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## **NUCLEAR ENERGY IN ARMENIA: RISKS, RESPONSIBILITY AND SAFETY**

*“Nuclear Energy Bears Many Uncertainties”*

*Gerd Rosenkranz, “Myths about Nuclear Energy”*

*Heinrich Böll Foundation, 2006*

### **Introduction**

The main object of the nuclear power in Armenia is the Armenian Nuclear Power Plant (ANPP) and interrelated processes of operational safety and safety of spent nuclear fuel, burial of radioactive wastes, safety of adjacent infrastructures, as well as responsibility for ensuring safety measures.

### **General Information**

“Haykakan Atomayin Elektrokayan” CJSC (“Armenian Nuclear Power Plant” CJSC) or ANPP is situated in Ararat Valley, 28 km west of the capital of Armenia - Yerevan. ANPP consists of 2 units constructed on the basis of two WWER-440 (V-270) type reactors with the seismic design. ANPP Unit 1 was commissioned on 22 December 1976, while Unit 2 was commissioned on 5 January 1980. The electrical power of each unit was 407.5 MW.

After the destructive earthquake which took place on December 7, 1988, in Spitak Town situated 83 km far from the ANPP, the Council of Ministers of the USSR reached a decision to shut down ANPP for the reasons safety. Unit 1 was shut down on 25 February 1989 and Unit 2 was shut down on 18 March 1989. However, following the USSR collapse under conditions of the energy crisis in the republic in 1993, when Armenia turned out to be in a blockade and couldn't meet the energetic demands of carbon products, the Government of Armenia reached a decision to restart ANPP Unit 2. Two years after the decision making upon completion of a huge scope of activities aimed at safety level enhancement and modernization activities ANPP Unit 2 was restarted on 5 November 1995 and it was connected to the power system. Currently, Unit 2 provides 35-38% of the electricity consumed in the republic. Unit 1 hasn't been connected to the power system since its decommissioning. The fuel for ANPP is supplied by “TVEL” Nuclear Fuel Company, which is a part of RosAtom Russian State Corporation.

*Management and liability for safe operation of Armenian NPP, as well as safe burial of radioactive wastes, entirely vests in the Armenian Government, which owns 100% of ANPP shares. The enterprise itself also bears responsibility.*

It can be stated that the collapse of the USSR affected the energetic policy, as a whole and the situation with the ANPP, in particular. As a matter of fact, ANPP was and remains the only

nuclear power plant in the Caucasus region, except for the Islamic Republic of Iran, which has its own nuclear power plant in Bushehr.

The other countries neighboring Armenia such as Georgia, Azerbaijan and Turkey don't have any nuclear power plants. Turkey expressed its intention to construct a nuclear power plant with the support of Russia, which agreed to make investments in the construction, but the protest demonstrations of the local population, unstable political situation in very Turkey, as well as the relations with Russia have led to upholding making Russian investments in the nuclear energy sector in Turkey. Turkey is also running negotiations with South Korea on the construction of two new nuclear power plants on the shore of the Black Sea, not far from Trabzon.

The factor of ANPP is used in the political discussions with all interested parties, specifically in stability and safety matters. In the dialogues with the society, the most used argument in favour of ANPP is the energetic crisis for 1992-1995. Over this period of time, when ANPP operation was decommissioned, Armenia turned to be in a blockade, which resulted in the thermal power station to be left without sufficient fuel. The energetic crisis led to the massive felling of forests and green zones. In individual forestry enterprises from 10% up to 40% forest-covered areas had been felled down. These arguments are also currently used by ANPP supporters.

***It's beyond any doubts that all the issues related to ANPP must be resolved based on the objective assessments of ANPP safety at the top level with the participation of the interested society and the local population in decision-making processes. Decisions should be reached given the interests of the civil society and the safety of the population and country taking into consideration the accountability of the governmental bodies and the personal responsibility of the officials.***

Responsibility Level for ANPP Safety: At the international level the supervision over the safety level of ANPP is exercised by the International Atomic Energy Agency (IAEA). There is a Nuclear Energy Safety Council operating by the President of Armenia with the involvement of national and international experts. Since 1993 Armenia has undertaken commitments on international conventions on radiation safety, as well as there are laws and bylaws adopted regulating radiation safety (See <http://www.anra.am/index.aspx>, “Legislation” Section).

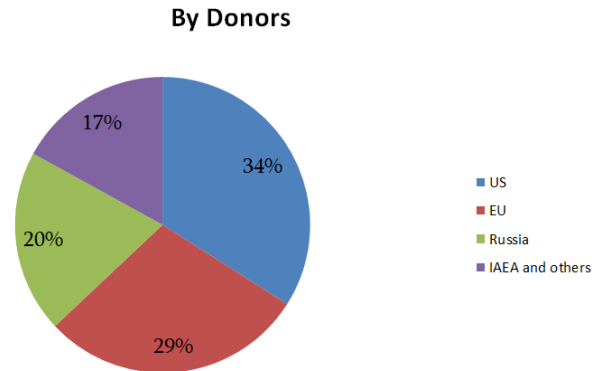
The supervisory functions over radiation safety are vested in the Armenian Nuclear Regulatory Authority for nuclear and radiation safety in atomic energy utilization field (ANRA) within the Government of Armenia. In the set procedure, the ANRA draws up reports for international organizations, first of all, for the IAEA, which you can find at <http://www.anra.am/index.aspx>.

The Armenian Government and ANPP also cooperate with specialized institutions and enterprises in the matters of safety, diagnostics, assessment of seismic sustainability, storage and burial of radioactive wastes. ANPP is the member of the World Association of Nuclear Operators, its main mission is the compliance of safety of nuclear power plants.

The General Constructor Enterprise on Constructing Nuclear Reactors (Russian Federation) is also directly connected with ANPP safety.

Since 1995 donor countries have provided a total of about US \$160 million in assistance to enhance the security of Armenian NPP. US \$65 million from this amount was provided by the US, 55 million by the EU, 8 million by Russia, 7 million by the IAEA and 25 million by other countries. Besides this US \$160 million, works for extension of design operation period of the

second power unit of the Armenian NPP are being implemented within the framework of Russian-Armenian cooperation with US \$270 million export loan provided by Russia and US \$30 million grant provided by the US. The Russian side has provided US \$30 million worth assets to Armenia with the condition that Armenia will take 270 million USD worth assets as a loan from Russia (“Union of Informed Citizens” NGO, <http://uicarmeria.org/ru/3516>).



### **ANPP Risks**

The official bodies and interested society give different assessments to ANPP risks. Reassessment of risks occurs, as a rule, after very important events, which cover ANPP safety, such as the Chernobyl disaster in 1986, the Spitak earthquake in 1988, ANPP rehabilitation and launch in 1995, Fukushima disaster in 2011 and after the adoption of the new law “On Construction of New ANPP Power Unit” in 2009, after the adoption of the governmental resolution on the life extension of the currently operating power unit 2 of ANPP up to 2026.

Under experts, ANPP main risks are associated with:

- Its own risks of construction and technology of a nuclear reactor,
- Seismic risks,
- Risks of insufficient water for cooling reactor equipment and other needs of ANPP,
- Risk of leak out of the pool designed for the storage of spent fuel,
- Dense population in ANPP area,
- Absence of regular monitoring of radiation background of water, soil, atmospheric air, agricultural products in the areas beyond ANPP,
- Worn-out equipment,
- Management risks and drain of qualified staff,
- Dependence on nuclear fuel supply,
- New risks related to ANPP lifetime extension and search for new forums for the burial of radioactive wastes.

(<http://ecolur.org/ru/news/nuclear-energy/expert-ninemagnitude-quake-not-possible-on-location-spot-of-armenian-nuclear-power-plant/4826/>, <http://ecolur.org/ru/news/nuclear-energy/hakob-sanasaryan-anpp-was-closed-not-because-of-greens-but-incompliance-with-accepted-standards/3768/>, <http://ecolur.org/hy/news/nuclear-energy/hakob-sanasaryan-fukushima-disaster-outlined-extent-of-nuclear-energy-hazard/2764/>, <http://ecolur.org/ru/news/nuclear-energy/how-armenian-npp-to-be-taken-out-of-service/3988/>).

**Own Risks of Construction and Technology of a Nuclear Reactor:** These risks have been assessed in the project documentation and comply with the IAEA standards. The risks are assessed and guaranteed by the State Committee on Regulation of Nuclear and Radiation Safety by the Government of Armenia.

*The public doesn't take part in the risk assessment and has to be content with limited information, which doesn't show either assessment methodology or description of carried out examinations.*

**Seismic Risks:** The territory of Armenia is exposed to high seismic risks. The recent destructive earthquake, which had 10 magnitudes out of 12, took place on 7 December in 1988, in Spitak. ANPP was exposed to shakes up to 6 magnitude; afterward the operation of ANPP was decommissioned with the resolution of the USSR government.

The Chairman of the Greens Union of Armenia Hakob Sanasaryan, who has studied the documentation on the justification of ANPP closure, claims there are tectonic faults under the ANPP area, which are located within a distance of 34 km, 16 km and 500 meters from the nuclear reactor, respectively. Under him, the seismic risks for ANPP are high. <https://rus.azatutyun.am/amp/2340433.html>

Arkadiy Karakhanyan, Dr. in Geological Sciences, Head of Department at Geology Institute of NAS RA, doesn't agree with the Greens Union of Armenia. Under him, the research having been carried out in recent years with the IAEA participation showed there aren't any faults within a distance of 25-30 km from ANPP ([http://finport.info/full\\_news.php?id=25211&lang=2](http://finport.info/full_news.php?id=25211&lang=2)).

The administration of ANPP and State Committee on Regulation of Nuclear and Radiation Safety by the Government of Armenia make a reference to the fact that ANPP had already overcome the experience with the Spitak earthquake in 1988, when no destructions and emergencies were recorded at ANPP and currently ANPP is an object capable of ensuring 9-magnitude earthquake.

*The assessment of the seismic risks is carried out by the specialists; nevertheless, the interested society should have an open access to the information on these risks, the results of the examinations, conclusions, as well as to the list of the experts participating in the examinations for the purpose of increasing the responsibility for risk assessment.*

### **Water Risks and Conflicts**

Water risks are one of the main threats to ANPP safety, where several aspects of these risks are considered. Ruben Yadoyan, PhD in Geological Sciences, an expert in hydrogeology, thinks the main water risks of ANPP are related to Ararat Valley, where the majority of agricultural products in the country are produced. Underground waters run under the territory of the Armenian Nuclear Power Plant and flow into Ararat Valley over the fracture. This drinking water is of high quality. As a result of snow melting their level increases, then lowers down. When their level is high, radioactive pollution risks also get high. The cooling system also poses danger for Ararat Valley: if there is any emergency, water will get to Ararat Valley. (<http://ecolor.org/en/news/nuclear-energy/---/2366/>).

Another problem is related to the water lack for ANPP because of overexploitation of groundwater resources in Ararat Valley, which partially supply water to the Sevjur water – the main water supplier for ANPP. Now the water discharge of the Metsamor (Sevjur)-Aknalich group of springs is 3 cubic meters per second (well below the historic rate of 17.8 cubic meters

per second in 1983) - (data presented by “ArmHydroProject” CJSC hydrogeologist Ashot Sargsyan, USAID “Clean Energy and Water”, March 2014, Yerevan). The cooling of the nuclear reactor of the currently operating power unit needs 1 cum per second water, while the river can currently provide only 0.5 cum per second. Twice as much will be needed, in case a new power unit is constructed. Three new groundwater wells have been drilled since 2013 to provide supplemental water for the ANPP, and the ANNP plans drilling ten new wells for securing its operational water demands by 2017. (<http://ecolur.org/en/news/water/overexploitation-of-groundwater-resources-in-ararat-valley-continuing/8672/>).

***The problem with water supply at ANPP remains tense and still no adequate solutions have been proposed. An alternative is the water supply to ANPP from the groundwater wells in Ararat Valley, which is not a reliable option, as the groundwater balance in Ararat Valley has been violated because of their overexploitation by fish farms, which resulted in the exhaustion of the water resources in Ararat Valley.***

### **Sustainable Management Risks ANPP, Drain of Qualified Staff**

Sustainable management of nuclear energy is based on the following legislation:

1. RA Law “On Safe and Peaceful Uses of Nuclear Energy” adopted by the National Assembly of Armenia on 1 February 1999: <http://www.arlis.am/DocumentView.aspx?docid=62188>.

2. RA Law “On Construction of Storage for Spent Nuclear Fuel of “Armenian Nuclear Power Station” CJSC” adopted on 25.05.2015. The law envisages constructing a burial site for the storage of spent nuclear fuel in a dry method for a term of 50 years:

<http://parliament.am/legislation.php?sel=show&ID=2331&lang=arm>

3. RA Law “On Providing Tax Privileges to “Armenian Nuclear Power Station” CJSC adopted on 13.10.1998, under which value-added tax paid by “Armenian Nuclear Power Station” CJSC shall be decreased after 1 July 1997 at the expense of the state loan provided by the Russian Federation in the amount of the VAT paid for the acquisition of various goods. <http://www.parliament.am/legislation.php?sel=show&ID=2051&lang=arm>.

Other laws and bylaws will be mentioned later.

The risks of ANPP sustainable management already have precedents with negative consequences. Sevan-Hrazdan hydrocascade was transferred by the Armenian Government to the ownership of the Russian state-owned company INTER RAO UES in 2003 at the expense of Armenia's debt to Russia for nuclear energy supplied by Russia to Armenian Nuclear Power Station. The experts assessed the value of the cascade in the amount of US \$ 500 million, i.e. 20 times more than the appraised value. This transaction was extremely harmful for Armenia, as such a low price for the cascade didn't enable to pay off the debts for the nuclear energy. Moreover, the assets management of the Armenian Nuclear Power Plant was passed on to Russia, which Russia uses only to pay off its expenses. The contract on asset management of Armenian Nuclear Power Plant was dissolved prematurely and unilaterally. The Armenian side learnt about this from the Russian newspapers. (<http://ecolur.org/en/news/sevan/russian->

[inter-rao-ues-directly-interested-in-additional-water-outlets-from-lake-sevan/9370/](https://news.am/eng/news/95179.html),  
<https://news.am/eng/news/95179.html>).

The results of unsustainable management were financial instability and conflicting situations at ANPP. In 2011, 158 employees from the engineering staff handed in resignation letters because of the problems with their salaries. RA Energy Minister Armen Movsisyan ordered to sign the letters of resignation, thus, jeopardizing the human factor, which is one of the most important safety guarantees in any nuclear power plant. The employees continued performing their obligations, as they stated “for the sake of ANPP safety”. This conflict was resolved after RosAtom Head Sergey Kirienko's visit and his negotiations run with the Minister.

Such type of conflicts became possible because of underestimation and insufficiency of the liability for ANPP safety and neglecting risks, which may have turned into a disaster.

### Emergency Risks

Since 1996 ANPP has automatic radiation monitoring system. It also used to have a laboratory for the radiation and epidemic control, which was based on a special anti-epidemic station in Metsamor, which was closed down because of the absence of finances. Now the liability for the radiation safety vests in the Ministry of Emergency States of Armenia.

International experts have different opinions on ANPP risks. Nuclear engineering expert Robert Kalantari, who owns Engineering Planning and Management Company, says Metsamor is like any other nuclear plant in operation worldwide. He said he is confident that Metsamor could operate safely in so-called "design basis accident" and that it could cope even with accidents beyond its design basis.

On the other hand, Antonia Wenisch of the Austrian Institute of Applied Ecology in Vienna, calls Metsamor "among the most dangerous" nuclear plants still in operation. She points to Armenia's own most recent report for the international convention on nuclear safety, which estimates the risk of "core damage frequency" to be nearly two incidents every 10,000 years. She said that number should be less than one. The average risk at U.S. nuclear power plants is 2 such incidents every 50,000 years, according to a report by the U.S. Electric Power Research Institute. (<http://news.nationalgeographic.com/news/energy/2011/04/110412-most-dangerous-nuclear-plant-armenia/> ).

After the accident at Japanese “Fukushima” nuclear power plant, stress tests were held at the Armenian NPP vs. post-Fukushima standards with the participation of the IAEA experts. The final opinion was positive stating the risks at ANPP are controllable and are at an acceptable level.

The public knows about two emergencies having occurred at the ANPP, which didn't lead to radioactive emissions and were controllable.

First accident: On 15 October 1982, an emergency happened at ANPP, which led to the fire. The power cable network over a distance of over 20 meters on the highway was exposed to fire and got out of order, as well as the equipment was partially damaged. Serious problems arose

with the support and control of cooling regime in the power unit №1, as well as difficulties with the maintenance of the normal cooling of the power unit №2.

Near the evening of the same day, relatively controllable cooling of the first circuit was launched. The same day, on 15 October, the control of nuclear flux was recovered at 20:40, while 6 channels of source ranges were put into operation at 11:00 on 17 October.

The fuel rods were not damaged in the active zone. After having extinguished the fire, radiation background was assessed with the help of mobile equipment in the cooling period. It has been found out that the background gamma radiation hadn't actually changed in the buildings in strict-regime zones and in ANPP area as compared with the pre-emergency level.

([http://rb.mchs.gov.ru/mchs/radiation\\_accidents/m\\_other\\_accidents/1982\\_god/Avariya\\_na\\_bloke\\_1\\_Armjanskoj\\_AJES\\_SSSR](http://rb.mchs.gov.ru/mchs/radiation_accidents/m_other_accidents/1982_god/Avariya_na_bloke_1_Armjanskoj_AJES_SSSR)).

Second case: On 21 January 2017, the emergency shutdown of a 110-kilowatt substation of ANPP took place. There were frozen parts on the 110-kilowatt voltage lines. The weather got warmer and melting started, it led to a short circuit, which resulted in the decrease of the magnitude of the power station up to zero. After eliminating the emergencies of high-voltage wires, the increase in nuclear power station magnitude was kicked off in line with operational regulations. There were no deviations recorded both in radiation and nuclear safety, as Chairperson of State Committee on Nuclear Safety adjunct to RA Government Ashot Martirosyan told EcoLur. The action plan on nuclear power station lifetime extension included measures aimed at modernization of substations with 110 and 220 voltage.

**Risk of Dense Population in ANPP-impacted Zone:** The ANPP-impacted zone has been determined by the National Plan for Protection of Population In Case of Nuclear or Radiological Emergencies, which was adopted under RA governmental resolution № 2328-N on 22 December 2005 (<http://www.arlis.am/DocumentView.aspx?docid=22060>).

Under the plan, the preventative safety measures are envisaged within the radius of 5 km from the ANPP, while the zone of planning urgent measures is envisaged within the radius of 5-10 km from the ANPP. Under the set criteria, at least 25 communities find themselves in the impacted zone – Armavir, Metsamor, Arshaluys, Aknalitch, Aratashen, Aghavnatut, Aragats, Artashar, Arevik, Yeghegnut, Zartonq, Horonq, Tsaghkalanj, Tsiatsan, Hovtamej, Astagh, Mayisyan, Mrgashat, Noravan, Zartonq, Taronik and Ferik, as well as Aragatsotn, Nor Amanos and Nor Yedessia communities in Aragatsotn Region.

*The governmental resolutions related to ANPP don't lay down affected communities, which means their status hasn't been determined, while the local population won't be able to appeal any governmental resolution, for example, in court. Uncertainty is also visible, because such American organizations, as the PeaceCorp, for example, doesn't allow its employees to settle in the territory of Armavir or Metsamor. Currently the local NGOs and population are raising the issue of official recognition of ANPP-affected community status in those communities located within a radius of 10 km from the ANPP.*

## **Risks of ANPP Lifetime Extension and Political Level of Decision-Making**

At the beginning of the 2000's, the EU was running negotiations with the Armenian government on the shutdown of both power units of ANPP and promised to allot 200 million Euros. As a result of the negotiations run with the EU, the Armenian Government adopted resolution №1637-N as of 12 October 2006 on opening a special account for decommissioning of Armenian NPP.

On 29 November 2006, with the protocol resolution of the Armenian Government № 48 the Strategy on decommissioning of the Armenian NPP was adopted, which envisaged to launch the works in 2016 when ANPP would presumably have its technical resources exhausted. Nevertheless, it hasn't been performed.

The government has all the time delayed the consideration of the decommissioning of the operating power units of Armenian NPP. Only in 2017 the draft governmental resolution was developed on the shutdown of the first power unit of ANPP, which has been decommissioned since 1989 (See RA draft law “On Decommissioning First Power Unit of “Armenian Nuclear Power Station” CJSC <https://www.e-draft.am/projects/272/about> ).

What about the currently operating second power unit, its lifetime was expended by 2026 with the governmental protocol resolution dated on 27 March 2014. One of the reasons is that ANPP secures 35-38% of all electricity production in the country and is fundamental in the daily load schedule of electricity production and consumption. Another reason is the interference of “RosAtom” State Russian Corporation, which is currently controlling the works on the second power unit lifetime extension. Below are a number of the governmental resolutions ensuring the agreements reached between Armenia and Russia:

1. In December 2014, an agreement was signed between the Government of the Russian Federation and the Government of the Republic of Armenia on the cooperation for the lifetime extension of the second power unit of the Armenian Nuclear Power Plant.

2. In February 2015, an agreement on allotting an export loan for to fund the works on the power unit lifetime extension of ANPP was signed. In June 2015, “RosAtom Service” JSC and “ANPP” CJSC signed a contract on performing works, supply and provision of services for the lifetime extension of the second power unit of the Armenian Nuclear Power Plant. The financial allocations are made by the Russian Federation through crediting. (see <http://armeniannpp.am/ru/about-us/history.html>).

The issue of ANPP power unit lifetime extension is directly connected with the construction of the new power unit of ANPP. RA Law “On Construction of New Power Unit(s) in the Republic of Armenia” was adopted on 27.10.2009. <http://parliament.am/legislation.php?sel=show&ID=3708&lang=arm> This law was left on the paper because of the absence of own financial funds and insufficient investments. Besides, later it was found out that the projected capacity of 1060 MW was not compatible with the energetic system of Armenia, where the most load in the winter season makes up 1240 MW taking into consideration all the sources of the electricity – thermal power plants and hydropower plants. Currently, this law has been amended, where the projected capacity has been reduced twice. Currently, the Program of the Armenian Government for 2017-2022 doesn't lay down anything about the construction of new ANPP (<http://www.gov.am/files/docs/2220.pdf>).



Thus, the construction of the new power unit was urgently replaced with the decision on the lifetime extension of the second power unit of the ANPP.

*The risks and problems of safety during the lifetime extension of ANPP were not discussed with the stakeholders, local population and the environmental impact assessment of environment and health hadn't been carried out.*

**Risks of Electric Power Systems for ANPP:** Director of "ENTEX" LLC Spartak Hakobyan, who used to be the chief engineer of "ArmEnerg" state enterprise. He thinks if not to secure the sustainability of the synchronous works of ANPP and electric power systems, a very hazardous asynchronous regime may arise, which may jeopardize not only the whole energetic system, but also ANPP operating in its system.

It should be added that the urgent topic of the modernization of the electric power system by "Electrical Networks of Armenia" CJSC (ENA) hasn't been solved because of a number of financial problems. In 2015 the ENA accrued debts for the provided electricity to a number of companies, including, ANPP. The public thinks that the financial problems have arisen due to high-level corruption risks and the government has vested the responsibility for the accumulated debts on the shoulders of tax payers. Currently, 100% owner of the shares of "Electrical Networks of Armenia" CJSC is "Tashir" Group Company owned by Russian tycoon of Armenian origin Samvel Karapetyan. He signed the contract on the purchase of the shares in 2016 with the ex-owner of ENA – INTER RAO UES. Currently, the Asian Development Bank (ADB) approved an \$80 million loan to Electric Networks of Armenia CJSC. <http://www.ena.am/news.aspx?kind=0&hid=357&lang=2>

#### New Governmental Resolutions in Nuclear Energy Sector in Armenia

In 2017, the Armenian Government developed several documents on nuclear energy sector and ANPP.

Prospecting of radioactive raw materials in Armenia: the Armenian Government again intends to deal with the prospecting of radioactive raw materials. On 28 September 2017 the Armenian Government adopted resolution №1212 - N "On Establishing Procedure of Preparation of Documentation Package and Financial and Technical Requirements Posed to Qualifications of Tender Participants on Receiving Soil Management Permit for Geological Prospecting for the Purpose of Exploring Radioactive Raw Materials" (<https://www.e-gov.am/gov-decrees/item/29307/>), on 28 September 2017 it adopted resolution № 1190-N "On Establishing Preliminary Form of Exemplary Sample of Contract To Be Signed between Competent Body and Person Having Won the Competition in Provision of Soil Management Permit for Geological Prospecting for the Purpose of Exploring Radioactive Raw Materials" (<https://www.e-gov.am/gov-decrees/item/29277/>), and 28 September 2017 it adopted its resolution № 1199-N "On Establishing Procedure of Activities of Competition Committee for Provision of Soil Management Permit for Geological Prospecting for the Purpose of Exploring Radioactive Raw Materials" (<https://www.e-gov.am/gov-decrees/item/29296/>).

Still in 2008, the Armenian Government together with Russia established "Armenian-Russian Mining Company" specifically for the additional prospecting of uranium mines. The wave of protest demonstrations in Syunik Region, where the company launched its works, suspended the

activities of the company, while the government stated that Armenia doesn't have perspective uranium mines. Now the same prospecting for uranium takes places, which is called in another way. *Thus, the Armenian Government is demonstrating inconsistencies in regard to its approach to the reserves of radioactive raw materials and holds extremely controversial positions neglecting the risks of mining radioactive raw materials in regard to health and safety of the environment.*

### **Strategy on Safe Management of Radioactive Wastes and Spent Nuclear Fuel**

On 5 October 2017, the Armenian Government adopted its protocol resolution № 42-12 “On Approving the Strategy on Safe Management of Radioactive Wastes and Spent Nuclear Fuel in the Republic of Armenia” (<https://www.e-gov.am/protocols/item/810/>). The need for the new strategy is substantiated with the fact that ANPP lifetime was extended by 2026, and, in this regard, new solutions are needed relating the safe management of radioactive wastes and spent nuclear fuel.

According to the rationale of the document, the wastes used to be transported to Russia for their storage and further processing. Nevertheless, because of transportation blockade of Armenia from the moment of the collapse of the Soviet Union in 1991, the transportation of the wastes became technically non-feasible. Before the rehabilitation and relaunch of ANPP in 1995, 600 units of the spent nuclear fuel was accumulated in the territory of the plant in 1995. In 2000, French “Framatom” Company constructed a burial site for long-term storage of dry wastes, where 616 units of spent nuclear fuel were delivered up to 2005. Each year the plant generates 80 units of the spent nuclear fuel.

In 2008, the first part of the second line was put into operation for the storage of 672 units of spent nuclear fuel, which was full already in 2015. In the same year, the second line of the second part was put into operation also designed for 672 units of spent nuclear fuel. By 2034, it's planned to construct the third line for 168 units and, at the same time, the fourth line for 593 units of the spent nuclear fuel. There is another problem linked with the spent nuclear fuel - longer-term storage of the spent nuclear fuel: since 2009 ANPP has been using fuel resistant to vibration, which is kept in the pools for 10-12 years.

One of the main clauses in the strategy is the selection of the platform for the construction of a new burial site for ANPP radioactive wastes with an option for its further expansion. For this purpose, it's proposed to examine the options of burying high-level radwaste in deep geological formations and hold relevant geological and hydrological investigations.

Taking into consideration the need for the safety of the management of radioactive wastes and spent nuclear fuel, probable risks and impact of spent nuclear fuel and radioactive wastes on the local population, their health and environment, the dense population in ANPP impacted zone, interested society and the representatives of the local population in the ANPP-impacted zone it's proposed:

1. To ensure the participation of the interested society and the community residents located in a diameter of 10 km from ANPP in the public hearings of the strategic concept on the safe management of radioactive wastes and spent nuclear fuel to ensure the necessary level of confidence and a constructive dialogue.

2. To recognize all the communities located in a diameter of 10 km from ANPP as affected communities and to confirm their status.
3. To specifically include the results of the public hearings in the strategic concept on the safe management of radioactive wastes and spent nuclear fuel in each stage of the taken measures.
4. To determine the criteria in the process of searching a platform for the burial of radioactive wastes and spent nuclear fuel to ensure geological protective component, as well as safety criteria taking into consideration the available risks, earthquake, landslides, groundwater and surface water, drainage and other factors, which affect the geological and morphological environment.
5. To present the assessment of the demand for ensuring water for the safe management of nuclear fuel. To give the assessment to the sustainable use of water resources, Metsamor River and water wells used for the management of the spent nuclear fuel and ANPP operation, to determine new potential springs for water supply.
6. To develop and adopt assessment and methodology for the safety requirements of radioactive wastes and spent nuclear fuel based on the adopted criteria and assessment, as well as for the environmental impact assessment and expertise.
7. To carry out environmental impact assessment of the measures prescribed in the strategic concept on the safe management of radioactive wastes and spent nuclear fuel.
8. To hold public hearings on the safety of the second power unit of the ANPP, the operation lifetime of which has been extended to 2026 and to present the experience of those countries, where there are old reactor lifetime extension programs.
9. To ensure the transparency of discussed topics, plans, and measures.
10. To carry out daily monitoring of soil, water, air and plants for the determination of radioactive background in a diameter of 10 km from ANPP and the burial site and to daily publish the findings on the official website of RA Ministry for Energy Infrastructures and Natural Resources.
11. To carry out courses in ANPP affected communities on how to protect from possible accidents, to disseminate info sheets among the resident, necessary facilities, and to publish the measures on how to protect from the accidents on the official websites of RA Ministry for Energy Infrastructures and Natural Resources and RA Ministry for Emergency States in visible and easily-navigable sections.”

## **Conclusion**

**The sector of nuclear energy in Armenia needs complex decisions based on the protection of interests of population, national and regional safety. In the resolutions and strategies on the development of nuclear strategy sector in Armenia, the government only proposes partial assessment of risks and partial outcomes. But the alternative decisions on each of the aforementioned problems are missing. There are no assessments of energy safety for a long-term period, the experience of the countries having refused from the operation of NPPs and not having carbon resources have not been taken into consideration. There are no economic assessments on the feasibility of replacing nuclear energy with alternative energy taking into consideration all the factors - financial, human, economic and natural resources. The participation of the**

**EU in increasing the safety of ANPP should be expanded, but not only in the development of risk assessment in ANPP operation, but also in the process of withdrawing ANPP out of operation and international experience should be referred to for this purpose. And only after receiving these assessments and having visions of probable alternatives, a common concept of nuclear safety in energetic sector of Armenia should be developed in exchange for the Development Strategy in this sector.**

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