ARMENIA

(Profile prepared in March 2015)

a. National Framework for management of radioactive waste and spent fuel

The RA Government protocol decree №43 as of 4 November 2010 on approval of the concept on safe management of radioactive waste and spent nuclear fuel in RA settles the objectives of the National Policy for safe management of radioactive waste and spent fuel in the Republic of Armenia.

During the development of the Policy document all the topics/typical elements highlighted in the IAEA Nuclear Energy Series No.NW-G-1.1 document on "Policies and strategies for radioactive waste management" and as well the others specific to the circumstances of the Republic of Armenia were taken into consideration.

The National Policy represents the views of all of the stakeholders involved in spent fuel and radioactive waste management and reflects the official attitude of the Government towards spent fuel and radioactive waste management in the country. In order to implement the Policy and to specify the ways for achieving the goals identified in the Policy, the activities on development of SF and RW management strategy document were initiated in 2011. And, within the frame of EC Development and Cooperation (DEVCO) Programme, the development of "National Strategy on Radioactive Waste and Spent Fuel Management" started in September 2013 and is expected to be finalized at the end of 2015.

b. National legal and regulatory framework

The Armenian Nuclear Regulatory Authority (ANRA), established in 1993 as a state authority under the RA Government, 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.

Regulatory framework of the RA is provided in the List of references (on page 6).

c. Radioactive waste management, decommissioning and spent fuel strategy and current practices & technologies

In Armenia the only producer of spent fuel and the main producer of radioactive waste is the Armenian NPP (ANPP). There are also other organizations (e.g. medical, industrial, etc.) which produce radioactive waste.

<u>Spent fuel management practice</u>

The source of spent fuel is the Armenian NPP. When its service life is expired, during refueling of the reactor core, fuel assembly is discharged from the reactor core and placed in cell of the Unit № 2 storage pool. Refueling is performed once in a year, when the reactor is shut down, depressurized and cooled down. Following discharge of spent fuel assembly from the reactor core it is tested for leak tightness. In case it is tight, a spent fuel assembly is placed in a cell of the storage pool. In case failed assemblies are detected they are placed in tight casings and stored in them.

Following the required storage time (3-5 years), spent fuel assemblies are relocated into the spent fuel storage pool of № 1, where they are stored until reaching the parameters required for their

transferring to Dry Spent Nuclear Fuel Storage facility (DSNFSF) of NUHOMS-56 type located on Armenian NPP site. Spent fuel assemblies are placed in Dry Shielding Canister (DSC), which is filled with nuclear purity helium of retained overpressure. The DSC shielding and insulation are provided by massive reinforced concrete Horizontal Storage Module (HSM). Radioactive decay heat caused by DSC and HSM is removed using draught ventilation system, which operation is based on a passive natural convection.

There are two buildings of the HSM built on the Armenian NPP site. The first building consisting of 11 modules is completely full and in the second one only 10 out of 12 modules are full.

Radioactive waste management practice

There are two waste management facilities in Armenia:

- Armenian NPP
- Near surface institutional RW storage facility (Radon type facility)

Armenian NPP

Solid radioactive waste (SRW)

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

Solid Radioactive Waste Storage System consists of:

- Storage for Low Level Solid Radioactive Waste (LL SRW)

Total capacity of LL SRW storage is 17051 m^3. Storage consists of two cells, the dimensions of each cell are 27x36x8,9 m. The cell bottom and walls are constructed of 0,6m thickness solid reinforced concrete with three-layer hydraulic insulation. The cells are covered with reinforced concrete plates and asphalted. The SRW is loaded into the cells through the hatches of 0,75x 0,75m. Totally there are 108 hatches.

- Storage for Intermediate Level Solid Radioactive Waste (IL SRW)

IL SRW storage is located in the Auxiliary building, representing separate compartments covered with hatches. The total capacity of the storage is 1001 m^3. Part of Deep evaporation facility (DEF) drums are also stored there. Due to insufficient storage capacity, the temporary storage place under metallic shelter on the roof of auxiliary building was designed. The useful storage capacity is not more than 3000 DEF drums based on working area of 655 m.

- Storage for High Level Solid Radioactive Waste (HL SRW)

HL SRW storage is located in the Central Hall of Reactor building. The facility consists of 380 cells of 0,18 m diameter, 8,9 m length, closed with 0,72m height plugs. A cell represents a metal tube of 6 mm wall thickness with a welded bottom.

Liquid Radioactive Waste (LRW)

All liquids from NPP control area are collected and evaporated continuously. The generated evaporator concentrate subsequently undergoes treatment at deep evaporation facility (DEF) and the resulting alloy (“salt cake”) is packed in metal containers, where it is solidified and placed for storage in DEF containers temporary storage site.

Liquid Radioactive Waste Storage System, located in Auxiliary building, consists of:

- Six evaporator concentrate tanks, made of stainless steel, with a volume of 550 m^3 each, which results in total storage capacity of 3300 m^3.
- Two high level sorbent tanks made of stainless steel with the volume of 420 m^3 each, which results on total storage capacity of 840 m^3. The tanks were originally designated for storage of high level activity sorbents, but as far as high level liquid waste is not generated at ANPP, these tanks are used for storage of intermediate level waste. Spent ion exchange resins (sorbents) are stored in one of these tanks.
- Two stainless steel tanks for storage of low level sorbents with capacity of 192 m^3 each, which results in total storage capacity of 384 m^3.

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

Near surface institutional RW storage facility

Institutional waste storage facility was designed as a disposal facility for solid and liquid waste generated by institutional RW producers. In the disposal facility the radioactive wastes were grouted into standard drums (200 l) bringing them to a suitable safety condition for their disposal, place them into an underground concrete vault and finally empty space between drums was filled with grouting. The designed disposal facility included two layers.

In 2009, according to the legislation in force, the operating company applied for the operation license as a RW disposal facility. Nevertheless, ANRA granted the license for operation as a RW storage facility. Currently, facility stores solid low- and intermediate level short lived (LL&ILW SL) waste from institutional producers.

The designed capacity of the facility is 2268 m^3, consisting of three separate storages, 756 m^3 of each, with seven double-layer underground concrete vaults covered with the concrete slabs.

d. Radioactive waste classification, waste and spent fuel quantities (inventory) (including disused sources that are declared radioactive waste)

Radioactive waste classification

In November 2014 RW classification was amended and adopted by the RA Government Decree N 1367 as of 27.11.2014. The new classification based on the IAEA proposed one stated in General Safety Guide No. GSG-1 “Classification of Radioactive Waste”.

RW are categorized based on the following criteria:

- Aggregate state, on which base RW are divided into solid, liquid, gaseous ones
- Radiation type, on which base RW are divided into alpha, beta, gamma emitting ones
- Activity content, on which base RW are divided into very low level, low level, intermediate level and high level waste.
- Half-lives of the radionuclides contained in the waste, on which base RW are divided into very short lived, short lived and long-lived.

Radioactive waste classification according to specific activity

Waste class	Specific activity of beta emitting radionuclides (Bq/g)	Specific activity of alpha emitting radionuclides (except for transuranic) (Bq/g)	Specific activity of transuranic radionuclides (Bq/g)
Very Low Level*	Less than 10^2	Less than 10	Less than 1
Low Level	$10^2 – 10^3$	$10 – 10^2$	1 – 10
Intermediate Level	$10^3 – 10^7$	$10^2 – 10^6$	$10^1 – 10^5$
High Level	$>10^7$	$>10^6$	$>10^5$

***** If the isotopic composition of solid radioactive waste is known, the very low level waste must meet the following condition:

$$1 \leq \sum_{i=1}^{n} \frac{A_{mi}}{A_{mi}^{c}} \leq 100,$$

where A_{mi} is the specific activity of the ith radionuclide in the material, A_{mi}^{c} is the value of specific activity for the radionuclide i clearance and n is the number of radionuclides present.

Radioactive waste classification according to half-live of prevailing radionuclides

Waste class	Half-live of radionuclides prevailing in the waste
Very short lived waste	Less than 100 days*
Short lived waste	100 days – 30 years
Long lived waste	More 30 years

* The half-life of radioactive isotopes prevailing in radioactive waste can be more than 100 days, but if the specific activity of waste can decrease below the clearance level for the time not more than 3 years, such waste is to be considered as very short lived.

Radioactive waste classification according to dose rate

Waste class	Dose rate (mSv/h)
Very Low Level	Less than 0.001
Low Level	0.001 – 0.3
Intermediate Level	0.3-10
High Level	>10

Radioactive waste classification according to surface contamination

Waste class	Activity Concentration of beta-emitting radionuclides (count/(cm^2 × min)	Activity Concentration of alpha-emitting radionuclides (except for transuranic) (count/(cm^2 × min)	Activity Concentration of transuranic radionuclides (count/(cm^2 × min)
Very Low Level	Less than 500	Less than 50	Less than 5
Low Level	$500 – 10^4$	$50 – 10^3$	$5 – 10^2$
Intermediate Level	$10^4 – 10^7$	$10^4 – 10^7$	$10^2 – 10^5$
High Level	$>10^7$	$>10^6$	$>10^5$

Radioactive waste quantities (inventory) as of 1 January 2014

Inventory of radioactive waste accumulated at Armenian NPP is as follows:

№	Storage system	Purpose & location	Design capacity, m^3	Waste volume, m^3
1	LL SRW	Storage of solid LLW, ANPP site	17051	6084
2	IL SRW	Storage of solid ILW, Auxiliary building	1001,32	482*
	IL SW "salt cake"	Temporary storage on the roof of Auxiliary building	Up to 3000 containers	435
	IL LRW (evaporator concentrate)	Evaporator concentrate tanks 1-6, Auxiliary building	6x550	2270
3	HL SRW	HLW storage, Reactor building	78.34	34
	HL LRW (spent resin)	High level activity sorbents tank, Auxiliary building	2x420	158.5**

* Including 324 m^3 of "salt cake" in drums;

**Class of waste is defined based on data of operational dose rate measurement (subject for further waste characterization).

Inventory of institutional radioactive waste accumulated at near surface institutional RW storage facility is as follows:

Storage system	Storage capacity, m^3	Waste volume, m^3	Total activity, TBq
L&IL SL SRW	2268	265	2.64

Spent fuel quantities (inventory) as of 1 January 2014

Spent Fuel is not considered as radioactive waste in Armenia and the inventory of Spent Fuel is as follows:

Location	Unit 1 spent fuel pool	Unit 2 spent fuel pool	Total at ANPP	DNSFSF-1	DNSFSF-2	Total in DSNFSF
Quantity of SF assemblies	344	305	649	11 DSC	10 DSC	1176
				616	560	

Detailed information is available but is highly confidential according to Article 5 of Safeguard Agreement and the Article 9 of Law of the RA on the state and service secret as of 03.12.96 and the para.7 of the Government Decree № 173 on approval of the list of information classified as state secret of RA as of 13.03.98.

List of references

The international treaties ratified by the RA

- Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management ratified on 21.03.2013
- Convention on Nuclear Safety ratified on 24.09.1997
- 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
- Amendment to the Convention on Physical Protection of Nuclear Material signed on 8 July 2005 adopted by the National Assembly as of 18.03.2013
- CTBT Comprehensive Nuclear-Test-Ban Treaty ratified on 21.12.1993
- 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

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 (22.07.2014)

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 (ANRA)
- 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 rules
- Government Decree № 1219-N as of 18.08. 2005 on approval of radiation safety norms
- 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
- Government Decree №1552-N as of 25.11.2010 on approval of amendments to the Government Decree № 1219-N as of 18.08.2006 on approval of radiation safety norms and the Government Decree № 1489-N as of 18.08.2006 on approval of radiation safety rules
- Government Decree №1611-N as of 17.11.2011 on amendments and supplements to the Government Decree № 400-N as of 24.03. 2005 on approval of the licensing procedure and licence form for operation of nuclear installations
- Government Decree № 418-N as of 05.04.2012 on approval of procedure on investigation of NPP operational events
- Government Decree № 709-N as of 04.07.2013 on approval of List of Internal Legal Acts Applied in Atomic Energy Utilization Field in Russian and in English
- Government protocol decree №43 as of 4 November 2010 on approval of Concept on safe management of radioactive waste and spent nuclear fuel in RA
- Government Decree № 1263 as of 24.12.2001 on approval of Special rules on transportation of nuclear and radioactive materials
- Government Decree № 1653 as of 11.12.2003 on Determination of the price for radioactive waste transport, neutralization and storage services
- Government Decree № 2141 as of 01.12.2005 on approval of the licensing procedure and licence form for decommissioning of radioactive waste storage and for closure of disposal facilities
- Government Decree № 931 as of 27.06.2002 on approval of Procedure for safe transport of nuclear and radioactive materials
- Government Decree № 1231 as of 11.09.2003 on approval of Concept of physical protection and security of Armenian NPP and nuclear materials and rules on physical protection of nuclear installations and nuclear materials
- Government Decree № 1597 as of 26.10.2004 on fulfillment of obligations undertaken under the Protocol Additional to the Agreement between the Republic of Armenia and the International

Atomic Energy Agency for the Application of Safeguards in Connection with Treaty on the Non-Proliferation of Nuclear Weapons

- Government Decree № 1953 as of 30.10.2004 on preparedness to response to nuclear and radiation emergencies in the RA
- Government Decree № 1751 as of 09.12.2004 on approval of licensing procedure and license form for use of radioactive materials, devices containing radioactive materials, or radiation generators
- Government Decree № 1790 as of 09.12.2004 on approval of licensing procedure and application form for import and export of radioactive materials, devices containing radioactive materials, or radiation generators
- Government Decree № 346 as of 24.03.2005 on approval of licensing procedure and license form for import and export of nuclear materials
- Government Decree № 375 as of 24.03.2005 on approval of licensing procedure and license form for import and export of radioactive wastes
- Government Decree № 376 as of 24.03.2005 on approval of licensing procedure, license and application forms for import and export of special materials, equipment and technologies in the RA
- Government Decree № 401 as of 31.03.2005 on approval of licensing procedure and license form for implementation of physical protection of nuclear installations and nuclear materials
- Government Decree № 416 as of 31.03.2005 on approval of licensing procedure and license form for construction of radioactive waste storage facility
- Government Decree № 417 as of 31.03.2005 on approval of licensing procedure and license form for construction of radioactive waste disposal facility
- Government Decree № 647 as of 05.05.2005 on approval of licensing procedure and license form for storage of radioactive wastes
- Government Decree № 652 as of 19.05.2005 on approval of licensing procedure and license form for operation of radioactive waste disposal facility
- Government Decree № 660 as of 05.05.2005 on approval of licensing procedure and license form for transport of radioactive waste
- Government Decree № 702 as of 19.05.2005 on approval of licensing procedure and license form for operation of radioactive waste storage facility
- Government Decree № 703 as of 19.05.2005 on approval of licensing procedure and license form for processing of radioactive wastes
- Government Decree № 745 as of 09.06.2005 on approval of licensing procedure and license form for storage of nuclear materials
- Government Decree № 746 as of 09.06.2005 on approval of licensing procedure and license form for transport of nuclear materials
- Government Decree № 762 as of 09.06.2005 on approval of licensing procedure and license form for use of nuclear materials
- Government Decree № 985 as of 07.07.2005 on approval of licensing procedure and license form for designing of radioactive waste storage facility

- Government Decree № 986 as of 07.07.2005 on approval of licensing procedure and license form for designing of radioactive waste disposal facility
- Government Decree № 1203 as of 11.08.2005 on approval of licensing procedure and license form for site selection of radioactive waste storage facility
- Government Decree № 1204 as of 11.08.2005 on approval of licensing procedure and license form for site selection of radioactive waste disposal facility
- Government Decree № 2129 as of 01.12.2005 on approval of licensing procedure and license form for closure of radioactive waste disposal facility
- Government Decree № 2140 as of 01.12.2005 on approval of licensing procedure and license form for manufacture of radioactive materials, equipment containing radioactive materials, or radiation generators
- Government Decree № 2141 as of 01.12.2005 on approval of licensing procedure and license form for decommissioning of radioactive waste storage facility

Ministerial Acts Adopted in Atomic Energy Utilization Field

- Requirements to format and content of conclusion on safety expertise in atomic energy utilization field (Registered by the Ministry of Justice of RA. Registration № 10503349 as of 12.11.2003)
- Establishment of Armenian NPP emergency planning zones (Registered by the Ministry of Justice of RA. Registration № 12506129 as of 04.05.2006)
- Statute and procedure on formation of commission on qualification check of physical persons holding positions and implementing practices important to safety in atomic energy utilization field (Registered by the Ministry of Justice of RA. Registration № 12507398 as of 21.11.2007)
- Requirements to content and form of program on decommissioning of nuclear installations (registered by the Ministry of Justice of RA. Registration № 12511432 as of 27.09.2011)
- Requirements to format and content of environmental radiation monitoring system of nuclear energy utilization installation (registered by the Ministry of Justice of RA. Registration № 12512230 as of 31.05.2012)
- Requirements to format and content of occupational exposure personal cards (registered by the Ministry of Justice of RA on 25 March 2013 under the state registration № 12513109)
- Requirements on accounting of radioisotopic and ionizing radiation sources at atomic energy utilization installations (Registered by the Ministry of Justice of RA. Registration № 12512188 as of 11.04.2012)
- Requirements to format and content of occupational exposure personal cards (Registered by the Ministry of Justice of RA. Registration № 12513109 as of 25.05.2013)