of event - oriented and/or symptom - oriented emergency operating procedures

Within the framework of US DOE and Argonne Laboratory assistance project for the Armenian NPP, new symptom-oriented emergency operating procedures (SOEOPs) are developed for the reactor power operation condition instead of old EOPs. Currently they are under validation. Also, the SOEOPs for shutdown reactor are developed which are under agreement by the ANRA.

The SOEOPs for the Armenian NPP consist of four sets of procedures:

- For optimal recovery;
- For recovery of the critical safety functions (CSF);
- For recovery of CSF in the reactor shutdown condition;
- For the spent fuel storage pools of Unit №1 and Unit №2.

The 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.

- The EOP under development take into account the following:
    - Modernizations implemented at the Armenian NPP;
    - Accidents and incidents initiated in the process of shutdown and start-up;
    - 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 the spent fuel pools of Unit №1 and Unit №2 and the DSFS.

- The EOP is being developed for the reactor cooling if in case of emergency evacuation from MCR is needed.

All procedures existing at the Armenian NPP will be revised with regard to results of the stress test of the Armenian NPP.

Development of severe accident management guidelines

Within the framework of US DOE and Argonne Laboratory assistance project for the Armenian NPP SAMG, the SAMGs are under development by the "Armatom" Institute.

The accident management program is developed. The accident management program identifies the documentation system which covers all corresponding types of activities on accident management in the form of both working and management documents.

The approach for establishing the SAMG is based on the Westinghouse generic guidelines.

14.5 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 with the internal technical support in the safety improvement area:

- The nuclear safety and reliability department;
- The engineering and technical support department;
- The workshop for thermal automatics and measurement;
- The technical department of planning and operation;
- The technical inspection.

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

- "Armatom" 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.

The engineering and technical support is provided mainly for the safety upgrades of the Armenian NPP that cover all safety aspects.

14.6 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 General Safety Regulations, the operating organization should provide the ANRA with information on operational events in the established order. The criteria for selection of events to be reported to the regulatory authority, are described in the procedure on investigation of NPP operational events approved under the RA

Government Decree № 418-N as of 05.04.2012. The procedure covers issues related to notification, account, investigation and reports on operational events occurred at the NPP and establishes:

- The categories of operational events;
- The procedure of accounting and notification of events;
- The 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 the event and to submit the event investigation report to the ANRA.

The reports on investigation of operational events are analyzed by the ANRA. If a 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.

The 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 the WANO.

10 operating events have occurred in the reporting period, all events were rated at the INES Level "0" (deviation). 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.

14.7 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 guideline on determination of event direct and root causes.

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 Database. 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 burned 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 of the licence holder programmes and procedures. The ANRA also uses the information received from the WWER Regulators Forum.

As of January 1, 2016, the database contains detailed information on more than 14500 plant events, and information on more than 5000 events occurred at other plants worldwide.

Currently the Event Database update is in process.

14.8 MANAGEMENT OF SPENT FUEL AND RADIOACTIVE WASTE ON THE SITE

There is a dry spent fuel storage facility (DSFS) located on the site of the Armenian NPP, consisting of 3 horizontal storage modules of NUHOMS-56 type. Two of them, housing 11 and 12 dry shield canisters, respectively, are completely full, and the third one in operation from 2016. The operation of the dry spent fuel storage facility (DSFS) is implemented in accordance with the operational license granted by the ANRA in 2000 (for the first module of the DSFS) and 2005 (for the second and third modules of the DSFS) and a number of relevant on-site procedures and programs such as:

- The program on shipment of transport container/dry shield canister to the dry spent fuel storage facility;
- The loading of spent fuel assembly in the transport cask/dry shield canister;
- The procedure on accounting and control of nuclear fuel at the Armenian NPP;
- The general procedure on loading of spent nuclear fuel into the dry spent fuel storage facility, and other.

The Armenian NPP consists of two WWER-440 (V-270 model) type power units 1375 MW thermal power each. The Unit №1 is not operated and there are no fuel assemblies in the core. Thus, spent nuclear fuel assemblies are stored in:

- The spent nuclear fuel storage pool of Unit № 2;
- The spent nuclear fuel storage pool of Unit № 1;
- The DSFS.

After the service life of spent fuel assembly expires in the reactor core, it is unloaded from the reactor and loaded into the spent fuel storage pool of the Armenian NPP Unit №2. Then, in 3-4 years the spent fuel assembly is transferred from the spent fuel storage pool of the Unit №2 to the spent fuel storage pool of the Unit №1. When the safety condition of the spent fuel stored in the Unit №1 reaches the criteria established in the SAR for Mediator NUHOMS Storage Facility, they are transferred to the DSFS. The total storage time of the spent fuel assembly shall meet at least the required value (not less than 5 years for the design type nuclear fuel and at least 10-12 years, for the profiled nuclear fuel with the initial enrichment 3.82% by U-235).

In the reporting period the Republic of Armenia ratified the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (hereinafter referred to as the Joint Convention) and in the frame of EC Project the suggestions on the strategic options for the spent fuel and radioactive waste management were provided by the international expert group.

The list of legal acts directly related to the safety of radioactive waste management is provided in the Annex 2.

All liquids from the Armenian NPP controlled area are collected and evaporated continuously; therefore the low level sorbents tanks 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 the solid intermediate level waste storage facility is used as an interim solution for disposition of the DEF containers. The Armenian NPP considers the options for safe management of the accumulated DEF containers to be submitted for the ANRA review in frame of the Armenian NPP Unit №2 design life time extension activities.

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

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

Fullness of radioactive waste storage facilities at the Armenian NPP as of 31.12.2015 is provided in Annex 10.

One of the main principles of the state policy in radioactive waste management is to ensure the generation of radioactive waste at the minimum practicable rate. This is achieved through development and implementation of the radioactive waste minimization program at the Armenian NPP. A number of activities are performed in accordance with the mentioned program, for instance, the standard committee is established to analyze quarterly the generation of radioactive waste and, if necessary (in excess of the expected level of waste generation), to develop corrective measures, daily monitoring of the volume of generated radioactive liquids is performed, before entering the controlled area equipment are withdrawn transport packaging and are removed from lubricants, the radioactive waste management issues are incorporated in the Armenian NPP personnel training programs, etc.

The clearance levels are established in the Radiation Safety Norms approved under the RA Government Decree № 1219 as of 18.08.2006 and amended in 2014 aimed to bring them in compliance with the IAEA General Safety Requirements Part 3.

No radioactive waste clearance practice is in place at the Armenian NPP.

A number of documents are submitted by the Armenian NPP for the ANRA review, for instance, the reports (quarterly and annual) on radioactive waste, the information on fulfillment of NPP operational license terms and conditions, on upgrade/modernization of radioactive waste management system, etc.

Based on the review results, the relevant report is submitted to the Armenian NPP with the indication of issues to be updated and of deadlines. Meetings and discussions are organized during the update.

Besides, the ANRA performs inspections, usually 2-3 planned inspections per year, to verify the compliance of radioactive waste management practice at the Armenian NPP with the safety requirements, the current state of activities specified in the submittals and the accuracy of information contained therein, the information on implementation of enforcement actions imposed earlier, etc.

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 fulfillment 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

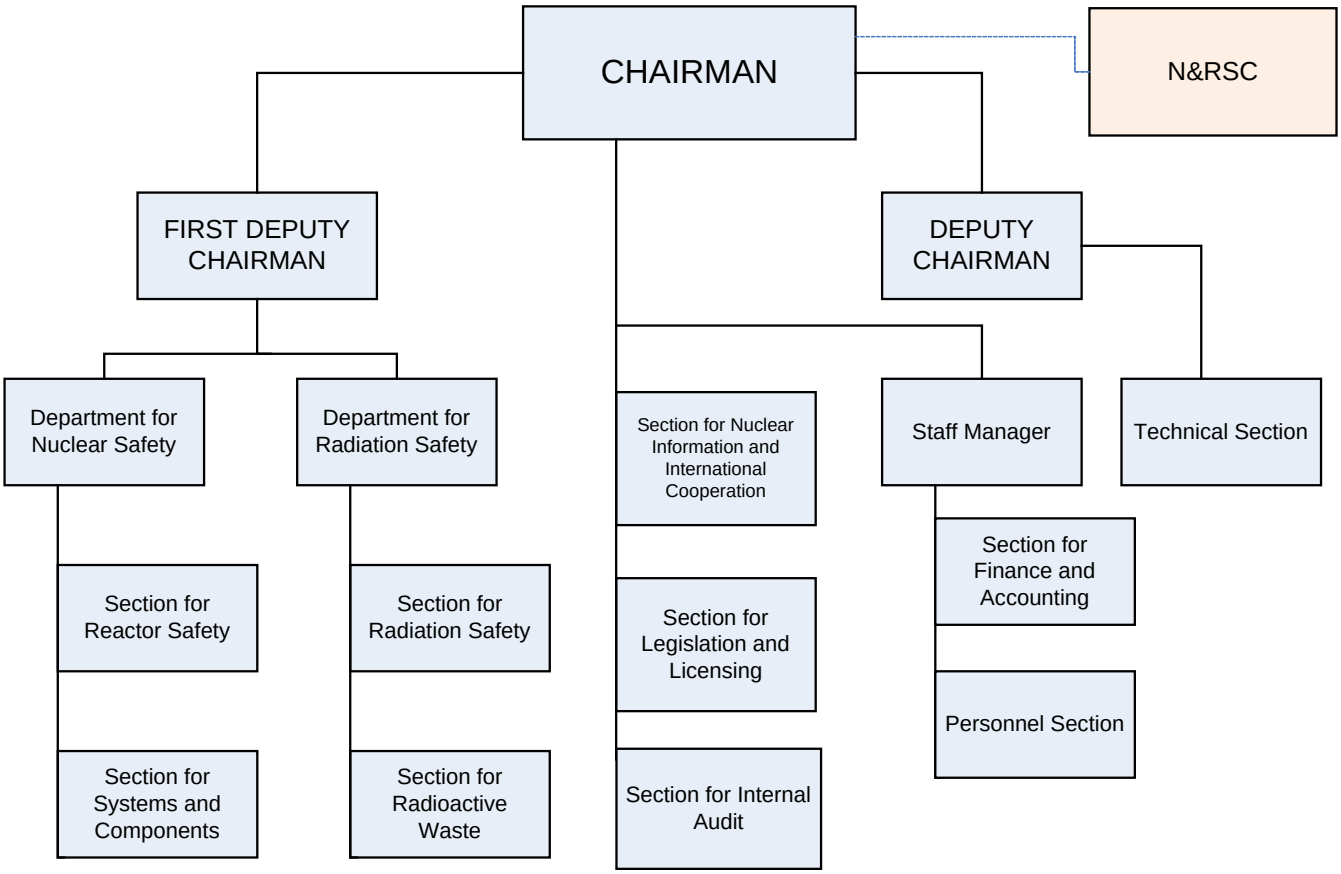
- Government Decree № 762-N as of 09.06. 2005 on approval of the licensing procedure and licence form for use of nuclear materials
- Government Decree № 985-N as of 07.07. 2005 on approval of the licensing procedure and licence form for designing of radioactive waste storage facility
- Government Decree № 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
- Government Decree №11-N as of 14 January 2016 on approval of the physical protection rules of radioactive materials and devices containing radioactive materials.

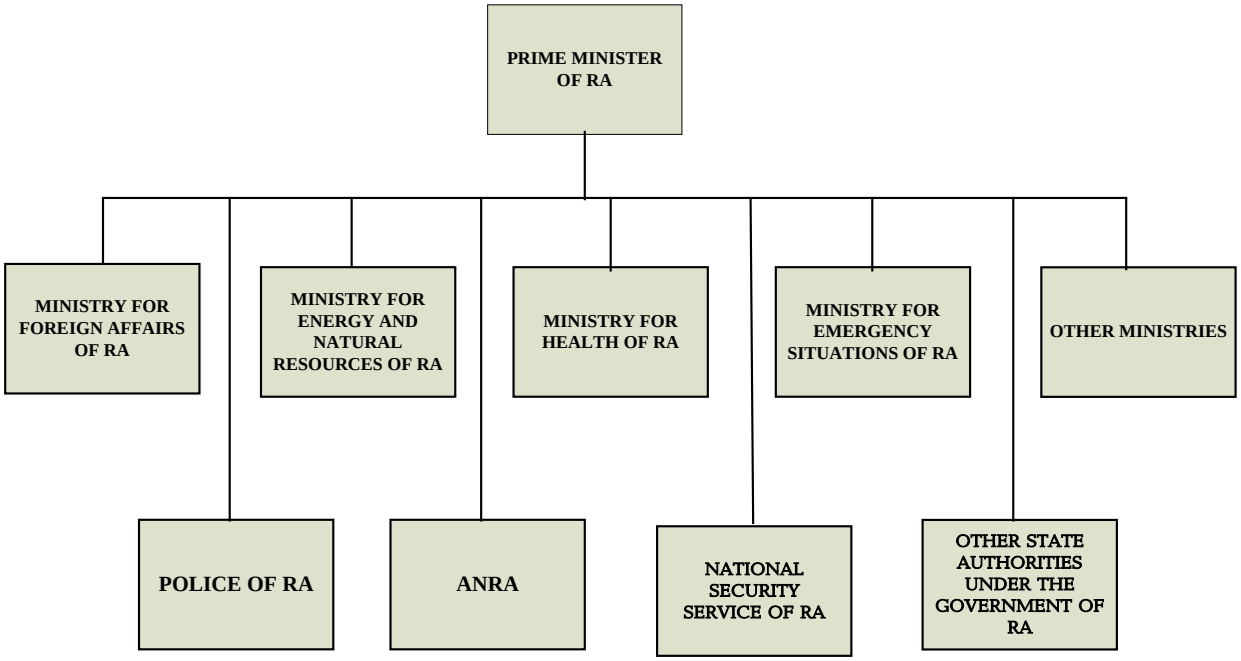
ANNEX 3. MINISTERIAL ACTS IN ATOMIC ENERGY UTILIZATION FIELD

- 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).
- "Requirements to content and form of the complex survey report" approved under the ANRA's order №9-N as of 19 January 2016 (registered at the RA Ministry of Justice under № 12516039 on 04 February 2016)
- "Methodology on analysis of deviations of Armenian NPP design and actual state from the legal acts applied in the nuclear energy utilization field" approved under the ANRA's order №98-A as of 22 April 2016

ANNEX 4. ORGANIZATIONAL STRUCTURE OF ANRA



ANNEX 5. POSITION OF ANRA IN THE RA GOVERNMENT STRUCTURE



ANNEX 6. 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

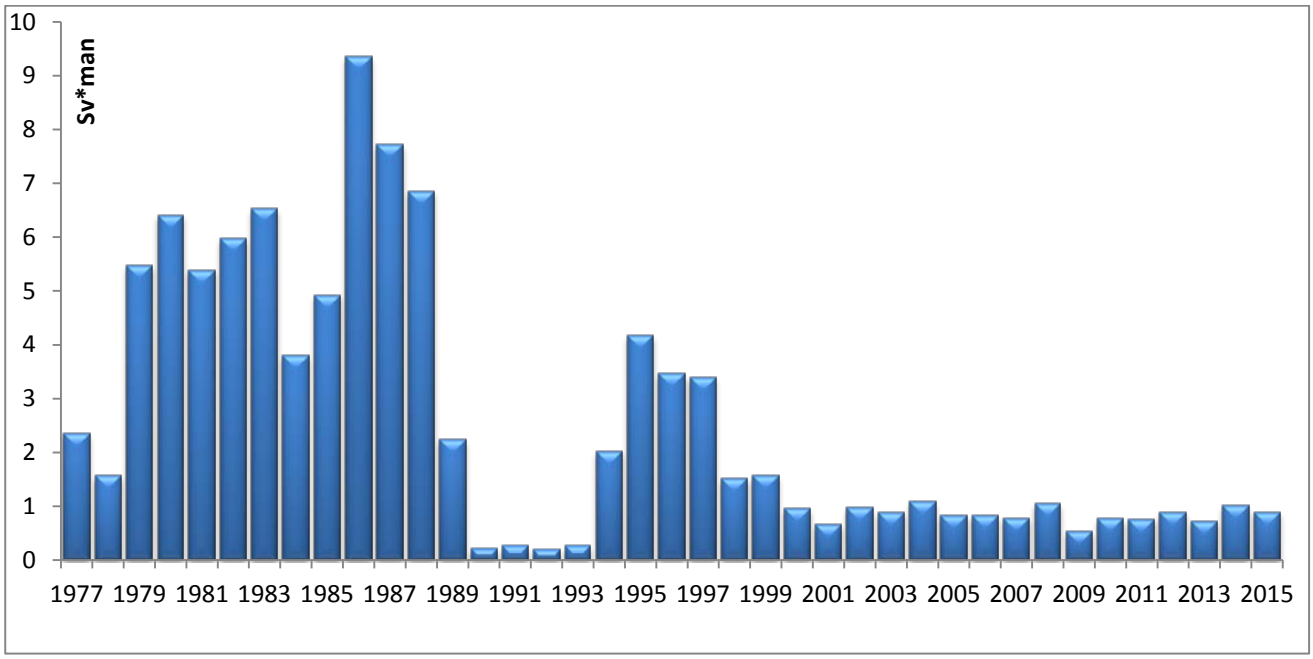


Figure 1. Annual Collective Equivalent Exposure Dose of Armenian NPP Personnel

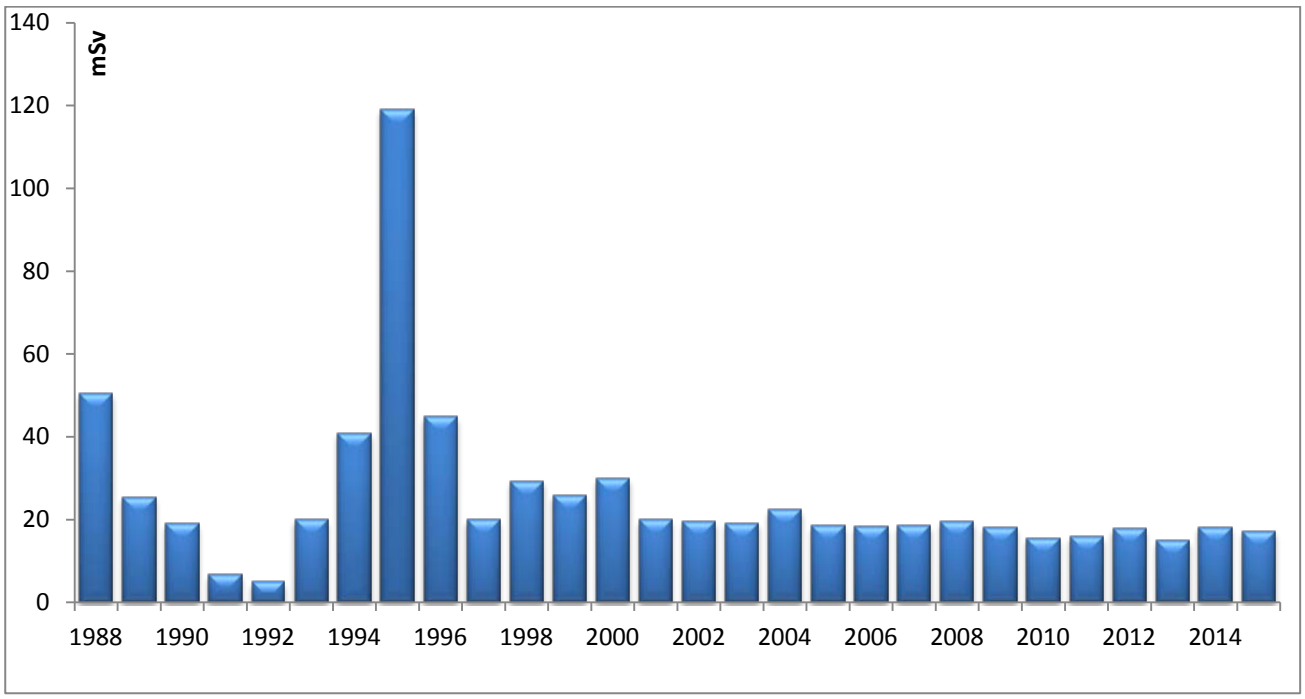


Figure 2. Individual Equivalent Annual Maximum Exposure Dose of Armenian NPP Personnel for the period 1988-2015

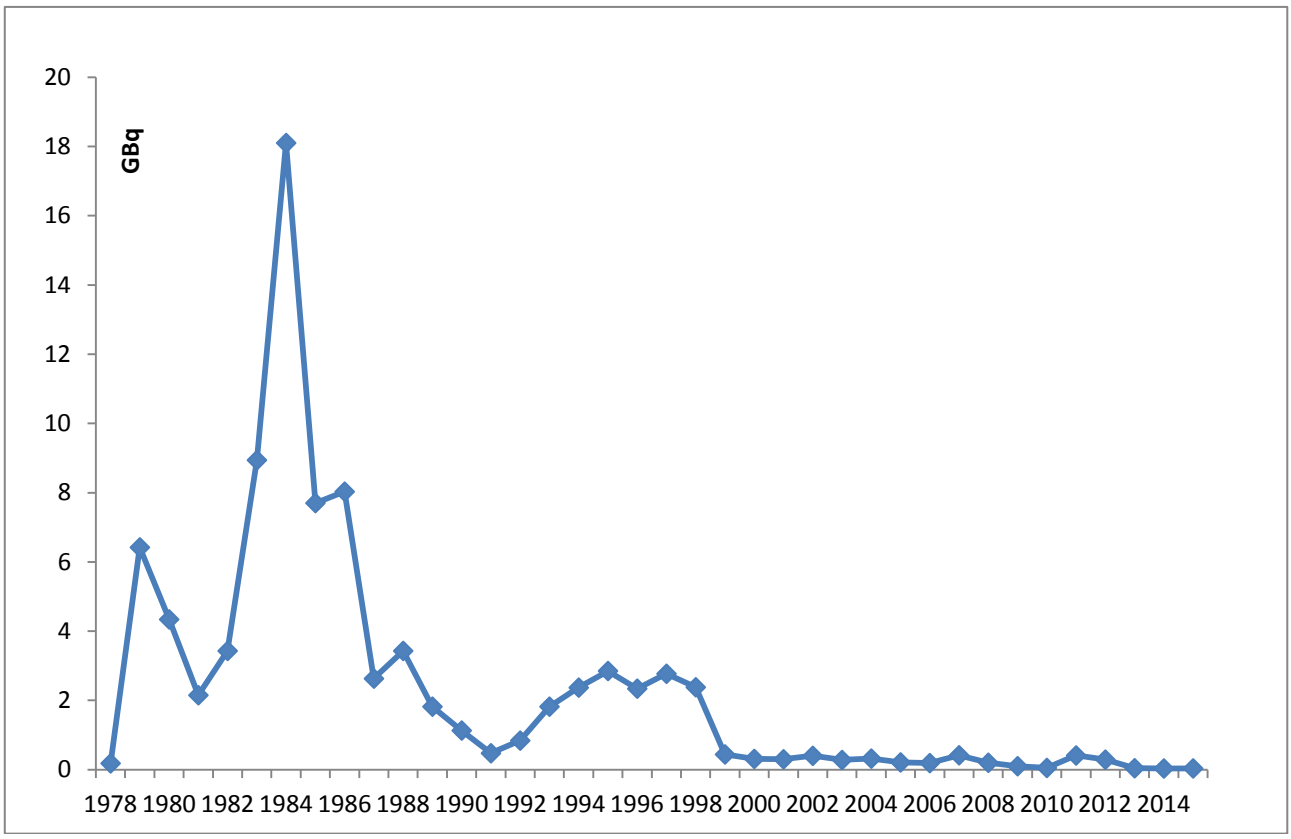


Figure 3. Annual Releases of Long-Lived Radionuclides (T1/2 more 24 hours) for the period of the Armenian NPP operation

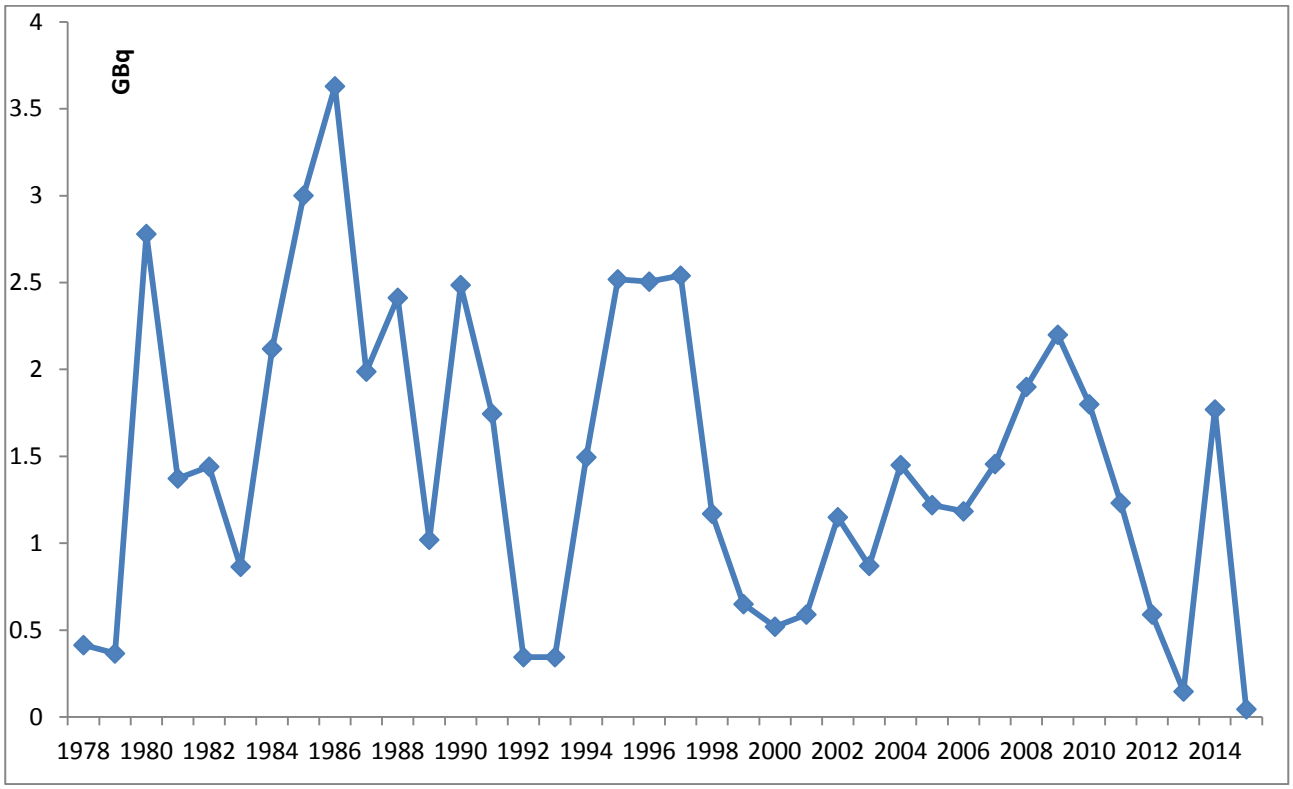


Figure 4. Annual Discharges of Long-Lived Radionuclides (Sr+Cs) from Armenian NPP in the period of operation

Environmental Radiation Monitoring Results for 2015

Table 1. The contamination of atmosphere* in the Armenian NPP supervised area in 2015 [10^{-4} Bq/m^3]

Name of location	Summary beta activity	^{137}Cs	^{90}Sr	^{7}Be**
Armenian NPP - 1 km	0.63	0.022	0.005	5.6
Metsamor town - 5 km	1.06	0.032	0.004	5.70
Water purification system of Armenian NPP - 6-7km	1.16	0.05	0.005	8.10
Yerevan city – 30 km (clean area for comparison of data)	1.22	0.05	0.004	8.7

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

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

Table 2. Contamination of soil in the Armenian NPP supervised are in 2015 [Bq/kg]

Name of location	Cs-134	Co-60	Ag-110m	Cs-137	Sr- 90
Armenian NPP	-	-	-	19.2	1.70
Territory with 3-6 km radius	-	-	-	8.5	1.20
Territory with 8-12 km radius	-	-	-	6.80	1.40
Territory with 14-18 km radius	-	-	-	11.80	1.10
Yerevan city – 30 km (clean area for comparison of data)	-	-	-	14.7	1.0

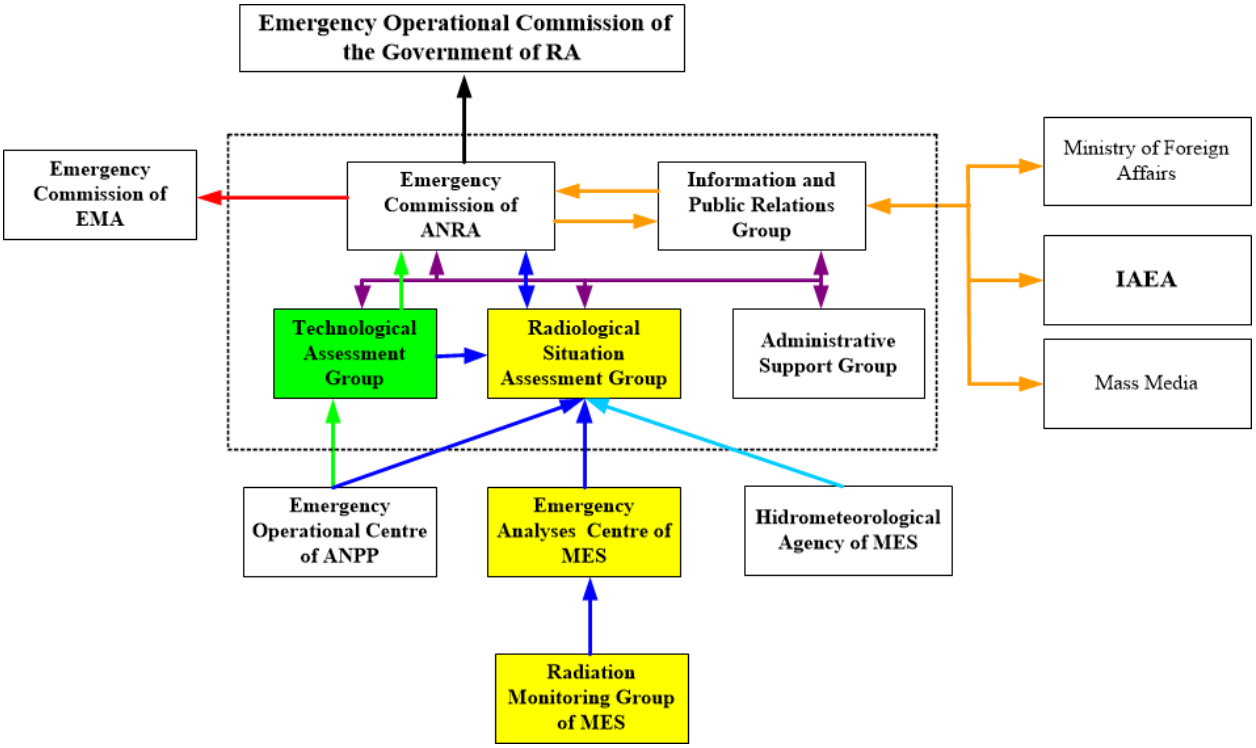
No radioactive isotopes generated due to operation of the Armenian NPP are available in the soil and vegetation of the Armenian NPP supervised area.

Table 3. Quantity of ^{137}Cs and ^{90}Sr radioisotopes in open reservoir of the Armenian NPP supervised area in 2015 [Bq/m^3]

Name of open reservoir	Radioactive isotopes	
	^{137}Cs	^{90}Sr
Lake Aknalich	10..0	3.50
Fishery Facility	13.50	25.0
Service Water Supply Pump Facility	17.0	1.95
Drinking Water Sampling for Metsamor	20.5	2.50
Drinking Water Sampling for Armavir	13.5	3.5
Sanitary Sewage Discharge Point	12.5	3.5
Site Rainwater Sewage Discharge Point	13.5	1.5
Big reservoir of Armavir	Dry water	Dry water

The limiting value of ^{137}Cs in open reservoirs is 11* 10^3 Bq/m^3, and the limiting value of ^{90}Sr is 5* 10^3 Bq/m^3, (Radiation safety norms, table 3)

ANNEX 7. SCHEME OF ANRA EMERGENCY RESPONSE AND INTERACTION WITH EXTERNAL ORGANIZATIONS



ANNEX 8. ARMENIAN NPP NOTIFICATION SCHEME

NPP SS

№	Position
1.	Armenian NPP General Director
2.	Armenian NPP Chief Engineer
3.	Co-coordinator of the ANRA Emergency Response Center
4.	Chairman of the ANRA
5.	Duty operator of the RA MES Rescue Team
6.	Duty operator of Armavir Marz Rescue Administration
7.	Head of Nuclear Energy Administration of the Ministry of Energy and Natural Resources

The functions of Leading Engineer of Electrical Control Board/Duty Electrician

When "Preparedness" is declared:

1. Notification of ANPP key positions

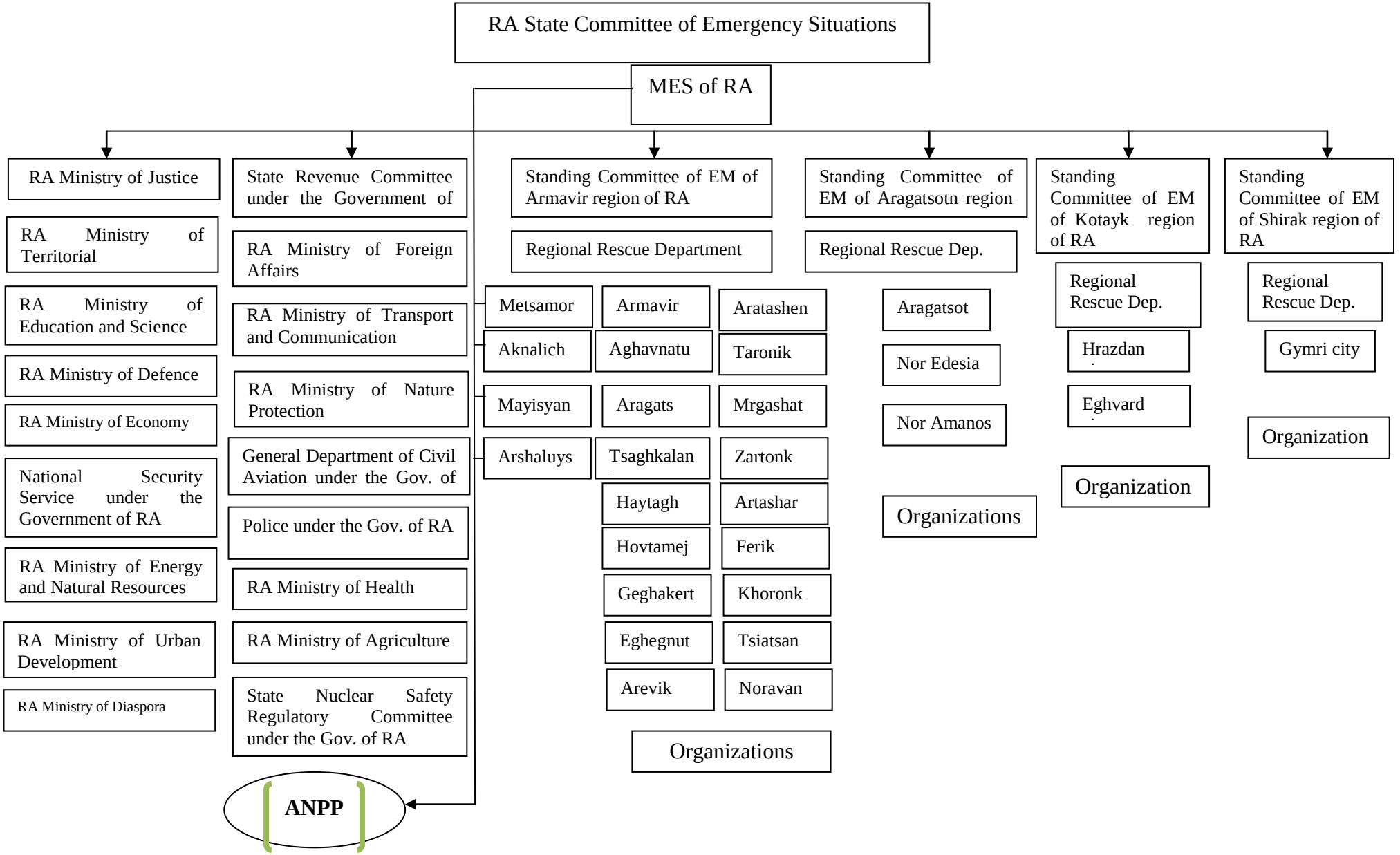
When "Local accident" is declared:

1. Connection of acoustic alarm at Armenian NPP site
2. Notification of call personnel according to the list
3. Notification of Armenian NPP key positions

When "General Accident" is declared:

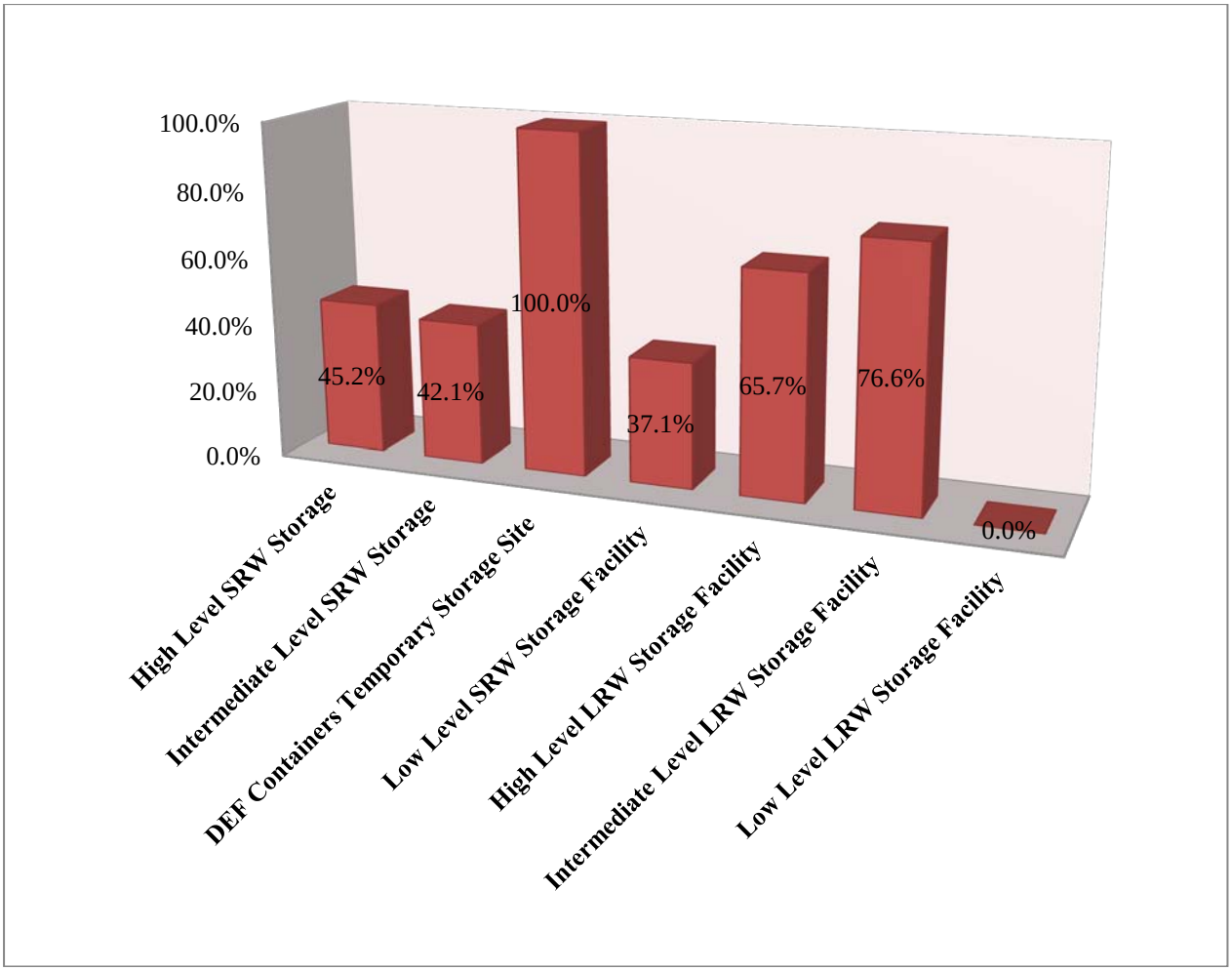
1. Connection of acoustic alarm at Armenian NPP site
2. Notification of populated areas of Preventive and Protective Measures Zone (Aknalich, Arshaluys, Mayisyan, Metsamor, Ferik, Yedesia)
3. Notification of call personnel according to the list

ANNEX 9. ORGANIZATIONAL CHART OF POPULATION PROTECTION PLANNING SYSTEM



ANNEX 10. RADIOACTIVE WASTE MANAGEMENT

Fullness of radioactive waste storage facilities at the Armenian NPP as of 31.12.2015



LIST OF ABBREVIATIONS

ALARA	As Low as Reasonably Achievable
ANL	Argon National Laboratory
ANRA	Armenian Nuclear Regulatory Authority
Armenian NPP	Armenian Nuclear Power Plant
ARS	Armenian Rescue Service
ASSET	Assessment of Safety Significant Events
BDBA	Beyond Design Basis Accident
BDBE	Beyond Design Basis Earthquake
BNL	Brookhaven National Laboratory
CES	Commission on Emergency Situations
CDF	Core Damage Frequency
CMC	Crisis Management Centre
CPR	Corporate Peer Review
CSF	Critical Safety Functions
DAR DG	System of Additional Emergency Cooling by Diesel Generator
DBA	Design Basis Accident
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
EC	European Commission
ECCS	Emergency Core Cooling System
EDG	Emergency Diesel Generator
ENR	Event Notification Report
ENSREG	European Nuclear Safety Regulators Group
EOP	Emergency Operating Procedure
ESP	Emergency Shutdown Panel
ERC	Emergency Response Center
EU	European Union
FSA	Fault Sequence Analysis
FAST-EE	Fault Sequence Tool for Extreme Events
HPES	Human Performance Evaluation System
INES	International Nuclear Event Scale Information Service
IAEA	International Atomic Energy Agency
INSC	Instrument for Nuclear Safety Cooperation
IPPAS	International Physical Protection Advisory Service
IPSART	International Probabilistic Safety Analysis Review Team
IRRS	Integrated Regulatory Review Services
IRS	Incident Reporting System
I&C	Instrumentation and Control
LOCA	Loss of Coolant Accident
LTE	Lifetime Extension
LTO	Long Term Operation
MCR	Main Control Room
MCP	Mail Circulation Pipe
MDE	Maximum Design Earthquake
MELCOR	Severe Accident Analysis Codes
MES	Ministry of Emergency Situations

MFS	Multi-functional Simulator
ND	Nominal Diameter
NPP	Nuclear Power Plant
NRSC	Nuclear and Radiation Safety Center
OE	Operational Experience
OSART	Operational Safety Review Team
OED	Operational Experience Department
PAMS	Post-Accident Monitoring System
PAZ	Preventive Actions Zone
PGA	Peak Ground Acceleration
PR	Peer Review
PRT	Peer Review Team
PSA	Probabilistic Safety Assessment
PSHA	Probabilistic Seismic Hazard Assessment
PROSPER	Peer review of the Effectiveness of the Operational Safety Performance Experience Review
PRZ	Pressurizer
PTS	Pressurized Thermal Shock
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
SALTO	Peer Review Service on Safe Long-Term Operation
SAMG	Severe Accident Management Guidelines
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
TLD	Thermo Luminescence Dosimeter
US NRC	United States Nuclear Regulatory Commission
US DOE	United States Department of Energy
UPZ	Urgent Protective Actions Zone
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators Association
WWER	Water-cooled Water-moderated Energetic Reactor