NATIONAL REPORT

OF THE REPUBLIC OF ARMENIA

CONVENTION

ON NUCLEAR SAFETY

September 2010

Contents

INTRODUCTION

The fifth National Report of the Republic of Armenia on implementation of the obligations undertaken under the Convention on Nuclear Safety provides an overview of the national nuclear safety program.

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

The report has been prepared in accordance with the Guidelines regarding the National Reports under the Convention on Nuclear Safety (INFCIRC/572/Rev.3, 28 September 2009) and will be submitted for peer review of the fifth review meeting under the Convention on Nuclear Safety, to be convened at the International Atomic Energy Agency in April 2011.

SUMMARY

The Republic of Armenia ratified the Convention on Nuclear Safety on 24.09.1997.

This report addresses changes in the national legislation, describes practices, challenges and issues related to the nuclear safety improvement, the licensing system, as well as demonstrates the efforts of the RA put to improve the nuclear safety by enhancing the national arrangements and international cooperation to meet the obligations under the Convention on Nuclear Safety. In particular, in the reporting period the status of the regulatory authority in the atomic energy utilization field – the ANRA- within the RA Government structure has been changed, the licensing system taking into account the international best practice has been established, the IAEA Design Safety Review Mission Follow-up to assess the resolution of IAEA Safety Issues at the Armenian NPP has been implemented, the Armenian NPP safety upgrading program for 2009-2016 has been approved, a set of the Armenian NPP important safety upgrades have been implemented.

The efforts have been undertaken with regard to construction of a new NPP unit in the RA. This intention is expressed in "Energy development strategy in the context of the RA economic development" approved on 25 June 2005 by the RA Government. In this regard on 27 October 2009 the National Assembly of the Republic of Armenia adopted the Law On Construction of New NPP Unit(s) in the Republic of Armenia. Then on 3 December 2009 the RA Government adopted decree №1458-N on Establishment of a Closed Joint Stock Company with the Purpose to Construct New NPP Unit(s) in the RA. The decree approved housing of a new NPP unit with WWER reactor facility (NPP-92 design), capacity -1060MW, service life - 60 years (Design confirmed by the European Utilities certificate) being constructed in the RA based on the results of the analysis performed by the management organization - "WorleyParsons".

All aspects of the obligations of the RA under the Convention on Nuclear Safety, as well as the issues raised during the fourth review meeting are addressed in the relevant chapters of this national report.

1. GENERAL PROVISIONS

1.1. EXISTING NUCLEAR INSTALLATIONS

Article 6. Existing Nuclear Installations

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

There is only one nuclear installation in the RA covered under the Convention on Nuclear Safety - the Armenian Nuclear Power Plant (Armenian NPP). The construction of the Armenian NPP was started in 1969. The Armenian NPP design was developed in 1960-ies. The Armenian NPP design is based on the first generation of V-230 reactor and takes into account the specifics of the plant site. The Armenian NPP consists of two WWER-440 type units, designated as version V-270. The Unit № 1 was commissioned in December 1976, and the Unit №2 - in January 1980. The installed capacity of each unit is 407,5 MWt, and the design lifetime is 30 years. The Armenian NPP was shutdown shortly after the Spitak earthquake of 7 December 1988, with its epicenter located 80km north of the plant site. Though the plant didn't suffer any damage, and both units of the Armenian NPP remained in operation, the USSR Board of Ministers adopted decree to shutdown the plant. Thus the Unit №1 was shutdown on 25.02.1989 and the Unit №2 was shutdown on 18.03.89. Both units were in long-term shutdown condition but not decommissioned. To overcome the energy crisis on 07.04.93 the RA Government adopted decree to restart the Armenian NPP Unit №2. Before and after the Armenian NPP Unit №2 restart, several hundred safety upgrades were developed and implemented and are continuously implemented in accordance with the RA Government Decree № 474 as of 05.10.1994 on approval of the Concept for the Armenian NPP Restart, the Armenian NPP Unit №2 safety upgrading program, which is periodically revised and updated taking into account recommendations made by the expert and review missions organized in frame of the international and technical cooperation projects with the IAEA, EC, USA. In particular, on the reporting period the Armenian NPP accepted the following missions:

IPSART Mission, 2007

In October 2007 the IAEA IPSART mission was conducted at the Armenian NPP to review the PSA results. The current PSA activities are aimed to resolve comments made during expertise process. As a result of the revising the PSA model will be brought in compliance with the state of the art for the end of 2009, i.e. upgrades to the systems. Updated data of the database on equipment failure are taken into consideration. The PSA review with the US ANL specialists will be completed at the end of 2010.

WANO Peer-Review Mission Follow-up, 2007

The objective of WANO peer-review mission follow-up in December 2007 was to verify implementation of corrective measures developed by the Armenian NPP based on the WANO peer-review mission results in 2004. The mission identified the positive progress in implementation of the corrective measures and the following examples of good practice at the Armenian NPP:

- Complex self-assessment system on different levels and for main directions of activity;
- The primary leak control system in reactor cover;
- Development of standard instructions for different areas of activity;
- Development and implementation of the complex program on operation experience and the events database.

The IAEA Mission on Verification of NPP Plant Self-Assessment Program, 2007

The IAEA mission on verification of NPP self-assessment program was conducted at the Armenian NPP in November 2007. The main objective of the mission was to analyze the self-assessment program and identify the areas for improvement. The main recommendations of the mission related to the areas of improvement covered the improvement of the whole strategy for prioritization and integration of improvement program, improvement of targeted self-assessment practice and feedback of self-assessment results. Two good practices were identified by the mission: indicators of the safety management system and the methods used for assessment of the safety management system. The self-assessment practice was improved based on the mission recommendations. At present measures are undertaken to incorporate the process oriented approach in the safety management system in frame of the IAEA ARM/9/021 project.

WANO Mission on Planning, Preparation and Implementation of NPP Equipment Maintenance and Repair, 2008

The WANO mission on planning, preparation and implementation of NPP equipment maintenance and repair was conducted at the Armenian NPP in June 2008. The objective of the mission was to gain positive experience on planning, preparation and implementation of the NPP equipment maintenance and repair. The mission made recommendations on effectiveness of the program for preventing foreign materials ingression in equipment and pipelines, application of check-lists at implementation of maintenance and repair of specific equipment, development and application of documentation, periodical examination of maintenance at personnel workplaces. With respect to the mission recommendations the Armenian NPP developed and implemented corrective measures in this area. In addition, in frame of preparation to the IAEA OSART mission the Armenian NPP in 2009 conducted self assessment of "Maintenance" area. The schedule of activities to bring the existing practice in compliance with the IAEA safety standards has been developed. All scheduled measures are expected to be implemented that before the OSART Mission (planned for May 2011).

WANO Mission on Personnel Training System Improvement, 2009

The WANO mission on personnel training system improvement was conducted at the Armenian NPP in October 2009. The objective of the mission was to improve the approaches and principles related to organization and conduct of the personnel training. The mission made recommendations on stressing the management role in the personnel training system, development and implementation of the programs for personnel training and qualification maintaining, effective use of training tools and technical support, and also exchange of experience with training centers of other NPPs. With respect to the mission recommendations the Armenian NPP conducted comprehensive self assessment of the personnel training system and analysis of needs for improvement, organized thematic training courses for management staff, developed and submitted to the EC proposal on providing the Armenian NPP with a full scope simulator. This proposal is agreed with the EC and included in AP-2010. The project envisages transmission of the full scope simulator of the Bohunice NPP (Slovak Republic) to the Armenian NPP. At successful implementation of the project at the end of 2010 the Armenian NPP will have the full scope simulator that will allow significantly

improving the effectiveness in training and maintaining qualification of the operating personnel and validation process of the emergency procedures.

IAEA Design Safety Review Follow-up Mission, 2009

The IAEA Design Safety Review Mission follow-up was conducted at the Armenian NPP in November 2009. The first mission was organized in 2003 aimed to review the implementation of recommendations specified in TECDOC 640 Ranking of Safety Issues for WWER-440 Model 230 Nuclear Power Plants. The review covered 45 safety issues. Based on the mission results 12 issues have been recognized resolved, including:

- Equipment classification;
- Operation control;
- I&C and electrical equipment classification;
- Application of leak before break concept;
- Pressure discharge system of primary circuit;
- Separation between high and low pressure systems;
- Core control and design
- Emergency alarming.

The other 33 safety issues have the resolution degree 3, i.e. the corrective actions to resolve issues are on the stage of completion, but the issues are not completely resolved. Based on the mission results the average degree of safety issues resolution is 3,46 (by 4 categories of ranking) confirming that design deficiencies are close to resolution. In particular it is planned to implement 8 measures for 2010 and for 2011 – 7 measures. It is expected that all safety deficiencies will be completely eliminated in the next years.

Mission on Assessment of Seismic Safety Re-Evaluation Program of the Armenian NPP Unit №2, 2009

The IAEA mission on verification of the Armenian NPP self-assessment program was conducted in November 2009. The seismic reevaluation of the Armenian NPP Unit №2 is implemented in accordance the Technical Guidelines Programme for the Seismic Re-evaluation of the Armenian NPP Unit №2 developed with the IAEA assistance in 1997.

Pre-OSART mission in 2009 and 2010

In June 2009 and in April 2010 the Pre-OSART missions were organized. The objective was to introduce to the Armenian NPP personnel the methodology of verification of operational safety, examples of wakdowns and self-assessment, discussion and agreement of organization and technical issues concerned with the OSART mission planned for May 2011.As a result the Armenian NPP obtained a set of international safety standards and practical skills on conduct of self-assessments and detection of departures from the international safety standards. Working groups for all 8 areas of assessment are composed at the Armenian NPP. At present measures on detection of departures and their elimination are in process.

Besides in frame of the EC ARTS06 project joint inspections were conducted by the ANRA and EC experts based on the OSART guideline addressing the issues which will be examined during the OSART mission, in particular operational safety, safety management and quality assurance, inspection of maintenance, technical support, operations management, Armenian NPP personnel

qualification and training as well as the on-site emergency plan and preparedness. The recommendations on areas of improvement have been made to assist with preparation to the OSART mission.

A number of expert missions assigned with specific safety related task were conducted at the Armenian NPP in frame of the IAEA TC national and regional projects. In frame of EC INSC program both the Armenian NPP and the ANRA received the on-site assistance in the areas covering the safety upgrading. Besides in frame of the same EC projects, the ANRA organized and conducted inspections jointly with the EC experts to verify the implementation of safety upgrades at the Armenian NPP with application of "2+2 approach". The implementation of the safety upgrades at the Armenian NPP is regularly reviewed by the Nuclear Energy Safety Council under the President of the RA.

2. LEGISLATION AND REGULATION

2.1 ESTABLISHING AND MAINTAINING LEGISLATIVE AND REGULATORY FRAMEWORK

Article 7. Legislative and Regulatory Framework

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

The 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 regulating the nuclear safety.

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 an integral part of the legislative framework and also belong to the first level of the legislative framework. If the international treaties ratified by the National Assembly of the RA stipulate provisions other than the ones stipulated in the law, 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. LEGISLATIVE AND REGULATORY FRAMEWORK OF THE REPUBLIC OF ARMENIA

2.2.1. National Safety Requirements and Regulations

The following laws directly pertain to the nuclear safety:

- 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 (№ N-172 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 are specifically oriented and settle specific relations, for instance:

- Ordinance № 121-N adopted by the President of Armenia on 20 May 2008 on reorganization of the inspectorate for nuclear and radiation safety regulation (ANRA) within the administration of the Ministry for Nature Protection of the RA into the State Committee under the Government of the RA on Nuclear Safety Regulation.
- The RA Government Decree № 1231-N as of 11.09.2003 on approval of the concept of physical protection and security of the Armenian NPP and nuclear materials and rules on physical protection of nuclear installations and nuclear materials that specifies the requirements to physical protection of nuclear facilities and nuclear materials, functions of responsible state authorities, legal entities and physical persons, requirements to notification of events concerned with physical protection of nuclear installations and nuclear materials and other issues.

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 Chairman and registered by the Ministry of Justice of the RA (that are binding), are adopted in pursuance of the legal acts of higher legal force. These legal acts belong to the third level of the legislative framework and settle specific issues. For instance the NPP emergency planning zones were approved under the order of the ANRA Chairman adopted on 27.03.2007 and registered in the Ministry of Justice of the RA under № 12506129 as of 04.05.2008.

The list of ministerial normative legal acts is provided in the Annex 2.

The relations concerned with development, agreement and approval of legal acts are settled by the Law of the RA on Legal Acts and the Ordinance of the RA President.

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 agreement and also posted on the web site of the ANRA.

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.

Ministries and state authorities make their comments and proposals to draft legal acts submitted for their comments. 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 on accepted comments and proposals as well as justification on the reasons for non-adoption of proposals or comments.

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

The following legal acts were adopted in the reporting period:

- With amendment to the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes and the Law of the RA on Licensing (19 May 2008) the jurisdictions of the ANRA in emergency situations have been precisely defined. The law also distinguishes the term “operating organization” from other installations important to safety in atomic energy utilization field and settles other relations in compliance with the new IAEA approaches and standards.
- The Ordinance № 121-N adopted by the President of Armenia on 20 May 2008 on reorganization of the inspectorate for nuclear and radiation safety regulation (ANRA) within the administration of the Ministry for Nature Protection of the RA into the State Committee under the RA Government on Nuclear Safety Regulation.
- The RA 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.

- Under the RA Prime Minister Decree № 724-A adopted in 2009 the ANRA staff number in the quantity 40 was approved and from 2010 the ANRA staff number was increased by 3 staffs in addition.
- Under the RA Government Decree № 602-N adopted on 25.05.2009 the amendments were introduced in the licensing procedures applied in the atomic energy utilization field with the purpose to simplify and define more precisely the licensing procedures and requirements. For that the list of documents to be submitted for obtaining a licence and the documents to be submitted for expertise were simplified and defined more precisely.
- The RA Government Decree № 631-N as of 4 June 2009 on approval of the procedure on radioactive waste management.

2.2.2. System of Licensing

Licensing related relations are settled 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 being subject to 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 of nuclear installation operation, 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.

The ANRA reviews application for obtaining licence for construction, operation and decommissioning of nuclear installations within 30 days after receiving all documents as required 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.

The ANRA establishes a licensing commission to make conclusions on granting, termination or revocation of license; the statute of licensing commission is approved by the ANRA.

The Licensing commission reviews licence applications in sessions. Applicant is duly notified about review not later that in 7 days in advance with indication of place (address) where review takes place, date and time.

Information about a session of commission, date and issues to be reviewed is published in the newspaper not later than 5 days before the session.

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 a valid reason and if postponement of review will not result in violation of terms specified in the legislation.

The 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 commission members, request arbitration.

Reviews are conducted with open doors. Reviews involving state, official and banking confidential information are conducted with closed doors.

At applicant's request reviews can be conducted with closed doors if commercial confidential information will be discussed during review. Journalists, specialists, officials and other persons can be involved in reviews conducted with closed doors. Closed-door review process can be audio and video recorded.

Provisions related to 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 pursuance 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 by the RA legislation:

1) 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,
2) 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,
3) 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,
4) As necessary, requests the persons responsible for new NPP unit(s) construction process to prepare publications and expert analysis related to the program,

5) 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 transport means.

In accordance with the Code of the RA on Administrative Offences a legal entity has no right to implement the practices subject to licensing without a 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 fine at the rates specified in the legislation. The Article 188 of the Criminal Code of the RA stipulates provisions related to implementation of activities without special permit (license), causing losses to the citizens 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.

2.2.3. System of Regulatory Inspection and Assessment

The ANRA has developed a strategic plan that provides a realistic and balanced approach for improving the functioning of the regulatory body in all aspects which are part of its mission and identifies the managerial, technical and administrative issues that are typically applicable by the regulatory body.

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 Instruction on organization and conduct of inspections at the NPP. The ANRA organizes inspections based on the 3-years baseline inspection program. Annual inspection plan for Armenian NPP is organized based on the mentioned program. There are planned and reactive inspections, that it its turn can be announced and unannounced. Reactive inspections are conducted as appropriate. In case of announced inspections the operating organization is notified in advance. Unannounced inspections can be conducted without prior notification. By the content of subject inspected, inspections can be complex, special and routine. Inspection consists of three stages:

- Preparations to conduct an inspection;
- Conduct of inspection;
- Recording of inspection results.

The ANRA Chairman issues order on appointment of an inspection team to conduct the inspection. Experts or specialists of the ANRA TSO can be involved in inspections. An inspection program and plan are developed prior to inspection. The inspection program includes:

- Objective of inspection;
- Issues to be inspected;
- Structural divisions of facility to be inspected;
- Inspection periods.

The inspection program is approved by the ANRA Chairman.

The commission collects the following information prior to an inspection:

- Safety norms and rules related to the inspected subject;
- Documents related to the organizational structure of the operating organization, quality assurance program for practices implemented by the NPP and related to the inspected subject;
- Terms and conditions of licenses/permits issued by the ANRA to the operating organization;
- Enforcement actions imposed by the ANRA earlier and information on their implementation, and also reporting documents developed based on results of earlier conducted inspections.

The inspection program and plan are transmitted to the NPP not later than in 10 days before inspection.

Visit to industrial areas, workplaces, observation of systems and elements important to safety are implemented in the order established at the NPP.

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

Inspection results are recorded in the form of reports if violations of NPP safety requirements are not detected or act-enforcement if a non-compliance with the NPP safety requirements is detected.

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.

Report and act-enforcement are signed by the commission chairman, all members of the commission and transmitted for signature to the NPP director.

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 and informs 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.

2.2.4. 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 a 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 place, name and surname of person drawing up the protocol, information on person committed an offence, time and place 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 4 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.

2.3 REGULATORY AUTHORITY

Article 8. Regulatory Body

1. ***Each Contracting Party shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7, and***

provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities.

2. ***Each Contracting Party shall take the appropriate steps to ensure an effective separation between the functions of the regulatory body and those of any other body or organization concerned with the promotion or utilization of nuclear energy.***

2.3.1 Establishment of the Regulatory Body

The 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 (hereinafter referred to as the 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:

1) 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;
2) Licensing of practices and physical persons implementing practices and holding positions important in terms of safety in the atomic energy utilization field;
3) 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;
4) Safety assessment, organization and conduct of expertise of practices, installations and equipment in the atomic energy utilization field;
5) Organization and conduct of researches for safety strengthening purposes in the atomic energy utilization field;
6) 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;
7) Verification of QA programs of contractors implementing safety important activities and rendering services to licensees in the atomic energy utilization field;

8) Control on preparedness of licensees to possible emergency situations;

9) 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;

10) 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;

11) Control on safeguards implementation;

12) 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;

13) The right to stop immediately the Armenian NPP operation rests with the Chairman, his relevant deputy and the site inspector;

14) 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;

15) 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;

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

17) 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;

18) State registration of nuclear materials, ionizing radiation sources and radioactive waste;

19) 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;

20) Cooperation with international and foreign competent organizations on safety regulation related issues;

21) Coordination of the RA national and regional projects in frame of technical cooperation with the IAEA;

22) 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;

23) 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;

24) 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;

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

26) Adopting ministerial acts;

27) Monitoring and controlling exposure to environmental radiation.

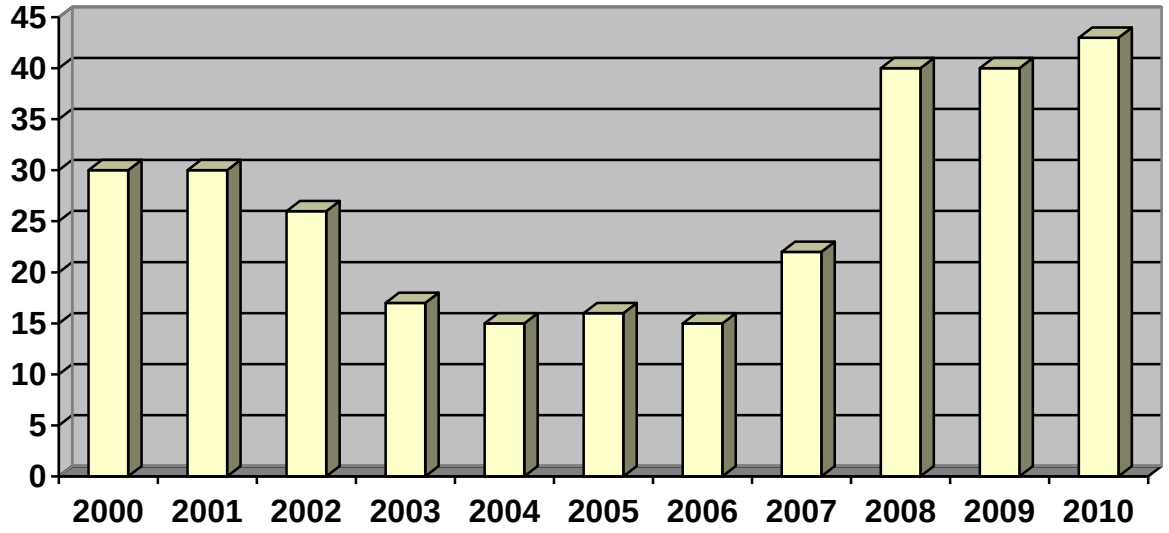
The organizational structure of the ANRA is provided in the Annex 3.

ANRA Human Resources

The ANRA staff list as of 01.01.2010 includes 43 positions. At present 37 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



It is planned to increase the ANRA staff number till 2016 in average by 3-5 specialists per year, with the total number up to 25 specialists additionally who will be mainly involved in licensing of new NPP unit.

The ANRA is financed from the State Budget of the RA. The budget for 2010 is 191,17 million Armenian Drams (AD) (approximately 500,000 USD), which is for 76 million AD more than in 2007. 45 million AD are 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 which was certified for conformity with the requirements of ISO 9001-2000 standard. 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. At present measures to improve and extend the existing quality management system and transition to the Integrated Management Ssystem managing the totality of objectives (Safety – Health – Environmental – Security – Quality – Economic – Others) are planned, allowing implementation of 10 new fundamental safety principles described in the IAEA Integrated Safety Fundamentals, Vienna 2006.

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.

Under the cooperation agreements and the technical cooperation projects of the IAEA and EC, ANRA cooperates with the following organizations:

- 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 15 March 2007)
- 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)

In frame of EC 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

The ANRA has no advisory committees. A 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 on nuclear safety and its development priorities, development of instructions and development of 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 based on the nuclear safety process 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 place of the ANRA within the structure are provided in the Annex 4.

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.

The ANRA receives the technical support in implementation of the regulatory functions from the scientific and technical center on Nuclear and Radiation Safety, CJS established under the Government Decree № 342 as of 25.04.2001. The NRSC hires experts on contractual basis and employs 29 permanent staffs (average age: 35), among whom:

- PhD: 8;
- PhD students: 3;
- Engineers 8;
- IT specialists: 3;
- Management & Administration: 7.

The Nuclear and Radiation Safety Center provided 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 support at licensing of ionizing radiation sources;
- Expertise and review of the revised SAR of the Armenian NPP Unit №2;
- Technical support of the inspection activities of nuclear facilities, ionizing radiation sources, radioactive waste storage and disposal facilities;
- Development and review of the documents for regulation and control of the radiation safety, radioactive waste management and decommissioning;
- Drafting of the Design Safety Requirements;
- Review of the SAR of Spent Fuel Storage;
- Participation in seismic safety upgrading program;
- Participation in PSA Level 1 developments;

- Development of procedures for ERC of ANRA;
- Participation in radiation sources registration and licensing process.

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.

2.3.2. Status of the Regulatory Body

The place of the ANRA in the governmental structure is provided in the Annex 4. The organizational structure of the ANRA is provided in the Annex 3. The information on status, jurisdictions, responsibilities, reporting obligations of the ANRA is provided in the section 2.3.1- Establishment of the regulatory body.

2.4 RESPONSIBILITY OF LICENCE HOLDER

Article 9. Responsibility of the Llicence 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) Periodically submits reports in the manner prescribed on the safety of the object 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 object, 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 object (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) Develops the response plan in the manner prescribed for emergencies occurring in the atomic energy utilisation object 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 object are in accordance with the current regulations;

n) Carries out periodical safety assessments of the object 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.

2. The operating organisation of the atomic energy utilisation object 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 object;

c) Provides periodically the governor (mayor of Yerevan) of the territory included in the supervised area of the atomic energy utilisation object 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.

3.GENERAL SAFETY CONSIDERATIONS

3.1 PRIORITY TO SAFETY

Article 10 Priority to Safety
Each Contracting Party shall take the appropriate steps to ensure that all organizations engaged in activities directly related to nuclear installations shall establish policies that give due priority to nuclear safety.

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

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

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

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

Over the past years numerous safety upgrades were implemented at the Armenian NPP. The upgrades involved all aspects of the Armenian NPP safe operation. Since 1994 the principle of step-by-step safety improvement has been implemented at the Armenian NPP.

In the reporting period the Armenian NPP hosted a number of expert missions on evaluation of different safety aspects:

- IAEA IPSART mission was conducted at the Armenian NPP to review the PSA results in October 2007;
- WANO peer-review mission follow-up in December 2007;
- IAEA mission on verification of NPP self-assessment program in November 2007;
- WANO mission on planning, preparation and implementation of NPP equipment maintenance and repair in June 2008;
- WANO mission on personnel training system improvement, October 2009;
- IAEA Design Safety Review follow-up Mission was conducted at the Armenian NPP in November 2009;
- IAEA mission to assess implementation of Seismic Safety Re-Evaluation Program of the Armenian NPP Unit №2 in November 2009;
- Pre-OSART missions in June 2009 and April 2010.

The following major safety upgrades have been implemented at the Armenian NPP:

- Obtaining spectrometric kit to perform fuel cladding leak tightness test;
- Physical protection system improvement;
- Equipping the Armenian NPP with diagnostic systems according to the analysis of the "Leak before break" concept application to the Armenian NPP;
- Modernization of DG rotation speed and voltage control devices, as well as physical separation of DG into two channels;
- Reconstruction of the automatic load sequencer;
- Replacement of switchers on low voltage switchboards of "RTZO" type by the switchers with enhanced reliability;
- Modernization of source range neutron flux monitoring system;
- Replacement of reversible motor generator 1÷ 4;
- Modernization of automatic power controller;
- Modernization of water level automatic control system in steam generator.
- Assessment of environmental conditions of safety systems in the premises where temperature can abruptly change if the list of design accidents is extended.

The following safety upgrades are in process of implementation:

- The SG-RCP compartment (confinement) sumps protection against clogging;
- Determination and implementation of I&C devices necessary for post accident monitoring of the unit;
- Ensuring sufficiency of filtration of the air supplied to the main control room-2, and ensuring protection of the MCR against flying objects;
- Establishment of emergency control room;
- Modernization of refueling machine;
- Implementation of reactor emergency gas removal and reactor water level control;
- Neutron flux monitoring system in power and intermediate ranges;
- Installation of boron concentration control system;
- Analysis of consequences of the primary and secondary high pressure pipelines breaks passing near the safety system and systems important to safety; qualification of the SG safety valve output pipelines for steam-water mixture and water flows;
- Implementation of the Armenian NPP Unit №2 seismic re-evaluation program.

The following safety upgrades will be implemented:

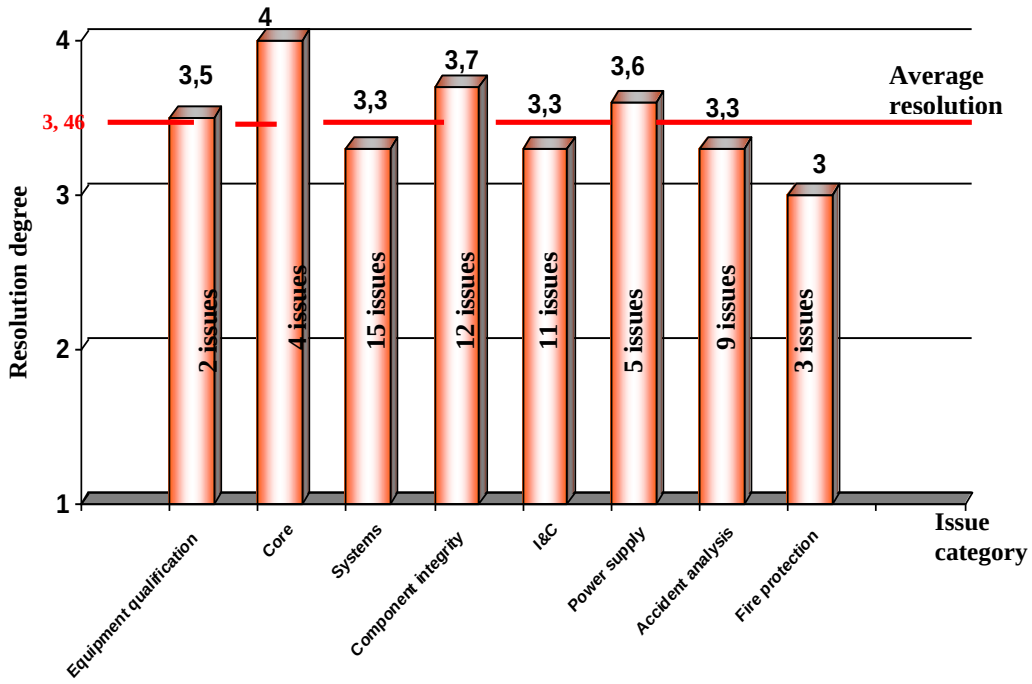
- Improvement of separation and independence of channels and logic of the reactor protection actuation by thermal and mechanical parameters;
- Development of the program on qualification of safety important equipment in compliance with the enforced standards;
- Reconstruction of the spray system;

- Modernization of in-core monitoring system;
- Development of comprehensive modernization programme;
- Revision of water chemistry specifications of the Armenian NPP I, II, III circuits.

The IAEA Design Safety Review Follow-Up Mission was carried out on 2-12 November 2009 to assess the resolution of IAEA safety issues at the Armenian NPP. The follow-up mission reviewed 45 issues with the following result:

Resolution degree	1	2	3	4
Number of Issue sheets	None	2	31	12

WWER-440/230 design safety deficiencies as a result of the follow-up mission are specified below.



Safety Issue Resolution Status

The issue resolution degree was evaluated in compliance with the following scale accepted by the IAEA:

- Resolution degree 4: All IAEA recommendations are completely implemented. The issue is resolved;
- Resolution degree 3: IAEA recommendation objective is achieved but the issue is not completely resolved;
- Resolution degree 2: The issue is identified and activities are launched to resolve it;
- Resolution degree 1: No progress in issue resolution.

Based on the mission results we can state the following: average safety issue solution degree is 3,46 confirming that the design safety deficiencies are close to their resolution.

All the design problems identified by the IAEA that had not been fully resolved during the previous IAEA missions have been reviewed. The information exchange between the expert group and the NPP staff was very open, professional and productive during the review In the opinion of the IAEA experts, this reflects the NPP's management's and personnel's adherence to permanently enhance the safety level.

The list of the Armenian NPP Unit №2 safety upgrading measures has been further updated.

The licensing of the current modifications for elimination of safety deficiencies of the Armenian NPP unit № 2 is based on the Procedure on implementation of modifications at the nuclear installations approved by the ANRA.

The regulatory control over nuclear and radiation safety in the atomic energy utilization field in the RA is implemented by the ANRA in accordance with the legal acts adopted in the RA and the IAEA safety standards. In frame of EC projects, the ANRA organizes and conducts inspections jointly with the EC experts to verify the implementation of safety upgrades at the Armenian NPP with application of "2+2 approach".

The ANRA implements the regulatory control over the Armenian NPP safety through the periodical safety assessment, regular inspections to verify:

- Implementation of a list of technical measures on design safety upgrades, including modification of safety important systems and components;
- Organization of personnel training, implementation and enhancement of safety culture;
- State of emergency response and emergency preparedness system;
- State on nuclear safety;
- State of radiation safety and personnel protection;
- State of radioactive waste safety;
- State and management of operational safety;
- Operation management;
- Organization of maintenance and repair;
- Safeguards implementation;
- Complex inspection before start-up after outage, refueling and modernization at the Armenian NPP Unit №2;
- Operation of the dry spent fuel storage facility (DSFS).

3.2 FINANCIAL AND HUMAN RESOURCES

Article 11 Financial and human resources

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

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

3.2.1 Financial Resources

In accordance with the Article 19 of the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes and the Law of the RA on Energy the Armenian NPP as the operating organisation allocates financial resources for advancement and operation of the plant throughout the whole lifecycle: site selection, design, construction, operation, commissioning and decommissioning.

In accordance with the Article 19[1] the operating organization from a product consumption (services rendered) shall allocate normative financial assignments for nuclear, radiation, and technical safety, fire protection, physical protection, nuclear material account and control, implementation of safety upgrades, scientific and technical support, as well as securities needed for storage of spent nuclear fuel and for decommissioning. Financial securities for decommissioning of nuclear installations are accumulated on a special account of the ministry of finance and economy of the RA. The use of these financial means in other purposes is prohibited. Then the RA Government adopted decree №1637-N as of 12 October 2006 on opening a special account for decommissioning of the Armenian NPP that establishes the procedure of servicing and transfer of amounts to the account and reporting.

The safety upgrades are financed also from the energy proceeds and under EC, RF Government and US DOE assistance programs.

3.2.2. Human Resources

Recruitment, training and permit-to work and control of personnel during NPP operation is organized in accordance with the "Main provisions on recruitment, training and permit-to-work and control of personnel during NPP operation". Based on the mentioned regulations and the IAEA Safety Standards Series No. NS-G-2.8 "Recruitment, Qualification and Training of Personnel for Nuclear Power Plants", the Armenian NPP developed the documents that specify personnel recruitment, training and qualification related issues.

From 1997 measures are undertaken to implement the SAT at the Armenian NPP in frame of the IAEA and the US DOE technical cooperation projects. Thus, guides, instructions and procedures that specify methodologies for development of training materials and conduct of training have been developed and enforced. The analysis of requirements to competence, knowledge and training is based on the method of analysis of specifics of works and tasks of separate positions and the Armenian NPP on the whole.

The Armenian NPP personnel training and qualification maintaining are implemented according to the approved standard and individual programs where the types of training and their sequence, as well as simulator training are specified. Centralized training on theoretical part is conducted in the Training Centre of the Armenian NPP during the initial training, qualification maintaining and simulator training.

Since 2001 a multifunctional simulator has been functioning at the Armenian NPP for training and maintaining qualification of the MCR operating personnel. The technological modes modeled on the multifunctional simulator correspond to the operational modes of the Armenian NPP Unit №2 in

operation. The scope of the Armenian NPP operational modes modeled on the multifunctional simulator allows to conduct training and to maintain qualification of the MCR personnel.

Upgrades (installation of new equipment), activities implemented during annual outage and refueling at the Armenian NPP are simultaneously incorporated also in the multifunctional simulator to bring it in conformity with the Armenian NPP unit №2.

At present measures are undertaken to acquire and install a full-scope simulator from the Bohunice NPP (Slovakia) at the Armenian NPP.

The training of the Armenian NPP maintenance personnel and the engineering support personnel is mainly conducted on the job using the method of mentoring.

Measures were undertaken on regular training (theoretical part) of the maintenance personnel and engineering support personnel in the plant training center according to the plan of activities on improvement of the Armenian NPP personnel training system and with the IAEA and US DOE support.

The training programs are periodically revised and corrected taking into account the analysis of the training conducted, departments feedback, trainees' comments and suggestions.

In the framework of cooperation between the Armenian NPP and US DOE, international organizations (IAEA, WANO) the following activities were performed: "Self-assessment of efficiency of "Armenian NPP personnel training system" and "Analysis of needs for improvement of "Armenian NPP personnel training system". As a result the recommendations were made and the action plan on implementation of these recommendations was developed that includes also recommendations on improvement of the training programs.

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

On 22 December 1999 the RA Government adopted Decree №768 on approval of the list of persons holding positions and implementing practices important to safety in the atomic energy utilization field. The licensing of individuals implementing practices and holding positions important for safety of atomic energy utilization field is implemented by the ANRA in accordance with the RA 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.

The ANRA implements the regulatory control over the personnel training of the operating organization by:

- Licensing of management and operating personnel;
- Regular verification of schedules on personnel training and retraining at the Armenian NPP;
- Regular verification of implementation of emergency and fire exercises of the Armenian NPP personnel in shift;
- Regular verification of functioning of the training center, its effectiveness and quality;
- Verification of implementation of enforcements issued based on inspections results.
- In case of modifications, modernizations and other, required personnel training (in full scope and in accordance with the approved training program).

3.3 HUMAN FACTORS

Article 12. Human Factors
Each Contracting Party shall take the appropriate steps to ensure that the capabilities and limitations of human performance are taken into account throughout the life of a nuclear installation.

The design of any modification takes into account the human factor with implementation of the principle "Operator noninterference". 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.

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

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

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

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

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

The program envisages implementation of regular self – assessments on:

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

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

The standard guideline was developed on organization and performance of self-assessments to ensure the structural approach at self-assessments in different areas of activities and in different divisions. By now, self-assessments of the personnel training system, maintenance and repair, radiation safety and of the activity of the maintenance planning and implementation department have been performed.

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

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

3.4 QUALITY ASSURANCE

Article 13 Quality Assurance
Each Contracting Party shall take the appropriate steps to ensure that quality assurance programmes are established and implemented with a view to providing confidence that specified requirements for all activities important to nuclear safety are satisfied throughout the life of a nuclear installation.

The 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 is provided in guidelines. Thus, administrative management program with its set of guidelines for a specific activity provides the detailed and complete description of the process, including distribution of responsibilities of personnel and divisions. The Armenian NPP launched a 2-years project for "Transfer of the Quality Management System to an integrated management system based on the process oriented approach". This project is implemented with the IAEA expert support and is aimed at ensuring the conformity of the management system with the modern international requirements specified in the IAEA GS-G-3.1 Safety Guidelines "Application of the management System for Facilities and Activities", GS-G-3.5 "The Management System for Nuclear Installations" and quality standards ISO 9001:2008 "Quality Management Systems - Requirements", ISO 9004:2009 "Managing for the Sustained success of an organization – A Quality Management Approach".

A significant 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.

Gap analysis of the management system performed in the frame of the above-mentioned project detected that the measurement and assessment of the management system efficiency is the weakness in the management system. Thus, the principal task that the Armenian NPP faces now, in connection with the management system improvement, is the identification and implementation of quality indicators/criteria that enable to perform a clear assessment of efficiency and a continuous improvement of the management system.

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 an order issued by the Director General of the Armenian NPP.

For the regulatory control over the quality assurance of the Armenian NPP and other organizations 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 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 control over implementation.

3.5. ASSESSMENT AND VERIFICATION OF SAFETY

Article 14 Assessment and Verification of Safety

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

(i) comprehensive and systematic safety assessments are carried out before the construction and commissioning of a nuclear installation and throughout its life. Such assessments shall be well documented, subsequently updated in the light of operating

experience and significant new safety information, and reviewed under the authority of the regulatory body;
(ii) verification by analysis, surveillance, testing and inspection is carried out to ensure that the physical state and the operation of a nuclear installation continue to be in accordance with its design, applicable national safety requirements, and operational limits and conditions.

3.5.1 Assessment of Safety

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

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

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

At present in accordance with the Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes and the legal acts the NPP licensing consists of 4 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 should submit the following documentation in support to the licence application:

- Assessment results of external events;
- Assessment results of human factor induced events;
- Assessment results of events with human induced hazard;
- Assessment of NPP impact on population and environment;
- Results of public hearings.

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 should submit the following documentation in support to the licence application:

- Preliminary safety analysis report;
- NPP environmental impact assessment report and conclusion;
- Report on site selection.

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 submit the following documentation in support to the licence application:

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

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

- Decommissioning program;
- Safety analysis report at NPP decommissioning;
- Program on management of generated radioactive wastes;
- Plan on emergency response at decommissioning;
- Justification on safe handling of nuclear materials and radioactive wastes at NPP; decommissioning (physical protection).

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

After adoption of the Government decree on NPP restart in 1993, there were initiated activities on safety reevaluation and detection of deficiency in design safety with involvement of foreign experts and specialists from Armenian organizations. The assessments and analysis with deterministic approach have been applied. Experts from the IAEA and organizations of EC and USA participated in engineering assessment for detection of deficiencies in the design safety level of the Armenian NPP unit № 2. Based on the analysis results the program of measures aimed at improving the Armenian NPP Unit №2 safety, reliability and safety culture was developed for elimination of deficiencies by priorities in the below mentioned sequence:

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

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

For in-depth safety analysis of the Armenian NPP Unit №2 the ANRA developed the requirements to contents and form 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 started development of the safety analysis report. The activities were implemented in close cooperation with the national laboratories of the USA in frame of US DOE assistance projects. The US DOE assistance consisted of training and retraining of the specialist for establishment of the analytical group, collection of information, establishment of database for SAR development, analysis of systems and so on.

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

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

Afterwards the seismic hazard was also integrated in the internal initiating events PSA model by ENCONET. In accordance with the obtained results for internal events and seismic hazard the total core damage frequency equals to 1.82E-04 [1/year] (see table below).

Table 1. PSA Results

Initiating event	**CDF mean value [1/year]**	**CDF upper bound (95%) [1/year]**	**CDF lower bound (5%) [1/year]**
Internal events	7,58E-05	6,60E-04	3,35E-05
Seismic hazard	1.06E-04	1.64E-04	5.76E-05
Total CDF	**1.82E-04**		

In 2007 the IAEA IPSART mission and Risk Engineering company (Bulgaria) conducted expertise of the internal initiating events PSA model. Also the internal PSA review was made by the NRSC. The current PSA activities are aimed to resolve comments raised during expertise process.

There have been made calculations for accident included in the list of design and beyond design accidents. Full scope reactivity accident analyses were performed using 3D kinetics PARCS-RELAP coupled code system. The reactor core model was developed with assistance of PARCS code developer team (Purdue University, USA). The cross-sections for WWER hexagonal fuel, control assemblies and reflector were developed by HELIOS code with assistance of the Pennsylvania State University (USA).

Analysis of radiological consequences with RADTRAD code has been started in 2010. Currently radiological accident analysis is being performed for following accidents:

- Steam generator tube rupture;
- Main steam line break.

The Armenian NPP submitted the revised SAR to ANRA for review in 2009. The ANRA will complete the SAR review to the end of 2010.

The Armenian NPP with the IAEA support initiated a project on complex safety analysis with regard to results of the SAR and the PSA with the purpose to develop a comprehensive safety upgrading program with regard to the safety goals and criteria, agreed with the ANRA and including LOCA-200 as design basis accident.

3.5.2. Verification of Safety

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

- Annual reports on safety assessment of the Armenian NPP Unit №2 operation;

- Regular inspections on assessment of the safety level in accordance with the annual schedule of the ANRA;
- Regular inspections organized jointly with the foreign organizations in frame of EC projects.
- Inspections organized jointly with the IAEA on design safety level assessment.

3.6. RADIATION PROTECTION

Article 15 Radiation Protection
Each Contracting Party shall take the appropriate steps to ensure that in all operational states the radiation exposure to the workers and the public caused by a nuclear installation shall be kept as low as reasonably achievable and that no individual shall be exposed to radiation doses which exceed prescribed national dose limits.

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

Chapters III and V of Radiation safety norms specify the dose limits for workers and public.

Limits for workers occupationally exposed to ionizing radiation are:

For category "A" personnel:

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

Chapter II of radiation safety norms defines the individual lifetime risk criteria of stochastic effects due to exposure at normal operating conditions, as 1.0×10^{-3} $year^{-1}$ for workers and 5.0×10^{-5} for public.

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

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

The regulation “Sanitary Rules for NPP Design and Operation”, specifies the dose constraint 250 μSv/year for NPP, which is considered as the upper boundary of public dose optimization during the normal operation of NPP. The lower level of optimization is 20 μSv/year.

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

The ALARA Committee has been established at the Armenian NPP. The committee developed and implemented the measures aimed at making the individual doses at the Armenian NPP as low as possible. For this propose special blanks for organization and conducting of the radiation hazard are developed. The measures have been undertaken to keep and manage the records on doses more accurately.

In order to have more confident results at Armenian NPP three methods for individual dose measurement are established: TLD, film and operative electronic dosimeters. They are used in parallel, especially during implementation of special activities.

The annual collective and the individual maximal effective doses trends at the Armenian NPP are shown in diagrams 1 and 2 of Annex 5.

The maximum individual effective committed dose from intake in lung is 0.22 mSv, and the collective dose for intake is 0.008 man*Sv. The collective dose of contractors is 0.01 man*Sv.

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

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

The airborne releases volumetric beta activity trends, which are 100 times lower than the authorized levels of releases from the Armenian NPP are demonstrated in Diagram 3 of Annex 5. The yearly activity of liquid effluences from the Armenian NPP are demonstrated in Diagram 4 of Annex 5. They are lower the authorized levels.

The main contribution to releases is made by the following radionulcides: ^{60}Co (57.6%), ^{137}Cs (28.1%), ^{90}Sr (0.25%), ^{131}I (9.0%) ^{58}Co (5.0%). Amounts of ^{110m}Ag, ^{54}Mn and ^{103}Ru is less then 3%. The ^{60}Co, ^{58}Co,^{110m}Ag, ^{54}Mn and ^{103}Ru are corrosion radionuclides and the ^{137}Cs,, ^{131}I and ^{90}Sr fission radionuclides: The analysis of radioactive releases into the atmosphere in 2009 showed that they were on the level of the previous year and lower than the average level of all the operating period. Radionuclides ^{137}Cs, ^{60}Co and ^{110m}Ag (excluding radioactive noble gases) make the main contribution to the quantity of the releases. The noble gases releases are 19.5 TBq (the permissible level is 2708 TBq). The low levels of releases from the Armenian NPP are conditioned with reliability of the first barriers of defense in dept.

Instructions on radiation safety specifies the steps for radiation protection and methodologies of occupational dose control and workplace monitoring.

During the scheduled outage and refueling of 2009 the personnel dose loads were planned as 862 mSv. During the annual outage and refueling in 2009 the Armenian NPP personnel actual dose has made 450,1 mSv.

At present, measures are undertaken at the Armenian NPP on modernization of the radiation monitoring system. The purpose of the modernization is to minimize the dose loads at the personnel and public. The modernization will enable to implement:

- Control of radioactivity in samples of air, sediments, soil, vegetations and grasses, local food and open water pools and underground water;
- Measurement of dose rates in the territory in surrounding of the Armenian NPP;
- Measurement of public dose with TLD dosimeters established in supervised area;

The results of environmental radiation monitoring for 2009 are provided in the Annex 5.

Based on the monthly and yearly reports from the Armenian NPP on radiation situation at the Armenian NPP and in supervised area, the ANRA makes regulatory assessment and review.

In order to check the reports as well as other information (documents submitted for review and approval) submitted by the Armenian NPP, the ANRA periodically organized the announced and unannounced inspections during which the following issues have been pointed out:

- Ensure of radiation protection and safety requirements by the Armenian NPP (requirements to be ensured in controlled area);
- The QA programme for the works at controlled area;
- Ensure the limits and conditions of radiation protection and safety in accordance with radiation control Technical Specification;
- Occupational radiation protection program and implementation of ALARA;
- ALARA implementation measures during the airborne and liquid releases from the Armenian NPP to the environment.

3.7. EMERGENCY PREPAREDNESS

ARTICLE 16. Emergency Preparedness

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

3.7.1. Legislative Framework

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

- Law of the RA on Safe Utilization of Atomic Energy for Peaceful Purposes;
- Law of the RA on Population Protection During Emergencies;
- Plan on Protection of Population in case of Nuclear and Radiation Emergencies at Armenian NPP (off-site emergency plan of Armenian NPP) approved under the Government Decree № 2328 as of 22.12.2005 as amended in 2008, 2009;
- Basic requirements to emergency planning and response at nuclear and radiation emergencies;
- Standards on Radiation Safety;
- Rules on Radiation Safety.

Besides the above mentioned there are a number of legal acts that regulate separate issues concerned with the emergency preparedness (notification, organization and implementation of evacuation, transportation, emergency radiation monitoring and so on).

3.7.2. Structure of the National Emergency Response System

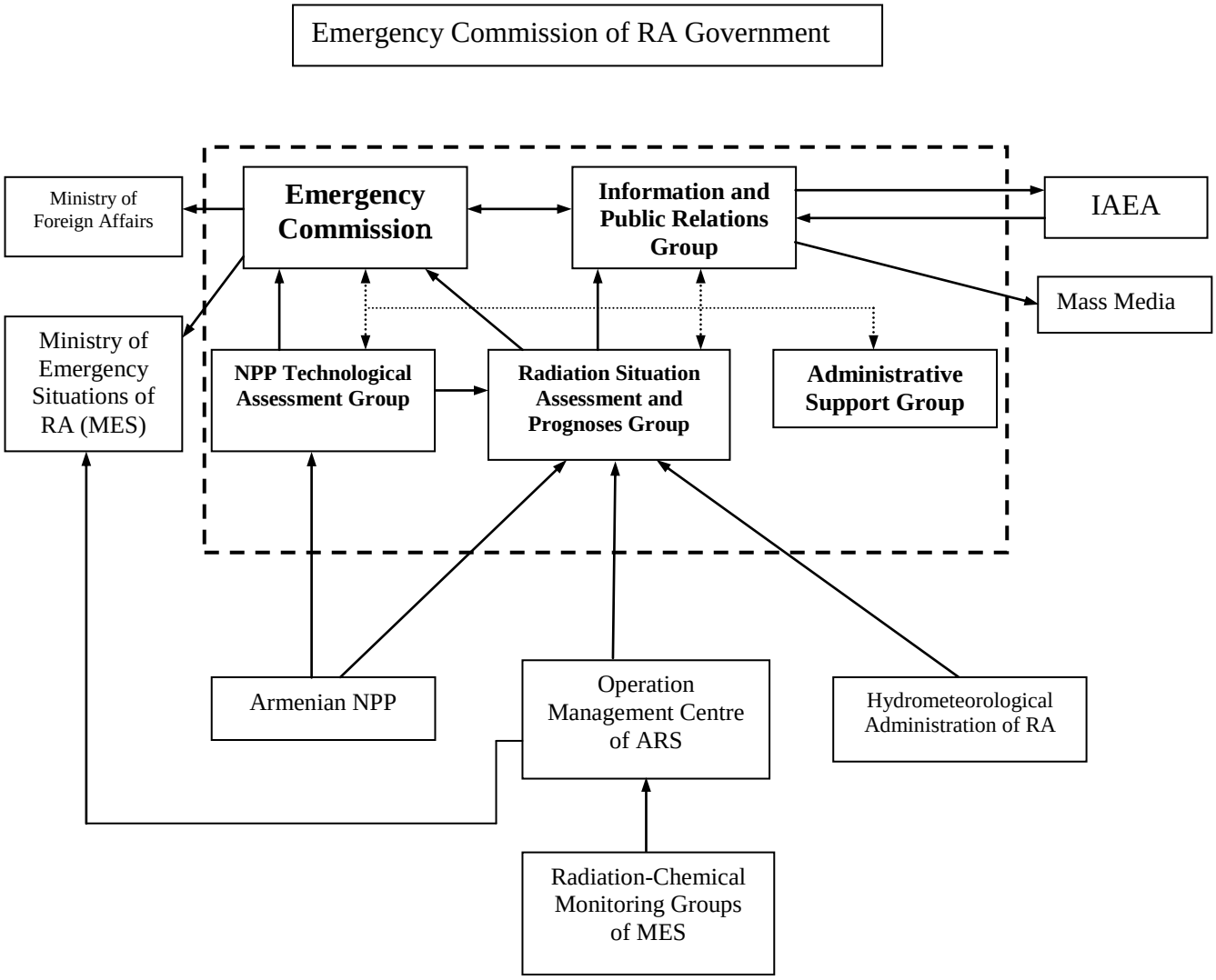
The key organizations of the national emergency response system are Armenian NPP, Rescue Service of Armenia and ANRA.

The Armenian NPP is responsible for classification of emergency situation at NPP, prompt notification about emergency situation, bringing the reactor in safe condition and NPP personnel protection.

The Rescue Service of Armenia functions as the national coordinator in organization and implementation of population protection measures. To cope with this task Rescue Service operates analytical and information center equipped with modern equipment and communication means. Rescue Service is the competent authority and the contact point under the Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency. From 2008 the Rescue Service of Armenia functions within the ministry for emergency situation of the RA.

The ANRA is the national advisor in organization of response and also the contact point under the Convention on Early Notification about Nuclear Accident. To cope with this task ANRA operates appropriately equipped emergency response center and has a relevantly trained emergency personnel. With support of NRSC and external experts 25 emergency procedures have been developed. The procedures specify reactor condition assessment, assessment of radiological situation of Armenian NPP and adjacent territories, prognosis on situation change, development recommendations on radiation protection of Armenian NPP personnel, emergency personnel and population and other.

The Emergency Response Structure of the ANRA



The functions of the ANRA ERC groups are:

1) The Emergency commission – management of the ERC operations.

2) 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;

3) 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

4) The Information and Public Relations Group – receiving from and sending to information of the emergency commission, communication with public and mass media.

Interaction with other organizations of the emergency response system:

1) The ERC in case of threat to population notifies the Ministry for Emergency Situations on the emerged situation, provides with information on situation in the area where emergency took place

and in adjacent to it territories, makes recommendations on organization of activities of mobile teams, and also makes recommendation on implementation of protective measures.

2) The Armenian NPP notifies the ERC on emergency, ensures transmission of information on NPP technological parameters and radiation situation at the NPP radiation situation to the ERC.

3) The Ministry for Emergency Situation transmits radiation monitoring data in area where emergency took place and in adjacent to it territories to the ERC.

4) The Hydrometeorological Service provides the ERC and the Ministry for Emergency Situations with the information on meteorological situation in the area where emergency took place and prognosis.

5) The ministry for foreign affairs provides the information received from the ERC on emergency to the foreign representative offices and RA embassies in other countries.

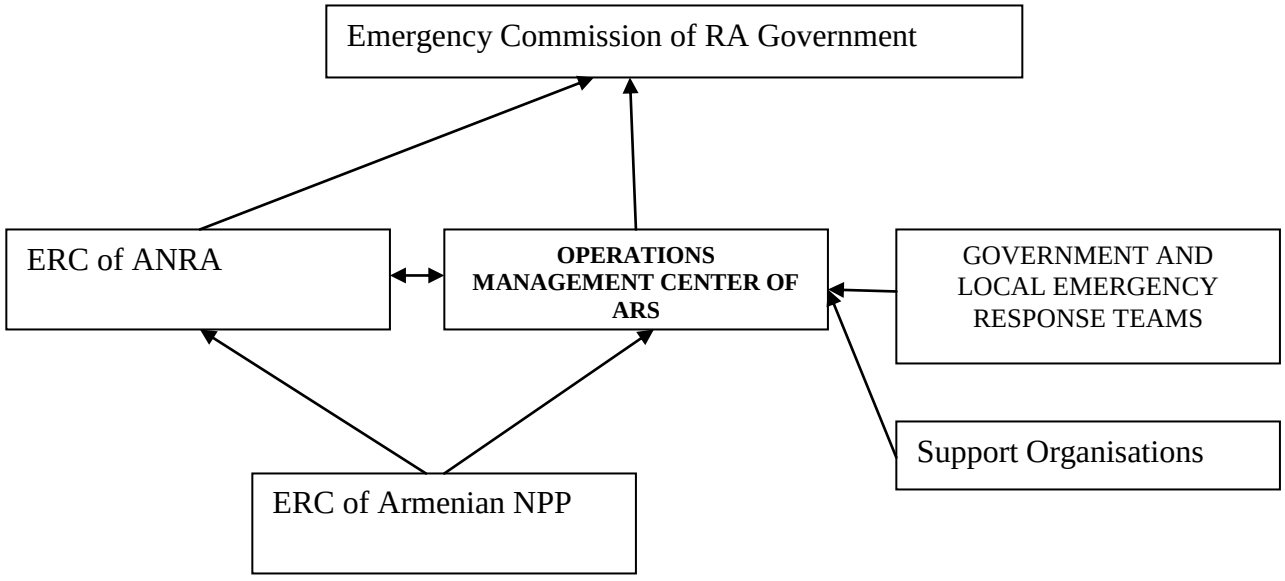
3.7.3. Classification of Emergency Situations

System for classification of emergency situations is a part of Armenian NPP on-site emergency plan. The classification of emergency situations is made based on analysis of situation in Armenian NPP and its adjacent territories. The system has been developed based on IAEA Safety Standard GS-R-2.

3.7.4. National Emergency Preparedness Scheme

The plan for protection of population at nuclear and radiation emergencies at the Armenian NPP (off-site emergency response plan of Armenian NPP) developed with account taken to requirements of GS-R-2, GS-G-2.1 and EPR-METHOD-2003, has been enforced since December 2005. The plan establishes functions of organizations involved in the national emergency response system, procedure for the system activation, implementation of protective measures, radiation and dosimetric monitoring, medical, police, transport and material support for response, and also estimates of material, human and technical resources required to carry out population protection measures.

The National Emergency Response System



3.7.5. On-site Emergency Plan of Armenian NPP

The Armenian NPP plan for response to nuclear and radiation emergencies (the on-site emergency plan of the Armenian NPP) has been enforced since December 2005. The plan meets the requirements specified in the basic requirements to planning and response to nuclear and radiation emergencies and the IAEA recommendations. The on-site emergency plan of the Armenian NPP was partially revised based on results of the excises conducted in 2008.

3.7.6. Notification about Event

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

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

- The Armenian NPP – notification of population residing in the preventive actions zone,
- The Rescue Service of Armenia – notification of population residing in the urgent protective actions zone, and if necessary also population of other settlements.
- The ANRA – international notification about nuclear and radiation emergencies at the Armenian NPP, and for receiving information about emergencies occurred in nuclear installations of other countries.

3.7.7. Emergency Training and Exercises

Emergency training and exercises are regularly conducted in accordance with the approved schedules with the purpose to maintain continuous emergency preparedness of the Armenian NPP personnel and organizations involved in the national emergency response system.

On 14-18 July 2008 "ATOM-2008" emergency exercise was conducted in frame of the Armenia-NATO Civil Military Emergency Preparedness program with participation of the IAEA**,** the United States Army Corps of Engineer jointly with the Armenian response forces.

On 14 November 2008 the emergency exercise under the title "Response to general emergency at Armenian NPP" combined with the exercise of the Ministry of Emergency Situations of the RA on personnel notification and gathering in case of emergency situations was conducted.

The national table top exercise "Response to general emergency at the Armenian NPP" was conducted from 15 to 19 December 2009 and was aimed to verify the preparedness of the national emergency response system to emergencies at the Armenian NPP on different levels. The observers and evaluators from the IAEA, EC, USA and Ukraine participated at the exercise.

3.7.8. International Cooperation

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

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

The Republic of Armenia is ready to cooperate with other countries on emergency planning related issues.

The conducted exercises demonstrated that the Republic of Armenia is prepared to adequately respond to nuclear and radiation emergencies at the Armenian NPP. At the same time it is necessary to continue updating of emergency response measures of the organizations involved in the emergency preparedness and their personnel training. It is also necessary to improve the procedure on notification population for emergency preparedness purposes.

4. SAFETY OF INSTALLATIONS

4.1 NPP SITING

Article 17 Siting
Each Contracting Party shall take the appropriate steps to ensure that appropriate procedures are established and implemented:

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

4.1.1. Evaluation of Site Related Factors

The site selection of the Armenian NPP was carried out in 1968 in accordance with the acting at that period normative documents. 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;
- Geological conditions of site are acceptable, steady;
- Ground waters deposited on depth 85-90m;
- Seismicity of site MDE-8 degree on scale MSK-64;
- 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 with 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 detailed requirements to the NPP site evaluation are developed.

The Armenian NPP is located in a high seismicity region and the seismic threat is a major safety issue for the plant.

The original seismic design basis for the Armenian NPP site was developed based on studies conducted between 1966 and 1972. Those studies concluded that the maximum earthquake intensity anticipated for the site area was I=7 (equivalent to 0.10g as peak ground acceleration) according to the MSK-64 scale the plant was designed according to the USSR seismic code for the conventional building structures. During the design development of the NPP in 1972, a CNIISK (Central Building Research Institute of USSR) recommended to increase the seismic input, using a maximum ground acceleration of 0.40g for the reactor shaft and 0.20g for the reactor building confinement. These values refer to the quasi static equivalent accelerations as requested by the rules valid at that time. Accordingly, design upgrades were performed for safety related systems, building structures and components.

The first USSR norm for seismic design of nuclear power plants was issued in 1987, i.e. the PNAEG 006-87 Standard. Accordingly, the site seismicity was redefined as 8 degrees (about 0.20g for the peak ground acceleration) and a reconstruction project for equipment, systems and buildings was launched with that seismic input.

After the Spitak earthquake in December 1988 and during the shutdown period of the plant 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 reconstruction project was completed by 1995 before the restart.

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 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.

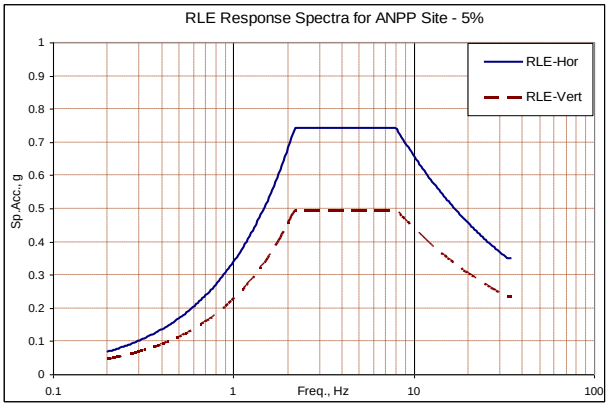
Overview of the Armenian NPP site seismic hazard assessment history since 60-ies till 2000's provided in the below table.

№	Date	Seismicity (intensity scale MSK-64) , I^0		Peak accelerations PGA, g		Reference
				Without account of local effects	With account of local effects	
1	1975	For main structures	7		0.1	"Armenian NPP site seismic zoning", IGIS, Leninakan,1968
		For main structures	8	0.2	-	
		For calculation of maximum expected accelerograms	9	0.4	-	
2	1977	For main structures	8	0.2	-	Supplement to main report, IGIS, 1978
		For main structures	9	0.3	-	
3	1985	DE (100 years)	7		0.1	Estimation of DE and MDE Gotep, 1985
		MDE (10000)	8		0.2	
4	1989	DE (100 years)	9	-	-	Decree of USSR Gosstroy №127 as of 08/16/1989
		MDE (10000)	10	-	-	
5	1995	DE	7	0.1	-	Complementary study of seismic conditions of the Armenian NPP site
		MDE-8	8	0.21 (50%)	0.21	
				0.34 (84%)		
6	1999	Reviewed level earthquake	-	0.35		Technical Guideline of IAEA
7	2002		-	0.4	0.2	Complementary study of geotechnical conditions by geophysical methods NSSP, 2002 /7/

At present the Armenian NPP site seismic hazard defined by the Review Level Earthquake is outlined in the Technical Guidelines for the Seismic Re-evaluation Programme of the Metsamor NPP - Unit №2", 1997. The RLE is the basic input for the Armenian NPP seismic re-evaluation and is characterized by certain parameters.

For the broad-band RLE it was accepted:

- A free field surface horizontal peak ground acceleration of 0.35g which corresponds to the 84^{th} percentile.
- A 50^{th} percentile response spectra shape for rock site, as provided in USA-NUREG/CR-0098.
- The vertical acceleration component should be equal to 2/3 of the horizontal acceleration.
- Artificial time histories should be generated according to the procedures indicated in US ASCE 4-98.



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 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 document.

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

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

The Radiation Safety Standards and Rules were developed by the ANRA and approved by the Government (see Annex 2) in 2006. The Radiation Safety Standards and Rules define the radiation protection principles, establish dose limits for categories of personnel under normal and accident conditions, and establish requirements for exposure of members of the public to human made sources under normal conditions and due to natural radiation sources. The Radiation Safety Standards 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.

At present the maximum design accident from the point of view of radiological consequences is the primary leak with 32mm equivalent diameter. However the ANRA required increasing of the maximum design accident and making relevant modifications aimed to raise the NPP safety level. The accident analysis were performed in frame of the SAR; the analysis demonstrated that maximum design accident form the point of view of the core cooling can be increased to D100mm.

To perform this task the Armenian NPP in cooperation with the US DOE performs analysis of radiological consequences for selected initiating events.

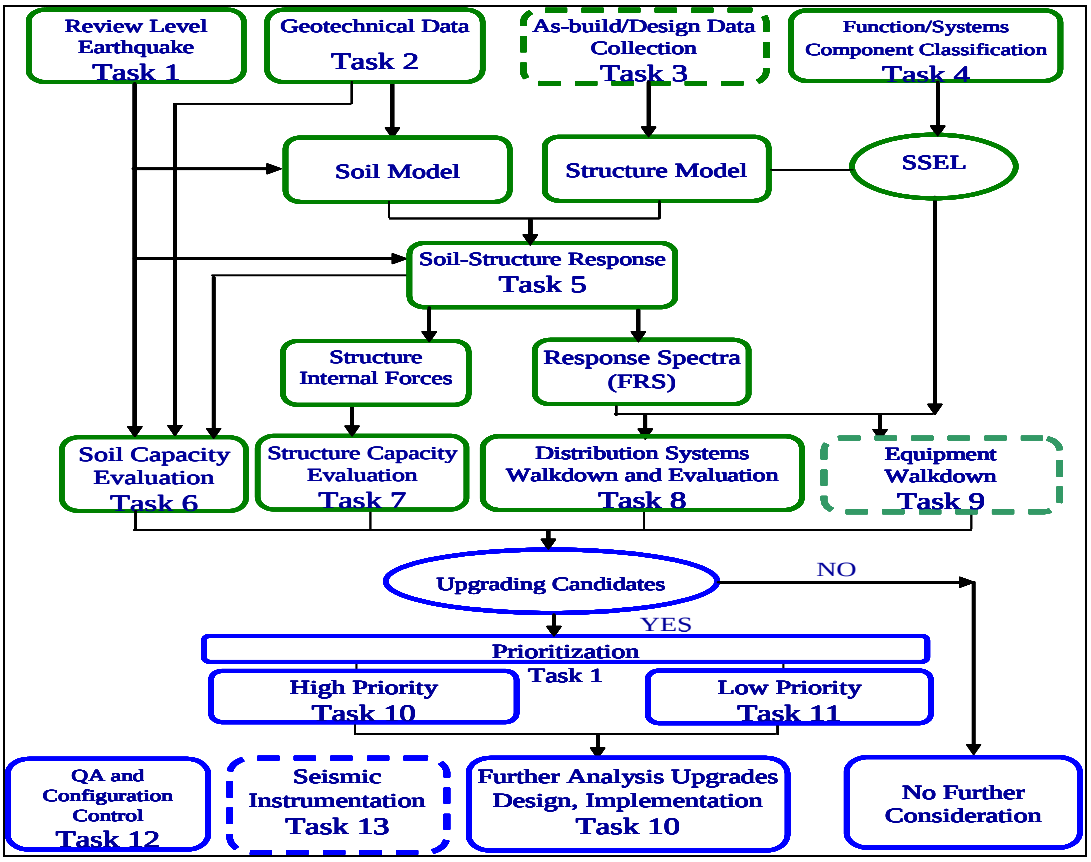
The analysis of radiological consequence for design and beyond design accident are performed with application of methodologies developed by the US NRC (RG -1.183 and RG -1.4).

The analysis results demonstrated that the population dose loads do not exceed the radiation safety standards 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 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. Analysis of environmental monitoring results and evaluation of population exposure dose origination through food chain show that exposure dose incurred by population residing around the Armenian NPP was significantly lower than the dose limit mentioned in the section 3.6 of this report.

4.1.3. Re-evaluation of Site Related Factors

The current status of the ANPP unit №2 seismic re-evaluation programme is demonstrated in flow-chart below (completed tasks are outlined by green).



The final seismic walkdown was performed in 2007. During the walkdown all components and distribution systems from the SSEL were tested. As a result 1193 items were seismically qualified according to the accepted methodology, 109 components have to be considered in detail with the certain indication of activity type according to the component: analysis, test. 44 components belong to the group of easily eliminated and will be implemented during the expected scheduled outage. 29 equipment require significant modifications and strengthening. 26 equipment (control rods, SG blowdown tubes, steamlines, drainage of the main circulation pipeline, seismic qualification of electrical relays) require more detailed qualification confirmed by calculations and experimental justifications.

Altogether 1199 equipment from the safe shutdown list are seismically qualified. 44 components belong to the group of easily eliminated and will be implemented during the expected scheduled outage. 29 equipment require significant modifications and strengthening. 26 equipment (control rods, SG blowdown tubes, steamlines, drainage of the main circulation pipeline, seismic qualification of electrical relays) require more detailed qualification confirmed by calculations and experimental justifications.

The mentioned tasks together with the IAEA comments and recommendations require complex developments and the Armenian NPP develops action plan to resolve these issues with the purpose to complete the Program on Armenian NPP Unit №2 seismic safety reevaluation and improvement at the end of 2011.

In relation to the new Armenian NPP unit the ANRA developed a regulatory guide on seismic hazard assessment of on the Armenian NPP site. The guide was reviewed by the US NRC and BNL experts, who made comments on improvement of format, content and ANRA requirements.

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

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

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

4.2 DESIGN AND CONSTRUCTION

Article 18. Design and Construction
Each Contracting Party shall take the appropriate steps to ensure that:

(i) the design and construction of a nuclear installation provides for several reliable levels and methods of protection (defense in depth) against the release of radioactive materials, with a view to preventing the occurrence of accidents and to mitigating their radiological consequences should they occur;

(ii) the technologies incorporated in the design and construction of a nuclear installation are proven by experience or qualified by testing or analysis;

(iii) the design of a nuclear installation allows for reliable, stable and easily manageable operation, with specific consideration of human factors and the man-machine interface.

4.2.1. Implementation of Defence in Depth

All modifications at the Armenian NPP are implemented in accordance with the "Procedure of performing technical modifications at nuclear installations". All the new systems are implemented based on an up-to-date technology.

Examination, testing and inspection of new systems are performed according to the programs developed on the basis of requirements of up-to-date regulations in the atomic energy utilization field; the experience of similar NPPs is also taken into consideration.

"Man-Machine" interface is taken into account when implementing any modification.

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

- Fuel matrix;
- Fuel cladding;
- Reactor coolant boundary limit;
- Confinement.

All four levels of defense in depth are implemented at the Armenian NPP.

The many years experience of successful operation of WWER-440 reactors demonstrated the validity and reliability of the accepted design solutions. The positive features of WWER-440 reactor facility are: comparatively low power rating of core, availability of specific volume of the primary

coolant and cooling water reserve in the SGs of the secondary side and features of the primary side contributing to the coolant natural circulation that enables passive core cooling in natural circulation modes at accidents during long time and reduces dependency on earlier operator actions.

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

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

- Upgrade of primary circuit protection system against pressure rise. In particular, installation of PRZ impulse safety valves certified to be operated in water media;
- Upgrade of secondary circuit protection system against pressure rise. In particular, installation of PRZ impulse safety valves certified to be operated in water media;
- Upgrade of steamline system. In particular, installation of fast acting valves;
- Upgrade of automatic DG start-up system. This upgrade allows actuation of 4 pumps 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. In particular, pump was installed on each safety channel to increase the flow rate;
- Confinement tightness is regularly increased. At present the confinement leaktightness level makes 25.4% per hour;
- The system for additional make-up of SG with installation of diesel pump was implemented.
- Separation of channels of electric power supply and I&C.

The following upgrades are planned to be implemented:

- Upgrade of the emergency core cooling system. In particular, the upgrade is aimed to increase design accident with the primary leak to equivalent diameter 100mm;
- Upgrade of the spray system. In particular, upgrade is aimed to separate systems into two independent channels and increase of water flow rate supplied by the spray system into the confinement. This upgrade will allow reducing quantity of radioactive materials to be released into the environment at accident conditions;
- Implementation of post accident monitoring system;
- Implementation of passive autocatalytic recombiners to prevent accumulation of explosive hydrogen concentration in the confinement;
- Implementation of the automatic system for the reactor vessel protection against cold overpressurisation;
- Reactor cover gas removal system;
- Separation of the reactor protection system into two independent channels;
- Implementation of emergency control room;
- Ensuring habitability and normal functioning of the control room.

All above mentioned upgrades are going to be implemented based on analysis of WWER operation experience and the IAEA missions recommendations.

With respect to the implemented design modifications and upgrades in the period 1995-2008 the operating organization revised the list of safety upgrades for the Armenian NPP unit №2 and developed a new list for 2009-2016.

At present in cooperation with the IAEA it is planned to develop a comprehensive modernisation programme with respect to the results of SAR and PSA and based on safety goals and criteria that have been developed by the Armenian NPP and agreed with the ANRA.

Regarding operational safety the complete list of inconsistencies related to operational safety and the Armenian NPP operational safety enhancement measures are specified in the following documents:

- «Armenian NPP operational safety enhancement program», approved by the operating organization in 2005.
- «Plan of Armenian NPP operational safety enhancement», approved in 2008.

All documents related to the safety upgrades are mandatorily submitted to the ANRA for approval.

The ANRA implements regulatory control in accordance with:

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

4.2.2. Incorporation of Proven Technologies

At present in accordance with the RA Government Decree the ANRA with the technical support of the NRSC started development of document specifying requirements to design of new NPP unit(s) in Armenia. 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;

At development of the document the recommendations of the IAEA, WENRA and International Regulatory Development Partnership (IRDP) were taken into account, a study of relevant documents was made.

Description of review and control activities of the ANRA is provided in detail in the section 3.5.1 of this report.

4.2.3. 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 inspection, maintenance, testing and repair of the NPP technological systems having impact on safety. Information on verification of performance of safety important systems is provided to the ANRA.

Impact of human factor on safe operation is described in detail in the Section 3.3 of this report. 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.

Description of the regulatory review and control activities is provided in detail in the Section 3.5.1 of this report.

4.3. OPERATION

Article 19 Operation
Each Contracting Party shall take the appropriate steps to ensure that:

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

4.3.1. Initial Authorization

The 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 analysis with application of the deterministic approach have been performed:

- "Complex analysis of NPP design safety level based on deterministic and probabilistic approaches " Atomenergoproekt, 1994;
- "Report on thermal hydraulic calculations to justify design operation conditions of the Armenian NPP unit №2. Gidropress, 1995;
- "Final safety analysis report of the Armenian NPP " Framatom, 1992;
- "Report of Bechtel Corporation specialists";

- "Analysis of working conditions, materials and radiation resource of the Armenian NPP Unit №2 reactor vessel ". Gidropress, 1995;
- "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 operational license and the requirements to the SAR, based on which the operating organization prepares the documents for obtaining the operational license.

4.3.2. Operational Limits and Conditions

The operational limits and conditions of the Armenian NPP are brought in compliance with the technical standards set in the Armenian NPP design and in future modifications.

The set of safe and normal operation limits and conditions is specified in the Technical Specification of the Armenian NPP unit №2 operation with WWER-440 (V-270) type reactor. It is planned to put into force a new Technical Specification for Operation at the end of 2011 taking into account the implemented upgrades.

The ANRA verifies safety management, maintenance and repair and control through inspections. The ANRA identified progress on the side of operating organization in relation to establishment of the programs on testing of safety systems and success criteria. Based on the recommendations of the ANRA the quality of the operating documentation related to implemented modifications has been improved. The Armenian NPP initiated development of new administrative procedures. Recommendations on improvement of the procedures for maintenance and repair have been made.

Revision and update of the safe operation limits and conditions is made based on the safety analysis results (including the PSA) or in-depth safety assessment.

4.3.3. Procedures for Operation, Maintenance, Inspection and Testing

The Armenian NPP systems and equipment are classified in accordance with “Classifier of reactor facility equipment and system”. Thus, the systems and equipment are classified by:

- Safety affecting (safety important systems) and
- Not safety affecting.

The operation, maintenance, inspection and testing are implemented in accordance with the Technical Specification.

The mentioned practices are performed in line with the procedures developed in accordance with the requirements of the rules and standards.

4.3.4. Procedures for Responding to Operational Occurrences and Accidents

By means of inspections and tests, maintenance and repair safety systems are maintained in operable condition which is the guaranty of reactor safety function performance. The operating personnel, in compliance with administrative management procedures, in its work places is provided with all the necessary documentation, procedures and is trained according to training programme. The procedure for responding to operational occurrences and accidents is described in the section 4.3.6 of this report.

4.3.5. Engineering and Technical Support

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

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

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

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

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

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

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

4.3.6. Reporting of Incidents Significant to Safety

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

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

Events, detected during implementation of operational and maintenance activities, walkdowns, inspections, audits etc. at the Armenian NPP should be reported. Any unfavorable, unforeseen action that resulted in deviation from the established requirements and standards should be also reported to the ANRA. Events to be reported to the ANRA are classified by the INES scale in accordance with "International Nuclear and Radiological Event Scale (INES)", 2008 Edition. The categories of events and accidents to be reported are provided in the Annex 7. At the request of the ANRA the assigned event level can be changed.

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

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

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

For the last three years, 10 operating events have taken place: 8 events are classified at Level «0» (under the scale, deviation) on International Nuclear Event Scale (INES), and two events are classified at Level «1» - important to safety (anomaly). The events occurred didn‘t result in violation of the safe operation limits and conditions. Corrective measures for all the violations were developed and implemented.

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

4.3.7. Operational Experience Feedback

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

The information on event and undertaken corrective measures are entered into the Event Data Base. As a rule the corrective measures are registered in an administrative document and they are not limited by implementation of purely technical measures. The lessons learned from external event analysis are also implemented with the following methods:

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

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

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

- Use of information on external events at the Armenian NPP is reported at annual meetings of WANO contact persons;

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

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

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

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

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

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

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

- What are the lessons that could be 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 DB 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 review and control activities for licence holder programmes and procedures are provided in the section 4.3.6 of this report. The ANRA also uses the information received from the WWER Regulators FORUM.

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

The RA Government Decree №631-N as of 4 June 2009 on approval of procedure for radioactive waste management.

The Concept on safe management of radioactive waste and spent fuel in RA has been developed, discussed with the concerned ministries and is currently in the stage of approval by the RA Government. It is planned to develop "Nuclear waste management strategy for Armenia" in frame of the EU assistance project.

Radioactive waste at the Armenian NPP are generated during daily cleaning and decontamination of rooms in the controlled area, during decontamination and repair of equipment, implementation of repair works in the controlled area, etc. RAW include also parts of process equipment not subject to decontamination or irradiated in the reactor, I&C, pipelines or safety valves, protective clothes and personnel protection equipment contaminated above the permissible values, filters of ventilation systems, selected sources of ionizing irradiation, instruments, waters from laundry, hatches, showers, etc.

According to the aggregate condition radioactive wastes are divided into solid (SRW) and liquid (LRW) which in turn are classified according their activity to low level, intermediate level and high level.

Solid radioactive wastes, before transfer for storage in the storage facilities, undergo preliminary treatment, including:

1. Collection;
2. Classification according to activity;
3. Defragmentation (if needed);
4. Packaging;
5. Placement in interim SRW containers;
6. Transportation and placement of SRW in corresponding storage facilities.

Solid radioactive wastes are not processed at the Armenian NPP.

Liquid radioactive waste at the Armenian NPP are processed at the deep evaporation facility (DEF), the originated alloy ("salt cake") is packed in metal containers, where it is solidified (crystallized) and placed for storage in the solid intermediate level waste storage facility and in DEF containers temporary storage site.

In the frame of the EU support project the "Rendering harmless of radioactive waste" CJSC (near-surface radioactive waste repository for municipal waste) was upgraded to enable receiving and temporary storing the DEF containers from the Armenian NPP. The documents for the obtaining permission for transportation and temporary storage of DEF containers were submitted to the ANRA on February 2010 by the Armenian NPP. The ANRA has reviewed the documents and made comments. Currently the documents are updated with regard to the ANRA review results as of March 2010.

Fullness of RAW storage facilities as per 31.12.2009 is the following:

It. No.	Storage facility name	Storage capacity, m^3	RAW quantity in the facility	
			m^3	%
1	Low level SRW storage facility	17051	5647.1	33.1
2	Intermediate level SRW storage facility	1001.3	300	30
3	High level SRW storage facility	78.34	34.48	44
4	DEF containers temporary storage site	Max. 3000 containers	2317	77.2
5	Low level LRW storage facility	320	---	---
6	Intermediate level LRW storage facility	3170	2006	63.3
7	High level LRW storage facility	350	145.5	41.6

The measures on optimization of radioactive waste management, were implemented throughout the whole period of the Armenian NPP operation. In particular, at the NPP there is a deep evaporation facility to minimize the volume of medium level radioactive wastes.

On the stage of generation of SRW preliminary actions are undertaken to minimize waste streams according to the "Program of minimization of wastes at the Armenia NPP".

Design and actual annual SRW streams at the Armenian NPP are the following:

N	SRW categories	Design waste streams, m^3	Actual waste streams, m^3
1	LL	284.2	73.3
2	IML	16.7	0.77
3	HL	1.3	0.95

Although capacity of SRW storage facilities is sufficient for the whole Armenian NPP operational lifetime, the Armenian NPP studies the options of acceptable technologies for treatment of accumulated waste ("historical waste").

Radioactive materials exemption/clearance levels are established in the RA Government Decree № 1219 as of 18 August 2006 on approval of radiation safety norms.

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

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

Spent fuel is stored in designed spent fuel pools. After five years of storage the spent fuel is placed into dry shielding container (DSC) of NUHOMS-56M type and are placed into horizontal storage modules (HSM). At present 2 sets of HSM were built on site. The second set is designed for12 DSC. At present in the second set 5 DSC are loaded and 3 more are planned to be loaded this year. After Unit №1 shutdown its spent fuel pool is used as a temporary storage facility for spent fuel.

ANNEX 1. THE INTERNATIONAL TREATIES RATIFIED BY THE RA

- 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

ANNEX 2. LEGISLATIVE FRAMEWORK OF THE RA

Laws Adopted in Atomic Energy Utilization Field

- Law on Safe Utilization of Atomic Energy for Peaceful Purposes with amendments and supplements as of 21.03.2000 HO- 44; 09.11.2004 HO-119-N; 15.12.2005 HO-8N; 22.02.2007 Ho-119-N; 19.05.2008 HO-70-N; 19.03.2009 HO-72-N
- Law of the RA on Licensing (adopted 30.05. 2001 NO-193 with supplements as of 16 March 2004 HO-52, 19.03.2009 HO-73-N)
- Code of the RA on Administrative Offences
- Law of the RA on Legal Acts (03.04.2002. HO-320N)
- Law of the RA on Civil Service (27.12.2001 HO-272)
- Law of the RA on Population Protection in case of Emergencies (02.12.1998 HO-265)
- Law of the RA on Organization and Conduct of Inspections (17.05.2000 HO-172)
- Criminal Code of the RA (18.04.2003)
- Law of the RA on Administration Principles and Procedure (18.02.2004 HO-41N)
- Law of the RA on Energy (07.03.2001 HO-148)
- The Law of the RA on Environmental Impact Expertise (20.11.1995)

Government Decrees Adopted in Atomic Energy Utilization Field

- Government Decree № 573 as of 13.11.1993 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 positions important in terms of safety in atomic energy utilization field
- Government Decree № 342 as of 25.04.2001 on establishment of the scientific and technical center on nuclear and radiation safety
- 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 № 912-N as of 27 June 2002 on reorganization of ANRA
- 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 № 1953-N as of 30.10.2004 on preparedness to response to nuclear and radiation emergencies in the RA
- Government Decree № 1792-N as of 09.12. 2004 on approval of the procedure licensing and form of license for storage 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 object
- 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 object
- Government Decree № 345-N as of 24.03.2005 on approval of the licensing procedure and licence form for expertise of atomic energy utilization objects, their designs and other documents
- 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 № 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 № 649-N as of 12.05. 2005 on approval of the licensing procedure and licence form for construction of nuclear installations
- 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 № 781-N as of 16.06. 2005 on approval of the licensing procedure and licence form for services and practices not foreseen in the original design implemented

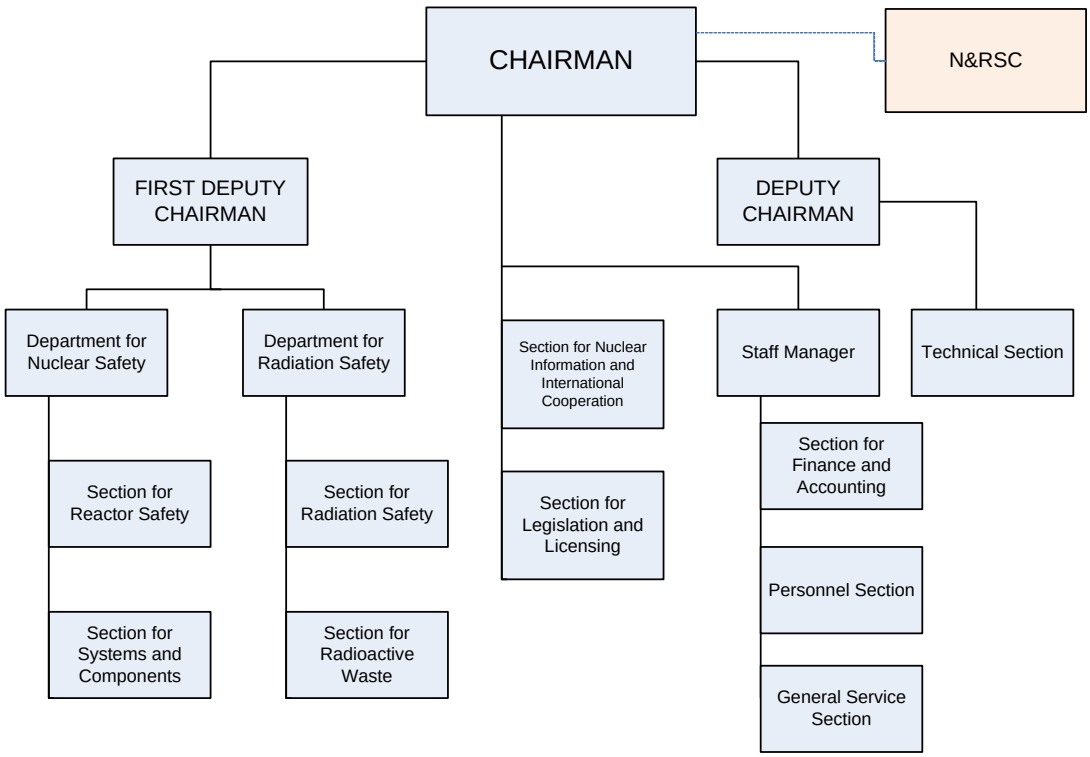
during site selection, designing, construction, commissioning, operation and decommissioning of nuclear installations

- Government Decree № 1858-N as of 14.12.2006 on approval of the licensing procedure and licence and application form and procedure for qualification check of physical persons holding positions important for safety in atomic energy utilization field
- Government Decree № 1489-N as of 18.08. 2005 on approval of radiation safety norms
- Government Decree № 1219-N as of 18.08. 2005 on approval of radiation safety rules
- Government Decree № 1637-N as of 16.10.2006 on opening a special account for decommissioning of Armenian NPP
- Government Decree № 532-A as of 03.05.2007 on approval of composition of a commission on management of special account for decommissioning of Armenian NPP
- Government decree № 866-N as of 17.07.2008 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 № 602-N as of 29.05.2009 on amendments to the licensing procedures of the atomic energy utilization field
- Government Decree № 631-N as of 04.06.2009 on approval of the procedure on radioactive waste management

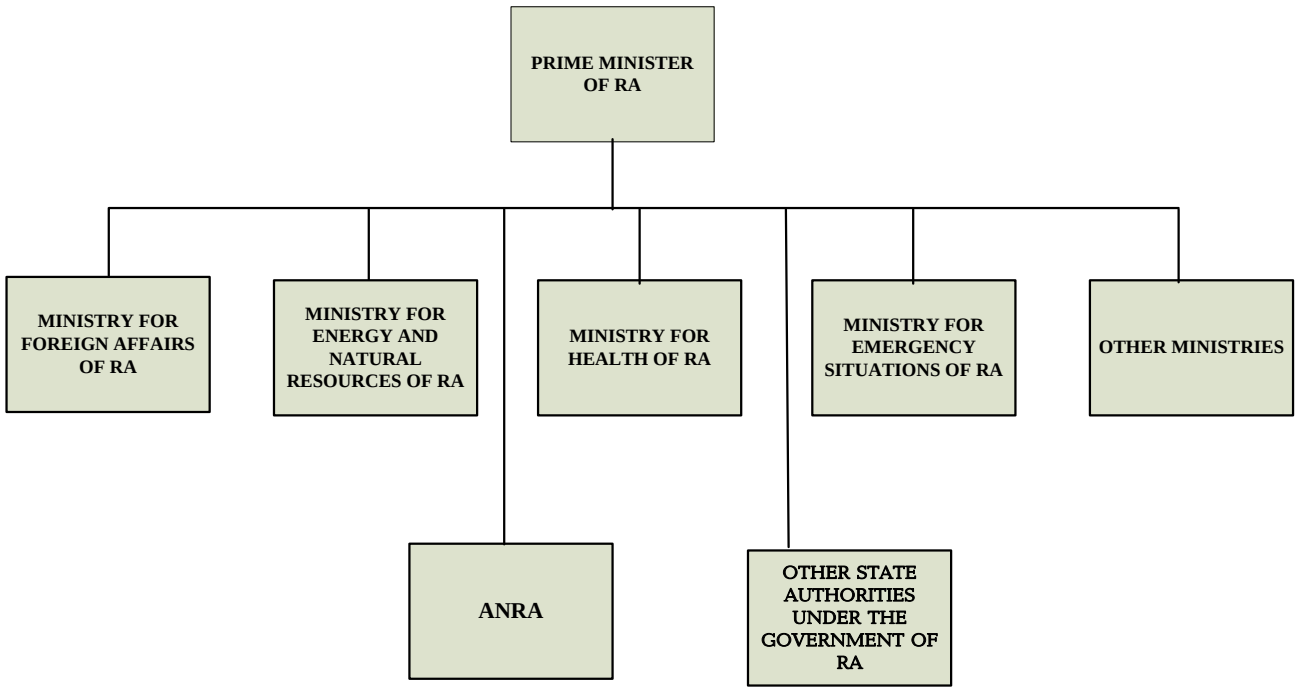
Ministerial Acts Adopted in Atomic Energy Utilization Field

- Requirements to form and content of expert 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).

ANNEX 3. ORGANIZATIONAL STRUCTURE OF ANRA



ANNEX 4. PLACE OF ANRA IN THE GOVERNMENTAL STRUCTURE



ANNEX 5. RADIATION SAFETY PARAMETERS

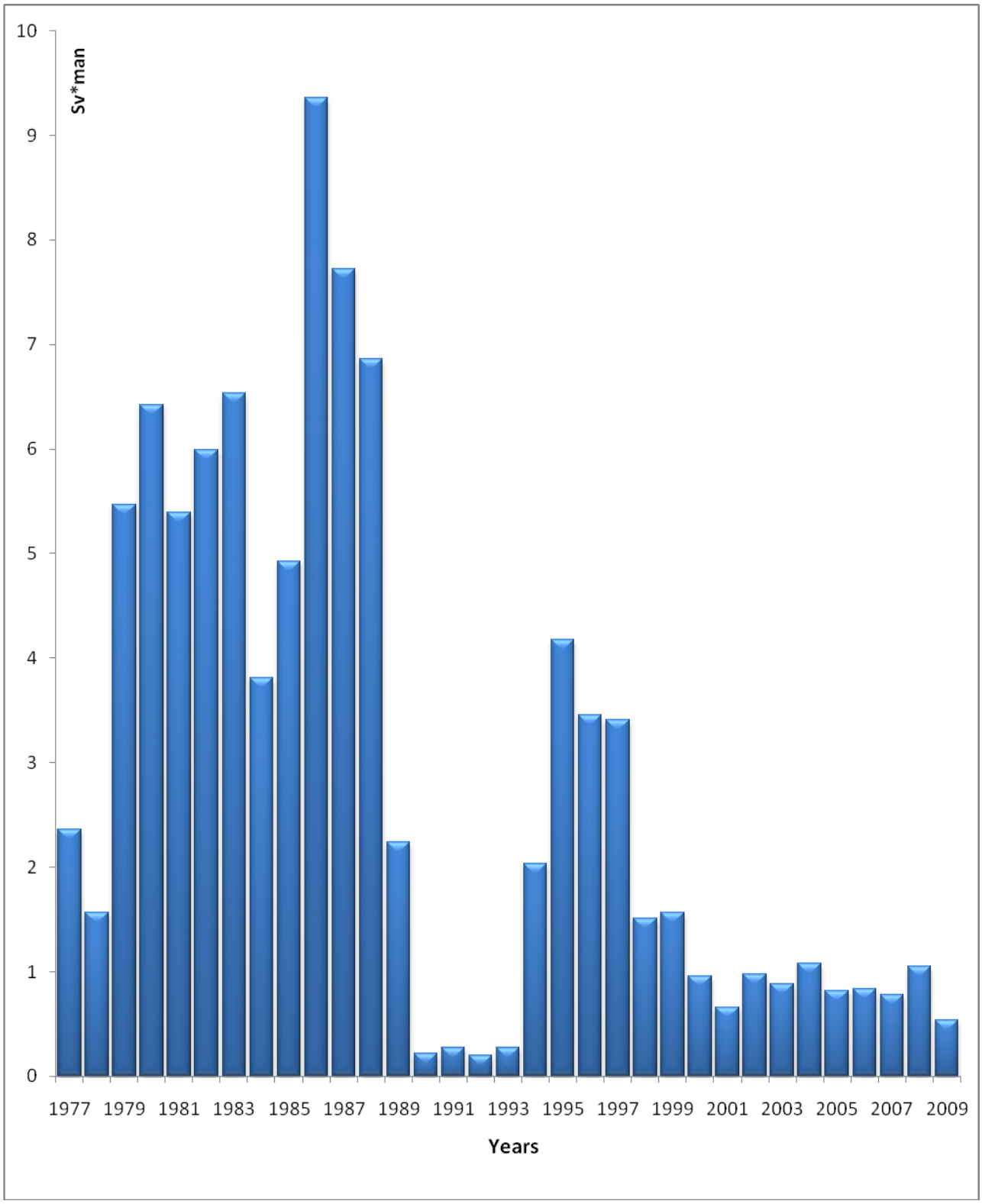


Diagram 1. Annual Collective Equivalent Exposure Dose of Armenian NPP Personnel (1977-2009)

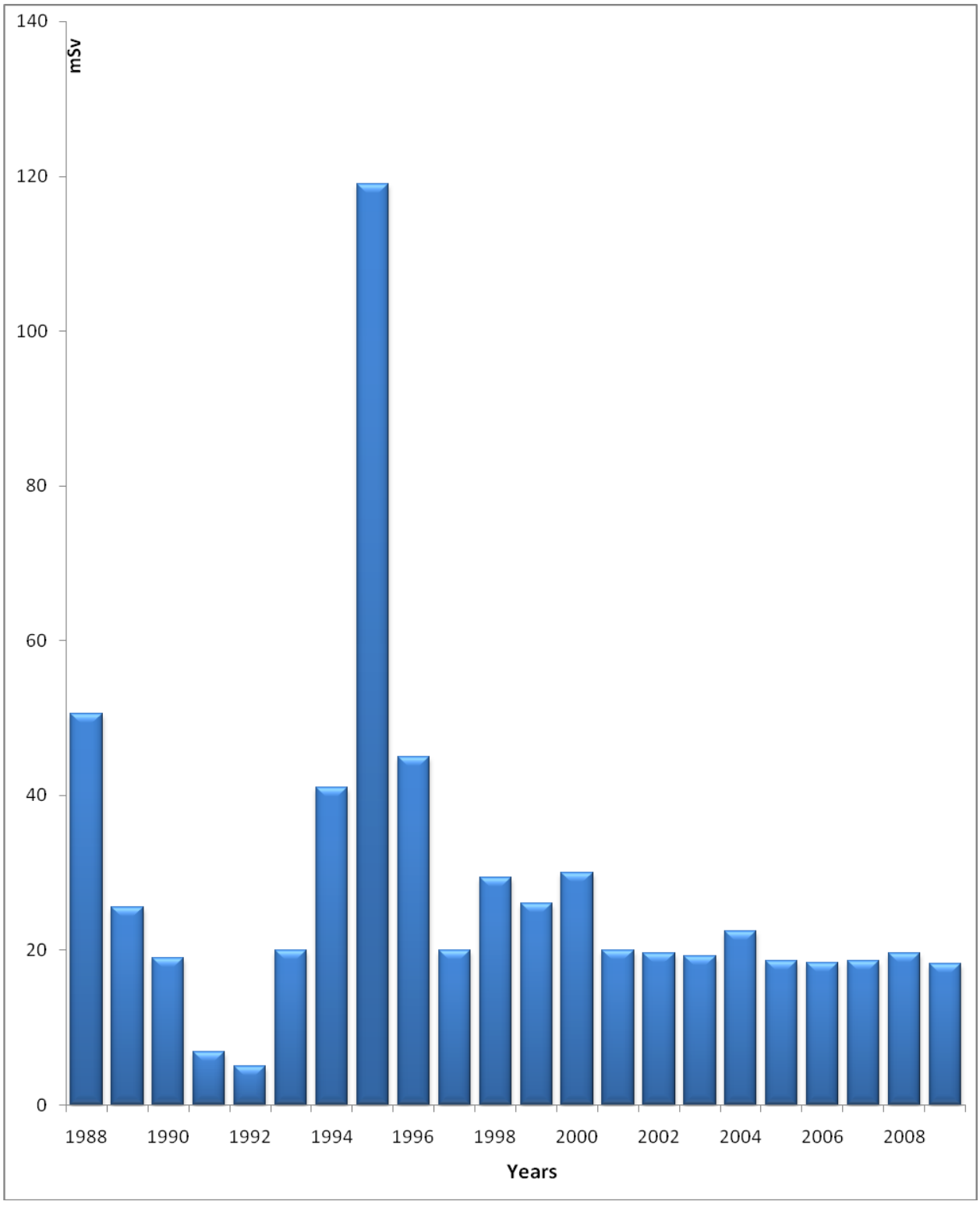


Diagram 2. Individual Equivalent Annual Maximum Exposure Dose of Armenian NPP Personnel (1988-2009)

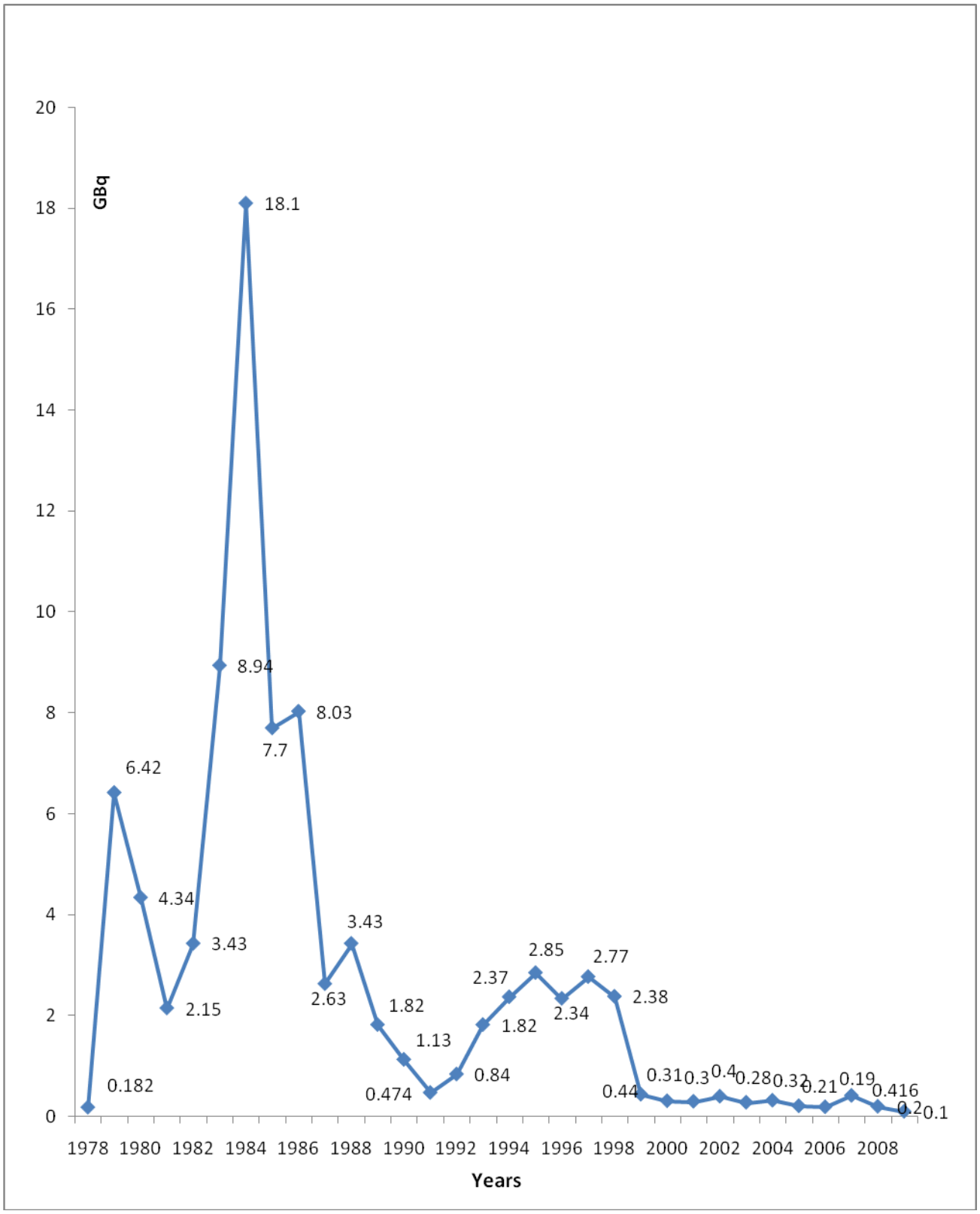


Diagram 3. Annual Releases of Long-Lived Radionuclides (T1/2 more 24 hours) for the period of the Armenian NPP operation (Maximum Allowable Annual Release - 203 GBq).

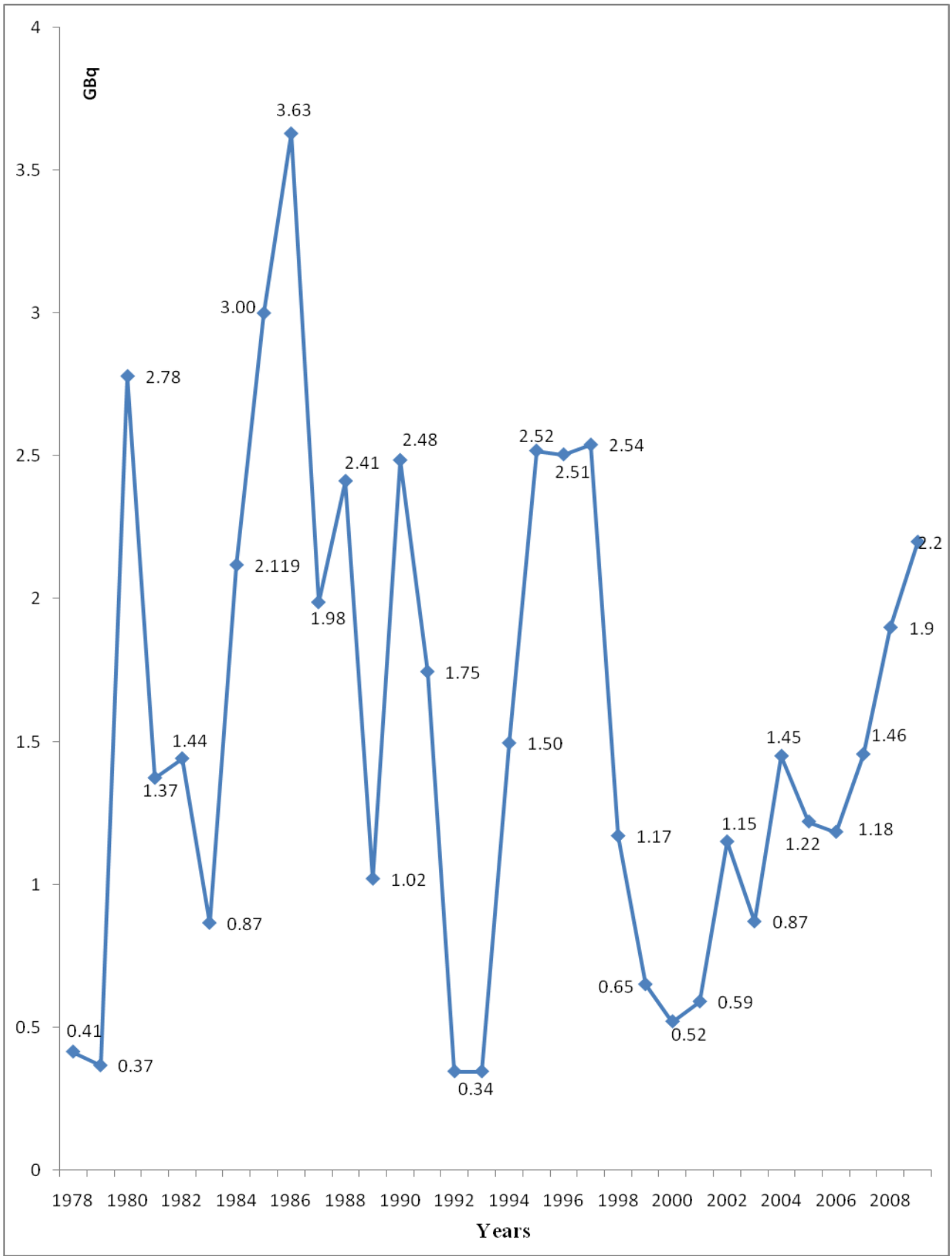


Diagram 4. Annual Discharges of Long-Lived Radionuclides (Sr+Cs) from Armenian NPP in the period of operation (annual permissible discharge – 55.5 GBq)

Radiation Dose Rate in Control Points of NPP Supervised Area (μSv/h).

N meas. points	Months												Average per year
	1	2	3	4	5	6	7	8	9	10	11	12	
1	0.085	0.085	0.08	0.095	0.075	0.095	0.085	0.075	0.075	0.10	0.09	0.095	**0.087** / 0.092
2	0.085	0.08	0.075	0.075	0.08	0.085	0.095	0.08	0.095	0.10	0.095	0.075	**0.085** / 0.086
3	0.10	0.085	0.09	0.095	0.095	0.08	0.085	0.070	0.095	0.11	0.10	0.095	**0.092** / 0.098
4	0.085	0.08	0.075	0.075	0.085	0.065	0.10	0.095	0.085	0.095	0.085	0.085	**0.084** / 0.084
5	0.080	0.09	0.095	0.090	0.085	0085	0.10	0.085	0.085	0.12	0.11	0.10	**0.095** / 0.083
6	0.075	0.080	0.075	0.095	0.095	0.095	0.090	0.080	0.090	0.10	0.085	0.10	**0.089** / 0.088
7	0.095	0.095	0.090	0.075	0.075	0.0900	0.085	0.075	0.095	0.105	0.090	0.090	**0.088** / 0.087
8	0.085	0.080	0.070	0.095	0.085	0.085	0.070	0.095	0.075	0.115	0.10	0.105	**0.088** / 0.086
9	0.080	0.085	0.090	0.085	0.095	0.085	0.090	0.075	0.090	0.140	0.130	0.135	**0.098** / 0.094
10	0.080	0.080	0.085	0.080	0.090	0.095	0.075	0.090	0.090	0.10	0.09	0.095	**0.088** / 0.087
11	0.095	0.095	0.105	0.090	0.095	0.080	0.075	0.080	0.090	0.095	0.095	0.085	**0.09** / 0.088
12	0.105	0.075	0.075	0.095	0.085	0.065	0.085	0.095	0.095	0.110	0.105	0.110	**0.092** / 0.089
13	0.191	0.211	0.196	0.204	0.195	0.179	0.171	0.166	0.195	0.227	0.205	0.206	**0.19** / 0.2
14	0.095	0.095	0.095	0.090	0.095	0.095	0.080	0.080	0.090	0.115	0.095	0.095	**0.093** / 0.10
15	0.100	0.105	0.095	0.085	0.095	0.085	0.075	0.070	0.090	0.110	0.110	0.095	**0.093** / 0.092
16	0.080	0.075	0.075	0.080	0.085	0.075	0.075	0.100	0.085	0.125	0.120	0.110	**0.090** / 0.08
17	0.095	0.085	0.075	0.080	0.075	0.085	0.085	0.085	0.085	0.105	0.095	0.095	**0.087** / 0.092
Average	0.0951	0.093	0.091	0.093	0.093	0.090	0.0895	0.0955	0.110	0.143	0.112	0.012	**0.102**

1- Metsamor town; 2- Aknalich; 3- Aspiration unit АЭС; 4- Armavir town; 5- Aghavnatun village; 6- Echmiadzin town; 7- Aygeshat village; 8- Mrgashat village, 9- Mugan village; 10- Yerevan; 11- Nor Armavir village; 12- Nairi village; 13- Armenian NPP site (average for four points). 14-Road from Armenian NPP to low level RAO depository; 15-Metsamor-Armenian NPP road; 16-Walkaround way; 17-Road to special institutional waste storage facility.

Volumetric β-activity in Atmosphere of NPP Supervised Area (10^{-4} Bq/m^3)

Sampling point	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
NPP	2,0	1,9	2,2	2,6	4,6	4,4	4,2	4,3	4,5	7,9	3,5	2,5
Metsamor	2,3	2,5	6,4	9,2	8,9	9,0	7,3	3,4	9,2	8,6	5,3	6,2
Pond	3,0	2,9	8,9	6,0	11,1	5,9	4,6	5,7	6,1	6,0	8,8	5,7
Yerevan	3,4	3,7	3,5	1,5	4,8	2,8	1,3	1,7	2,0	2,6	3,0	4,5

Radionuclide Concentration in Atmosphere of NPP Supervised Area (10^{-4} Bq/m^3)

Isotope	Sampling point			
	NPP 1 km	Metsamor 5 km	Pond 11 km	Yerevan 30 km
1st quarter				
^{137}Cs	0,0185	0,0126	0,0084	0,023
^{90}Sr	0,014	0,008	0,007	0,005
^{7}Be	4,6	2,96	3,3	1,85
2nd quarter				
^{137}Cs	0,007	0,03	0,026	0,025
^{90}Sr	0,004	0,018	0,009	0,021
^{7}Be	2,96	18,5	13,54	3,5
3rd quarter				
^{137}Cs	0,019	0,024	The facility	0,008
^{90}Sr	0,013	0,02	Was not	0,006
^{7}Be	7,9	7,9	operated	3,5
4th quarter				
^{137}Cs	0,069	0,016	0,026	0,073
^{90}Sr	0,049	0,01	0,01	0,062
^{7}Be	3,67	1,91	18,7	2,5
Average per year				
^{137}Cs	**0,028**	**0,021**	**0,02**	**0,032**
^{90}Sr	**0,02**	**0,014**	**0,009**	**0,023**
^{7}Be	**4,78**	**7,8**	**11,84**	**2,8**

Total β-activity of Radionuclides in Air Fall-outs (10^6 Bq/km^2 month)

Sampling point	Months												Total for year
	1	2	3	4	5	6	7	8	9	10	11	12	
NPP	27,5	28,6	23,5	29,8	30,1	32,4	31,6	20,5	28,9	28	25,7	23,4	**330**/368,2
1 radius	28,8	27,6	32,8	29,4	35,6	38,9	29,4	24,6	31,5	32,8	29,0	25,7	**366,1**/370,2
2 radius	24,7	22,8	25,6	30,4	31,1	33,8	22,6	19,5	28,8	28,0	23,8	20,1	**311,2**/369,6
3 radius	26,9	28,5	31,9	32,4	38,9	40,1	30,6	28,2	30,5	29,6	26,8	25,0	**369,4**/369,9
Yerevan	19,6	22,3	20,5	24,1	25,0	28,6	25,1	18,2	21,3	24,1	19,4	15,6	**263,8**/349,1

Air Fall-outs Radionuclides Concentration (10^7 Bq/km^2 quarter)

Isotope	Sampling points				
	NPP	1 radius	2 radius	3 radius	Yerevan
1st quarter					
^{137}Cs	0,3	0,26	0,32	1,1	0,67
^{90}Sr	0,2	0,22	0,15	0,21	0,19
^{7}Be	0,89	0,3	4,44	1,67	14
2nd quarter					
^{137}Cs	0,17	0,17	0,9	0,85	0,37
^{90}Sr	0,12	0,15	0,18	0,24	0,27
^{7}Be	2,89	5,4	14,41	15,1	3,63
3rd quarter					
^{137}Cs	0,30	0,32	0,35	0,73	0,57
^{90}Sr	0,17	0,19	0,21	0,35	0,42
^{7}Be	0,95	3.7	8.1	9.4	4.9
4th quarter					
^{137}Cs	0,32	0,36	0,41	0,62	0,69
^{90}Sr	0,14	0,23	0,19	0,30	0,38
^{7}Be	0,98	4.3	5.2	6.5	3,9
	Total per year				
^{137}Cs	**1,09**	**1,11**	**1,98**	**3,3**	**2,3**
^{90}Sr	**0,63**	**0,79**	**0,73**	**1,10**	**1,26**
^{7}Be	**5,71**	**13,7**	**32,15**	**32,67**	**26,43**

Rated β-activity of soil (Bq/kg)

No. of control point										
1	2	3	4	5	6	7	8	9	10	11
542	367	484	502	452	625	572	627	540	491	463

1- Metsamor town; 2- Aknalich; 3- Aspiration unit АЭС; 4- Armavir town; 5- Aghavnatun village; 6- Echmiadzin town; 7- Aygeshat village; 8- Mugan village; 9- Yerevan; 10- Nairi village; 11- Armenian NPP site (average for four points).

Soil Radionuclides Activity (Bq/kg)

Control points	Radionuclides				
	^{134}Cs	^{137}Cs	^{90}Sr	^{60}Co	^{110m}Ag
Armenian NPP (site)	--	**21,75** / 16,8	**5,8** / 4,3	--	--
1 radius	--	**16,23** / 14,7	**4,9** / 5,2	--	--
2 radius	--	**19.25** / 15,7	**5,1** / 4,9	--	--
3 radius	--	**20,15** / 17,4	**4,7** / 4,9	--	--
Yerevan (control point)	--	**24** / 14,6	**4,1** / 3,2	--	--

Rated β-activity (Bq/kg) in Flora

No. of control point										
1	2	3	4	5	6	7	8	9	10	11
652	458	491	583	527	604	715	562	593	514	608

1- Metsamor town; 2- Aknalich; 3- Aspiration unit АЭС; 4- Armavir town; 5- Aghavnatun village; 6- Echmiadzin town; 7- Aygeshat village; 8- Mugan village; 9- Yerevan; 10- Nairi village; 11- Armenian NPP site (average for four points).

Radionuclides Activity (Bq/kg) in Flora

Control points	Radionuclides				
	^{134}Cs	^{137}Cs	^{90}Sr	^{60}Co	^{110m}Ag
ANPP (site)	--	**21.9** / 20	**4,1** / 3,9	--	--
1 radius	--	**19.5** / 21,2	**4,9** / 4,5	--	--
2 radius	--	**16.33** / 24,8	**5,3** / 4,8	--	--
3 radius	--	**18,65** / 24,3	**4,6** / 4,2	--	--
Yerevan (control point)	--	**21** / 23,9	**3,9** / 4,3	--	--

Rated β-activity of Bottom Deposits and Their Radionuclide Concentration (Bq/kg).

Control points	Rated β-activity	Radionuclides	
		^{137}Cs	^{90}Sr
Lake Aknalich	438/ 489	**11,9** / 12,0	**4,6** / 4,1
Fish industry	495/ 522	**11,0** / 10,5	**3,8** / 3,2
Service water pump supply station	620/ 688	**10,9** / 11,8	**3,6** / 3,1
Drinking water intake for Metsamor town	607/ 679	**11,3** / 10,5	**3,2** / 2,9
Water intake for pump station	438/ 610	**12,5** / 11,9	**3,6** / 2,7
Drinking water intake for Armavir town	495/ 590	**11,8** / 10,6	**3,6** / 3,4
Domestic sewage drainage point	572/ 625	**18,3** / 17,9	**3,2** / 2,9
Rain water sewage drainage point	607/ 645	**15,9** / 16,2	**4,3** / 3,9

Rated β-activity of Algae and Their Radionuclide Concentration (Bq/kg).

Control points	Rated β-activity	**Radionuclides**	
		^{137}Cs	^{90}Sr
Lake Aknalich	710 / 690	**12,5** / 12,6	**1,8** / 1,6
Fish industry	672/ 785	**12,4** / 11,3	**2,2** / 1,9
Service water pump supply station	540/ 626	**11,8** / 10,8	**1,8** / 1,7
Drinking water intake for Metsamor town	624/ 780	**11,4** / 10,2	**2,1** / 1,9
Water intake for pump station	647/ 750	**12,8** / 12,7	**2,6** / 2,0
Drinking water intake for Armavir town	680/ 710	**11,4** / 10,5	**2,9** / 2,5
Domestic sewage drainage point	515/ 690	**12,0** / 12,7	**2,1** / 2,4
Rain water sewage drainage point	658/ 750	**10,4** / 9,4	**1,9** / 1,7

NPP Sanitary Protection and Observation Area Deep Water Boreholes Observation Data.
Total Rated β-activity of boreholes water (Bq/l)

Borehole No.	1	2	3	4	5	6	7	8	9	10
β-activity	2,1	1,9	1,85	1,77	No water	1,9	No water	No water	2,5	2,6

Total β-activity of Open Basins (Bq/l)

Measurement	Control points								
	1	2	3	4	5	6	7	8	9
1	0,51	0,46	0,69	0,79	0,65	0,67	0,90	0,82	0,57
2	0,41	0,62	0,51	0,45	0,55	0,79	0,81	0,83	0,68

1-Lake Aknalich, 2-Fish industry, 3-Service water pump supply station, 4-Drinking water intake for Metsamor town, 5-Water intake for pump station, 6- Drinking water intake for Armavir town, 7-Domestic sewage drainage point, 8-Rain water sewage drainage point, 9-Large Armavir Channel.

Cs^{-137} Radionuclides Concentration Open Basins Water (Bq/l)

Measurement	Control points								
	1	2	3	4	5	6	7	8	9
1	0,11	0,08	0,12	0,16	0,13	0,14	0,21	0,18	0,13
2	0,13	0,11	0,14	0,14	0,16	0,16	0,23	0,16	0,16

1-Lake Aknalich, 2-Fish industry, 3-Service water pump supply station, 4-Drinking water intake for Metsamor town, 5-Water intake for pump station, 6- Drinking water intake for Armavir town, 7-Domestic sewage drainage point, 8-Rain water sewage drainage point, 9-Large Armavir Channel.

Sr-90 Radionuclides Concentration Open Basins Water (Bq/l)

Measurement	Control points								
	1	2	3	4	5	6	7	8	9
1	0,04	0,015	0,02	0,019	0,017	0,089	0,021	0,023	0,027
2	0,03	0,013	0,03	0,013	0,021	0,019	0,022	0,028	0,024

1-Lake Aknalich, 2-Fish industry, 3-Service water pump supply station, 4-Drinking water intake for Metsamor town, 5-Water intake for pump station, 6- Drinking water intake for Armavir town, 7-Domestic sewage drainage point, 8-Rain water sewage drainage point, 9-Large Armavir Channel.

ANNEX 6. EXPOSURE DOSE LIMITS IN NORMAL AND EMERGENCY CONDITIONS ANNUAL PERMISSIBLE RELEASES

Population Exposure Dose Limits

Specified values	Dose Limit
Effective Dose	1 mSv/year in average in any consecutive 5 years but not greater 5 mSv/year
Annual equivalent dose in lens of the eye, skin, hand and foot	15 mSv 50 mSv

Requirements to Limitation of Population Exposure in Radiation Emergency Conditions

Population dose constrains due to releases and discharges at normal operation of NPP, μSv/year

Radiation Factor	NPP	
	In Operation	Constructed or Designed
Airborne Releases	200	50
Liquid Releases	50	50
In Total	250	100

Annual Permissible Releases of Radioactive Gases from NPP into Atmosphere

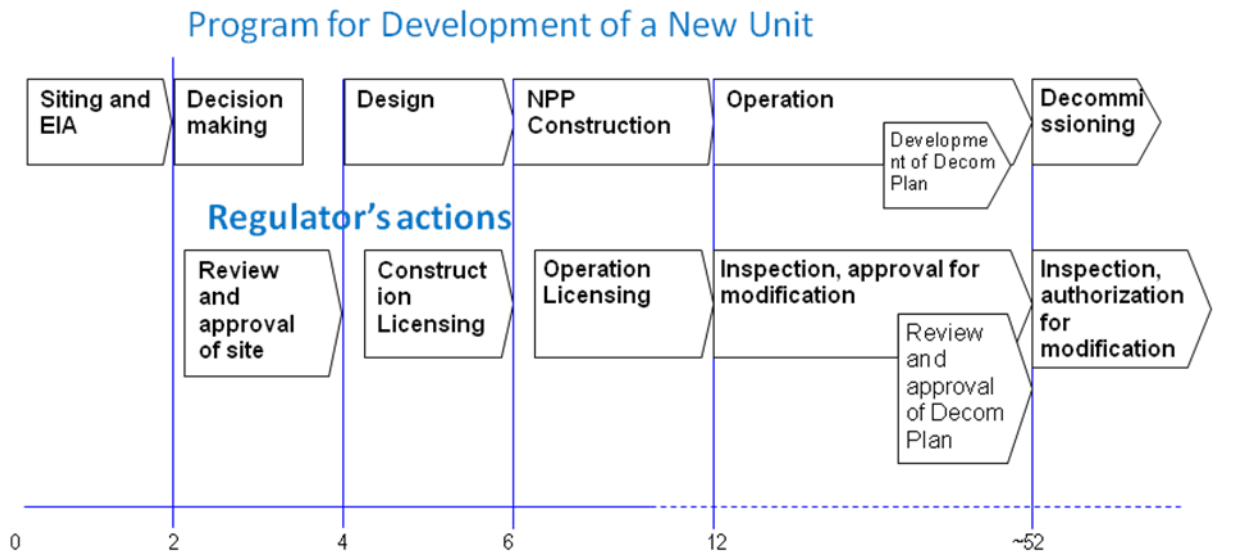
Radionuclide	NPP with WWER and Fast Neutrons
Inert Radioactive Gases [TBq]*	690
131 I (gas +airborne forms [GBq]**	18
60Co [GBq]	7,4
134Cs [GBq]	0,9
137Cs [GBq]	2

ANNEX 7. CATEGORIES OF EVENTS AND ACCIDENTS TO BE REPORTED

Index of event category	Characteristics and Consequences
Accidents A01	Environmental release of radioactive substances at severe beyond design accident, resulting in possible severe radiation injury to faces of NPP personnel and individuals, damage to their health, large area contamination. Possible transboundary migration. Long-term radiation impact on environment.
A02	Environmental release of radioactive substances resulting in reaching or exceeding the level "B" of decision making criteria in sanitary-protection area of the NPP in early period of accident: the projected exposure dose in the first 10 days 500mGy for the whole body or 5000mGy on thyroid, lungs, skin.
A03	Environmental release of radioactive substances resulting in reaching or exceeding the level "A" of prompt decision making criteria beyond sanitary-protection area border in early period of accident: the projected exposure dose in the first 10 days 50mGy for the whole body or 500mGy on thyroid, lungs, skin. Note. 1 Accidents of categories A01, A02, A03 are characterized by excess of maximum design level of cladding damage. 2. Levels "A" and "B" for making urgent decisions on early stage of accident correspond to NRB-96
A04	Environmental release of radioactive substances resulting in excess main dose limit for population 5mSv/year. One-time internal and/or external exposure of individuals with the dose exceeding the potentially hazardous dose (200 mSv). Cladding damage when the safe operation limit by quantity and size of cladding defects is exceeded, and maximum design limit is not exceeded.
Events 01	Ingression of radioactive substances in premises of permanent attendance of the personnel, NPP site and environment as a result of failure of systems (elements), deficiencies in operating procedures, personnel errors resulting in: • contamination of permanently attended premises reaching beta nuclides 10000 frequency/min sm^2 and/or alpha nuclides 200 frequency/min sm^2 • Contamination in sanitary protection area resulted in exposure dose not exceeding 5mSv/year. One-time external and/or internal exposure of individuals with dose exceeding the main dose limit but potentially hazardous (200 mSv).
E02	Violation of safe operation limits (except for radiation)
E03	Violation of safe operation conditions
E04	Inoperability of one or several safety systems channels detected during

	scheduled testing or observation of NPP unit operation
E05	Activation of safety system connected with the need to perform safety function during NPP unit operation and accompanied with additional in comparison with accounted during design accidents failures of safety systems elements beyond single failure and/or personnel errors.
E06	Activation of safety system connected with the need to perform safety function during NPP unit operation and not accompanied with additional in comparison with accounted during design accidents failures of safety systems elements beyond single failure and/or personnel errors.
E07	Activation of safety system or safety channel not connected with safety function including the part of fire extinguishing which provides for safety system functioning.
E08	Reactor shutdown or unit disconnection from the grid without emergency protection activation during unit operation caused by failure of system (elements), and/or personnel errors or external impact.
E09	NPP unit load drop for 25% and more from the power level immediately preceding it caused by failure of system (elements), and/or personnel errors or external impact
E10	Drop and/or damage of fuel assemblies, cladding at operations with fresh and/or spent nuclear fuel caused by failure of systems, elements (including lifting equipment of NPP used during nuclear fuel handling) and/or personnel errors.
E11	Damage or deficiencies of safety class 1 and 2 elements occurred or detected during NPP unit operation, but did not resulted in initiating event.

ANNEX 8. LICENSING PROCESS



ANNEX 9. LIST OF ABBREVIATIONS

AD	Armenian Dram
ALARA	As Low as Reasonably Achievable
ANL	Argon National Laboratory
ANRA	Armenian Nuclear Regulatory Authority
ARS	Armenian Rescue Service
ASSET	Assessment of Safety Significant Events
ATWS	Anticipated Transient Without Scram
BNL	Brookhaven National Laboratory
CES	Commission on Emergency Situations
CDF	Core Damage Frequency
DE	Design Earthquake
DEF	Deep Evaporation Facility
DG	Diesel Generator
DGS	Diesel Generator Station
DSC	Dry Shielding Container
DSFS	Dry Spent Fuel Storage Facility
EAR	Event Analysis Report
ENR	Event Notification Report
ERC	Emergency Response Center
HPES	Human Performance Evaluation System
INES	International Nuclear Event Scale Information Service
IPSART	International Probabilistic Safety Analysis Review Team
IRDP	International Regulatory Development Partnership
I&C	Instrumentation and Control
LRW	Liquid Radioactive Wastes
MCR	Main Control Room
PSA	Probabilistic Safety Analysis
MDE	Maximum Design Earthquake
MES	Ministry of Emergency Situations
NRSC	Nuclear and Radiation Safety Center
NSSP	National Service of Seismic Protection
OSART	Operational Safety Review Team

PGA	Peak Ground Acceleration
PROSPER	Peer review of the Effectiveness of the Operational Safety Performance Experience Review
PRZ	Pressurizer
QMS	Quality Management System
RA	Republic of Armenia
RF	Russian Federation
SSC	Systems, Structures and Components
QA	Quality Assurance
RLE	Reviewed Level Earthquake
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
US NRC	United States Nuclear Regulatory Commission
US DOE	United States Department of Energy
WANO	World Association of Nuclear Operators
WENRA	Western European Nuclear Regulators Association