# JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

# SIXTH NATIONAL REPORT

## 2017

**República Argentina**

*Argentine Republic*

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# JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

## SIXTH NATIONAL REPORT

On December 19, 1997, during the 41st Session of the General Conference of IAEA, the Argentine Republic executed the JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT, agreed upon in Vienna during the Diplomatic Conference conducted on September 15, 1997. On July 6, 2000, the Argentine Congress enacted Law No. 25279 therefore ratifying the terms of the Joint Convention which entered into force on June 18, 2001.

The present National Report was prepared in accordance with Section 32 of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management to be submitted in compliance with Section 30 of the afore mentioned Convention.



JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

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# ACRONYMS

| | |
|---|---|
| **AECL** | **Atomic Energy of Canada Ltd.** |
| **AGE** | **Ezeiza Radioactive Waste Management Area** |
| **ABACC** | **Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials** |
| **ALARA** | **As Low As Reasonably Achievable** |
| **ANSI** | **American National Standards Institute** |
| **APS** | **Probabilistic Safety Analysis** |
| **ARN** | **Nuclear Regulatory Authority** |
| **ASECQ** | **Spent Fuel Dry Storage System** |
| **ASME** | **American Society of Mechanical Engineering** |
| **BSI** | **British Standard Institute** |
| **CAB** | **Bariloche Atomic Centre** |
| **CAC** | **Constituyentes Atomic Centre** |
| **CAE** | **Ezeiza Atomic Centre** |
| **CALPIR** | **Advisory Committee for the Licensing of Personnel of Type I Installations** |
| **CANDU** | **Canadian Deuterium Uranium Reactor** |
| **CAREM-25** | **Argentine 25-MWe SMR** |
| **CCPP** | **Cementing and Compacting Pilot Plant** |
| **CFR** | **Code of Federal Regulations** |
| **CMFSR** | **San Rafael Mining and Milling Complex** |
| **CNA I** | **Atucha Nuclear Power Plant – Unit I** |
| **CNA II** | **Atucha Nuclear Power Plant – Unit II** |
| **CNE** | **Embalse Nuclear Power Plant** |
| **CNEA** | **Argentine Atomic Energy Commission** |
| **CSA** | **Canadian Standards Association** |
| **DCMFEI** | **Central Storageof Special Irradiated Fissionable Material (MTR SF Storage)** |
| **DIN** | **German Standards Institute** |
| **DLM** | **Master Logical Diagram** |
| **DOE** | **US Department of Energy** |
| **ECCS** | **Emergency Core Cooling System** |
| **EPS** | **Emergency Power System** |
| **ESC** | **Structures, Systems and Components** |
| **EWS** | **Emergency Water System** |
| **ENREN** | **Nuclear Regulatory Entity (Former Nuclear Regulatory Body)** |
| **FACIRI** | **Research Reactors Irradiated Fuel Storage Facility** |
| **GRR** | **Radioactive Waste Management** |
| **HEU** | **High Enriched Uranium** |
| **HLW** | **High Level Waste** |
| **ICRP** | **International Commission on Radiological Protection** |
| **ILW** | **Intermediate Level Waste** |
| **ISO** | **International Standard Organization** |
| **LOOP** | **Loss of Offsite Power** |
| **LABCAR** | **Radioactive Waste Characterization Lab** |
| **LTS** | **Long Term Storage** |
| **LUE** | **Enriched Uranium Laboratory** |
| **LLW** | **Low Level Waste** |
| **LILW** | **Low and Intermediate Level Waste** |
| **LWR** | **Light Water Reactor** |
| **MCNP** | **Monte Carlo Neutron Particle Code– Calculation Code** |
| **MDG** | **Mobile Diesel Generator** |
| **MTR** | **Material Testing Reactor** |
| **NASA** | **Nuclear Power Plant National Operator(Nucleoléctrica Argentina)** |
| **NEWMDB** | **Net Enabled Waste Management** |
| **NPPs** | **Nuclear Power Plants** |
| **NORM** | **Natural Occurring Radioactive Material** |
| **NUSS** | **IAEA Nuclear Safety Standards** |
| **IAEA** | **International Atomic Energy Agency** |
| **OSART** | **Operational Safety Review Team** |
| **PHWR** | **Pressurized Heavy Water Reactor** |

| | |
|---|---|
| **PNGRR** | **Radioactive Waste Management National Program** |
| **PEGRR** | **Radioactive Waste Management Strategic Plan** |
| **PFS** | **Sealed Source Production Plant** |
| **PPMo99** | **Molybdenum-99 Production Plant** |
| **PPR** | **Radioisotope Production Plant** |
| **PPRS** | **Radiological Protection and Safety Program** |
| **PPUO2** | **Uranium Production Plant** |
| **PRAMU** | **Uranium Mining Environmental Restoration Project** |
| **PSR** | **Periodic Safety Review** |
| **PTARR** | **Treatment and Conditioning Plant of Radioactive Waste** |
| **RA-0** | **Argentine Reactor 0** |
| **RA-1** | **Argentine Reactor 1** |
| **RA-2** | **Argentine Reactor2** |
| **RA-3** | **Argentine Reactor 3** |
| **RA-6** | **Argentine Reactor 6** |
| **RA-10** | **Argentine Reactor 10** |
| **RADWASS** | **IAEA Radioactive Waste Safety Standards** |
| **RPV** | **Reactor Pressure Vessel** |
| **RW** | **Radioactive Waste** |
| **RRII** | **Research Reactors** |
| **SAC** | **Quality Assurance System** |
| **SBO** | **Station Blackout** |
| **SG** | **Steam Generators** |
| **SHS** | **Second Heat Sink** |
| **SIEN** | **Nuclear Emergency Response System** |
| **SF** | **Spent Fuel** |
| **SIER** | **Radiological Emergency System** |
| **SIFEM** | **Emergency Federal System** |
| **TCV** | **Volume Control Tank** |
| **ULE** | **Low Enriched Uranium** |
| **UFA** | **Spent Fuel Storage Building (CNA II)** |
| **VLLW** | **Very Low Level Waste** |
| **WANO** | **World Association of Nuclear Operators** |

## GLOSSARY*

- *"closure"* means the completion of all operations at some time after the emplacement of spent fuel or radioactive waste in a disposal facility. This includes the final engineering or other work required to bring the facility to a condition that will be safe in the long term;

- *"decommissioning"* means all steps leading to the release of a nuclear facility, other than a disposal facility, from regulatory control. These steps include the processes of decontamination and dismantling;

- *"discharges"* means planned and controlled releases into the environment, as a legitimate practice, within limits authorized by the regulatory body, of liquid or gaseous radioactive materials that originate from regulated nuclear facilities during normal operation;

- *"disposal"* means the emplacement of spent fuel or radioactive waste in an appropriate facility without the intention of retrieval;

- *"disposable waste"* means those materials that cannot be dispersed in the environment due to its activity concentration and or total activity and therefore require treatment, conditioning and final disposal;

- *"exempt waste"* means those radioactive materials that can be removed from the regulatory control due to its activity concentration and or total activity, after a limited storage period for decaying;

- *"historical waste"* means those radioactive waste treated, conditioned or finally disposed applying criteria beyond the current regulatory frame and that require its re-assay;

- *"license"* means any authorization, permission or certification granted by a regulatory body to carry out any activity related to spent fuel or radioactive waste management;

- *"nuclear facility"* means a civilian facility and its associated land, buildings and equipment in which radioactive materials are produced, processed, used, handled, stored or disposed on such a scale that it is required to take safety into consideration;

- *"operating lifetime"* means the period during which a spent fuel or a radioactive waste management facility is used for its intended purpose. In the case of a disposal facility, the period begins when spent fuel or radioactive waste is first emplaced in the facility and ends upon closure of the facility;

- *"radioactive waste"* means radioactive material in gaseous, liquid or solid form for which no further use is foreseen by the Contracting Party or by a natural or legal person whose decision is accepted by the Contracting Party, and which is controlled as radioactive waste by a regulatory body under the legislative and regulatory framework of the Contracting Party;

- *"radioactive waste management"* means all activities, including decommissioning activities, that relate to the handling, pre-treatment, treatment, conditioning, storage, or disposal of radioactive waste, excluding off-site transportation. It may also involve discharges;

- *"radioactive waste management facility"* means any facility or installation whose primary purpose is radioactive waste management, including a nuclear facility in the process of being decommissioned only if it is designated by the Contracting Party as a radioactive waste management facility;

- *"regulatory body"* means anybody or bodies given the legal authority by the Contracting Party to regulate any aspect of the safety of spent fuel or radioactive waste management,including the granting of licenses;

- *"reprocessing"* means a process or operation, the purpose of which is to extract radioactive isotopes from spent fuel for further use;

- *"sealed source"* means radioactive material that is permanently sealed in a capsule or closely bonded and in a solid form, excluding reactor fuel elements;

- *"spent fuel"* means nuclear fuel that has been irradiated in and permanently removed from a reactor core;

- *"spent fuel management"* means all activities related to the handling or storage of spent fuel, excluding off-site transportation. It may also involve discharges;

- *"spent fuel management facility"* means any facility or installation, the primary purpose of which is spent fuel management;

- *"State of destination"* means a State to which a transboundary movement is planned or takes place;

- *"State of origin"* means a State from which a transboundary movement is planned to be initiated or is initiated;

- *"State of transit"* means any State, other than a State of origin or a State of destination, through whose territory a transboundary movement is planned or takes place;

- *"storage"* means the holding of spent fuel or of radioactive waste in a facility that provides for its containment, with the intention of retrieval;

- *"transboundary movement"* means any shipment of spent fuel or of radioactive waste from a State of origin to a State of destination.

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# JOINT CONVENTION ON THE SAFETY OF SPENT FUEL MANAGEMENT AND ON THE SAFETY OF RADIOACTIVE WASTE MANAGEMENT

# SIXTH NATIONAL REPORT

## SECTION A INTRODUCTION

### A.1 Summary of the Main Topics of the Report

The structure of the Fifth National Report complies with the *Guidelines Regarding the Form and Structure of National Reports*(INFCIRC/604/Rev.3).

**Section A** describes the scope of the nuclear activity developed in Argentina since 1950 as well as the legal and regulatory framework. It also makes reference to the *Strategic Plan for Radioactive Waste Management (PEGRR, by its Spanish acronym)*, which refers to the safety of Spent Fuel Management and Radioactive Waste Management.

**Section B** sets out the policies for the safety of Spent Fuel Management and Radioactive Waste Management and includes a description of national practices in connection with said policies.

**Section C** lays down the scope of application for Argentina of the terms of the Joint Convention, regarding spent fuels, naturally occurring radioactive materials (NORM) and disused sealed sources. The content of this section does not reflect modifications with respect to the declarations in the prior National Reports.

**Section D** describes the facilities destined for spent fuel management and radioactive waste management, including their respective inventories. Discharges and pertinent doses are included in Section F.

**Section E** explains the Legislative as well as the Regulatory framework. Special emphasis is given to the implementation of safety measures and regulations. The structure and responsibilities of the Regulatory Body are also described.

**Section F** explains the obligations foreseen with reference to the responsibilities of the license holder, human and financial resources, quality assurance, operational radiation protection, emergency preparedness and decommissioning.

**Section G** deals with the safety of spent fuel management and the obligations defined by the Joint Convention regarding:

- General safety requirements
- Existing facilities
- Siting of projected facilities
- Design and construction of facilities

- Safety Assessment of facilities
- Operation of facilities
- Final disposal of spent fuel

This section includes a brief description of the facilities, their condition and the actions taken or foreseen to improve safety.

**Section H** specifies the degree of compliance with the responsibilities foreseen for radioactive waste management on the following matters:

- General safety requirements
- Existing facilities and past practices
- Siting of projected facilities
- Design and construction of facilities
- Safety Assessment of facilities
- Operation of facilities
- Institutional measures after closure

This section includes a brief description of the facilities, their condition and the actions taken to improve safety.

In this Section,a summarized description of the situation of Uranium mining wastehas also been included.

Ingeneral, the contents of Section G also apply to Section H equivalent responsibilities, except for those cases where the latter are specific.

**Section I** covers the obligations and experiences inherent to transboundary movement provided in article 27 of the Joint Convention.

**Section J**makes reference to disused sealed sources provided in article 28 of the Joint Convention.

**Section K** describes the activities planned to improve safety and specifies the measures that are foreseen to be adopted in the future.

**Section L** includes the Annex containing therelevant Laws, and R&D activities related to SF & RW.

## A.2 Overview

The present National Report describes the actions taken in Argentina on the safety of spent fuel (SF) management and on the safety of radioactive waste (RW) management, in order to provide evidence of the fulfilment of the obligations derived from the Joint Convention. To facilitate the reading and a better understanding, it has been decided to include a summary of those parts of the prior National Reports that are considered necessary in order to comply with this objective.

Nuclear energy began its development to be used for different applications in Argentina during 1950, when the Argentine Atomic Energy Commission (CNEA) was created. Initially research and development activities were conducted in basic areas.In the following years, progress has been made with the development of nuclear technology, the operation of relevant facilities working on the production of radioisotopes for medical and industrial applications and the performance of tasks in connection with the nuclear fuel cycle, including mining and uranium processing activities, manufacturing of fuel elements for research and power reactors, production and generation of nuclear power, production of heavy water and the operation of two nuclear power plants. In the past, reprocessing programs were undertakenat demonstrative scale.

As a result of these activities and others performed in the nuclear field by other private and public entities, different types of radioactive waste have been generated, which are managed by applying the legal and regulatory provisions in force, in agreement with the obligations derived from the Joint Convention.

The legal framework applicable to radioactive waste management integrates with the provisions of the National Constitution and with the legislation adopted by the National Congress by Law No. 24804[1] which regulates the Nuclear Activity and Law No. 25018[2] which determines the Radioactive Waste Management Regime along with Law No. 25279 which approved the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, as well as different laws related to the nuclear activity in accordance with treaties, conventions, agreements and international conventions.

In addition, accordingly with the Federal Government adopted in Argentina, a number of provincial and municipal regulations are in force with a significant impact on radioactive waste management activities in the country.

The National LawNo. 24804 National Law of Nuclear Activity assigns CNEA the state ownership of spent fuel and the responsibility for the management of radioactive waste.

It also sets forth that CNEA shall determine the way in which nuclear power plants and any other significant facilities (Type I Facilities) are decommissioned.

Furthermore, the same Act creates the *Nuclear Regulatory Authority* (ARN), successor to the Nuclear Regulatory Entity (ENREN), which is empowered to regulate and supervise the nuclear activity in all matters related to radiological and nuclear safety, security and safeguards. Likewise, it authorizes the ARN to supervise the use of nuclear materials, the licensing of persons and facilities, and the verification of national and international safeguards.

Likewise, Law No. 25018 appoints CNEA as the implementing authority to perform all the activities related to radioactive waste management and sets up the *National Radioactive*

[1] Law No. 24804 National Law of Nuclear Activity

[2]Law No. 25018 Radioactive Waste Management Regime

*Waste Management Program* (PNGRR), responsible for the compliance with the *Specific Strategic Plan* (PEGRR).

For a better understanding of the contents of this National Report, the definition of *radioactive waste*has been specified, understanding that it includes:

- **exempt radioactive materials (exemption/clearance)**: radioactive materials that on account of their concentration of radioactivity and/or total radioactivity may be released from regulatory control.

- **discharges**: liquid and gaseous effluents containing radioactive materials that originate from the normal operation of a facility and that due to their total activity may be discharged into the environment in a planned and controlled manner.

- **radioactive waste**: materials that on account of their concentration of activity and/or total activity, cannot be dispersed into the environment and therefore, require treatment, conditioning and final disposal.

## A.3 National Program for Spent Fuel and Radioactive Waste Management

As has already been mentioned, as from September 23rd1998 CNEA was appointed through Law No. 25018as the application authority for matters related to radioactive waste management and determined the obligation to develop a *Radioactive Waste ManagementStrategic Plan (PEGRR)*, subject to the approval of the National Congress.

This PEGRR outlines the commitments that the National Government must assume for the safety of Spent Fuel Management and Radioactive Waste Management, ensuring public health, the protection of the environment and the rights of future generations.

The last update of the PEGRRincludes the Fourth Nuclear Power Plant construction and its commercial start-up, the life extension of Embalse Nuclear Power Plant, Atucha I Nuclear Power Plant, as well as the start-up of CAREM Prototype Reactor. These activities were declared to be a matter of national interest in the provisions of Law No. 26566[3].

Likewise, the Plan includes the relevant amendments to Atucha NPP, Units I and II, current research and production and reactors in operation and those to be erected, the facilities of the ARGENTINE ATOMIC ENERGY COMMISSION and the Argentine corporationsCONUAR S. A. and DIOXITEK S. A.; as well as the changes related to URANIUM MINING ENVIRONMENTAL RESTORATION PROJECT (PRAMU) and PILCANIYEU TECHNOLOGICAL CENTRE and so on.

PEGRR establishes the mechanisms to manage in a safe manner all waste originated from the development of practices and also those generated in decontamination activities

[3]Law N° 26566 Nuclear Activity (*Activities that enable CNE life extension)*

and decommissioning of nuclear facilitiesand radioactive installations. Moreover, it proposes research and development plans associated with technologies elected for every management stage, suitable human resource training, availability of necessary funds in furtherance of the Plan and related social communication activities.

This document outlines technological solutions related to the state-of-the-art technology which enableradioactive waste and spent fuels generated in Argentina to be managed efficiently.

Although spent fuel is considered a potential energetic resource due to its fissile material content, the decision about including spent fuel management reprocessing has been postponed until 2030.

Every activity included in PEGRR that may imply a radiological risk is regulated by ARN. Standards and regulations issued by ARN are based on radiologic and nuclear safety criteria consistent with those internationally adopted.

On the other hand, PEGRR is encompassed within the environmental policy of our country that, in the case of waste management, takes into account the concurrent powers of the Nation, the Provinces and the Autonomous City of Buenos Aires. In this sense, Section 4 of Law No. 25018 sets forth that CNEA shall coordinate with the Provinces and the Autonomous City of Buenos Aires the enforcement of the Radioactive Waste Management System, in order to make it possible to manageradioactive waste produced in these places and set up cooperation and advisory systems for the competent organizations.

With reference to the sites where the future facilities for the final disposal of radioactive waste shall be located, Law No. 24804 sets forth that CNEA, in its role of Responsible Organization, shall propose the potential sites that may result from the studies performed. These sites will require the approval both of ARN from the radiological and nuclear safety point of view and of a Law issued by the Provincial Government where the proposed repository would be placed.

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# SECTION B POLICIES AND PRACTICES

## B.1 Spent Fuel Management Policy

In Argentina, spent fuel is not considered radioactive waste. The Government exercises state ownership of special radioactive fission material contained in spent fuel from any origin: nuclear power plants and experimental, research and/or production reactors. (Section 2, Law No. 24804).

In this sense, the decision whether to reuse or not fissile material contained in spent fuel has to be adopted before 2030. At such time, the installation of the underground laboratory must have been started, which allows a deep geological repository to be designed and constructed. Said repository must be operative by 2060 (Strategic Plan – Law No. 25018).

With regard to spent fuel generated in the operation of research reactors or radioisotope production reactors and for which neither recovery nor further use are envisaged, the strategy considers two alternatives:

- Shipping to the country where the nuclear material was originally enriched, if possible.
- Wet interim storage. Afterwards, treatment and conditioning for final disposal.

Here we may underline that due to the adhesion of Argentina to the RERTR Program (Reduced Enrichment for Research and Test Reactors) in December 2000, July 2006 and November 2007, all spent fuel from research and production reactors containing Highly Enriched Uranium (HEU) were exported to the Department of Energy of the USA (USDOE) in the frame of the *Spent Nuclear Fuels from Foreign Research Reactors Acceptance Program.*

## B.2 Spent Fuel Management Practice

The practice adopted in Argentina with reference to management of spent fuel generated in power reactors has been wet storage during the time necessary to allow for sufficient decay of the fission products and later interim dry storage.

In the case of CNE nuclear power plant, the spent fuel is stored in pools at the facility for a period of at least six (6) years and is subsequently transferred to dry storage (in concrete silos ASECQ, described in Section G) until it is disposed of in a repository.

At CNA I, spent fuel is subject to wet storage at the power plant itself. Its capacity was enough to store spent fuel in CNA I until 2015. In 2012 the Spent Fuel Dry Storage System (ASECQ) started which consists of building an annex to CNA I. This building will have vertical dry silos for interim storage of 2754 SF and will be constructed with the aim of allowing the transfer from the pools building of those more decayed SF (see G.4.1). However, by taking into account that the abovementioned could not be finished before 2015, an alternative project started to transfer 620 spent fuels —with power lower than 6000 MWd/TonU— to Unit II pools, thus enabling storage until ASECQ finishes, which is

foreseen by the first quarter of 2018 (see G.4.1).

At CNA II, the SF to be produced during its commercial operation will be subject to wet storage in pools within the same NPP (see G.2.2).

Spent fuel generated by the operation of research and radioisotope production reactors is stored in a pool at the respective reactor site, until the fission products decay sufficiently. Spent fuel generated in reactor RA-3 is later transferred to a new wet spent fuel storage facility, Research Reactors Irradiated Fuel Storage Facility (FACIRI) which replaced the Central Deposit for Special Irradiated Fissionable Material (DCMFEI), which includes safety improvements.

ARN granted FACIRI the start up license on 5 September 2014 and the first fuel element was transferred from RA-3 on 9 September 2014. FACIRI has the operating license granted by the ARN on 29 November 2016; it has 608 storage lots and a capacity for 25 to 30 years more of operating RA-3 reactor which releases an average of 13 fuel per year. Moreover, it can contain spent fuels of other operating research reactors in Argentina.

Currently the DCMFEI does not have any more fuels from RA-3 as the fuels are directly stored in FACIRI. However, 149 fuel assemblies are still stored in the Central Storage of Special Irradiated Fissionable Material (DCMFEI). These assemblies will be transferred to FACIRI during 2017-2018.

Currently, all spent fuel from research and production reactors containing Highly Enriched Uranium (HEU) provided by the USA have been returned to the Country of origin.

For the remaining low-enriched SF (20%), as mentioned above, there is a first extended wet storage, where it will stay until its return to the country of origin, its reprocessing or final disposal in a deep geological repository are defined.

Beyond the decision to be adopted, the Strategic Plan foresees the development of research and development activities related to the final disposal of spent fuel, or the liquids from the reprocessing containing fission products in case this option is chosen.

## B.3 Radioactive Waste Management Policy

The main guidelines of the policy to be applied to radioactive waste management are:

The radioactive waste generated from all nuclear applications performed in the country, including waste arising from the decommissioning of related facilities, will be managed safely, ensuring the protection and the rights of present and future generations and the environment.

- Radioactive waste generated in all of the nuclear facilities developed in Argentina, including waste derived from decommissioning of associated facilities will be managed safely, guaranteeing the protection and rights of present and future generations as well as of the environment.

- The responsibility from radioactive waste management is born by the State through the Argentine Atomic Energy Commission where the generator will be responsible from the conditioning and safe storage of waste generated by the facility that operates until it is transferred to CNEA.

- The PEGRR that will be authorized periodically reviewed and audited by the National Congress.

- The sustainable procedure to obtain and to manage the necessary financial resources in order to comply with the obligations arising from the performance of the assigned responsibilities with reference to this matter, considering that many of them imply costs deferred in time.

- A system for registry and preservation of information to ensure complete tracking of inventories of radioactive waste generated and to be generated from all nuclear activities in the country.

- A public communication and information program will be implemented.

In agreement with this policy, the following additional factors have been taken into account:

- The main responsibility for radioactive waste management lies in the National State through the *Argentine Atomic Energy Commission (CNEA*).
- The regulation and supervision of radioactive waste management are duties inherent to the National State performed by the *Nuclear Regulatory Authority (ARN).*
- The implementation of the policy on this matter will follow the guidelines of the *National Radioactive Waste Management Program*, with the responsibilities specified in Law No. 25018, handling the radioactive waste management in the Republic of Argentina with an integrated perspective.

In order to achieve its objectives, this *National Radioactive Waste Management Program* shall ensure the following:

- Identification and assessment of accumulated and projected waste inventories
- Adoption of the appropriate technological solutions for the safe management of such waste, with scientific-technological support
- Definition of responsibilities and specification of obligations, and interrelations of the involved parties, from the generation of waste to the final stage of management
- Definition of the required facilities for final disposal
- Communication of its activities to the public and provision of the required information
- Assessment of the costs associated to all these activities, determination of the financial sources and the financial and management methods

The establishment of the PEGRR implies the definition of the treatment methodology and the final disposal technological systems for the different types of waste. The review every three years of the *Strategic Plan* is conducted as set forth in the provisions of the Law and provides the opportunity to introduce the modifications originated by management optimisation in its technological aspects derived from scientific breakthroughs, or from the development of innovative technologies and eventual changes in the strategic definitions relative to spent fuel treatment.

The communication and information program intended for the public will provide the required information so that the population may value the scope of the proposed plans as well as their benefits, providing the adequate environment for public participation in subjects of their concern.

## B.4 Radioactive Waste Management Practice - Criteria

The following criteria are applied to radioactive waste management:

- The radioactive materials that on account of their activity concentration and/or total activity may be considered exempt will be released from regulatory control.
- The systems to limit discharges of liquid and gaseous radioactive materials released into the environment in compliance with the authorized discharge limitations determined for each facility and significant radionuclide.
- Those radioactive materials that on account of their activity concentration and/or total activity cannot be released into the environment will be treated and conditioned for their final disposal.

Regarding the first case, the Nuclear Regulatory Authority sets the exemption criteria that radioactive materials may be exempt in case the resulting effective dose for individuals most exposed does not exceed 10 µSv/year.

The regulatory guidelines AR6 set general exemption levels for 300 radionuclides in values or concentration levels corresponding to those stated in the Safety Collection GSR Part 3, Annex I, Chart I-I: Radiation Protection and the Safety of Radiation Sources: International Basic Safety Standards (Interim Edition), for moderate quantities of material.

Moreover, by means of a Resolution, the ARN adopted a number of general values for clearance which correspond to the values indicated in IAEA Safety Guide No. RS-G-1.7. The Regulatory Guidelines AR8 was published in March 2011 in order to apply those values.

In the second case, the Standard AR 6.1.2, *Radioactive Effluents Limitation Standard for Type I Radioactive Facilities*, determines that in the design stage:

- The release of radioactive material to the environment should be as low as reasonably achievable.

- The effective annual dose in the critical group due to radioactive effluent discharge of each facility should not exceed 0.3 mSv.

In addition, since June 2013, ARN has established that in case of the design of a nuclear power reactor, a nuclear research reactor or a Type I radioactive facility within a site containing several facilities, discharges originated by all the facilities of the site do not exceed the annual dose in a person, equivalent to more than 0.5 mSv.

In the operating licensing process of a relevant facility, the ARN determines establish authorized discharge limits to release gaseous and liquid effluents with which the facility should comply. These annual values are understood as an operating restriction and arise from the radioactive level of each significant radionuclide during discharge. In order to achieve this, the reference is the optimized discharge level, considering an appropriate flexibility margin that guarantees the public protection without interfering with the operation of the facility.

In the Operating Licenses granted to the relevant facilities by ARN, these limits are established.

Facilities include storage and/or decay tanks for liquid effluents in order to control the effluent discharge into the environment in agreement with authorized values established in the license.

Finally, the Regulatory Standard AR 10.12.1 “Radioactive Waste Management” determines the general and particular criteria for waste generators and for those responsible for their management. This standard regulates the management of materials containing radioactive substances that on account of their nature and/or activity cannot be released into the environment.

### B.4.1 Criteria Applied to Define and Classify Radioactive Waste by Categories

The new category proposed by IAEA has recently been adopted as a classification system which entails six classes of radioactive waste, mainly based on long term safety considerations and on the disposal of radioactive waste. While the generic relationship is entailed between different classes of waste and options, the acceptance of waste for a particular disposal facility requires to be proved by means of a safety analysis.

(1) Exempt waste (EW): Waste that meets the criteria for clearance, exemption or exclusion from regulatory control for radiation protection purposes.

(2) Very short lived waste (VSLW): that waste with a very short decay period and a level higher than those exempted. Waste that can be stored for decay over a limited period of up to a few years and subsequently cleared from regulatory control according to arrangements approved by the regulatory body, for uncontrolled disposal, use or discharge. This includes waste containing very short half-lives radioisotopes often used for research and medical purposes.

(3) Very low level waste (VLLW): Waste that does not necessarily meet the criteria of EW, but that does not need a high level of containment and isolation and, therefore, is suitable for disposal in near surface landfill type facilities with limited regulatory control. Such landfill type facilities may also contain other hazardous waste. Typical waste in this class includes soil and rubble with low levels of activity concentration.

(4) Low level waste (LLW): Waste that is above clearance levels, but with limited amounts of long lived radionuclides. Such waste requires robust isolation and containment for periods of up to a few hundred years and is suitable for disposal in engineered near surface facilities. This class covers a very broad range of waste. LLW may include short lived radionuclides at higher levels of activity concentration, and also long lived radionuclides, but only at relatively low levels of activity concentration.

(5) Intermediate level waste (ILW): Waste that, because of its content, particularly of long lived radionuclides, requires a greater degree of containment and isolation than that provided by near surface disposal. However, ILW needs no provision, or only limited provision, for heat dissipation during its storage and disposal.ILW may contain long lived radionuclides, in particular, alpha emitting radionuclides that will not decay to a level of activity concentration acceptable for near surface disposal during the time for which institutional controls can be relied upon. Therefore, waste in this class requires disposal at greater depths, of the order of tens of meters to a few hundred meters.

(6) High level waste (HLW): Waste with levels of activity concentration high enough to generate significant quantities of heat by the radioactive decay process or waste with large amounts of long lived radionuclides. They should be included in insoluble matrixes such as glass or ceramic and packed in high-integrity and -durability containers. Disposal in deep, stable geological formations usually several hundred meters or more below the surface is generally the option used for disposal of HLW.

This classification is used only with the aim of providing information about radioactive waste inventories and to organize the information of this National Report. As regards the limits of content of each radioisotope, said limits will be established in accordance with safety assessment of the final disposal site once it has been selected.

### B.4.2 Origin of Radioactive Waste

The origin of radioactive waste included in each one of the categories stated in Section B.4.1 is the following:

- EXEMPT WASTE: those generated from different activities. This waste shall not be considered radioactive waste once they have been released from regulatory control.
- VERY SHORT LIVED WASTE: Solid and liquid biological waste generated from research centres, medical applications, etc., containing radioisotopes with periods of disintegration less than 100 days such as Ir-192, Tc-99m, I-131, Fe-59 which

may be released from regulatory control after being stored until they decay below the authorized limits.

- VERY LOW LEVEL WASTE: They are included in the category of waste generated in extracting operations and processing of uranium. The remains of the material are finally divided as sand after extracting the largest amount of uranium and are technically named “mill tailings”.

  Mill tailings, along with mineral not economically exploitable and ores, are known as “mining waste”. Also included in this category are contaminated soils and waste originated during the operation and decommissioning of nuclear facilities with activity levels slightly superior to those specified in the levels of exemption.

- LOW LEVEL WASTE: This waste may be classified as:

  a) Conditioned Waste: conditioned under procedures framed into a quality system, in specially designed metallic 200 L drums, safely stored in authorized facilities. These waste include:

     - Solid and liquid waste originated in NPPs in radioisotope production facilities, in isotope production and research reactors and facilities related to the fuel cycle.
     - Incompressible non-compactable waste from the operation of nuclear power plants and other nuclear facilities, conditioned directly in 200 L drums.
     - Wet solid waste (sludge) originated in the treatment of liquids from CNA I, conditioned on site with cement matrixes within 200L drums.
     - Short-lived decayed or disused sealed sources ($T_{1/2}$<5 years), conditioned in industrial drums embedded in cement matrixes.
     - Liquid and solid biological waste generated in research centres, medical applications and so on, treated and conditioned by means of specific techniques adequate to the type of waste.
     - Waste originated from decommissioning of nuclear power plants.

  b) Non-conditioned waste: safely stored, to be characterized and tested in order to define the proper treatment and conditioning in accordance with the definition of acceptance criteria for its future disposal or long term storage.

     - Spent ion exchange resins and filters used in nuclear facilities.
     - Decayed sealed sources originated from medical and industrial applications.
     - Contaminated and/or activated structural elements originated in decommissioning of nuclear facilities.
     - Organic or watery liquids originated from radioisotope production and manufacture of nuclear fuels, stored in stainless steel containers.
     - Solid wet waste. Sludge originated from fuel manufacture and spent resins coming from radioisotope production reactors or research reactors.

- INTERMEDIATE LEVEL WASTE: This kind of waste consists of alpha emitters from the experimental development of mixed oxide fuel (MOX) and other materials containing long lived isotopes as those used in medicine (Radium-226 tubes, cells

and needles, Pu-238 pacemakers, depleted-Uranium shields, etc.) and in industry (neutron sources). Resin and filters that do not comply with the limits established for low level waste are also included in this type of waste.

- HIGH LEVEL WASTE: These are fission products contained in spent fuel from the operation of nuclear power plants and spent fuel elements from research and production reactors.

### B.4.3 Practices Applied for Radioactive Waste Management

Radioactive waste management practices have been defined in the PEGRR. These practices are based on the consideration of different alternatives for final disposal and they take into account technical, operational and financial factors.

Parts of these practices include the minimization and segregation of waste at the generator's facilities. Based on the performed segregation, treatment and conditioning technologies are applied to each type of waste according to the foreseen final disposal alternative.

**Low Level Waste**

In the case of *compactable solid radioactive waste* generated from the operation and maintenance of Nuclear Power Plants as well as in other nuclear and radioactive facilities, the treatment consists in reducing the waste volume compacting it in 200 L drums. *Non-compactable solids* such as metal parts, debris, etc. are also stored in 200 L drums.
More frequent sludge is generated from cleaning drainage channels are low dose rates and are treated by common dewatering and are conditioned in 200 L drums; contaminated oils also have low level dose rates and are conditioned in 200 L drums and are characterized to request from the ARN for its clearance.

With reference to low level *liquid waste* generated in nuclear power plants, the management is different depending on the technologies used in each plant. At CNA I, liquid waste generated from operation and maintenance activities is collected in tanks and characterized. In CNA II, liquid waste is collected and decontaminated by the Liquid Waste Storage System (KPK) and the Liquid Radioactive Waste Treatment System (KPF).
In the case of CNE, liquid waste originated from operation and maintenance activities are treated in resin beds, discharging in a planned and controlled way the lowered activity level current into the environment, following pre-established procedures and within the range of discharge values authorized by the Regulatory Authority.

Spent resin beds and mechanic filters, classified as low or intermediate level radioactive waste, depending on the limits established in the licences of future repositories, are stored at the facilities specially designed in each Power Plant awaiting treatment and conditioning in accordance with compatible procedures in compliance with the waste acceptance requirements determined by the Managing Organization of final disposal.

At AGE, there is an especially designed interim storage facility where non-conditioned waste may be stored prior to their processing, as well as conditioned waste packages awaiting transport and/or final disposal.

**Repository for Low Level Radioactive Waste**

Initially, the practice applied for the final disposal of *Low Level* solid radioactive waste has consisted in the disposal of conditioned waste packages in engineering enhanced surface semi-containment systems located in the Ezeiza Radioactive Waste Management Area (AGE), operated by the Argentine Atomic Energy Commission (CNEA) as Management Organization. Since 2001, every final disposal activity of radioactive waste at AGE has been discontinued in order to conduct the Radiological Safety re-evaluation and to define the conditions for its closure.

Packages that had been located within the solid waste semi-containment system and that had not been covered with the multilayered system, have been recovered, re-encapsulated and placed in transoceanic containers stored within the Long Term Storage Deposit awaiting their final disposal.

The Long Term Storage Disposal was designed based on the safety analysis for different scenarios (flood, intrusion and fire). The license was granted by the ARN in 2010 and ever since period inspections were conducted in order to guarantee the system integrity.

Conditioned packages with high doses of exposure are confined in special concrete containers which provide the adequate shield so that they can be safely handled.

In the case of *very short lived liquid waste,* the practice at the AGE consisted in the adsorption of radionuclides by silt-calcareous soil beds with a high content of high-retaining capacity clays, thus certain radionuclides with very short half-life decayed to negligible levels during their permanence in the bed volume.

The disposition of *structural waste* which on account of its size cannot be conditioned in drums was made directly at the AGE's *Structural Material Final Disposal System*, conceived to handle low level waste (generally metal pieces coming from contaminated areas), which was periodically immobilized with a concrete casting in order to avoid dispersion.

The Strategic Plan aims to build new repositories for very low and low level waste. Works related to the first stage to search for and select sites and areas to locate both repositories within the same site are being performed, which is planned to be selected by 2020.

In the case of *Low Level* waste requiring a bigger level of isolation, the construction of final disposal systems near surface is foreseen, similar to those in operation in L'Aube, France and El Cabril, in Spain. This type of repository is based on the use of multiple and redundant barriers, completing the model with the application of approximately 300 years of institutional post-closure control. Waste will be immobilized in cement matrixes and packed in 200L drums and/or in special concrete containers.

## High and Intermediate Level Waste

With respect to *High Level Waste* generated in the final stage of the nuclear fuel cycle, spent fuel is temporarily stored until a decision on its reprocessing or final disposal is adopted.

The PEGRR foresees to perform studies for the siting, construction and operation of a Deep Geological Repository. The deadline for the decision on the possible reprocessing or final disposal of the SF will be made before 2030. Also the studies for the siting of the Deep Geological Repository shall be concluded by 2030at the latest.

Duly treated and conditioned *Intermediate Level Radioactive Waste*s hall also be disposed of in the deep geological repository.

## Deep Geological Repository

As already has been informed, the need to have a deep geological repository in Argentina is foreseen in the very long term.

The PEGRR foresees to conduct studies for the siting, construction and operation of a Deep Geological Repository.

The decision over an eventual spent fuel reprocessing or final disposal shall be made before 2030. Also studies for the Deep Geological Repository siting shall be concluded by 2030 at the latest.

Until the projected Waste Repositories are available, waste and spent fuel awaiting final disposal are stored in facilities especially designed for this objective.

## SECTION C SCOPE OF APPLICATION

As in previous reports, this Sixth National Report deals with safety measures applied to the management of spent fuel and radioactive waste originated from all uses of nuclear energy, both inside and outside the fuel cycle, including wastes originated from nuclear power generation, manufacturing of nuclear fuel, mining and uranium processing, production of radioisotopes for medical purposes, industrial uses, research and development activities, including controlled and planned radioactive discharges derived from the normal operation of the facilities where the above mentioned practices are performed.

The present National Report also deals with safety of disused sealed sources.

This National Report is not applicable to Naturally Occurring Radioactive Material (NORM) originated outside the fuel cycle since Law No. 25018, “Radioactive Waste Management Regime”, in its Section 2, defines its scope of application exclusively to those derived from the nuclear activity conducted in the Argentine national territory.

As has been stated in prior National Reports, Argentina has no reprocessing plants in operation and such plants are not included in plans for the near future.

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# SECTION D LISTS AND INVENTORIES

## D.1 Spent Fuel Management Facilities

The current spent fuel management facilities are the following:

| SITE | FACILITY |
|---|---|
| **CNA I** | **I & II Pool Building** |
| **CNA II** | **Pool Building (UFA)** |
| **CNE** | **Storage pool** |
| | **Storage silos (ASECQ)** |
| **Ezeiza Radioactive Waste Management Area (AGE)** | **Central Storage Facility for research reactors SF (DCMFEI – FACIRI[1])** |
| **Ezeiza Atomic Centre (CNEA)** | **Research Reactors Irradiated Fuel Storage Facility (FACIRI)** |

([1]) Licensing in process

A brief description of these facilities is shown of each of the facilities in *Section G.2 Existing Facilities*.

## D.2 Spent Fuel Inventory

### D.2.1 Atucha Nuclear Complex

**Unit I**

| INVENTORY at 31 December 2016 (*) | | | |
|---|---|---|---|
| **SYSTEM** | **QUANTITY** | **U total** | **Pu (**)** |
| | | **kg** | **kg** |
| **Pools I - II** | **11,201** | **1,705,127.373** | **6,405.647** |

**Unit II**

| INVENTORY at 31 December 2016 (*) | | | |
|---|---|---|---|
| **SYSTEM** | **QUANTITY** | **U total** | **Pu (**)** |
| | | **kg** | **kg** |
| **Piletas** | **1058** | **185,789.718** | **679.015** |

### D.2.3 CNE Embalse Nuclear Power Plant

| INVENTORY at 31 December 2016 (*) | | | |
|---|---|---|---|
| SYSTEM | QUANTITY | U total | Pu (**) |
| | | kg | kg |
| Pool | 32,101 | 600,475.400 | 2,056.496 |
| Silos | 113,160 | 2,111,529.164 | 7,753.933 |
| TOTAL | 145,261 | 2,712,004.564 | 9,810.429 |

### D.2.3 AGE – Radioactive Waste and Spent Fuel Management Area

| INVENTORY at 13 August 2013 (*) | | |
|---|---|---|
| TYPE | QUANTITY | Kg |
| MTR | 146 | 173.327 |
| PINS (***) | 232 | 14.188 |
| Total | 378 | 187.515 |

(*) PIV Date (PIV: Physical Inventory Verification, IAEA)
(**) Estimates obtained by means of a calculation code, on the basis of SF burn-up, residence time, and position in the core.
(***) Pins: Research reactors pin type fuel
(****) Additionally: 13 disarmed fuel plates and 120 filters with 20% enriched U

### D.2.4 Research Reactors Irradiated Fuel Storage Facility

| INVENTORY at 31 December2016 (*) | | |
|---|---|---|
| TYPE | QUANTITY | Kg |
| MTR | 60 | 73.065 |

(*) PIV Date (PIV: Physical Inventory Verification, IAEA)
(**) Estimates obtained by means of a calculation code, on the basis of SF burn-up, residence time, and position in the core.
(***) Pins: Research reactors pin type fuel

## D.3 Radioactive Waste Management Facilities

| SITE | FACILITY |
|---|---|
| Atucha Nuclear Power Plant Unit I | Liquid Radioactive Waste Treatment & Conditioning System |
| | Liquid Radioactive Waste Treatment System by Concentration |
| | Immobilization System by Cementation of Radioactive Waste |
| | Treatment & Conditioning System for Solid Radioactive Waste |
| | Storage Facilities for Solid Radioactive Waste |
| | Treatment & Storage System for Mechanical Filters from the Reactor's Primary Circuit |
| | Storage System for Exhausted Ion Exchange Resin |
| | System for gaseous radioactive waste discharge |
| Atucha Nuclear Power Plant Unit II | Treatment & Conditioning System for Liquid Radioactive Waste |
| | Treatment & Conditioning System for Solid Radioactive Waste |
| | Treatment System by Concentration of Liquid Radioactive Waste |
| | Immobilization System by Cementation and Storage of Radioactive Waste, Exhausted Ionic Exchange Resin, and Mechanical Filters from the Reactor's Primary Circuit |
| | Discharge System for Gaseous Radioactive Waste |
| Embalse Nuclear Power Plant | Treatment & Conditioning System for Solid Radioactive Waste |
| | Solid Radioactive Waste Storage Facilities |
| | Exhausted Resin Storage Tanks |
| | Liquid Radioactive Waste Treatment System |
| | Gaseous Radioactive Waste Treatment Facility |
| | Facilities for Storage of Low, Intermediate and High Level Radioactive Waste for the Life Extension Project |
| Ezeiza Atomic Center | Plant for Decay, Pre-treatment and Discharge of Active Liquids from the Radioisotope Production Plant - PPR |
| Ezeiza Radioactive Waste Management Area(AGE) | Low Level Solid Radioactive Waste Treatment Facilities (**) |
| | Radioactive Sources and Waste Interim Storage Facility |
| | Handling Yard and Stowage of Items |
| | Long Term Storage Deposit |
| | Final Disposal Systemfor Structural Solid Radioactive Waste and Sealed Sources (*) |
| | Semi Containment System for Solid Radioactive Waste (*) |
| | Semi Containment System for Very Low Level and Very Short Lived Liquid Radioactive Waste (*) |
| | Cementing and Compacting Pilot Plant |
| Pilcaniyeu Technological Complex | CTP Low Level Radioactive Waste Deposit |
| Uranium Dioxide Production Plant | Uranium Dioxide Production Plant Raw Material Deposit |

(*) These facilities have concluded their operations.
(**) This facility is in the process of back-fitting.

A brief description of each facility is shown in *Section H.2 Existing Facilities and previous practices.*

### D.3.1 List of Facilities with Waste from Mining and Processing of Uranium Minerals

Mining waste and uranium minerals processing waste appear in the following facilities:

| SITE | FACILITY |
|---|---|
| **MALARGÜE (Mendoza Province)** | **Malargüe Former Industrial Mining Complex 1954 - 1986** |
| **HUEMUL (Mendoza Province)** | **Huemul Site Stopped operating in 1974** |
| **CÓRDOBA (Córdoba Province)** | **Córdoba Mining Complex Began operating in 1982** |
| **LOS GIGANTES (Córdoba Province)** | **Former Industrial MiningComplex Los Gigantes 1982 - 1989** |
| **PICHIÑÁN (Chubut Province)** | **Former Industrial Mining ComplexPichiñán 1977 - 1981** |
| **TONCO (Salta Province)** | **Former Industrial Mining Complex Tonco 1964 - 1981** |
| **LA ESTELA (San Luis Province)** | **Former Industrial MiningComplex La Estela 1982 - 1990** |
| **LOS COLORADOS (La Rioja Province)** | **Former Industrial MiningComplex Los Colorados 1993 - 1997** |
| **SAN RAFAEL (Mendoza Province)** | **San Rafael Mining and Milling Complex 1979-now** |

A brief description of the management status of these facilities is shown in *Section H Waste from Mining and Processing of Uranium Minerals.*

### D.4 Radioactive Waste Inventory

The following is the radioactive waste inventory until December 31st, 2016. The presentation of data has been prepared with information in accordance with the shape of the NEWMDB of the International Atomic Energy Agency. (http://www-newmdb.iaea.org).

### D.4.1CNA Unit I

| ATUCHA I NUCLEAR POWER PLANT | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of Waste | Place of Facility | Proc. | Est. | Volume ($m^3$) | RO % | FF/FE % | RP % | NA % | DF % | DC/RE % | ND % |
| LLW | Storage | No | Yes | 115.95 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| LLW | Storage | Yes | Yes | 575.40 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| HLW | Storage | No | Yes | 49.12 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |

### D.4.2 CNA Unit II

| CENTRAL NUCLEAR ATUCHA II | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of waste | Place of facility | Processed | Est. | Volume ($m^3$) | RO % | FF/FE % | RP % | NA % | DF % | DC/RE % | ND % |
| LLW | Storage | No | Yes | 3.28 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| LLW | Storage | Yes | Yes | 0.00 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |

### D.4.3 CNE

| EMBALSE NUCLEAR POWER PLANT | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of Waste | Place of Facility | Proc. | Est. | Volume ($m^3$) | RO % | FF/FE % | RP % | NA % | DF % | DC/RE % | ND % |
| LLW | Storage | No | Yes | 413.69 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| LLW | Storage | Yes | Yes | 1,514.30 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |
| HLW | Storage | Yes | Yes | 110.60 | 100 | 0 | 0 | 0 | 0 | 0 | 0 |

Est.=distribution is an estimate, Proc.=Is the waste processed (Yes/No)? RO=Reactor Operations, FF/FE=Fuel Fabrication/Fuel Enrichment, RP=Reprocessing, NA=Nuclear Applications, DF= Defence, **DC/RE=Decommissioning/Remediation, ND=Not Determined.**

### D.4.4 Pilcaniyeu Technological Complex

| PILCANIYEU TECHNOLOGICAL COMPLEX INVENTORY AT 30 APRIL 2012 | |
|---|---|
| Stored Waste (#) | Vol ($m^3$) |
| Process Waste | 3.6 |
| Miscellaneous Waste | 34.6 |

### D.4.5 Uranium Dioxide Production Plant

| $UO_2$ Production Plant INVENTORY AT 31 DECEMBER 2013 | |
|---|---|
| Stored Waste (#) | Vol ($m^3$) |
| Operational Waste | 81.6 |

(#) Material contaminated with Natural Uranium

### D.4.6 Ezeiza Radioactive Waste Management Area (AGE)

| EZEIZA RADIOACTIVE WASTE MANAGEMENT AREA – 31 DECEMBER 2016 | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of Waste | Place of Facility | Proc. | Est. | Volume ($m^3$) | RO % | FF/FE % | RP % | NA % | DF % | DC/RE % | ND % |
| LLW | Storage | No | Yes | 4,265.7 | 9 | 42 | 0 | 49 | 0 | 0 | 0 |
| LLW | Storage | Yes | Yes | 760.9 | 53 | 22 | 0 | 25 | 0 | 0 | 0 |
| LLW | Disposal | Yes | Yes | 2,397.3 | 66 | 1 | 0 | 33 | 0 | 0 | 0 |
| ILW | Storage | No | Yes | 4.3 | 0 | 28 | 0 | 72 | 0 | 0 | 0 |
| ILW | Storage | Yes | Yes | 23.0 | 0 | 43 | 0 | 57 | 0 | 0 | 0 |
| ILW | Disposal | Yes | Yes | 169.6 | 2 | 46 | 13 | 39 | 0 | 0 | 0 |

Est.=distribution is an estimate, Proc.=Is the waste processed (Yes/No)? RO=Reactor Operations, FF/FE=Fuel Fabrication/Fuel Enrichment, RP=Reprocessing, NA=Nuclear Applications, DF=Defense, DC/RE=Decommissioning/Remediation, ND=Not Determined

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# SECTION E LEGISLATIVE AND REGULATORY SYSTEM

## E.1 Implementation of Measures

Argentina has a legal framework that regulates all nuclear activity, including radioactive waste management and spent fuel management. The administrative and regulatory structure that has been implemented with reference to this issue is comprised in the following manner:

- An Independent Regulatory Body
- A National Organization which is responsible for radioactive waste management, for the determination of the manner in which nuclear power plants and any other relevant facility will be decommissioned and holds the ownership of the special fissionable materials contained in irradiated fuel elements
- An appropriate set of radiological and nuclear safety “regulatory standards”
- A system to grant licenses
- A control system to verify the compliance with the regulatory standards and radiological and nuclear safety requirements
- A sanction system for cases of non-compliance of licenses, standards or other requirements
- A clear assignation of responsibilities

## E.2 Legislative and Regulatory Framework

### E.2.1 Legal Framework

In order for the report to be self-consistent, all relevant legal background in areas of safety of spent fuel and radioactive waste management until the moment this report is closed will be presented.

#### E.2.1.1 Background

CNEA (Argentine Atomic EnergyCommission) was created in 1950 by Decree No. 10936/50. One of CNEA’s specific responsibilities was the control of all public and private nuclear activities performed in the national territory.

Later, various legal regulations defined CNEA’s competence also as the Regulatory Body for nuclear and radiation safety matters, especially regarding the protection of individuals and of the environment against exposure to the harmful effects of ionising radiation, safety of nuclear facilities, and control of the destination of nuclear material. In this regard, the specific regulations were Decree Act No. 22498/56, ratified by Law No. 14467 and Decree No. 842/58.

Law No. 14467 determined CNEA’s competence to issue the necessary regulations for the permanent control of the activities related to radioactive substances and to provide the necessary means to control the existence, marketing and use of materials related to peaceful applications of atomic energy.

Furthermore, Decree No. 842/58 has approved the regulation for the *Use of Radioisotopes and IonisingRadiation Regulation* and made it effective to govern the use and application of radioactive materials and the radiations they emitted or which were originated by nuclear reactions and transmutations. The use of *X Rays* generators was excluded from the competence of the CNEA, and is of exclusive concern of the Ministry of Health.

The sustained growth of the nuclear activity in the country made it necessary to strengthen the independence of the Regulatory Body with respect to the other activities carried out by CNEA. In 1994, by Decree No. 1540/94, the National Executive Power created the National Nuclear Regulatory Body (ENREN) to perform the regulation and surveillance of the nuclear activity, transferring the complete staff, equipment and facilities from CNEA's Regulatory Affairs Management to ENREN. As from 1997, ENREN adopted the present denomination of Nuclear Regulatory Authority (ARN).

### E.2.1.2 Current situation

The present legal framework comprises the National Constitution, the treaties and conventions, laws and decrees as stated below and by the regulatory standards described in E.2.2.1.

- **National Constitution**, specifically Art. 41 which sets out that:

  **Art. 41.** - All inhabitants are entitled to the right to a healthy and balanced environment fit for human development and that productive activities may meet present needs without endangering those of future generations; and they have the duty to preserve it. As a first priority, environmental damage shall bring about the obligation to remediate as determined by law.

  The authorities shall provide for the protection of this right, the rational use of natural resources, the preservation of the natural and cultural heritage and the biological diversity and shall also provide for environmental information and education.

  The Nation shall issue the standards that include the minimum protection budgets and those complementary regulations required for the provinces, without altering their local jurisdictions.

  The admission into the national territory of actually or potentially dangerous waste and of radioactive waste is forbidden.

- **International Treaties and Conventions:** The Argentine Republic has adhered as contracting party, to a number of bilateral and multilateral international instruments, which have higher status than laws under the National Constitution and imply different commitments and obligations in the nuclear field for the State. These are strict commitments and obligations regarding the control of: **(a)** the non-proliferation of nuclear weapons; **(b)** nuclear safety; **(c)** spent fuel and radioactive waste safe management; **(d)**security of nuclear materials; and **(e)** cooperation in case of nuclear accidents and radiological emergencies.

- **Law No. 24804**, enacted in 1997. This Act determines that the National State will establish the nuclear policy and perform research and development activities through CNEA, and regulatory and surveillance actions through the ARN, successor to the ENREN. The law also provides that CNEA is the national organization which, among other duties, advises the National Executive Power on the definition of the nuclear policy, is responsible for radioactive waste management, determines the manner in which nuclear power plants and any other relevant facility shall be decommissioned and holds the ownership of the special radioactive fissionable materials contained in irradiated fuel elements.

- **Annex I to Decree No. 1390/98** that regulates Law No. 24804, enacted in November 27th, 1998. According to this Decree, every individual person or legal entity that, as a result of a licensed or authorised activity, produces radioactive waste or irradiated fuel assemblies shall provide resources to the ARGENTINE ATOMIC ENERGY COMMISSION so that the latest can perform its duty of waste management. The entity or person generating waste shall be responsible for the storage of such material, within the scope of the facility it owns, having to comply with the dispositions which, to that effect, are established by the Nuclear Regulatory Authority. In the case of a NPP, the entity generating waste shall take the necessary measures in order to assure the safe operation of the plant and to have storage capacity sufficient to keep all the fuel assemblies included in that facility.

  In turn, the ARGENTINE ATOMIC ENERGY COMMISSIONshall define the moment and the procedure by which the waste producershall perform the transfer of the radioactive waste and of the irradiated fuel assemblies produced by itself to that organization.

- **Law No. 25018**, enacted in September 23th, 1998. The Argentine State, by means of the Argentine Atomic Energy Commission, assumes responsibility for all radioactive waste management. In turn, waste producers are responsible for the conditioning and safe storage of the waste generated in the facilities operated by them, until that waste is transferred to CNEA. The latter is in charge of elaborating a Radioactive Waste Management Strategic Planas part of the Radioactive Waste Management National Program.

- **Law No. 26566**, enacted in 2009, declares of national interest the activities for the construction of a fourth nuclear power plant, as well as all the necessary acts to enable the life extension of Embalse (CNE) and Atucha Unit I (CNA I) NPPs, and the activities involved in the construction, commissioning and operation of Atucha Unit II (CNA II) Nuclear Power Plant. Law No. 26566 also declares of national interest the design, implementation and commissioning of the CAREM [*Central Argentina de Elementos Modulares*] prototype reactor to be built in Argentina, committing CNEA for that purpose.

- Article No. 61 of **Law No. 26784**, enacted in 2012, revokes Article No. 34 of Law No. 24804, which stated that the nuclear energy generation activity developed by NASA was subject to privatization.

## E.2.2 Regulatory Framework

### E.2.2.1 National Requirements and Provisions on Radiation safety

The Nuclear Regulatory Authority (ARN),successor to ENREN, was created by Law No. 24804 and is the organization responsible for the regulation and control of nuclear activities in order to:

- Protect the individuals against the harmful effects of ionising radiations and maintain a reasonable degree of radiological and nuclear safety in the nuclear activities performed in the Argentine Republic.

- Ensure that nuclear activities are not performed with purposes not authorized by this Act and regulations resulting therefrom, as well as by international agreements and the non-proliferation policies adopted by the Argentine Republic.

- Prevent intentional actions which may either have severe radiological consequences or lead to the unauthorized withdrawal of nuclear material or other materials or equipment subject to control.

In this sense, Law No. 24804, Art. 7 determines that the ARN is in charge of the regulation and control of the nuclear activity in all aspects regarding radiological and nuclear safety, security, control of the use of nuclear material, licensing and control of nuclear facilities and international safeguards, as well as the advisory role to the National Executive Power in the corresponding matters. In addition,Law No. 24804 in its Art. 10 sets forth that the regulation and control of the nuclear activity in said aspects is subject to national jurisdiction, and Art. 14 provides that the ARN shall act as an independent agency under the jurisdiction of the Presidency of the Nation.

Besides Law No. 24804, Art. 16 grants the ARN the following powers, among others: the power to issue regulatory standards in matters of its competence, to grant licenses, permits or authorizations to facilities and persons, to conduct regulatory inspections and assessments, and to impose sanctions in the corresponding cases (for further details see Section E.3 of this report).

The regulatory system of ARN[(1)] to the end of this National Report is composed of 64—mandatory— regulations and 9 regulatory guidelines —recommendations.

ARN regulations include licensing of nuclear facilities, radioactive facilities and their personnel, conjointly with different of radiological protection, nuclear safety and transport

[(1)]These are known as Normas AR (Standards AR).

of radioactive materials requirements. In order to have access to these regulations, visit the following website: http://www.arn-gob-ar.

The basic regulatory approach of the regulatory standards is focused on performance, that is, they define the compliance of safety objectives, complementing with prescriptive requirements. In this sense, the manner to achieve said objectives is mainly based on the appropriate decisions taken by the Responsible Organization and by complementing this process with ARN surveillance in different stages of licensing a facility. IAEA Standards are used as reference and permanent consultation during the process of elaboration, revision or change of AR standards associated to radioactive waste management.

Regulatory Standard AR 10.1.1, Basic Radiation safety Standard, determines the requirements and provisions on the matter which are consistent with the recommendations of the International Commission on Radiation protection (specifically with issue No. 60).

Although the regulatory system has not undergone major changes with respect to previous reports, the Regulatory Organization has continued updating current regulations, especially modifying the following standard:

**Table 1 – Standards Updates during 2014-2016**

| CODE | DENOMINATION |
|---|---|
| Standard AR 10.16.1 Rev. 3 | Transport of Radioactive Material |
| Standard AR 10.12.1 Rev. 3 | Radioactive Waste Management |

In addition, the following regulatory standards and guides have been incorporated:

**Table 2 -New Standards and guides introduced during 2014-2016**

| CODE | DENOMINATION |
|---|---|
| StandardAR10.01.1 Rev. 0 | Nuclear Power Reactors Siting Evaluation |
| Guideline AR 13 | Radioactive Waste Storage |

### E.2.2.2 Licensing System

Hereinafter the fundamental concepts of the system are summarized.

In Argentina the licensing system for radiation safety is defined in the Basic Standard AR 10.1.1 currently under revision. Radioactive waste management facilities, spent fuel facilities of nuclear power plants and spent fuel management facilities of research reactors are categorized by this standard as Type I or Relevant. Therefore, in the licensing stage of these facilities, as well as in the licensing of their staff, the standards *AR 0.0.1 Licensing of Type I Facilities* and *AR 0.11.1 Licensing of Staff of Type I facilities* are applicable.

The regulatory standards (AR Standards) determine that the construction, start up, operation and decommissioning of Type I facilities cannot be started without the corresponding licenses requested by the Responsible Organization and granted by the Regulatory Body. The licenses are granted after the ARN has performed an independent evaluation of the safety conditions foreseen and presented in the corresponding “Safety Report”.

The validity of said licenses is subject to the compliance with the conditions set forth therein and with the standards and requirements issued by the Regulatory Body. Failure to comply with one or more of these standards, conditions or requirements may cause the ARN to suspend or cancel the corresponding license, in accordance with the sanction system in force.

The staff of a nuclear or radioactive facility has to be properly trained and qualified in accordance with their duties at the facility. The ARN requires that all staff assigned to significant safety-related tasks is licensed and has specific authorizations to perform the assigned duties. Standards AR 0.11.1 and AR 0.11.2 determine the criteria and procedures to grant individual licenses and specific authorizations to the staff performing tasks that require licenses in nuclear and radioactive facilities. Said standards also set out the terms and conditions according to which the ARN, prior review and report from its Advisory Boards, will grant these licenses and authorizations.

Based on regulatory criteria, international experience and the recommendations made by the IAEA, a gradual modification process for the validity of the Operation Licenses for Type I facilities has begun. They are being changed from an indefinite or permanent period of time to an expiration term. In order to condition their renewal, a limited term is determined, among other requirements, to a global re-assessment of safety at regular intervals (Periodic Safety Reviews - PSR). This is a complementary tool to the continuous safety revision performed routinely by the persons responsible for the facilities and by the Regulatory Nuclear Authority. The validity period is made explicit in the Operation License itself.

### E.2.2.3 Prohibition to Operate without a License

Law No. 24804, Section 9 provides that in order to develop a nuclear activity any natural or legal person shall, among other requirements, comply with ARN regulations in its scope of competence and request a license, permit or authorization that will enable them to perform the activities and comply with the obligations in safeguards or non-proliferation matters that Argentina has subscribed to or will subscribe to in the future.

### E.2.2.4 Control System

Since the beginning of nuclear activities in the country and in order to verify that nuclear and radioactive facilities comply with the standards, licenses and requirements in force, the Regulatory Authority has determined a control system. At present, the control system includes regulatory evaluations, inspections and audits. If necessary, the ARN requires the

implementation of corrective measures, and in case they are not complied with may lead, as a last step, to impose the sanctions provided in the regulatory system.

### E.2.2.4.1 Documentation and Reports

During the licensing process, the Responsible Organization has to submit to the ARN the documentation related to radiological and nuclear safety it has created. The main components of said documentation in the case of an Operation License for a nuclear power plant, which includes the management of the radioactive waste and the spent fuel generated by said facility, are the following:

- Safety Report
- Operation Policies and Principles Manual
- Quality Manual
- Operational Organization Chart, Missions Tasks and Duties of the Personnel
- Operation Manual
- Code of Practice including the Emergency Plan
- Environmental Monitoring and Waste Management
- Maintenance Manual
- Probabilistic Safety Assessment
- Management of Operational Experience Program
- Staff Training Manual and Staff Training Programme
- Education and Training Requirements for Staff Performing Specific Duties
- Preliminary Plan for the Decommissioning of the Facility
- Any other documentation related to radiological and nuclear safety, safeguards and security

The detail of the documentation sent to ARN such as the chronogram for its presentation is set in Standard AR 3.7.1.

The above documentation has to be kept permanently updated, and the modification proposals must be forwarded to the Regulatory Authority.

The license and the above mentioned documentation constitute the Mandatory Documentation. On the other hand, any other standard or requirementissued by the Nuclear Regulatory Authority in connection with radiological and nuclear safety, safeguards and security is also mandatory. In addition, the License granted by the ARN determines the periodical reports that the Organization that is responsible for the facility has to submit to the Nuclear Regulatory Authority. In the case of an Operation License for a nuclear power plant, the communications related to Radiological and Nuclear Safety includes the following, among other topics:

- Occurrence of an abnormal event.
- List of non-relevant events occurred, in accordance with the provisions of the Operational Experience Management Program.

- Activity values for each relevant radionuclide discharged to the environment and results of environmental monitoring sample tests.
- Inventory of processed and stored solid radioactive waste.
- Values of the doses received by the staff exposed due to their work.
- Report on the annual Emergency Plan application drill: development, results and experiences learnt.
- All evidence or information which, in the criteria of the Responsible Organization, shows weakness or degradation in the quality of components, equipment and systems which are important for safety or different risks in magnitude or nature from those foreseen in the Final Safety Report or in the Probabilistic Safety Assessment.

In the other nuclear and radioactive facilities, requirements related to the Mandatory Documentation and Reports are graded in accordance with the hazard involved.

#### E.2.2.4.2 Regulatory Inspections and Audits

Law No. 24804 authorizes the ARN to perform regulatory inspections and evaluations, carried out by their staff from the beginning of the regulatory activities in the country, in the following manner:

- *PlannedInspections*: Programmed inspections offer the opportunity to examine the operator's activities to corroborate its proper performance and discover possible problems at an early stage. These inspections consist of observation and evaluation of routine activities in terms of safety to assess the effectiveness of the licensee performance.

- *Reactive Inspections:* Reactive inspections, by individuals or teams, are usually fostered by the regulatory body in response to an unexpected, unplanned or unusual situation or an incident, in order to assess its significance and implications and the adequacy of corrective actions. A reactive inspection may be caused by an isolated incident or by a series of minor events taking place in the considered facility.

- *Non-routine inspections*: These are regulatory inspections related to a safety assessment in the stage of licensing or to particular situations of licensed facilities.

- *Special Inspections*: They are performed by experts in different matters (dosimetry, implementation and control, etc.) in coordination with the inspectors. They have different objectives as, for example, the supervision of preventive maintenance tasks during scheduled shutdowns.
- *Technical Evaluations*: They involve the analysis of data collected during inspections or from other sources. For example, evaluations of the radiation safety of specific practices at nuclear or radioactive facilities to detect their potential weaknesses and identify possible measures to reduce staff or public doses or to improve the safety level.

- *Regulatory Audits*: They are performed in accordance with written procedures and are scheduled to review organizational, operational and procedural aspects related with nuclear and radiation safety.

### E.2.2.5 Specific Regulatory Actions

The regulatory actions that may be taken by the ARN regarding a particular facility may originate from*:*

- The results of regulatory inspections and evaluations performed at the facility.

- The knowledge of abnormal events that have occurred at the facility or at a similar facility.

- The results of independent technical evaluations.

In such cases, the ARN sends a regulatory document to the Responsible Organization in the form of a requirement, recommendation or request for additional information, as the case may be; in this document the ARN urges the Responsible Organization to take the required corrective measures within a determined term. These documents have the following scopes:

- *Requirement*: It is a regulatory order that the Responsible Organization must comply with in the requested manner.

- *Recommendation*: It is an order which differs from a requirement in that the Responsible Organization has certain flexibility to comply by means of alternative solutions (for example, engineering alternatives) which ensure, at least, the same result required by the recommendation. These alternative solutions must be proposed to the ARN for their evaluation.

- *Request for additional information:*It is a regulatory order whereby more details of the documentation provided are required, for example, the explanation of an assertion, and the demonstration of the result of calculations or additional documentation.

### E.2.2.6 Sanction System

Non-compliance with the Regulatory Standards and requirements set out in the respective licenses or permits authorizes ARN to impose the appropriate Sanction System. Article 16 of Law No. 24804 authorizes ARN to impose sanctions which shall be graded according to the seriousness of the fault as follows: warning, fines (which shall be proportional to the seriousness of the fault and the potential damage), suspension of the license, permit or authorization or its cancellation.

For these purposes, ARN is authorized to lay down the relevant procedures that may apply in case of violation of the standards to be issued in the exercise of its competence, ensuring the constitutional guarantees of due process and the defence rights.

The sanction system represents the last link of the safety chain. ARN considers that if the regulatory system is really effective and the Responsible Organizations fully exercise their responsibilities, the application of sanctions and fines should occur only in exceptional cases.

In this sense, an informal ARN function is to make Responsible Organizations and Primary Responsible aware of their responsibility regarding safety, in order to increase the communication of safety culture at all levels of the organization structure.

### E.2.2.7 Clear Assignment of Responsibilities

The Argentine Atomic Energy Commission (CNEA) is an autarchic body which depends on the Ministry of Energy and Mining of Argentina. Its powers and functions are set mainly in the National Law of Nuclear Activity (Law No. 24,804). Law No. 24804, in its Art. 31, sets out that the responsibility for the radiological and nuclear safety of a facility rests without excuse on the holder of the license, permit or authorization. Its compliance with the provisions of the above mentioned Law or with the regulatory standards or requirements that may derive from it do not exempt the holder from said responsibility or from making all that is reasonable or compatible with its possibilities in favour of radiological and nuclear safety, safeguards and security.

The holder of a license, permit or authorization may delegate, in whole or in part, the execution of tasks, but continues having the full responsibility determined by this Act.

Concerning the responsibilities of the radioactive waste generator and the transfer of said waste to the managing organization, Law No. 25018 in its Art. 6 sets out that the National State, through the authority in charge of the application of this Act (CNEA), shall assume the responsibility for radioactive waste management. The generators of this waste must provide the necessary resources to perform it in due time and manner.

The generator will be responsible for the conditioning and safe storage of waste generated by the facility he operates, in accordance with the conditions set out by the Regulatory Body, until they are transferred to CNEA, with the obligation to give immediate notice to the ARN on any event which could result in an incident, accident or operation failure.

Article 7 of Law No. 25018 authorizes CNEA to determine the acceptance criteria and the transfer conditions for radioactive waste that may be necessary to assume the corresponding responsibility. This article also determines the approval requirement by the ARN for these transferconditions.

Article 8 sets out that the transfer of radioactive waste and irradiated fuel elements to CNEA shall be made at the time and in accordance with the procedures laid down by CNEA, with ARN’s previous approval. In no event, shall the operator of the generating

installation be exempted from the responsibility for contingent civil and/or environmental damages until the transfer of the radioactive waste is completed.

Therefore and in agreement with Decree No. 1390/98, which regulates the provisions of Law No. 24804, said transference defines the limit of responsibility of the operator of the generating facility, with reference to radioactive waste and irradiated fuel elements.

## E.3 Regulatory Body

### E.3.1 Duties and Competence of the Regulatory Body

In Argentina, nuclear development started in 1950. All nuclear activities performed in the country until the year 1994 were controlled by the Argentine Atomic Energy Commission (CNEA) through its regulatory branch: the Regulatory Branch Management. The applied regulatory system was defined by Law No. 14467 and its Regulatory Decree No. 842/58.

In 1994, the National Government, considering that the regulation and supervision of nuclear activities should be reserved to the National State, assigned the exclusive performance of these duties to an independent agency, in order to differentiate the role of the controller from that of the controlled parties.

Thus, Decree No. 1540/94 creates the National Nuclear Regulatory Body (ENREN – Ente Nacional Regulador Nuclear) to perform regulatory and control duties of the nuclear activity, transferring the complete staff, equipment and facilities from CNEA's Regulatory Branch.

In 1997 the National Congress enacted the National Law of Nuclear Activity (Law No. 24804), creating the NUCLEAR REGULATORY AUTHORITY (ARN) with the aim of regulating and controlling the nuclear activity, receiving the transfer of all ENREN's resources.

The Nuclear Regulatory Authority acts as an independent agency under the jurisdiction of the Argentine Presidency and is subject to a public control system. As provided by Section 7 of the Act, it is responsible for the regulation and control of the nuclear activity on matters of radiological and nuclear safety andsecurity, as well as the control of the use of nuclear materials, licensing and supervision of nuclear facilities and international safeguards.

The above stated Law sets out that the regulation and control of nuclear activities are "subject to national jurisdiction". The ARN also acts as an advisory body to the National Executive Power in matters of its competence.

Law No. 24804 assigns a wide set of faculties and responsibilities to the ARN. Among the most important are the following:

- Issuing the regulatory standards with reference to nuclear and radiation safety, security and control of the use of nuclear materials, licensing and supervision of nuclear facilities, international safeguards and transport of nuclear materials regarding nuclear and radiation safety and security.

- Granting, suspending and cancelling licenses for the construction, commissioning, operation and decommissioning of nuclear power plants.

- Granting, suspending and cancelling licenses, permits or authorizations for mining and uranium concentration matters, safety of research reactors, relevant accelerators, and relevant radioactive facilities, including facilities for radioactive waste management and nuclear applications in medical and industrial activities.

- Undertaking inspections and regulatory evaluations at the facilities subject to ARN regulation, with deemed necessary frequency.

- Imposing sanctions, which shall be graded according to the seriousness of the fault and which may imply confiscating nuclear or radioactive materials; the preventive closure of the facilities subject to regulation if nuclear activities are performed without the appropriate license, permit or authorization or upon the detection of serious non-compliance of the nuclear and radiation safety and security of materials and nuclear facilities.

- Creating, in accordance with international parameters, nuclear and radiation safety standards for the staff working at nuclear and radioactive facilities and granting the specific licenses, permits and authorizations to perform the task subject to license, permit or authorization.

- Evaluating the environmental impact of any licensed activity, such as monitoring activities, review and follow-up of any impact, evolution or possibility of environmental harm that may result from the licensed nuclear activity.

It should also be noted that Annex I to Decree No. 1390/98, whichregulates the above mentioned Act, provides that for a better compliance of its duties, the Nuclear Regulatory Authority shall approve contingency plans in the case of nuclear accidents, programs to deal with emergencies and, when necessary, offer the corresponding training to workers and neighbours.

These plans must foresee an active participation of the community. The Security Forces and the representatives of civil institutions of the area where these procedures take place shall report to the officer to be appointed by the Nuclear Regulatory Authority for said purpose. National, provincial and municipal authorities that may have any involvement in the creation of these plans must comply with the guidelines and criteria defined by the Nuclear Regulatory Authority organization, which for these purposes shall exercise the powers determined by the Convention on Nuclear Safety.

Law No. 24804 and Annex I of regulatory Decree No. 1390/98 grant the ARN the necessary legal competence to determine, develop and apply a regulation and supervision system for all nuclear activities performed in the country as well as radiation activities with exception to X Ray and NORM activities. In order to ensure an appropriate level of control, said legal competence is complemented by an adequate technical competence.

For this reason, as from the beginning of the regulatory activities in the country, it has been considered imperative to have qualified staff, so that with their level of knowledge and experience endow the Regulatory Body its own independent criteria in all aspects of nuclear and radiation safety, safety in the transport of radioactive materials and in radioactive waste management, as well as safeguards and physical protection.

For the same reason and as mentioned above, when the Regulatory Body was created, all human resources and materials were transferred to it from CNEA regulatory branch.

It is also worth highlighting that the ARN is authorized to contract experts who may advise on aspects specifically related to the performance of its functions. Therefore, the global strategy of the Argentine regulatory system is summarised the following basic aspects:

- Training of staff involved in radiological, nuclear, transport and waste safety; safeguards and security, either belonging to the ARN or at facilities performing practices subject to its control, also offering collaboration to IAEA's training programs.

- Periodical creation and revision of the corresponding standards.

- Undertaking of regulatory inspections and audits to verify the fulfilment of the granted licenses and authorizations.

- Independent execution of studies and tests related to the licensing of regulated installations.

- Development of scientific and technical aspects related to radiological, nuclear, transport and radioactive waste safety.

### E.3.2 ARN Organizational Structure and Human Resources

The Nuclear Regulatory Authority is managed by a Board of Directors constituted by a Chairman, a 1st Vice-Chairman and a 2nd Vice-Chairman reporting to the General Secretariat of the Presidency of the Nation. The Chairman also performs ARN's executive duties.ARN's organic structure in force is shown in Figure 1.

The main tasks performed by the *Radiation Safety, Security and Safeguard Department* are to conductregulatory inspections and the evaluations concerning the Radiation Safety of Radioactive Facilities (medical, research and industrial facilities), Transport, Safeguard control and Nuclear Safety control.

The Measurements and Radiation Protection Evaluations Department participates in the regulatory control of complying with the adequate levels of protection of people and the environment related to those facilities overseen by the ARN. The ARN is responsible for conducting radiation safety assessments, modelling and measurements along with the evaluations in the scope of radioactive waste management and spent fuels as well as radioactive facilities shields, criticality accidents and ventilation systems. Moreover, it

coordinates the activities to control radiation protection compliance during the programmed NPP shutdowns and conducts the environmental radiation impact evaluation and development over radiation safety aspects in order to support and improve the knowledge and techniques necessary for regulatory purposes.

The *Non Proliferation Policies and Institutional Affairs Department* participates in the definition and implementation of the country's policies on regulatory issues at the relevant corresponding national and international forum. It ensures the correct institutional relationship at national and international level, leading to a better compliance of ARN's regulatory functions. It promotes and communicates ARN's image and its regulatory institutional policy to the different publics and interested parties. Taking into account the ARN'srole, it manages the solution of conflicts in the national nuclear area and institutional crisis that involve media or political aspects. In order to improve the regulatory actions it promotes internal and external communication.

The Licensing and Control of Nuclear Power Plants Department is in charge of guaranteeing the control of radiological and nuclear safety of nuclear power plants, research reactors and critical assemblies during operation, after closure and during decommissioning. It is also in charge of guaranteeing the licensing process of new nuclear power plants, research reactors and critical assemblies as well as the workers at these facilities who hold positions requiring a license issued by the ARN. It also verifies licenses, regulations, requirements, agreements and international conventions in force, and undertakes the corresponding regulatory actions.

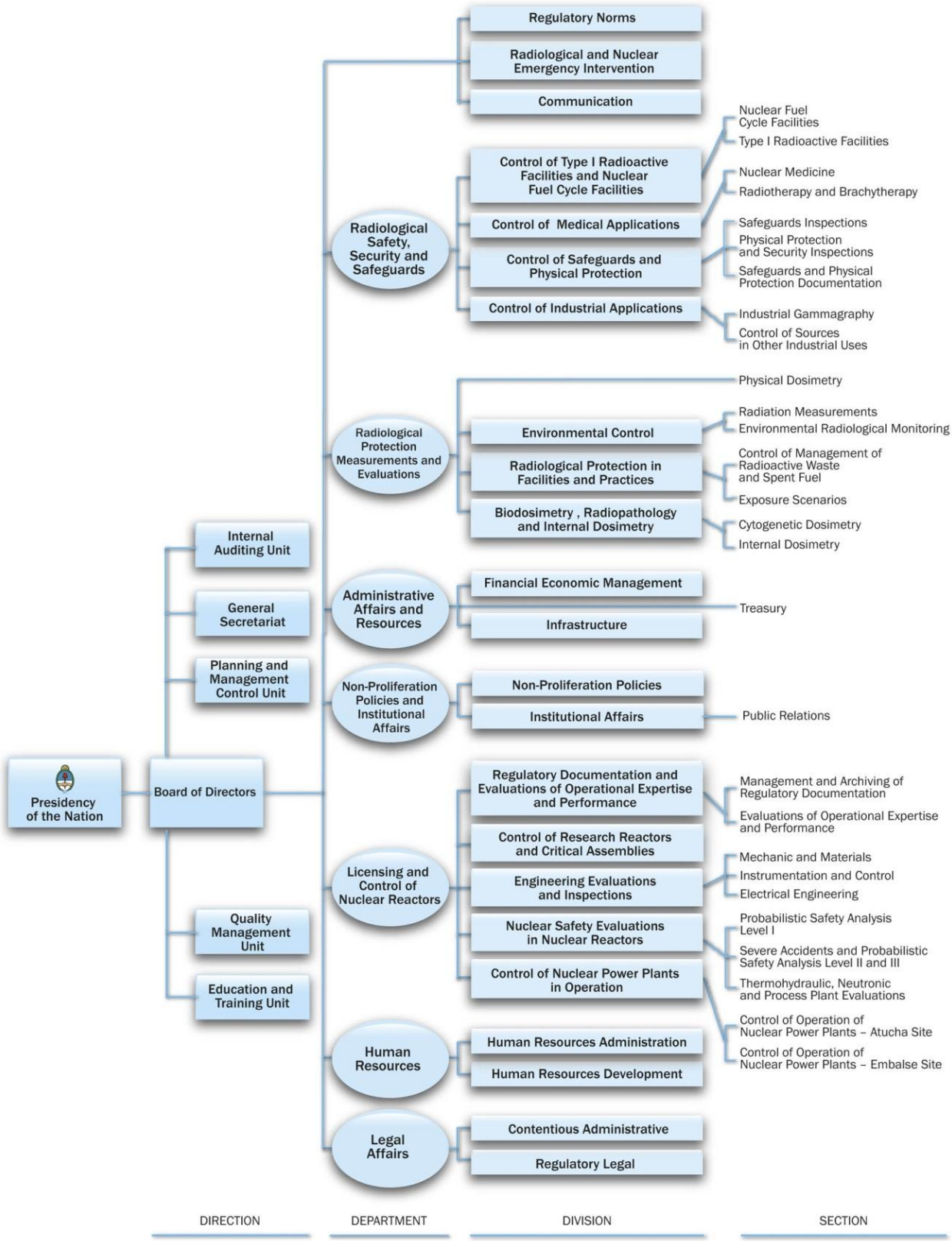
Regarding ARN staff, until December 2016, the organization had 460 workers, out of which 52% are professional, 16% hold a postgraduate degree, 2% have done a Master's degree and 2% hold a PhD. From the professionals, 42% are Engineers and the rest hold a university degree in Natural and Exact Sciences, in a 28%, and in Social Sciences in a 15%.

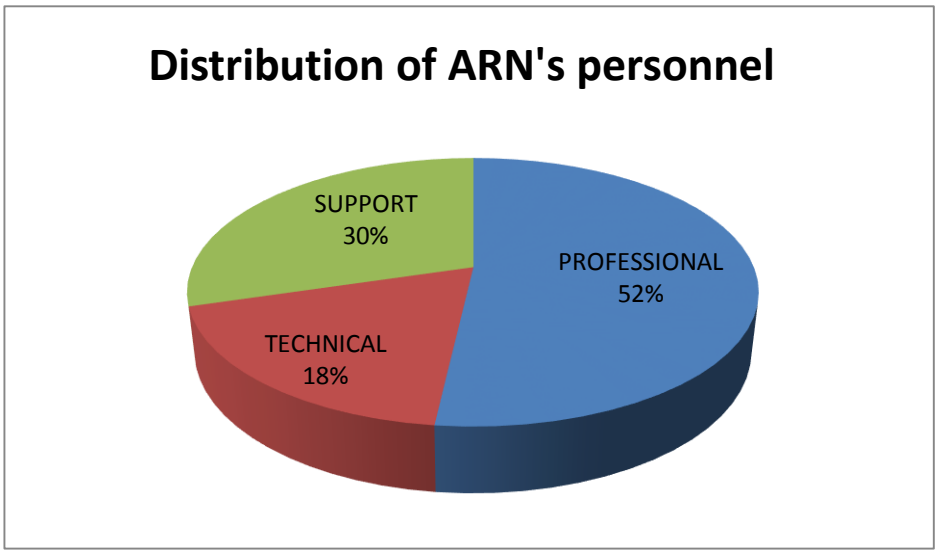
The *Administrative Affairs and Resources Department* offers administrative and accounting support to ARN's regulatory tasks.

As regards degrees in Engineering, the professionals have graduated in Chemical Engineering (33%), Electronic Engineering (20%), Industrial Engineering (11%) and Mechanical Engineering (10%).

The ARN has seven Departments, out of which three are devoted to specific activities with 75% of the staff devoted to the tasks in the mentioned Departments.

## Figure 1– Organizational Chart ARN 2016






The distribution of the workforce in the different locations is divided into the following: 76% is working in ARN's Headquarters, 21% in Ezeiza Atomic Center, 3% in CNA and CNE, and 1% in other branches. The geographical distribution of all ARN employees is presented in Table 3:

**Table 3 – Geographical Distribution of ARN employees**

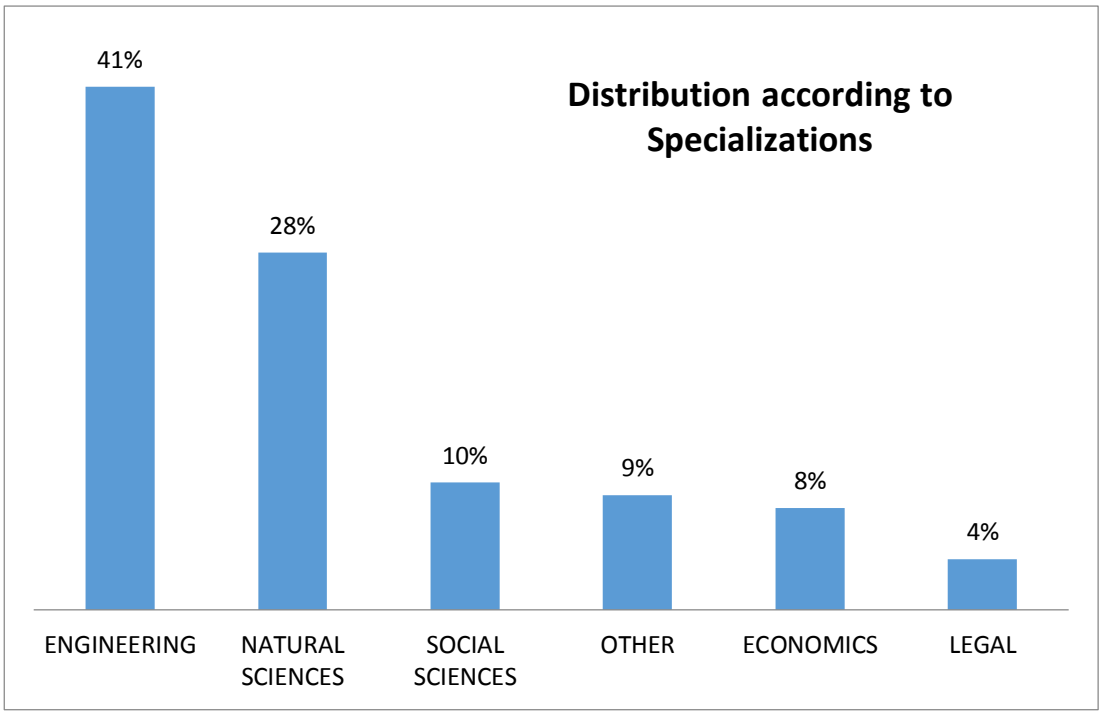
| | |
|---|---|
| HEADQUARTERS | 76% |
| EZEIZA ATOMIC CENTER | 21% |
| CNA & CNE NUCLEAR POWER PLANTS | 2% |
| OTHERS | 1% |

### E.3.3 Resources Assigned to the Regulatory Control of Facilities under Surveillance

The distribution of ARN's workforce assigned to safety inspection and evaluation tasks, directly related to the safety of regulated facilities is described in the *Annual Work Plans*.

These*Plans* discriminates efforts according to the different type of activitiesperformed, directly or indirectly related to the safety of the facilities: inspections and evaluations of nuclear safety, radiation safety, radioactive waste management safety and transport of radioactive material safety, safeguards and security, scientific support, radiation measurements, environmental studies, electronics, administration, legal affairs, information technology, planning, training and institutional relations.

Spent fuel management and radioactive waste management are conducted as part of the inspection global and assessment tasks of the facilities controlled by ARN, estimating a total load of approximately 3,770 man/day, which represents a 16% of the total of activities of the involved sectors.




### E.3.3.1 Qualification of the ARN Staff

SpecializationCourses in Radiation protectionand Radiation Sources Safetyand in Nuclear Safetyare part of the basic initial training for the technical staff joining ARN's workforce. This initial training is then complemented with the programme known ason the jobtraining, as well as with the participation, both at national and international level, in specific courses, congresses, seminars and research projects both in the national and international spheres. Moreover, in order to train all of the personnel working in the technical area, there is at least one edition per year of the Technician Level Radiation Protection Course of ten weeks which offers an excelling opportunity for workers with a university postgraduate course and which is also of interest for technicians and professionals working in the nuclear industry or who start to work in nuclear.

All of the trainings offered by the Nuclear Regulatory Authority through its Regional Training Centre for Latin America and the Caribbean are offered for all of the nuclear industry in Argentina and in the region, as the regulation of the responsible personnel of facilities fosters safety culture.

### E.3.3.2 Maintenance of the Regulatory Body's Competence

ARN signed an Agreement-Program with the Undersecretary of Public Administration, in which a Matrix of commitments for Management Results is determined so as to approach the development of a comprehensive quality management system, the staff performance evaluation and a demand plan for personnel recruitment.

### E.3.3.3 Training Activities

Education and training have been two of the main aims of the ARN, due to its certainty that building specialized knowledge is one of the axes of radiation safety for workers and society in general. In the same direction, the ARN trains its staff in order to accurately comply with its technical functions.

One of the permanent activities of ARN is to train specialists in nuclear safety and radiation protection through postgraduate specialization courses and a radiation protection course at a technician level, through attending safeguards and physical protection, as well as participation in congresses and expert meetingson the four regulatory areas at a national and international level.

Argentina's experience in education and training in radiological and nuclear safety is based on its postgraduate courses inRadiation Protection and Safety of Radiation Sources, and in Nuclear Safety, which, during the last 35 years provided education to 1138 professionals, 46% of whom are Argentine and 54% are foreigners, most of them from the region.

IAEA's decision of building competencies in radiological and nuclear safety by means of training and knowledge management has driven the Agency to establish a commitment with ARN to support this activity in the long term.

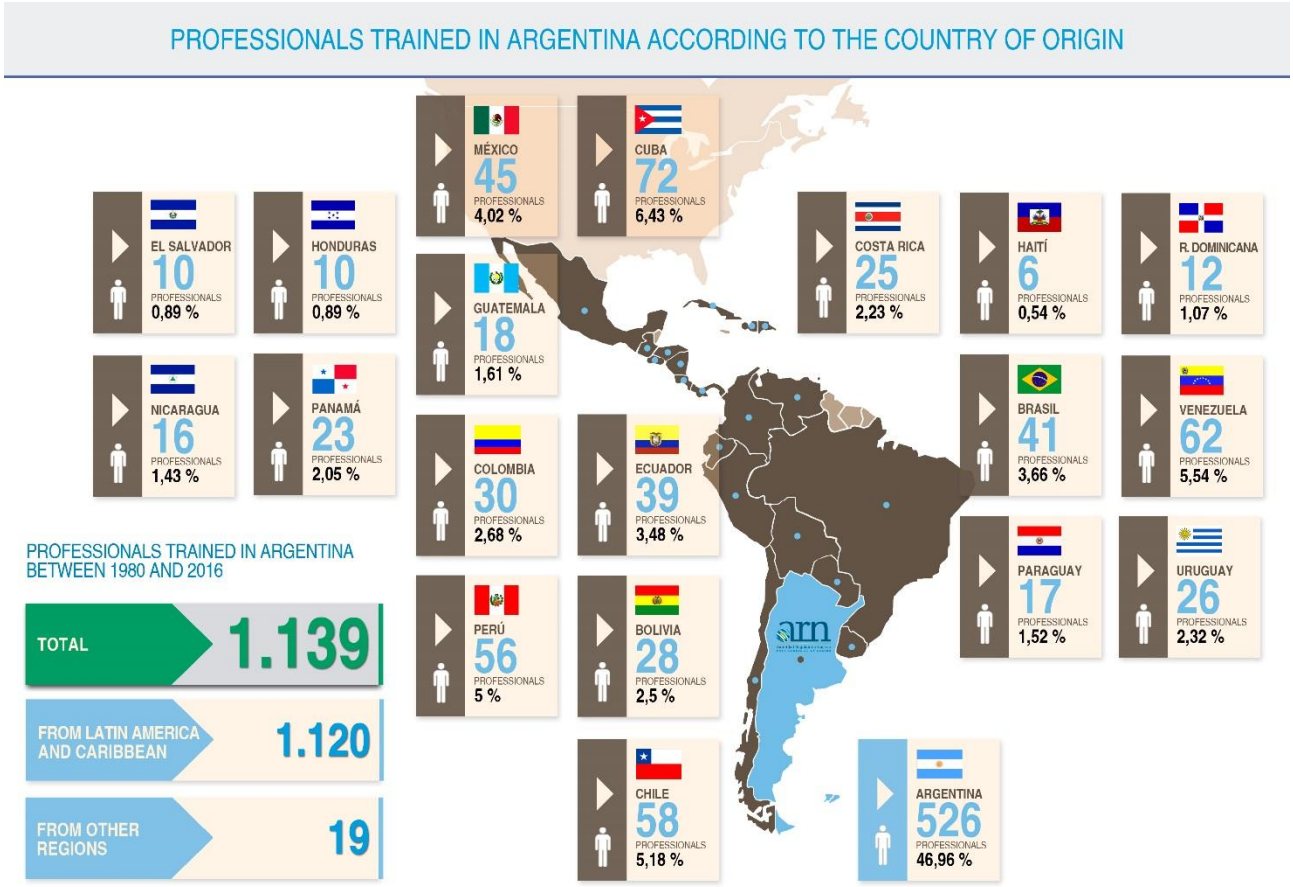
In this line, the Argentine Government and the IAEA signed in September 30$^{th}$, 2008 an agreement by which Argentina becomes the Regional Training Centre in Latin America and the Caribbean in terms of Nuclear, Radiological, Transport and Waste Safety. This agreement was deployed by the ARN Education and Training Unit, created in 2010 and dependent on the ARN Board of Directors.

In July 2012, as a milestone achieved looking for education excellence, the Postgraduate Course in Radiation protection reached the academic hierarchy of the Specialization Course of the University of Buenos Aires, and at the beginning of 2014, was entitled the same status to the Postgraduate Course in Nuclear Safety.

The new academic hierarchy of these postgraduate courses imply the following advantages:

- Diplomas issued by the University of Buenos Aires
- National and regional validity (in countries with whom agreement exist)
- University frame advantages
- Professors with academic acknowledgement. All of them are appointed by the University of Buenos Aires meeting the necessary curricular standards.
- Option of being recognised as Specialists for those graduates who have studiedin previous editions of the postgraduate courses

**Figure 4: Professionals trained in Argentina according to the country of origin**




The ARN also offers Radiological Protection training courses for the technical staff of the organization, of CNEA and of other national, public and private institutions related to the nuclear activity. In addition, the ARN provides training courses in specific areas associated with regulation, such as Safe transportation of radioactive material; Safeguards for national inspectors of the IAEA, the ABACC and operators; Monitoring of aerosols for International Surveillance System operators;Security of nuclear facilities and materials; Physical security of sources; Illicit traffic prevention and Medical response in case of accident caused by radiation.

### E.3.3.4 Quality Management System

ARN has established, documented and implemented a Quality Management System in agreement with the requirements determined in the IRAM-ISO 9001:2000 Standard. The facts and requirements of said system are described in the “ARN Quality Manual”. In this document, the Board declares, among others, the Quality Policy, the commitment with the Quality Management System, the Management by Processes and Constant Improvement.

The Quality Management System is implemented on the basis of the approach by processes. Therefore, five (5) regulatory or main processes and four (4) strategicprocesses and eight (8) support processes have been identified.

The analysis and follow up of these processes are performed through internal quality audits executed by persons who are independent from the process to be audited and who also have the adequate qualifications. From2014to 2016,seventy four (74) internal audits have been carried out, and thirty three(33) external audits have been received, from the Certification Body, to the processes that certify its quality management system.

At present, the ARN has certified the following courses under the ISO 9001 Standards:

- Licencing of staff working in Type I facilities and in nuclear fuel cycle Type II and III facilities
- Management of ARN inbound and outbound documents
- Writing and update of Standards and Regulatory Guidelines
- Intervention in radiological and nuclear emergencies
- Control of the transport of radioactive materials (TMR process) by means of:

  Package Licencing, special radioactive materials and consignment.
  Inspection of radioactive materials transport.
  Advice, radioactive material transporttraining and communication.

- Operation and maintenance of Station for Detection of Radionuclides RN01, made up of the particle systems ARPO1 and noble gases ARX01, from the International Monitoring System (IMS) within the frame of the existing agreements (CTBTO, Comprehensive Nuclear-Test-Ban Treaty Organization). Management of radionuclides laboratory ARLO1 according to CTBTO quality system and within the framework of the binding agreement.
- Physical protection of materials and nuclear facilities and physical security of sealed sources.
- Control of national safeguards and the application of international safeguards.
- Import and export of radioactive materials, nuclear material and materials or equipment of nuclear interest.
- Curricular development, planning and development of courses and training activities in radiation protection, nuclear safety, safeguards and physical protection.
- Follow up of internal documentation of the Technical Scientific Support.
- Rendering of library services.

The labs accredited as per Standard 17025 are the following:

**Physical Dosimetry Lab**

Calibration Lab No. 029:

Calibration of detectors of the radiation field.
Calibration of detectors of surface contamination.

Essay Lab No. 222:

Determination for Personal Dose Equivalent by Thermoluminescent Dosimeter (TLD)

**Biological Dosimetry Lab**

Essay Lab 147:

Biological Dosimetry Essays (cytogenetic) according to ISO 19238:2014

**Internal Dosimetry Lab**

Essay Lab No. 193:

Determination of activity in $^{131}I$ in thyroids

**Environmental Control Lab**

Essay Lab No. 116

Detection of gamma emitters radionuclides activity
Detection of uranium by fluorimetry
Detection of uranium traces with KPA equipment (Standard ASTM D-5174-07 – Passed again in 2013)
Detection of Tritium in water by liquid scintillation
Detection of Strontium 90
Detection of Tritium in milk

## Documentation Management

Until mid-December 2016, two hundred eighteen (218) documents have been approved and thirty nine(39) documents are under revisionprocess.The ARN has a Document and Registry Control system. Moreover an Information Security Policy is under implementation.

Documentation and quality management system tools have been extended, providing documents that can identify the processes and their interaction with support, strategic, and direction processes. These have been achieved by the creation of maps and process data sheets, included in the ARN general map, by means of and internal web or Intranet. Up to now, twenty two (22) Process Data Sheets have been approved.

Regarding the Registry control, twenty three (23) Control forms are still valid and available on the Intranet, three (3) are under revision, which belong to different processes.

During the period 2014-2016, all procedures related to the Quality Management Unit, the ARN Quality Control Manual and other associated documents have been updated. New forms have also been incorporated and others have been modified within the quality system, which are used by the Unit and by ARN different processes. During the year 2017, new requirements of the Standard ISO 9001 version 2015 started to be incorporated.

The process of Measurements and Assessments in Radiation Protection was developed to integrate the documents related to the management of Standard 17025 labs, and the documents of the ARN quality system management. Twenty three (23) “Quality Checks” have also been developed to help continuous improvement of processes.

## Interest group Satisfaction

ARN focuses on the requirements of third parties involved, controlling safety is not compromised, while other actions related to law, public and staff safety and environment protection are taken.

During implementation meetings conducted by the Quality Unit with the different certified and certification-in-progress processes, several methods are set out according to the

process needs, in order to measure interest group satisfaction and evaluate the suggestions provided, as well as other aspects helping to improve the management system. There is a new communication channel. It deals with a survey available on the external website:
http://www.arn.gob.ar/index.php?option=com_content&view=article&id=369%3Aencuesta-permanente-de-satisfaccion-del-usuario-externo&catid=51%3Aencuestas&lang=es

### E.3.3.5 Financial Resources

Law No. 24804 sets out in its Section 25 that the necessary financial resources for ARN proper functioningshall originate mainly from:

- Annual regulatory fees,
- Contributions from the National Treasury determined for the budget of each fiscal year, and
- Other funds, assets or resources that may be assigned according to applicable laws and regulations. Subsidies, heritage, legacies, donations or transfers acquired under any title.
- Interests and benefits deriving from the management of its own funds.

Section 26 of said Law determines the annual regulatory fee payable by the holders of an authorization or permit or by corporate bodies whose activities are subject to ARN's surveillance, specifying the fees for nuclear power plants and authorizing the ARN to determine the fees applicable to other regulated activities.

In this sense, the ARN approved a "Licensing and Inspection Fee System" that sets out the respective fees for the issuance of licenses and permits in accordance with the facility or practice, as well as the annual fee for the operation of said facilities or practices.

The System determines an annual fee during the operation of each facility or practice by means of a simple formula which takes into account two factors: the "Regulatory Effort" stated as the number of inspection/evaluation hours that the ARN assigns to the regulatory control of the facility or practice and the cost of said effort, based on the monetary value of the hour of inspection/evaluation, which is determined on an annual basis.

On a yearly basis,the ARN prepares a budget project, which includes a list of the inflow provisions from regulatory fees and justifies request of funds to the National Treasury. This budget is published in the Official Bulletin in order to clearly indicate the manner in which the funds from persons and institutions which are bound to pay regulatory fees shall be used. The budget assigned to the ARN for the 2016 fiscal year was ARS 353,748,001, as shown in Chart4.Below, several charts show the budgetary distributions of the execution of the work plan for 2016, of expenses according to different criteria. Figures 5 and 6 show the budget distribution of regulatory tasks by type of inspection and by type of task, and Figure 7 shows budget distribution by item.

**Chart 4–ARN Budget of the fiscal year 2016**

| ITEM | VALUEIN AR$ |
|---|---|
| 1. Staff | 208,695,000 |
| 2. Inputs | 10,448,000 |
| 3. Services | 102,006,000 |
| 4. Equipment | 16,136,000 |
| 5.1 Scholarships | 3,709,581 |
| 5.9 Transfersabroad | 8,237,419 |
| 9. Figurative expenses | 4,516,000 |
| TOTAL | 353,748,001 |

**Figure No. 5: Budgetary distribution per type of inspection**

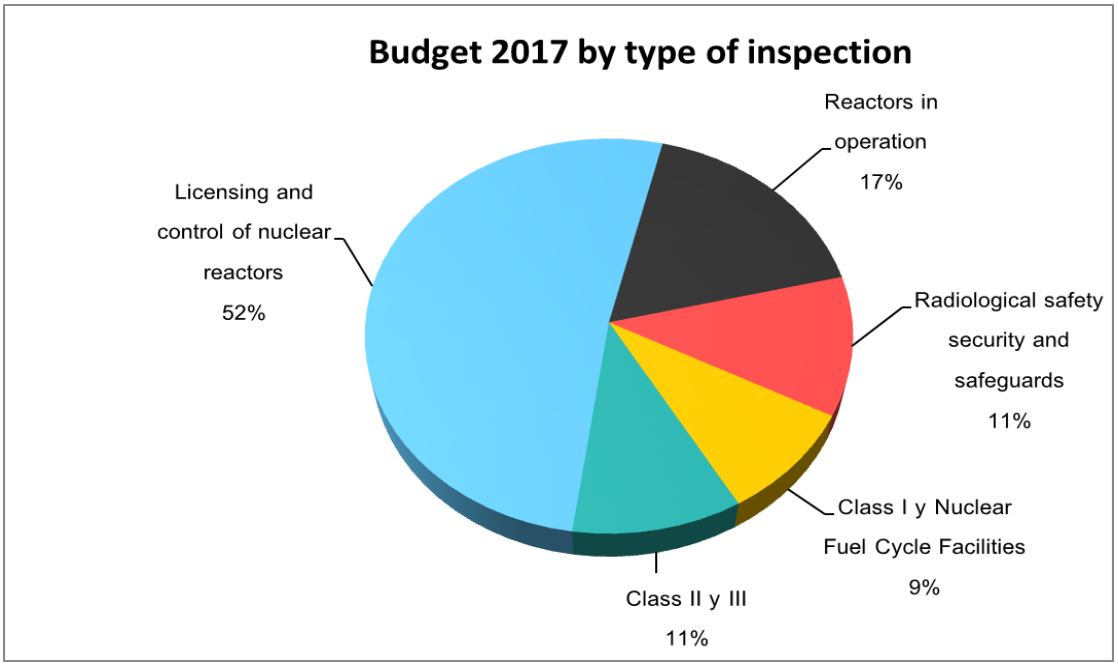


**Figure No. 6: Budgetary Distribution per type of tasks**

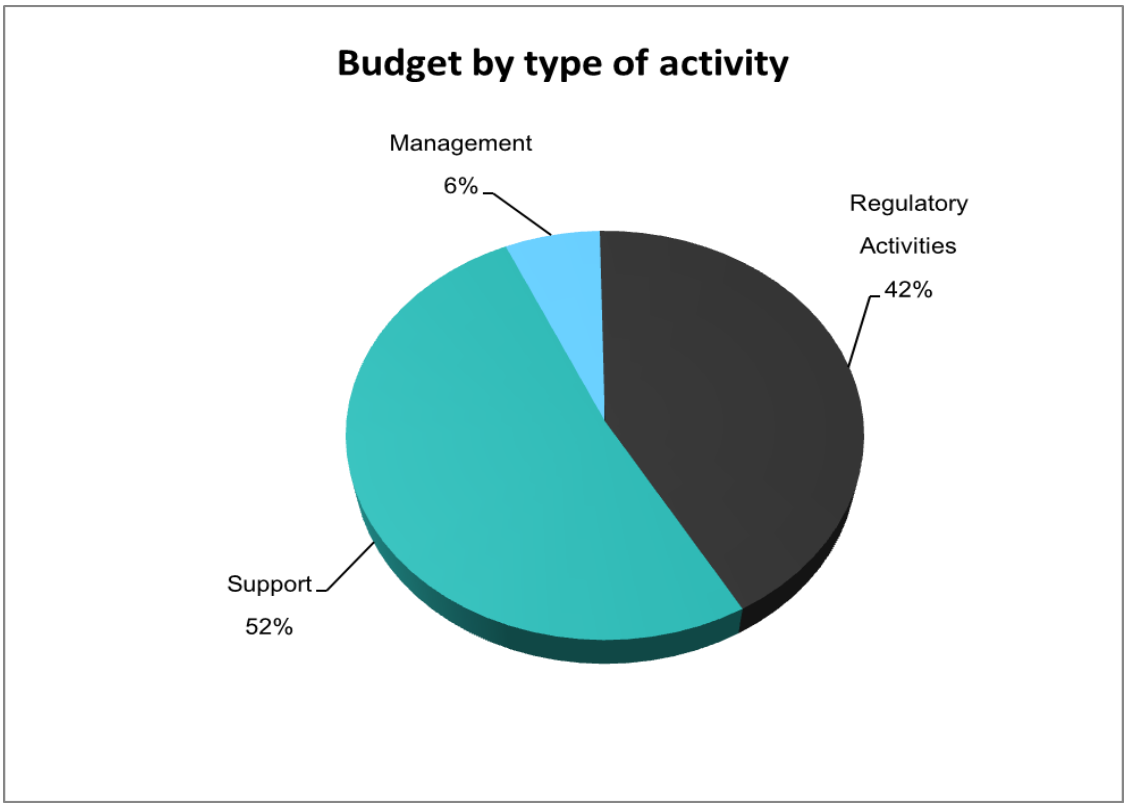
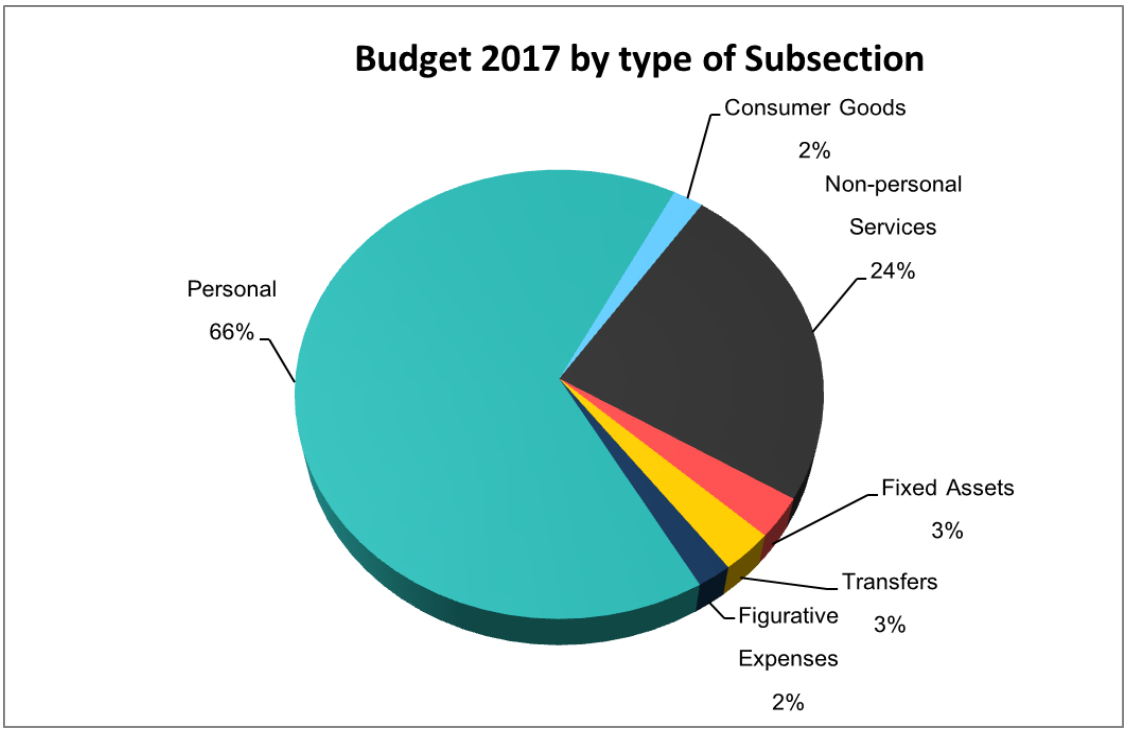



**Figure No. 7: Budgetary distribution per item**



### E.3.4 Relationship with Other Organizations

In the period 2014-2016, the ARN continued with cooperative activities with other organizations, with agreements in force. Within this framework, with the Ibero American FORO of *Radiological* and *Nuclear Regulatory Agencies*, formed by the radiological and nuclear regulatory bodies of Argentina, Brazil, Chile, Colombia, Spain, Mexico, Peru and Uruguay in order to maintain high nuclear, radiation safety and physical and physical security in the Ibero-American region.

The ARN actively participates in its technical programme, which is made jointly and continuously in coordination with the action plans of the International Atomic Energy Agency (IAEA) and sustained by a knowledge network on nuclear, radiation safety and physical security which enables information exchange among regulatory agencies from the region. In this framework, leading projects have been conducted which were of great interest internationally in areas of Radiation Protection in Medical Applications, Occupational Radiation Protection, Nuclear Safety and Control of Radioactive Sources.

The ARN has kept strong links with other national and international agencies by entering intocooperation agreements. During the period of this report, the ARN subscribed three national agreements and five international agreements. Moreover, different actions were undertaken to implement binding commitments, mainly through bilateral meetings, technical visits and specific trainings.

In addition, ARN high level specialists and experts participate, as nominated experts, in the following international committees and advisory groups:

- Commission on Safety Standards, “CSS” (IAEA)
- Radiation Safety Standards Committee, “RASSC” (IAEA)
- Nuclear Safety Standards Committee, “NUSSC” (IAEA)
- Waste Safety Standards, Committee “WASSC” (IAEA)
- Transport Safety Standards Committee, “TRANSSC” (IAEA)
- Emergency Preparedness and Response Standards Committee (EPReSC) (IAEA)
- Nuclear Security Guidance Committee (NSGC) (IAEA)
- Permanent Advisory Group on Safeguards Implementation, “SAGSI” (IAEA)
- United Nations Scientific Committee on the Effects of Atomic Radiations, “UNSCEAR” (UN)
- International Commission on Radiological Protection (ICRP)

During the period 2014-2016, the IAEA got a total of 28 Safety Standards drafts for the Member States consideration—5 in 2014, 15 in 2015 and 8 in 2016.

### E.3.5 Annual Reports

Every year the ARN submits to the National Executive Power and to the Argentine Congress a Report on the activities performed the previous year, in agreement with the dispositions in Art. 16 of The National Act of Nuclear Activity.

These Reports describe the main supervisory and regulatory activities performed by the ARN in nuclear and radiological matters, safeguards and security during the previous calendar year.

In order to give the widest possible coverage to the activitiesconducted and to the use of the assigned budget resources, the Report is also forwarded to public libraries, national universities, regulatory bodies, officers in health, energy and environmental areas and to the main users of radioactive material. Since 1998 the contents of the Annual Reports are published in the institutional web page, http://www.arn.gob.ar

In conclusion, the report and its distribution contribute towards transparency of regulatory activities and communication with the public.

# SECTION F OTHER GENERAL SAFETY PROVISIONS

## F.1 Responsibility of the License Holder

### F.1.1 Background

Nuclear activity started in Argentina in the 1950's. At that time, the facilities did not have the magnitude and complexity they have nowadays. The responsibility for nuclear and radiological safety fell on an individual, usually the head of the nuclear facility who, assisted by his staff or by contracting third party services, performed all safety-related activities. Once the facilities had the appropriate means and equipment, and the staff was trained, the Regulatory Body granted the person responsible for them the pertinent operation license.

Even though the above mentioned concepts are still essentially valid, a number of significant improvements have been introduced to the regulatory system throughout the years. Thus, depending on the magnitude of the nuclear facilities, the Regulatory Body demands that the people who occupy specific positions in the operation staff undergo a special training and hold an individual license. Furthermore, training requirements for the operating staff were increased.

On the other hand, in the case of larger and complex nuclear facilities, the Regulatory Body considered that, having the necessary number of trained operating staff was not sufficient by itself to ensure their operation with an appropriate safety level. Therefore, it was required to periodically review the design and operational aspects of relevant facilities and to introduce, whenever necessary, modifications in terms of safety as advised by state-of-the-art technology. In response to such considerations the Responsible Institution was formed.

### F.1.2 Responsible Institution and Primary Responsible

The ARN requires that each nuclear facility shall be supported by an organization able to provide the appropriate support to the staff of the plant in tasks inherent to radiological safety, nuclear safety, security, safeguards and radioactive waste management safety, such as the review of operating procedures, maintenance of safety systems, technical modifications to the plant, etc.

This role falls on the Responsible Institution, which in the case of nuclear power plants is Nucleoeléctrica Argentina S.A. (NASA), responsible for the operation of Atucha Nuclear Power Plant – Unit I (CNA I), Unit II (CNA II) and Embalse Nuclear Power Plant (CNE), including the nuclear fuels storage systems and the management of waste generated in these facilities. CNEA is the Responsible Institution for the Ezeiza Waste Management Area (AGE) facilities as well as for a number of significant facilities, including several research reactors.

AR 0.0.1 and AR 10.1.1 regulatory standards set the responsibilities of the Responsible Institution, amongst which the most significant are:

- The Responsible Institution shall make every reasonable effort in accordance with its possibilities to ensure safety, complying at least with ARN's regulatory standards. Such responsibility also includes design, construction, commissioning, operation and decommissioning of the facility.
- Fulfilment of the regulatory standards and procedures is a necessary but not sufficient condition concerning the responsibilities of the Responsible Institution, which shall make every reasonable effort, within its possibilities, to ensure safety. The Responsible Institution shall also comply with the regulatory standards and requirements set by other competent authorities that are not related to nuclear activities as for example the conditions concerning the release of chemical effluents. (see Section H.1).
- The Responsible Institution may be in charge of the operation of more than one nuclear facility and delegate totally or partially the execution of tasks, however, it remains fully responsible for them.
- In every nuclear facility the Responsible Institution shall appoint a Primarily Liable comprised of one person from its staff, called the Primary Responsible, who shall be directly in charge of the radiological and nuclear safety of the facility, as well as the compliance with the licenses and regulatory requirements applicable thereto. In the case of nuclear power plants in operation, their directors are the Primary Responsible.
- The Responsible Institution shall provide the necessary assistance to the Primary Responsible, so that the Primary Responsible may exercise its responsibilities. The Responsible Institution must supervise the Primary Responsible to verify that it complies with its safety-related responsibilities.
- The Responsible Institution shall evaluate the nuclear facility safety and submit to the ARN the respective technical documentation to award the license required.
- No modification altering the design, operating characteristics or the mandatory documentation included in the operating license of a nuclear facility/radioactive related to radiationor nuclear safety may be made without ARN's prior authorization.
- The Responsible Institution and the Primary Responsible shall facilitate the inspections and audits required by the ARN.
- Any change in the organizational structure of the Responsible Institution that may affect its capacity to comply with its responsibilities shall require ARN's prior consent.

Apart from the responsibilities of the Responsible Institution and of the Primary Responsible, the ARN has set the responsibilities of the employees who work at the facility. In this regard, regulatory standard AR 10.1.1 sets that employees are responsible for their compliance with the procedures established to ensure their own protection as well as the protection of other employees and of the public. This condition is consistent with the recommendations of the International Atomic Energy Agency (IAEA).

### F.1.3 Regulatory Control of Fulfilment of License Holder's Responsibilities

In order to verify that licensees comply with their responsibilities,the Nuclear Regulatory Authority (ARN) performs different types of controls as follows:

- ARN is permanently updated about the operational organizational structure. In case there is any modification, the Responsible Institution shall send to ARN a document stating the new operational organizational structure, the missions, functions and requirements of the staff. It is clear that every proposed change must be duly justified. ARN evaluates the documents and its corresponding justifications and, in the case of not finding any observations, the document enters in force when the facility has the capacity to cover all the posts to be licensed.
- Regulatory Standard AR 0.11.1 determines the requirements to be fulfilled by Class I (relevant) facilities staff to obtain an individual license or specific authorization.
- The procedure to grant individual licenses and specific authorizations allows ARN to control the competence of the people that have to be in charge of safety-related responsibilities in the facility. Said competence is re-assessed whenever the specific authorization is renewed, a process related to the validity of the psychophysical aptitude certificate, annual retraining and the adequate task development.
- The individual license may be cancelled or revoked by ARN if during the performance of the duties, non-compliance with any of the conditions required for its granting is demonstrated. Likewise, the specific authorization may be modified, cancelled or revoked.In addition, ARN regularly verifies the compliance of the Primary Responsible with its obligations regarding the safety of the facility, especially its compliance with the applicable standards, conditions of the operating license and any other requirement related to radiological safety, all of which is carried out through evaluations, regulatory inspections and audits performed by ARN's resident inspectors and analysts, and whenever necessary, with the assistance of external experts.
- The ARN undertakes specific inspections to verify the fulfilment of radioprotection aspects during planned shutdowns of NPPs.
- Standards AR 10.14.1, AR 10.13.1 and AR 10.13.2 state requirements to be fulfilled by facilities regarding Safeguards, Protection and PhysicalSecurity.
- ARN has establisheda regime ofsanctions to beapplied in casesof non-compliance withanyregulatory requirement.

## F.2 Human and Financial Resources

### Introduction

The Argentine Atomic Energy Commission (CNEA), as set forth in prior National Reports, is the State responsible organization for Spent Fuel (SF) Management as well as for any

radioactive waste generated in the national territory. For that purpose, the *National Program for Radioactive Waste Management* (PNGRR) was created by Law No. 25018, which setsCNEA as the responsible authority for the development and periodic updating of a*Strategic Plan for Radioactive Waste Management* (PEGRR).CNEA depends on the Under secretariat of Electricity and the National Ministry of Energy and Mining. In that stage of the government, the Nuclear Energy Under secretariat has been established in order to foster nuclear power generation and growth.

Both financial and human resources are essential for the assurance of safety conditions of nuclear facilities. Consequently, the Regulatory Body requires that all staff working at SF and radioactive waste management facilities shall be properly trained and qualified in accordance with the tasks performed, and that the staff assigned to safety-related tasks shall hold a license and the Specific Authorization permit.

In the case of SF and radioactive waste generated by nuclear power plants, the Responsible Institution that reports for the operation of Nuclear Power Plants (NASA), has the responsibility not only to have trained and qualified personnel in accordance with the current legal and regulatory framework, but also to provide the financial resources necessary for the development of operation activities, which include the storage of radioactive waste and the storage of SF until those responsibilities are transferred to CNEA.

**Financing of the National Program for Radioactive Waste Management**

CNEA has implemented PEGRR, whichis supported by the National Treasury contributions included in the regular budget and approved by the Executive Power.

**CNEA Organizational Structure and Human Resources**

The*National Program of Radioactive Waste Management* and the *PRAMU*(described later) now report directly to the Nuclear Safety and Environment Management.

The Nuclear Safety and Environment Managementundertake the following activities:

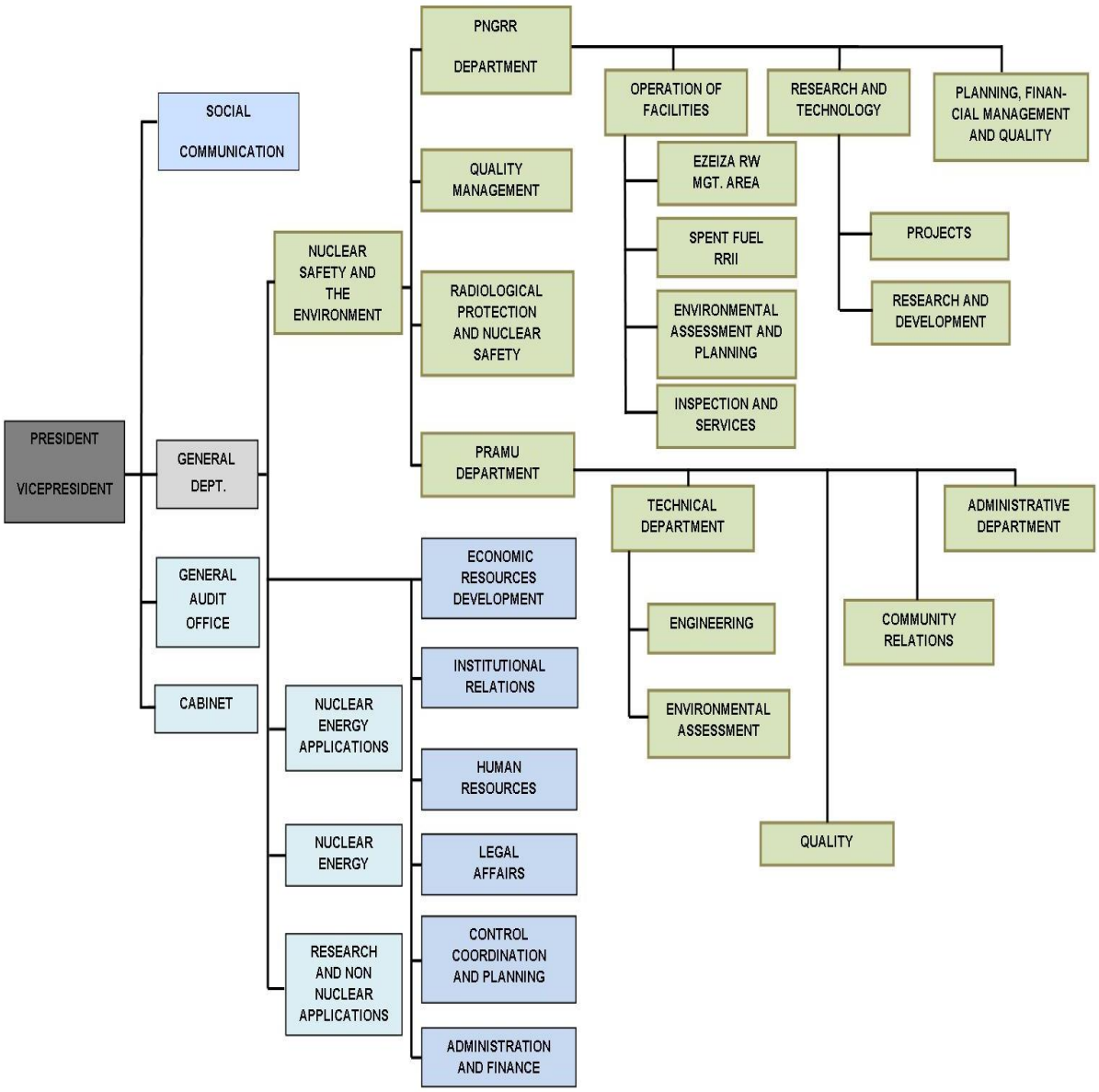
- It establishes methodologies of management and criteria for Safety, Environment and Quality.
- It conducts the follow-up of performance in Safety, Environment and Quality.
- It coordinates, advises and provides other Managements and Sites with technical assistance on these topics.

In order to achieve this, CNEA has established a Radiological Protection and Safety Department, a Quality Department and an Environmental Management Department.

As part of all this, in CNEA, a Quality Management, Safety and Environment Integrated System is being implemented by applying the most prevalent standards related to this topic. This system, based on a policy of continuous improvement, is the most efficient

methodology for complying with CNEA policies, through planning objectives and the necessary processes to obtain results according with that policy; the implementation of processes established to meet the goals; monitoring of those processes concerning the policy; objectives and requirements established and the revision and decision-taking to improve its performance.

**CNEA Organizational Structure**




The main elements of this system are the identification of hazards, risk assessment and determination of controls, identification and control of environmental aspects, identification and compliance with legal requirements, establishment of programs and improvement objectives, determination of roles and responsibilities and assignation of resources, ensuring the competence of the personnel through its training, awareness and application of methodologies of communication and participation and response to emergencies, incident research, non-conformities, corrective and preventive actions and, internal

auditing and systematic performance revision conducted by the Departments in furtherance of their duties.

The PNGRR Department is responsible for conducting activities of management of radioactive waste originated in their facilities, in facilities which are external to CNEA, such as nuclear power plants and other small facilities, as well as management of SF originated from research and radioisotope production reactors.

The following charts show the assigned financial resources and distribution of personnel in accordance with the objectives.

**Financial Resources of CNEA devoted to RW and SF management (2016) (Included PRAMU)**

| ITEM | RESOURCES (ARS) |
|---|---|
| Research & Development | 2,250,636 |
| SF and RW Management | 1,875,896 |
| Foreseen Improvements | 39,959,883 |
| Personnel | 59,544,537 |
| **TOTAL** | **103,630,952** |

**Human Resources of CNEA devoted to Radioactive Waste Management and Spent Fuel Management (2016) – (Included PRAMU)**

| QUALIFICATION | Complete Dedication | PartialDedication |
|---|---|---|
| Professionals | 67 | 23 |
| Technicians and assistants | 66 | 11 |
| Fellowshipholders | 8 | 13 |
| **TOTAL** | 141 | 47 |

**Training of Human Resources**

Most employees devoted to RW and SF Management have taken a postgraduate educational course (PGECs)on Radiation Protection sponsored by the IAEA (currently the postgraduate educational course in radiation protection and the safety of radiation sources) and the postgraduate course on Nuclear Safety for professionals (currently the Specialization Course on Nuclear Safety) or the Radiation Protection Course for technicians offered by the ARN. The specializations are offered by the University of Buenos Aires and the ARN.

In addition, the staff is encouraged to attend and participate in courses, seminars, and training at universities and other science and technical institutions. For some specific

matters regarding nuclear issues, it has been possible to train them abroad through scientific and training visits, and attendance to specialization courses and seminars.

Also, RW and SFmanagement personnel participates yearly in dictating training courses on Radioactive Waste Management in the Postgraduate course in Radiochemistry and Specialization in Nuclear Reactors organized by CNEA's Dan Beninson Institute jointly with the National University of San Martín and in the specialization course in Technological Applications of Nuclear Energy at CNEA's Balseiro Institute jointly with the University of Buenos Aires.

NASA members of staff, who perform specific duties at nuclear power plants, as well as AGE staff,are re-trained in accordance with the requirements set by Regulatory Standard AR 0.11.3. In order to comply with those requirements, at the beginning of each calendar year, NASA and CNEA send ARN the retraining program to be developed in each period. The program includes the courses of study for each specific duty, time schedule, list of topics, lecturers appointed, and assessment of courses.

**Training of Fellowship Holders**

The PNGRR has a staff of fellowship holders devoted to the main lines of research and development carried out at CNEA three Atomic Centres and at CNEA headquarters, all of them under the direction of specialized professionals in specific disciplines.

Some fellowship holders have completed postgraduate courses at CNEA´s Educational and Training Institutes; therefore, they have a supplementary training prior to their commitment to the assigned lines of research and development. Fellowships for professionals may include advanced courses or master or doctoral theses. In the case of technical fellowship holders, they are researcher's assistants. Scholarships have also been granted to advanced students of other disciplines.

## F.3 Quality Management

### F.3.1 Introduction

In the Argentine Republic the application of an adequate quality management program during the design, construction, commissioning, operation and decommissioning stages of a nuclear facility is a regulatory requirement.

With this purpose Regulatory Standard AR 3.6.1 *Nuclear Power Plant Quality System*, issued by the regulatory body ARN,determines the quality system requirements applicable to Nuclear Power Plants.

Regulatory Standard AR 3.7.1 *Schedule for the Documentation to be Submitted Prior to the Commissioning of a Nuclear Power Plant*, and other related to other type of facilities,

determines the time when the Responsible Institution has to submit the program and the quality manual to the Regulatory Body.

Furthermore, the licenses for the operation of facilities set that during said stage they shall have quality management programs. Said quality management programs and manuals are mandatory for the facility.

The Regulatory Body controls the implementation of quality programs through the Responsible Institution through regulatory assessments and regulatory audits.

1) Through the regulatory assessments, the regulatory body assesses whether the programme and the quality manuals sent by the Responsible Entity comply with the requirements set forth in the Regulatory Standards AR, mainly the Regulatory Standard AR 3.6.1 (Quality System in NPPs).
   These assessments are conducted under the procedure regulatory assessments in order to grant a licence / a building authorization / start up / use of the site of NPPs. The most important actions in this procedure are writing reports and assessments (with and without external technical support), the approval of the relevant technical report, the follow-up and conclusion of relevant findings produced by the evaluations.

2) Through the regulatory audits periodically conducted in the Responsible Entity, the regulatory body verifies the degree of compliance of quality systems according to the requirements set forth in the AR regulatory standards, mainly the AR 3.6.1 regulatory standard. These audits are conducted under the quality regulatory audits in NPPs procedure. The most important actions of these procedures are the approval of an annual programme of quality audits, undertaking of audits, sending approved audit reports to the responsible entities and follow up and conclusion of corrective actions developed after the regulatory audits.

### F.3.2 Nucleoeléctrica Argentina Sociedad Anónima (NASA)

Since the Argentine corporation NASA was organized in 1994 (Decree No. 1540/94), it has developed its nuclear activity in connection with the operation of CNA I (Atucha Nuclear Power Plant – Unit I), CNA II – Unit II and CNE (Embalse Nuclear Power Plant).

Law No. 26566 determined that NASA would build, start up and operate a fourth nuclear power plant and would conduct any and all acts in furtherance of extending the lifetime of the Embalse Nuclear Power Plant and the finalization of Atucha II Nuclear Power Plant construction and startup in operation since May 2016.

NA-SA, as the Responsible Institution, has a General Quality Assurance System, which is the reference framework for specific quality assurance programs for each organizational unit. The systemis described in the *General Quality Assurance Manual,* which was approved and made effective in November 1997.

Subsequently, the *General Quality Assurance Manual* has been reviewed on different opportunities.

Currently, Revision 4 of the Quality Assurance Manual is in force and includesthe requirements of ISO 9001:2008 at a corporate level. As mentioned above, the *General Quality Assurance Manual* complies with the requirements of AR 3.6.1 regulatory standard *Nuclear Power Plant Quality System* and IAEA Practice Code 50-C-Q.

The Quality Policy was adapted in its Revision 5 in order to meet the requirements of ISO 9001:2008. Revision 6, currently in effect, following the same guidelines than those from the previous version, was ratified by the new authorities of the Responsible Entity in 2016.

**NASA's Quality Assurance Program Status**

| ORGANIZATION UNIT | DOCUMENT | REVISION | NUMBER OF PROGRAMMING PROCEDURES |
|---|---|---|---|
| NASA | Quality Assurance Manual | 4 | 40 |
| CNA I - II | Quality Assurance Manual for Operation of CNA Units I and II | 5 | 216 |
| CNE | Quality Assurance Manual for Operation of CNE Embalse | 6 | 135 |
| UG-PN | Quality Assurance Manual for Construction | 0 | 61 |
| NPPs Services Management | Management System Manual | 8 | 27 |
| CNE Life Extension Project | Management System Manual | 2 | 131 |

### F.3.3 Argentine Atomic Energy Commission

**CNEA Quality Management System**

CNEA has established a quality policy, whose current version has been approved by CNEA's authorities by Resolution84 on March 17th 2017.

Each sector from the Institution including those which as part of their activities manage spent fuel or manage radioactive waste develops its Quality Management System in agreement with institutional policies.

The Quality Management Department responsibilities include coordinating the activities

of quality management performed in CNEA and centralizing information on this topic. State authorities are periodically informed of the development of quality management system of the sectors of the Institution.

Obligatory documents of the Institution must be integrated to its Management System and fulfilled by different sectors.

CNEA Quality System documentation is completed by the one issued at different sectors of the organization, such as management system manuals, general procedures, operative procedures, work instructions. They are all developed in accordance with CNEA applicable standards, applicable external documents such as regulations or specific codes and the applicable regulatory legislation, particularly ARN regulations and requirements.

The documents system is of two ways:

**Internal**

As set forth in AR 3.6.1 standard (points 48, 49 and 50), the authorities in each sector are responsible for conducting a “Management Self-Assessment” and also must get the results of an “Independent Assessment” of the efficiency in applying the Quality System in order to improve it.

**External**

The areas in CNEA that generate and manage radioactive waste or spent fuels are subject to audits and inspections of different kinds, characteristics and origins which include technical aspects and management systems:

Inspections by the Nuclear Regulatory Authority (ARN).
Audits by the National General Audit (AGN).
Audits by the National Auditing Committee (SIGEN).

There are some sectors with management systems that are certified, as well as laboratories with Management Systems and activities which are accredited. In these cases, these sectors also get an assessment from the external agency (i.e., a Certifying Agencyor the Argentine Accreditation Agency).

Radioactive Waste ManagementNational Program (PNGRR).

The PNGRR, organization implemented by CNEA in order to comply with its waste management responsibilities, has designed a *Quality System*for all radioactive waste management stages to ensure that the conditioned waste complies with the acceptance requirements both for its transport and for its interim storage.

The *Quality System*lies within the framework of CNEA’s Quality Management standard policy. The responsibility to prepare *Quality System* procedures and their compatibility with CNEA’s Quality Management Program is carried out by the Documentation and Quality Management Section which reports to the head of the Planning, Financing Management and Quality Department of PNGRR. To date, the *Quality System* includes 97 operational

procedures and 4 work instructions which correspond to several activities developed in the Program.

This Section has 6 workers directly engaged in quality management and documentation without taking into account Project and Operation inspectors. Also, it should be noted that during 2015 and 2016 the Quality Management Division has conducted an audit to the Quality Management System implemented in the PNGRR.

Also, in order to have an efficient access to documentation, a Data Base was implemented, where, in addition to the procedures mentioned, specifications and layout of the facilities and memories, reports and other technical documents.The regulations and legislation issued by regulatory and other authorities provide the frame for radioactive waste managementform another Database. At the moment, the Data Base firstly has 3221records, out of which 1594 are from binding documents. In the second database, there are 849 records.

According to regulations issued by the Regulatory Body, all sectors managing radioactive waste must submit safety reports including the description of their management systems in order to obtain the pertinent operation licences.

Uranium Mining Environmental Restoration Project (PRAMU)

For restoration activities of uranium mining sites, in 2000, CNEA developed the *Uranium Mining Environmental Restoration Project* -PRAMU- which defines the organization and activities to be performed in the management of blanks derived from uranium mining.

The Quality Management System, developed in PRAMU is being redesigned, having produced and revised 17 documents (procedures).

## F.4 Operational Radiological Protection

Basic radiological protection criteria applicable in the country establish that:

- Practices using radiation shall be justified.
- Radiological protection has to be optimised.
- Established limits and dose constraint levels shall be met.
- Accidents shall be adequately envisaged, but if they occur, emergency procedures must be implemented so that their radiological consequences can be mitigated.

The criteria of the Regulatory Body concerning radiological safety in spent fuel and radioactive waste management facilities have been defined in the following standards:

**AR 10.1.1** Basic Radiation Safety Standard
**AR 10.12.1** Radioactive Waste Management
**AR 3.1.1** Occupational Exposure in Nuclear Power Plants
**AR 3.1.2** Limitation of Radioactive Effluents in Nuclear Power Plants
**AR 4.1.1** Occupational Exposure in Nuclear Research Reactors

**AR 4.1.2** Limitation of Radioactive Effluents in Nuclear Research Reactors
**AR 6.1.1** Occupational Exposure in Type I Radioactive Facilities
**AR 6.1.2** Limitation of Radioactive Effluents in Type I Radioactive Facilities

## Dose Limits for the Public

The annual effective dose limit for members of the public is 1mSv in one year and is applicable to the total effective dose to arepresentative person due to all facilities and practices. Equivalent annual dose limits are 15 mSv and 50 mSv for crystalline and skin, respectively.

## Dose Constraints for the public

For the design purposes of every facility, the Regulatory Body has established a constraint of 0.3 mSv for the annual effective dose of the representative person, due to the release of liquid and gaseous radioactive effluents.

In addition, since June 2013, the ARN has established that in the case of the design of a nuclear power reactor, a research reactor or a Type I radioactive facility within a site with multiple facilities, enough retention against the release of radioactive effluents should be considered, so that the annual dose value in the representative person does not exceeds 0.5 mSv, taking into account the release of radioactive effluents of all facilities included in the site.

The Radiation Safety Basic Standard sets that it is not necessary to prove that systems are optimized, except that the Regulatory Authority expressly requires so when the design of the radiation protection systems assures that, under normal operating conditions, no worker may receive an effective dose higher than 5 mSv in a year; that no member can receive an effective dose higher than 100 microsievert in a year; and that the collective effective dose owing to an operational year is lower than 10 man-sievert,.

Even in those cases in which such demonstration is not required, facilities must implement systems and actions to keep the doses as low as reasonably achievable, even though these implementations do not necessarily arise from an optimization analysis.

## Occupational Dose Limits

Dose limits for workers are as follows:

- The effective annual dose limit is 20 mSv. This value shall be considered as the average in 5 consecutive years (100 mSv in 5 years), not exceeding 50 mSv in any single year.
- The equivalent dose limit of20mSv year for crystalline (according to Resolution 230/2016) taking this value as the average in five consecutive years (100 mSv in five years), not exceeding 50 mSv in one year and 500 mSv year for skin.

The dose limit is applicable to the sum of the dose due to external exposure in the period under consideration plus the committed dose from intakes in the same period.

## F.4.1 Conditions for Radioactive Material Release

### F.4. 1.1 Discharges

In accordance with regulatory standards, the systems used for the retention of radioactive effluents shall be optimised.

The Regulatory Body establishes that, the discharges of radioactive effluents to the environment shall be as low as it is reasonably achievable and the annual activity of each significant radionuclide in the effluent shall not exceed the value “authorized for discharge” duly established by the ARN.

The authorized discharge values are understood as an operative restriction and are derived from the representative individual estimated doses due to optimized gaseous and liquid discharges considering an appropriate flexibility margin that guarantees the protection of the public without interfering with the operation of the facility. For this, specific mathematic models are applied. In order to keep the continuous discharge conditions for the application of the respective models, daily and quarterly constraints are established.

Gaseous and liquid discharges that occur during normal operation of the facilities are continuously monitored by the operator and submitted periodically to the ARN.

The Regulatory Body performs a control verification program of discharges conducted by the operator, which includes measurements of activity concentration in discharge samples and an environmental monitoring plan independent of the operator’s plan, which includes collecting and measuring of water, sediment, and foods, such as vegetables, fish and milk samples.

The following Table shows the annual average activity discharged to the environment with gaseous and liquid effluents corresponding to the 2014-2016 period, discriminated by type of discharge and group of radionuclides for the 13 facilities authorized to perform controlled and planned discharges (nuclear power plants, research reactors and Type I radioactive facilities). Information on the annual dose limit fraction is also included, and it represents such liquid and gaseous discharges in the representative person. Discharges during the 2014-2016 period include tritium in equipment treated to be replaced by new pieces of equipment as part of the PEC. It is worth mentioning that the increase on the average discharge of tritium in the liquid effluents within the CNE, in the period described in this report with respect to the previous five-year period, is due to tasks of drying of SPTC and the Moderator System.

| ANNUAL AVERAGE OF CONTROLLED AND PLANNED DISCHARGES - PERÍOD 2014 - 2016 | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FACILITY | LIQUID | | | | | GASEOUS | | | | | | |
| | TOTAL ACTIVITY (Bq) | | | | % L. Dosis | TOTAL ACTIVITY (Bq) | | | | | | % L. Dosis |
| | H3 | β/γ | α tot | Unat | | Gases Nob | Aerosoles | H3 | Iodines | C14 | Nat U | |
| CNAI | 1.2E+15 | 1.3E+11 | 5.2E+08 | --- | 0.07 | 3.7E+13 | 2.6E+07 | 3.7E+14 | 3.0E+08 | 5.1E+11 | --- | 0.3 |
| CNAII** | 1.2E+14 | 2,0E+10 | 3.5E+07 | --- | <0.01 | 4.1E+13 | 1.8E+07 | 1.8E+14 | 1.3E+09 | 7.2E+11 | --- | 0.2 |
| CNE*** | 1.5E+14 | 2.3E+09 | --- | --- | 0.37 | 1.5E+12 | 1.1E+06 | 1.7E+14 | 3.1E+04 | 7.1E+10 | --- | 0.04 |
| PPUO2 | --- | --- | 1.9E+06 | 4.2E+08 | 0.01 | --- | <LD | --- | --- | --- | 7.3E+06 | 0.02 |
| RA3 | --- | 5.9E+07 | --- | --- | 0.3 | 2.3E+13 | 4.5E+07 | --- | 1.1E+06 | --- | --- | 0.09 |
| PPR | --- | ND | --- | --- | --- | --- | --- | --- | 7.2E+08 | --- | --- | 0.02 |
| PPMo99 | --- | --- | --- | --- | -- | 8.9E+12 | --- | --- | --- | --- | --- | <0.01 |
| PFS | --- | --- | --- | --- | -- | --- | ND | --- | --- | --- | --- | --- |
| CICLOTRON | --- | --- | --- | --- | -- | --- | 3.0E+11 | --- | --- | --- | --- | <0.01 |
| CONUAR | --- | --- | --- | 1.1E+05 | <0.01 | --- | --- | --- | --- | --- | 2.6E+05 | <0.01 |
| LUE | --- | --- | --- | --- | -- | --- | --- | --- | --- | --- | ND | -- |
| RA1 | --- | ND | --- | --- | -- | --- | --- | --- | --- | --- | --- | -- |
| FAC. ALFA | --- | --- | ND | --- | -- | --- | 9.6E+00 | --- | --- | --- | --- | <0.01 |
| RA6 | --- | 8.8E+06 | --- | --- | <0.01 | 2.1E+10 | --- | --- | --- | --- | --- | <0.01 |

References:
--- = Not Applicable
ND = No Discharges registered
<LD = Less than Detection Limit
* = in the period of time considered, the facility was closed
% DC = Indicates the percentage of the allowed dose limit for the public (1 mSv)
**The facility started generating discharges in May 2014 (thanks to the start up licence grant)
***The facility has been shut down since 28 December 2015.

In particular, discharges of CNA Unit II started by mid 2014 and gradually increased until the Operational license has been obtained in June 2016.

The methodology to calculate doses in a representative person owing to gaseous discharges uses the PC CREAM 08 programme with the weather bases related to each site. This basically implied a variation in the dilution factors and can explain the differences with the estimated doses in previous years.

### F.4.1.2 Disposal of Solid Materials

On September 21st 2009, the ARN´s Board's approved the Resolution of the "Generic Values of "Clearance" to release from the regulatory control the solid materials of very low level activity concentration. These levels areset in the International Atomic Energy Agency document "Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards,General Safety Requirements Part 3" and were derived from scenarios developed in the IAEA Safety Guide No. 44. Clearance levels derived from unlimited amounts of solid materials in terms of activity concentration.

Currently, Guide AR 8is already publishedand corresponds to the application of generic levels of clearance where the conditions for materials to be cleared are set. Until now, conditional dispenses have been given to small users.

### F.4.1.3 Exemption of Practices

In Regulatory StandardAR 10.1.1, ARN makes reference to exemption of practices and criteria of applicable doses, as follows:

*"Provided the approval of ARN, every practice is exempted in which it can be demonstrated that it is not conceptually possible to originate during a year an effective dose in more exposed individuals higher than 10 μSv or a collective effective dose higher than 1 man.Sv."*

In 2010, Standard AR 6 on "Generic Levels of Exemption"was approved. These levels were derived from 3 scenarios established in the document Radiation Protection 65 from the European Union which appear in the following IAEA document: "Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards,General Safety Requirements Part 3.

The exemption levels derive in total activity and activity concentration. They apply to moderated masses of radioactive material in the order of 1 ton in any physicochemical state (liquid, gaseous or solid). For those materials that do not exceed Generic Levels, exemption might occur automatically.

### F.4.2 Occupational Exposure

The Radiological Protection criteria adopted by the Regulatory Body to control the dose received by workers is consistent with ICRP's recommendations. Regulatory Standards AR 3.1.1, AR 4.1.1 and AR 6.1.1 applied to nuclear power reactors, research reactors and radioactive facilities Type I set different criteria to ensure that the occupational dose to workers stays as low as reasonably achievable and lower than the established dose constraints.

In practice and according to what regulatory standard 10.1.1 determines, it is considered that dose limit levels have not been exceeded when the following conditions are met:

$$\frac{H_p(d)}{L_{DT}} \leq 1$$

and

$$\frac{H_p(10)}{20mSv} + \sum_j \frac{I_j}{I_{L,j}} \leq 1$$

where:

- $H_p(d)$ individual equivalent dose at a depth of 0.07 mm and 3 mm for skin and crystalline, respectively, integrated in a year.
- $L_{DT}$ limit of equivalent dose in skin or crystalline, as appropriate.
- $H_p(10)$ individual equivalent dose at a depth of 10 mm from the skin surface, integrated in one year.
- $I_J$ intake value of nuclide *j* during a year.
- $I_{L,J}$annual intake limit for nuclide *j*, resulting from the division of 20 mSv by the dosimetric factor of effective dose commitment, per intake unit of the mentioned radionuclide.

In most facilities, the occupational doses are global values that include the doses received during operation and maintenance, for all the workers at the facilities subject to individual monitoring, therefore the doses received during radioactive waste and spent fuel storage activities are not distinguished.

Only in the case of doses to AGE staff, the reported doses correspond exclusively to radioactive waste management activities. In that facility, in the period 2014, 2015 and 2016, the effective collective doses were of 0.0050Sv.p, 0.0019 Sv.p and 0.0023 Sv.p. Regarding personal effective doses during the same period and annually averaged were the following: 0.28 mSv, 0.10 mSv and 0.13 mSv.

### F.4.3 Radiological and Nuclear Safety at CNEA

The Argentine Atomic Energy Commission (CNEA) responsible for the management of SF and RW generated in the national territory is the Responsible Institution for the operation of nuclear and radioactive facilities at several Atomic Centres.

In order to organise and coordinate organically the activities conducted at CNEA, related to radiological and nuclear safety, a Radiological and Nuclear Safety Department was created (GSR&N). This Department has goals, such as to strengthen policies to supervise and comply with the legislation and regulations in force and coordinate the implementation of measures, actions and practices in major facilities of CNEA in accordance with regulatory standards in force, in order to protect workers, population, the environment and the assets.

The main objective of the Radiological and Nuclear Safety Department is to strengthen the safety culture of CNEA in an integrated manner with qualified personnel to undertake this activity in an effective, efficient and transparent manner as a referent in this topic.

The Department coordinates the CNEA Safety Committee consisting of the Heads of Safety Units of Atomic Centers where nuclear facilities are located.

This Committee evaluates the state of documentation of facilities, formation and training of operating personnel, the state of facilities, failures or recorded detours, changes or modifications, innovations and improvements, and operating experience.

In order to achieve this objective, the GSR&Nhas the following main activities:

*Strengthen:*

- Current capacity in CNEA in relation to safety topics.
- Control systems and support to facilities.

*Optimize:*

- Environmental radiological monitoring programs of CNEA sites and the communication of their resultsamong the public.
- Radiological monitoring programs of the personnel of radioactive facilities and neighboring areas.

- Occupational health system.

*Consolidate:*

- A system of radiological public health medicine.
- A net for supporting the licensing of facilities.
- A program of radiological protection for the patient at a national level.

The Department also participates in adapting the regulations (standards) and other relevant legislation. This department is a national contact point and is in charge of ensuring the compliance with obligations of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (Law No. 25279).

## F.5 Emergency Preparedness

### F.5.1 Introduction

As presented in prior National Reports, the Nuclear Regulatory Authority requires that the responsible organization prepares a plan to answer in case of nuclear or radiological emergencies. This Emergency Plan includes the application of protective actions to prevent and/or mitigate eventual radiological consequences in accidental situations. The magnitude and scope of the plan are consistent with the type of facility. Every Class I facility should submit an emergency plan to be approved by the ARN in case of Type II Facilities and some non-routine practices, they must have at least one procedure to deal with emergency cases. In nuclear power plants, an external emergency plan is necessary to evaluate the probabilityof occurrence of radiological consequences in neighboring inhabitants.

Regulatory standards AR 10.1.1, AR 3.7.1 and AR 4.7.1, operating licenses and requirements presented to responsible organizations and primary responsible persons of facilities, regulate planning and preparation of the response in case of emergencies.

### F.5.2 Structure of the Emergency Plan in the National Scope

Law No. 24804 and its provisions through the Decree No. 1390 of November, 1998 provide the ARN with the legal framework necessary to approve and intervene in contingency plans in case of nuclear accidents.

Municipal, provincial and national authorities that may be related to the preparation of these plans shall comply with guidelines and criteria defined by the ARN, which shall have those powers conferred in the Convention on Nuclear Safety, approved by Law No. 24776.

In December 2002, an interim version of the National Plan of Nuclear Emergencies was approved in the scope of the Federal Emergency System (SIFEM) and the National Office of Civil Protection which was updated in agreement with the Nuclear Activity Act. In 2003, a Provincial Plan on Nuclear Emergencies was approved in Córdoba Province where the

Embalse NPP is located. The Provincial Plan on Nuclear Emergency is to be approved in Buenos Aires Province where the Atucha NPP (CNA-Units I and II) are located.

In the case of nuclear power plants, municipalities that might directly be affected by a nuclear accident within a 10-km radius have a Municipal Plan for Nuclear Emergencies. This is the case of the town Lima and its neighboring areas surrounding Atucha NPP , as with the towns La Cruz, Embalse, Villa del Dique and Villa Rumipal near CNE.

When considering atomic centers, potential accidents in each facility are assessed and characterized in safety reports.Most of these facilities have a low radioactive inventory, therefore, their probable radiological consequence would only affect them and,in the case of extreme conditions, also the atomic centres where they are located.

As it was previously mentioned, agreements with governmental authorities were reached in order to implement protective measures, and define responsibilities and positions of organizations in charge of applying them.

Facilities under ARN regulatory control conduct periodic emergency drills. Periodicity and characteristics of drills depend on the risk associated to the activities conducted in these facilities. Drills in NPPS operating in Argentina are annual conducted, while those drills which include members of the public are conducted every two years.

The purpose of drills in NPPs is to train the population and response staff, evaluate the performance of the Emergency Plan in the NPP and neighbouring towns and to try new concepts, ideas and equipment. Moreover opportunities for development improvement are expected to be identified during the response and during the coordination of participating organizations.

### F.5.3 International Agreements

By the end of 1986, Brazil and Argentina signed the Argentine-Brazilian Cooperation Agreement. Annex II to Protocol 11 thereof includes the *Reciprocal Cooperation and Assistance in Case of Nuclear Accidents and Radiological EmergenciesProgram*.

In February 1990, by Law No. 23371, Argentina adhered to the *Convention on Early Notification of a Nuclear Accident* and the *Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency.* The Regulatory Body is the contact and the Competent Authority of both instruments. In addition, Argentina is a member and contact of the The Radiation Emergency Medical Preparedness and Assistance Network (REMPAN) of the World Health Organization.

On the other hand, if an accident involving potential loss of nuclear material in spent fuels should occur, Argentina has assumed the commitment of reporting to international agencies characteristics, causes and consequences of the accident in a special report.

### F.5.4 Nuclear Power Plants Emergency Plans

In the case of spent fuel and radioactive waste management facilities located in nuclear power plants, the emergency plans of the plants contemplate the application of protective measures to prevent and/or mitigate the possible radiological consequences derived from nuclear accidents that might occur in those facilities. The emergency plans of nuclear power plants were described in the 1st National Report and have been fully developed in the reports of the Convention on Nuclear Safety.

### F.5.5 Atomic Centres Emergency Plans

As discussed in previous reports, CNEA as the responsible entity for the operation of nuclear and radioactive facilities, established a general procedure for developing emergency plans (facilities emergency and evacuation plans CNEA-PN00O01). This document sets out general guidelines to which the Atomic Centres and Principal Branch Offices under CNEA's jurisdiction should adopt and complywith.

## F.6 Decommissioning

### F.6.1 Introduction

CNEA has informed the ARN about its decision to decommission the RA-8 reactor in the short term. Now, the fuel assemblies of this reactor have been safely retired and storedalong with the source and main core barrel. The decommissioning plan was submitted to the ARN together with the Code of Practices for Radiation Protection.

### F.6.2 Regulatory Aspects

The legal and regulatory framework of nuclear activities described in Section E of this National Report is applicable to decommissioning activities of nuclear facilities. Therefore, the criteria and radiological safety standards, waste management, quality and safety culture concepts to the operation of the nuclear facilitiesare applied.

One of the main requirements of the regulatory system is that it is not possible to start construction, commissioning, operation and decommissioning of a significant nuclear facility if it does not have the pertinent license requested by the Responsible Institution and issued by the Regulatory Authority.

Specifically, Law No. 24804, Nuclear Activity Act, sets forth in Article 16 (b) that the Nuclear Regulatory Authority is authorized to grant licenses for the decommissioning of nuclear facilities.

The above mentioned law and its regulating Decree determine, among other issues, CNEA's liability as responsible organization for the manner in which NPPs should be decommissioned.

Regulatory standard AR-0.0.1 "Licensing of Type I facilities" sets out that a license issued by the ARN is required in order to proceed to the decommissioning of nuclear facilities.

Also, regulatory standard AR-3.17.1 “Nuclear power plant decommissioning” determines the basic requirements for the decommissioning of those facilities. The main conditions are as follows:

- The Responsible Institution, holder of the Decommissioning License, is responsible for planning and providing the resources required for the safe decommissioning of the nuclear power plant.
- The Decommissioning Program should consider the necessary institutional arrangements and foresee appropriate radiological protection in each stage. The Regulatory Authority’s prior approval is required to implement the Program.
- The Decommissioning Program should include all necessary steps to ensure an appropriate radiological protection with minimum surveillance after decommissioning.
- The Responsible Institutionwill be able to delegate the decommissioning activities, either totally or partially, to third parties, but it will continue being responsible for them. During the decommissioning process, the Responsible Institution shall contemplate and submit to ARN’s consideration, the following:

    - Project management
    - Site management
    - Roles and responsibilities of involved organizations
    - Radiological protection
    - Quality assurance
    - Waste segregation , conditioning, transport and final disposal
    - Monitoring after partial decommissioning stages have concluded
    - Security, safeguards and non-proliferation commitments

### F.6.3 Background

The dismantling of RA-2 Critical Facility at CNEA Constituyentes Atomic Centre, performed during 1984-1989, is a former milestone in terms of decommissioning. The building that housed the reactor is now open for unrestricted use.

In compliance with the Nuclear Activity Act, Law No. 24804, the responsibility for the mannerof how decommissioning activities areperformed, falls on CNEA.

### F.6.4 Planning for Decommissioning of Significant Nuclear Facilities

The reactor RA-8 has stopped operating since the nineties. Its fuel has been withdrawn and it has been safely stored in the controlled area of the reactor RA-6. It is planned to conduct the regulatory procedure for its decommissioning.

### F.6.5 Financing

As stated in prior reports and as determined by Decree No. 1390/98, regulatory of Law No. 24804 regarding Nuclear Activity, the funds to meet decommissioning costs of each

nuclear power plant would be set up with contributions of the company that would operate it if the nuclear power plant was to be privatised.

Law No. 26784 of 2012, in its Art. 61, revokes Art. 34 of Law No 24804;consequently, the operation of the nuclear power plants cannot be privatised, the responsibility for financing the decommissioning of Nuclear Power Plants, research reactors, and other significant nuclear facilities would be assumed by the National Government with its own funds.

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# SECTION G SAFETY IN SPENT FUEL MANAGEMENT

## G.1 General Safety Requirements

It should be clarified that in general the contents of Section G are valid for Section H homologous requirements, except in cases in which the latter are specific.

The general safety requirements associated with spent fuel management have not been modified with respect to the requirements described in the previous National Reports. A summarized presentation of these requirements may be found in Section H – Safety in Radioactive Waste Management, as they do not reflect substantial differences.

As a consequence of the accident at the Fukushima Daiichi Nuclear Power Plant and in order to apply lessons learned, the ARN requested a resistance test for each Argentine NPP in operation which consisted in a new safety margins assessment, assuming a sequence loss of defense lines in depth caused by the heat sinks, lines of external electricity provision and finally the simultaneous loss of both resources which could eventually lead to severe core accidents. Among other topics related to safety, such assessment included the following aspects:

- ✓ Description of current measures of accident management to give a response in case of loss of spent fuel pool cooling (i.e., assessment of available times for the conditions for planned scenarios, radiation protection, eventual failure and fuel degradation).
- ✓ Identification of any cliff edge effect.
- ✓ Adequacy of accident management strategies (guidelines and procedures developed to face a serious accident; analysis of possible additional accidents; adequacy/availability of required instrumentation; habitability and access to essential areas; accumulation of hydrogen in different containment buildings).
- ✓ Organization (personnel; resources and shift changes; use of external technical assistance and procedures; training and exercises).
- ✓ Availability to use equipment.
- ✓ Forecast for the use of mobile equipment.
- ✓ Supplies and availability management.
- ✓ Radioactive emissions management and forecast to limit them.
- ✓ Potential doses management for workers and provisions for limiting them.
- ✓ Communication and information systems.
- ✓ Activities forecast in the long term (after the accident).

The description of the ARN requirements during the stress test requested as a consequence of the accident in Fukushima is described in detail in the 2013 Report of the Nuclear Safety Convention.

In response to the regulatory requirement, the Responsible Entity for the operation of CNA Unit I, Unit II and CNE (NA-SA) conducted the required resistance test, and the relevant reports were submitted before the ARN.

The Nuclear Regulatory Authority assessed these reports. As a result, there have been

identified opportunities for improvement related to adding systems and additional actions of the operator tending to prevent the sequences leading to scenarios of severe accidents.

The improvements and modifications required to the Responsible Entity for the operation of nuclear power plants include a chronogram composed by short, mid and long-term actions which were acceptable by the regulatory body. Details of actions being conducted are included in section K.3.1.

## G.2 Existing Facilities

As described in previous Reports, spent fuel (SF) management consists in wet or dry storage, depending on each case. Wet storage is performed in pools or tubes for the period required for the decay of the fission products in order to allow its subsequent temporary dry storage.

To date, the existing SF storage facilities are the following:

| SITE | FACILITY |
|---|---|
| Atucha Nuclear Power Plant-Unit I (CNA I) | Pool Building I and II |
| Atucha Nuclear Power Plant-Unit II (CNA II) | Pool Building (UFA) |
| Embalse Nuclear Power Plant (CNE) | Storage Pool |
| | Storage Silos (ASECQ) |
| Ezeiza Radioactive Waste Management Area | Central Storage for Spent Fuel from Research Reactors (DCMFEI) |
| Ezeiza Atomic Centre (CAE) | Research Reactors Irradiated Fuel Storage Facility (FACIRI) |

### G.2.1 CNA I Spent Fuel Storage Pools

Spent fuels described in this section come from CNA I, type PHWR, with an installed capacity of 362 MW (e) which started operation in 1974.

At present, every CNA I spent fuel is temporarily stored under water. The Power Plant has two fuel storage areas known as Pool Buildings:

- Pool Building I
  Constituted by two decay pools
  Storage capacity: 3240 positions

- Pool Building II
  Constituted by four decay pools
  Storage capacity: 8304 positions

Both buildings include a handling pool or working area.

The storage of spent fuel takes place in pools, which have a stainless steel lining of several millimeters thick, in a double tier arrangement. Fuel assemblies hang from stainless steel *racks*.

In order to collect and direct possible leaks through the welded seams and to be able to locate their origin, small concrete channels are left below the steel lining. Prior to lining, the walls are coated with an appropriate kind of waterproof paint.

In case leaks should exist, they are checked at the inspection station located at the lowest level of the building. This leak detection system includes the floor and gate sealing frames.

Handling of spent fuels within the pools is performed using an overhead travelling crane with a telescopic mast fitted with the fuel handling tools. By maneuvering the crane and/or the telescopic mast it is possible to reach all points inside the pool.

With respect to the frequency at which the safety revisions are conducted, the ARN has adopted the *Periodic Safety Review* (PSR) methodology for Type I Facilities as well as the limitation of the period of validity for the Operation Licenses.

It is worth mentioning that a new facility is under construction for the dry storage of SF after a period of wet storage in CNA I (See Section G.4.1).

### G.2.2 CNA II Spent Fuel Storage Pools

Fuel assemblies are transported through the fuel transfer canal from the reactor building of CNA II to the pools.

Fuel assemblies are hung in a beam and stored in refrigerated demineralized water.

The number of positions in the four (4) pools is 6048 (1512 x 4). Storage maximum capacity of spent fuel during normal operation is 4536 in 3 pools (1512 x 3), and in Pool 2 of 733 SF, there is space left in case the whole reactor core needs to be removed. Such space shall be occupied in accordance with the strategy for removal and the composition of the fuel column.

Within the pools, there is enough space to use a transport container and fill it so that afterwards it can be taken out of the site with the irradiated fuel assemblies.

The pools are reinforced concrete structures with a stainless steel liner, and the design is such that no damage can be done to the concrete structure when water at the pool is at 60ºC.

### G.2.3 CNE Spent Fuel Storage Pools

CANDU type spent fuels are originated in the CNE Nuclear Power Plant (CANDU 600) that started operating in 1984.

The storage of these spent fuels is performed in a concrete pool coated with epoxy resin. The original pool capacity represented 10 years of operation at 80% of the reactor power. When the worktable of the Dry Storage System (ASECQ) was installed, the storage capacity was reduced to 45144 positions, corresponding to 8 years of operation.

Failed fuel assembliesare encapsulated and stored under water in the failed fuel storage pool. Unloading and transfer of spent fuel is remotely controlled. Other fuel handling operations in the service building as well as in **the storage pools** are carried out manually under water, using long reach tools assisted by cranes and power hoists. Spent Fuel assemblies are stored under water in stainless steel trays.

### G.2.4 Storage Silos for Spent Fuel (ASECQ), of the CNE

The Dry Storage System (ASECQ) integrated to the CNE facilities, comprises a pool work table, SF handling tools, pool shield with its transport cart, cranes, transfer building (including the operation cell), the tractor vehicle for the transport to the silos field, the transport cart, spent fuel baskets, flasks, a lifting system for silos transference shielding, and the silos themselves.

Spent fuel assemblies are stored in these dry storage silos (ASEQC) after 6 years of being refrigerated in the pool. The capacity of each silo is 540 spent fuel assemblies housed in 9 baskets, with 60 fuel assemblies per basket.

This system is in operation since 1993. There are plans to build the necessary silos to store the spent fuel generated during the whole lifetime of the power plant. At present, out of 248 silos are already built, the last 32 have been finished during 2013 and, towards the end ofOctober 2016, 209 silos were completely full already.

Upon request of ARN, the (ASECQ) system has been included in the *“Ageing Management Program for Power Plant Components and Systems Related to Nuclear Safety”.*As a consequence thereof, a surveillance plan for baskets, interior lining and concrete structure of all the ASECQ silos system was incorporated. In addition to this surveillance action, a periodic measurement of aerosol and noble gases content inside the silos is conducted.

The surveillance plan continues normally since it has been in force up to date, no abnormality whatsoever has been observed in the analysis of the behavior of these components.

### G.2.5 Centralized Storage of Spent Fuel from Research Reactors

Since 1972, CNEA has the “Central Storage of Special Irradiated Fissionable Material” DCMFEI, which is located at the Ezeiza Radioactive Waste Management Area (AGE).The facility was designed and built to store the SF from its research reactors. It comprises

underground storage of 2.10 m long and 0.141 m diameter stainless steel tubes, with capacity to hold two spent fuel assemblies type MTR or one control element in each tube. The tubes are closed with lead filled steel plugs. At present, it stores spent fuel from the research and radioisotopes production reactor RA-3, located in Ezeiza Atomic Center, which operates with MTR low U-235-content fuel (20%).

Additionally, within the AGE, there is a storing area where 232 LEU fuel rods are stored, corresponding to the first core of RA-1 reactor.

The studies conducted in order to determine the current situation of these deposits concluded that it was necessary and convenient to secure the integrity of stored fuel along time and, consequently, in 2003, the decision was to start the project of a new facility (FACIRI), adapting existing pools in a building located at CAE and outside AGE.

### G.2.6 Storage Facility for Research Reactors Spent Fuel (FACIRI)

This facility which replaces DCMFEI has been conceived for centralized wet storage of spent fuels definitively unloaded from the research reactors, enabling a better control of the state of spent fuel conservation and an adequate monitoring of the quality of the water, incorporating major safety improvements. Spent fuels showing failures will be encapsulated before being stored.

The FACIRI storage capacityis based on grids pilled one upon the other, forming two columns of grids located on the depth of a 16 m pool. In total, 608 spent fuel assemblies can be stored distributed in two columns of 19 grids storing 32 spent fuel assemblies each.

The positions for normal fuel assemblies are 416, those for control rods are 96, and those for encapsulated spent fuel assembliesare also 96.

The pools have a double stainless steel lining and includes a treatment system that allowskeeping the quality of deionized water at adequate levels in order to preserve the integrity of spent fuelsduring storage.

A monitoring station composed by a monitoring station and an underwater camera placed in one of the pools allows visual inspection of the stored spent fuels.

The design of the FACIRI will ensure that the spent fuels are received, handled, stored, inspected and removed in a safe manner, maintaining sub criticality, confining the radioactive material, offering protection against radiation and dissipating the heat generated by decay, complying, additionally, with the requirements concerning conventional safety and security.

During 2014, components and special systems were conducted and the mandatory documentation was completed. On 5 September 2014 ARN granted FACIRI the start up license and the first spent fuel was transferred from the RA-3 reactor on 9 September, giving way for the start-up stage.Operation license was granted on 29 November 2016. By the end of 2016, 60 spent fuels were stored and 149 spent fuels are to be transferred, which remain in the old facility (DCMFEI).

## G.3 Siting of Projected Facilities

For the new reactor CAREM-25 site, a comprehensive assessment has been conducted. Even though this new facility is located within the same area of CNA Unit I and II, independent analyses have been carried out for CAREM, including assessments of external events that could affect the plant safety, and the plant environment impact and potential effects on the population.

Likewise, for the RA-10 siting, a specific siting study of RA-10 was conducted. The assessment of the site is part of the design documents of every new facility required by the ARN for its licensing.

The evaluations were conducted in accordance with the IAEA Guidelines (NS-R-3 Site Evaluation for Nuclear Installations, NS-G-3.1/2/6, SSG-9/18/21, among others), ending in the respective design basis for the verification of the facilities.

As mentioned in the previous National Reports, the safety requirements for the remaining sites to be used for spent fuel management have not been modified.

## G.4 Design and Construction of New Facilities

### G.4.1 Atucha Nuclear Power Plant - Unit I

The available positions inspent fuel pools at CNA I willbefore the end of the lifetime of the unit; therefore, a new option for spent fuel storage should be available.

CNEA and Special Projects Division of CNA I developed the project conceptual engineering for the Burned Fuel Assemblies Dry Storage (ASECQ, Burned Fuel Assemblies).

This project foresees SF transfer with a major decay deposited in the Pool Building I to an annex which will be the Transitory Dry Storage Building. This building will include vertical subterranean silos (subterranean silos in an upright position) and will be an extension of the controlled area that will have the same features of the existing pool zone.

It is expected not only to reach end of life, but also to extend life operation of the plant for more than 5 years of full power, enough time to implement a new Dry Storage System compatible with both plants (CNA I and II).

According to the ASECQ project conceptual engineering, fuel will be located in a rectangular stainless steel storage unit (basket) with a capacity for nine SF; this unit will be hanging from a supporting grid in the upper part.

In order to handle the baskets with SF, there will be a device (shield for transportation and lifting) to store the baskets and provide an appropriate shield protection level to workers during transportation.

Every silo will be made up of stainless steel, with a storing capacity of 2 baskets with 9 SF elements inside each.

Some silos will include instrumentation for obtaining information about SF cladding temperature as well as the dose rate status.

Currently the responsibility for financial management and final work supervision is in charge of Atucha Nuclear Complex, the continuity and finalization of the development of engineering, surveillance and follow-up of the building work is in charge of the Management Unit PN. Its main stages are the following:

- Detail Engineering Project Implementation
- Civil Works Implementation
- Electromechanical Assembly Implementation
- Start-up

The civil works that began with the concrete retaining plate for floors, the beginning of excavation and installation of small piles for the building foundation.The new building contractor will start rendering services during at the beginning of 2017.
The facility is currently under construction. The civil building work has advanced 50%.

As the facility mentioned in the above paragraphs would not start up, as previously planned, and with the aim of protecting the operation of CNA I, the Nuclear Safety Department of CNA - II created the following alternative:

1) Reorganization of the reactor's internal components placed in the decay pools hangers within the Pool Building I and II: During the 2013 planned outage, 93 positions to store irradiated fuels elements were recovered, which allowed for four months extra of operation.

2) Spent fuel assemblies transfer from Unit I to Unit II: At the end of 2012, the project to transfer SF to CNA's storage pools began, and it was divided into three phases:

Phase I - Conceptual Engineering,
Phase II - Detail Engineering and Preliminary Safety Report, and
Phase III - Fabrication, Delivery of Components and Licensing.

The development of the two first phases was awarded to AREVA-Transnuclear. In mid-2013, the conceptual engineering was received, paving the way for the development of the documents included in Phase II.

Phase III was developed in Argentina, and it included the construction of four casks to transfer spent fuel assemblies with more than 25 years of decay; the fabrication of frames for lifting the casks using cranes from Unit I and Unit II (UFA) pools buildings; and finally the fabrication of a cask support to transfer them in horizontal position between both units. Those components, among other auxiliary devices that allow interaction between the casks and the facilities of the nuclear plant, will offer 620 free positions to store irradiated fuel from the reactor.

The ARN authorized the transference of 620 spent fuels from Unit I to the pools of Unit II. Requirements for transfer are a burning degree lower than 6740 MWd/tU and a minimal decay period of 33.5 years. By December 2016, 315 out of 620 spent fuels were transferred.

As the new facility has not yet been finalized, the transfer process began. By December 30$^{th}$ 2016, 327 spent fuels were transferred.

### G.4.2 CAREM-25 Nuclear Power Plant

CAREM-25 is an innovative design prototype reactor of small power (100 MWt) thought to offer new design solutions based on the worldwide expertise in the safe operation of light water reactors. CAREM-25 design is based on an integrated light water reactor, using enriched uranium as fuel. It is an indirect cycle reactor conceptually simple, which offers a high safety level.

The CAREM reactor prototype will be located in Lima, Zárate, Buenos Aires Province, next to CNA I y CNA II.

CAREM fuel assemblies have a hexagonal section with 127 rods: 108 are fuel rods; 18 are guide tubes for absorbing elements; and one is an instrumentation tube.

The reactor core has 61 fuel assemblies. There is an annual refueling and it comprehends the whole core.

Within the containment building, there is a spent fuel storage pool designed to store the SF originated during 10 years of full power operation, residual heat removal and a proper level of sub-criticality.

The SF storage pool will include a Cooling and Clean-up System whose functions are:

- Removing decay heat dissipated by irradiated fuel assembliesstored in the SF pool as a safety measure.
- In case it is required, it will allow decay heat removal of a whole core once the reactor has been extinguished for 60 hours.
- Keeping the radiological, physical and chemical parameters of the water of the fuel assemblies pool within an appropriate range.
- Compensate water loss by evaporation.

Furthermore, there is a plan to develop a replenish water system to compensate loss by evaporation at the maximum water temperature according to the operation design.

In case of emergency (loss of normal supply water line) it is planned to include a temporary support facility.

CAREM work is in the first stage of cementation of the containment.

### G.4.3 RA-10 Reactor

RA-10 reactor is a new multipurpose reactor for radioisotopes production, fuel irradiation, beams use, and neutron and thermal-hydraulic experiments. Its main purpose is to extend and consolidate radioisotopes production, provide materials and fuel irradiation, and offer new applications in the scientific and technological fields.

RA-10 reactor will be located at the Ezeiza Atomic Center (CAE). Its maximum thermal power will be 30 MW, and it will include a core consisting of MTR type fuel reflected by heavy water.

SF will be stored in pools inside the facility (enough to cover 10 years of operation) until they are transferred to a proper temporary storage facility. Pools cooling system will be designed so that decay heat can be safely removed from the core, from the experimental devices and from the irradiated fuel assemblies during normal and abnormal conditions.

## G.5 Safety Assessment of Facilities

The requirements forthe safety assessment of spent fuel and radioactive waste management facilities have not been changed since the presentation of the previous National Reports, except with reference to those expressed in section K.3.1 of the present National Report.

## G.6 Operation of the Facilities

As mentioned above, the safety requirements applied to the operation of spent fuel and radioactive waste management facilitieshave not been modified with respect to the previous National Reports.

## G.7 Final Disposal of Spent Fuel

At present, the safety requirements stated in the 1st National Report continue in force, as long as spent fuels are stored in facilities specially designed and operated for that purpose.

The last version of the PEGRR foresees a deep geological repository in Argentina by 2060.

To date, R&D activities have been conducted in relation to the geology of sites to locate the repository location.

In order to select the site, public acceptance is also very important and therefore communication actions are undertaken, which are intended to provide information to the public in general on nuclear power and the need for a repository. Moreover, there are several projects under execution to increase storage capacity in order to meet the lifetime of reactors and provide a period of several decades until spent fuels have been transferred to a reprocessing plant or to a repository.

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# SECTION H SAFETY IN RADIOACTIVE WASTE MANAGEMENT

## H.1 General Safety Requirements

The following paragraphs summarize the scope of the general safety requirements for the management of radioactive waste generated in Argentina.

### H.1.1 Criticality and Removal of Residual Heat Generated During Radioactive Waste Management

Radioactive waste stored or disposed of in the Argentine Republic does not require any particular measures associated with heat removal or criticality factors because it is classified as low or intermediate level on account of their radiological characteristics (half-life periods, types of radionuclides, energies and activity concentrations).

### H.1.2 Minimization of Radioactive Waste Generation

Minimization of radioactive waste generation is an essential concept applied in Argentina in order to comply with the following conditions:

- Minimizeradiation doses
- Reduce costs
- Minimize environmental impact

For that purpose, the minimization of generated wasteis taken into account and in consequence the contents of activity and volume from the different streams. Also, as part of the minimization strategy of waste management, the recycling and reuse of contaminated or active materials is envisaged. One example is the reutilization of stored radioactive sources, provided their use is justified according to regulatory criteria applied in the country.

### H.1.3 Interdependence between different Radioactive Waste Management Stages

Operational procedures associated with the treatment and conditioning stages take into account the interdependence between the different management stages (e.g. transport, temporary and long-term storage andfinal disposal).

In the planning of the management stages of different types of radioactive waste are set acceptance criteria for each of them based on their interdependence and the medium and long term strategies.

### H.1.4 Efficient Protection for Individuals, Society and Environment

The standard AR 10.12.1 – “Radioactive Waste Management” determines general requirements for the management activities to be performed with an appropriate level of radiological protection for individuals and for the preservation of the environment for current and future generations. The criteria to achieve this objective are:

*Dose and Risk Limits*: The main objective is to ensure that individual risks are below the appropriate applicable levels (Standard AR 10.1.1) and that the radiological impact remains as low as reasonable achievable (ALARA).

*Optimization of Protection Systems*: Radiological protection systems used for radioactive waste management must be optimized taking into account the reduction of the effective collective dose, the individual dose distribution, the cost of different options, uncertainties associated with long periods and applicable dose restrictions.

*Responsibilities:*Radioactive waste generators (operators of nuclear facilities and users of radioactive material) are responsible for the management of the waste generated by them including an appropriate level of protection for workers and for the public (Standard AR-10.12.1, Criterion 24).

*Liquid and Gaseous Waste*: In order to comply with the discharge authorised values established by the regulations in force, liquid and gaseous radioactive waste must be treated by decay or retention, if necessary.

*Solid Waste*: The stage of final disposal of solid radioactive waste must be confined during the necessary time so that radionuclides have enough decay to be released to the environment. The closure of a final disposal facility for radioactive waste or any system related to such facility must have ARN's prior authorization (Standard AR-10.12.1, criterion 65). The Responsible Entity for managing radioactive waste will continue to bear the responsibility during the stages ofdefinitive closure and when it is relevant afterwards, during the period of administrative controlauthorized by the ARN. When the Responsible Organization applies for the construction and operation licenses, it must provide evidence that the necessary steps have been taken for the system to comply with the safety requirements in all its stages, including closure and subsequent stages.

*Safety Evaluation of the Disposal Systems:* The responsible authority of the facilities that generate waste shall undertake safety assessments of the Repository during the stages of licencing under the approval of the Regulatory Authority. The safety assessment of the Repository shall contemplate a scenario of normal migration of radioactive material along with the situation resulting from disruptive events occurring during the foreseen isolation period. In the safety assessment that corresponds to the scenario of normal migration, estimated doses received by future generations shall not exceed dose restrictions set in the design of the Repository. Such safety assessment must fulfil the requirements of the Regulatory Authority in terms of doses, risk or other safety indicators adequate for the required isolation periods.

*Information to submit to the Nuclear Regulatory Authority*: Records associated to generation and management of radioactive waste must be compiled, updated, managed and preserved in agreement with the implemented quality management system. The responsible entity of a facility generating radioactive waste must keep inventories of radioactive waste transferred by the generators of radioactive waste, those stored and disposed definitely, keeping said inventories updated during the

operation stage of the Repository. At the time of closure of the Repository, the Responsible Entity shall submit all the records to the Regulatory Authority.

### H.1.5 Biological, Chemical and Other Risks Associated with Radioactive Waste Management

In agreement with the General Environmental Act No. 25675 of the Argentine Republic the provinces determine the specific requirements to be satisfied by all industries located in their territory.

Each management facility must comply with general and specific requirements determined by the competent application authority in environmental matters, with jurisdiction over the site of the facility.

For example, the Province of Córdoba has passed the Act No. 7343 on *Guiding Principles for Preservation*, *Defence and Improvement of the Environment* which has jurisdiction over the Embalse Nuclear Power Plant (CNE) located in this province.

### H.1.6 Avoid actions with greater impact on future generations than permitted for the present generation

Article 1 of Law No. 25018 determines the rights to safety of future generations (see L.1.3.2)

The Standard ARN-10.12.1 determines that in the safety assessment related to the normal migration scenario, the estimate doses received by future generationsshall not exceed the dose restrictions determined in the design of the repository.

On the other hand, and by foreseeing that the present technologies used for radioactive waste management do not imply a potential risk for future generations, diverse studies and evaluations are carried out during the pre-operational, operational and post-operational stages of the facilities which shall continue during the institutional control stage.

### H.1.7 Avoid Imposing Undue Burdens on Future Generations

The internationally accepted ethical principle where by the beneficiaries of a practice should bear the total cost of the management and final disposal of generated waste has been contemplated in Law No. 25018.In its Section 13, this Law provides the legal foundations for the existence of a fund for the management and final disposal of radioactive waste based on the contribution of the generators, in case they are private entities, keeping this requirement in the State in case it is the owner. It also takes into account the deferred costs of spent fuel and radioactive waste management.

In this sense, Article 11 of the same Act considers the recovery of sites affected by industrial mining activities of Uranium minerals.

The creation of the PNGRR determined by Law No. 25018, and by means of the PEGRR, establishes the legal, technical and financial requirements, to avoid imposing undue burdens on future generations.

Furthermore, in order to secure the availability of sufficient resources, the current regulations set forth the creation of funds for financing the PNGRR and the decommissioning of each NPP. These funds shall come from the main radioactive waste generators, which are currently within the sphere of the State.

In accordance with the principle of unity of action and patrimony of the State, and while the nuclear power plants remain within the sphere of the State, the funding for PNGRR activities will depend on the National Budget granted to CNEA.

Regarding long-term projects, such as the installation of future repositories, as long as the funds anticipated by the current regulation are not integrated, the national State shall secure the availability of sufficient resources for CNEA to deal, when necessary, with the expenditure and investments to finance the management of waste originated from nuclear power plants.

## H.2 Existing Facilities and Previous Practices

### H.2.1 Introduction

Radioactive waste management facilities are located in the following sites:

- AtuchaNuclear Power Plant - Unit I
- Atucha Nuclear Power Plant - Unit II
- Embalse Nuclear Power Plant
- Ezeiza Radioactive Waste Management Area (Ezeiza Atomic Centre)
- Ezeiza Atomic Centre
- Pilcaniyeu Technological Complex
- Uranium Dioxide Production Plant

Hereinafter follows a description of the present condition of such facilities.

### H.2.2 Facilities of Atucha Nuclear Power Plant - Unit I

As stated in the previous reports, the execution frequency of the safety revisions for Type I facilities responds to the *Periodic Safety Review - PSR* methodology. Moreover, the ARN has determined the limitation of the validity period of the operation licenses as stated in Section E.2.2.2 of this National Report. The application of these measures is effective for CNA I since December 2003.

Within this framework and as part of the Probabilistic Safety Analysis for Atucha I Nuclear Power Plant (APS IT 911), performed by means of the construction of a Master Logical Diagram in July 2000, it has been concluded that the doses associated to the events related to the safety of the radioactive waste management systems, is two order of

magnitude below the dose constraint value determined as reference value. In such report the Handling and Storage System for Spent Fuels were also included.

In the last eight years, it was not necessary to recondition the liquid radioactive waste and sludge in the storage tanks system (called TT11 and TT12) of the Plant due to the low generation annual rate of this type of waste and the wide storage capacity of the systems aforementioned. Other tasks performed were treatment and conditioning of low level solid waste; treatment and storage of spent mechanical filters; and storage of spent ion exchange resin.

Low level solid waste compacting operations are conducted internally with a new press installed during 2015. The mechanical filtersare processed in the new dismantling and storage of spent mechanical filters was started, which imply improvements in terms of personal protection and environmental isolation.

The Radioactive Waste Characterization Lab of CNA I is starting up. It will allow the radiologic information of the radioactive waste inventory to be finished in order to comply with the regulatory requirements.

### H.2.3 Facilities of Atucha Nuclear Power Plant - Unit II

The following paragraphs include detailed information about Atucha Nuclear Power Plant - Unit II regarding RW Management.

During the informed period, the processing of low level solid waste started through compacting in the press in the auxiliary building UKA; the internal interim deposit was conducted (within the ZRC radiologically controlled zone) of mechanical filters extracted from the primary system by means of the telemanipulation systems of extraction, transfer and deposit; the characterization by gamma spectrometry was conducted of the drums with the waste which were made with the drum monitoring system within the ZRC area; ionic exchange exhausted resins changes were conducted which were deposited in storage tanks of the cooling purification system and the moderator (KBE).

To date waste liquid through evaporation were not processed in the liquid waste treatment system (KPF) nor liquid cemented or resin campaigns were made with the processing system of radioactive concentrates (KPC).

### H.2.4 Facilities of Embalse Nuclear Power Plant

In this period, new equipment was acquired for the alpha and beta emitters' radioisotopes lab, the last step for acknowledging waste radiological characterization.

### H.2.5 Ezeiza Radioactive Waste Management Area (AGE)

The Ezeiza Radioactive Waste Management Area (Área de Gestión Ezeiza – AGE) is the facility exclusively destined for the treatment, conditioning and final disposal of low level solid and liquid radioactive waste. It is located in the province of Buenos Aires in an area of 8 hectares within the CAE. In 2006, CNEA decided to suspend permanently the operation

of the final disposal systems understanding that they had already concluded their operative stage.

In addition, low and medium level waste is safely conditioned and temporarily stored, awaiting the construction of an appropriate repository as foreseen in PEGRR. Within the same site, there is also a facility used to store disused sealed sources, as well as the remaining nuclear material of Mo-99 production among others.

**Safety Re-evaluation of the Ezeiza Radioactive Waste Management Area (AGE)**

In previous Joint ConventionReports, changes in factors related to hydrology, meteorology and demography that might affect Ezeiza Management Area operativeness were produced. Most final disposal facilities began operating in the early 1970.

Taking these factors into consideration, CNEA, as the Responsible Organization, which had already decided to suspend the Semi Containment System forSolid Radioactive Waste in 1999, decided during 2001 to do the same with the Final Disposal systems for liquids and structural waste, with the object to start with the safety re-evaluation of the AGE.

In 2007 the environmental characterization of the site and its surroundings was completed and, in 2010, drums places in the non covered sector of the Semi Containment System for Solid Radioactive Waste (ditch No. 2).

In addition, the radiological inventory and the conditions of other disposal systems information is being updated. AGE environmental evaluation and planning is being developed to improve the underground aquifers behaviour modelling. The aim is to increase quantity and quality of the data from spreading and longitudinal dispersion coefficient of PNGRR catalogue.

The situation of the AGE facilities by the end of 2016 is described in relation to the previous National Report in the following paragraphs.

**AGE Facilities for Treatment, Conditioning and Storage**

- **Handling Yard and Stowage of Packages**

  In the previous National Reports this reinforced concrete platform has been described, originally designed for the reception, control and management of temporary stored radioactive waste waiting to be characterised, treated and conditioned.

  After some structural changes, it is being used as an interim storage facility of liquid and structural contaminated radioactive waste, which will be treated in the Cementing and Compacting Pilot Plant and in the PTARR when operative and in the Decontamination Facility.

❖ **Treatment and Conditioning Plant**

This plant, known as Low Level Solid Radioactive Waste Treatment Plant, was built in the seventies to treat and condition waste from small producers (institutional waste) and included facilities to separate and compact solid waste, an incinerator and a bitumen ash immobilization system. Recently, it only conducted the compaction process.

Refurbishment of this facility is in its final stage within the PTARR project detailed in H.4.3.1.

❖ **Deposit for Temporary Storage of Radioactive Sources and Waste**

As a result of the routine operation if this deposit, the stored inventories of Radioactive Waste and Disused Sealed Sources have also been increased. The package stowage yards are divided into sectors in order to improve the operational doses and optimise storage areas.

The achieved improvements regarding the control systems of the access to the AGE in general as well as the security of sources storage in particular may be underlined.

❖ **Deposit for Long-Term Storage (DAP)**

This storage, located in the Ezeiza Atomic Centre site with administrative dependence on AGE, became operational in 2010 in order to store waste from old practices (drums containing radioactive waste removed from Trench No. 2 of the Semi-containment System for Solid Radioactive Waste). The characteristics of the deposit are detailed in the Fifth National Report (Section H.2.5).

## Final Disposal Facilities of AGE

### System of Semicontainment for Solid Radioactive Waste

In the previous National Reports, it has been informed that the Semi Containment System wasmade up of two trenches, according to the following details:

**Trench No. 1** (T1) finished operation stage in 1988 when the closure cover was completed. **Trench No. 2** (T2) started operating in 1988 and its operation was suspended in 1999.

In early 2010, tasks to remove the drums placed in sectors S and T of T2 (not covered) were completed.

These drums were encapsulated again and are located in the Deposit for Long Term Storage (DAP) especially built for this purpose. Said deposit is sited in Ezeiza Atomic Centre, and the conditioned waste will stay there until a new repository is built.

- **Semi Containment System for Very Low Level and Very Short Lived Radioactive Liquid Waste**

The system comprises three trenches filled with a bed of calcareous silt improved with clays, allowing the concentration of radionuclides for decaying to non-significant levels before they reach an environment accessible to the public.

The liquid Radioactive Waste generated at the Ezeiza Atomic Centre production plants were piped to AGE, where they were unloaded into the trenches. Trenches started operation in 1971; two of them stopped operating in 1986.

On account of the factors above mentioned, in June 2001 the decision to suspend the operation of the third trenchwas taken.

- **System for the Disposal of Structural Solid Radioactive Waste and Disused Sealed Sources**

In previous reports, the existence of two underground silos were mentioned, where structural parts from contaminated areas and some types of disused sealed sources were disposed of. These systems are not operative because of the same reasons above mentioned.

### H.2.6 Facilities at the Ezeiza Atomic Centre

**Decay, Pre-Treatment and Discharge Plant for Active Liquids from the Radioisotope Production Plant**

This facility has been conceived to provide easier decay of the Radioactive Liquid Waste generated in the Radioisotope Production Plant and the Reactor RA-3[1] containing short half - lives and low activity radionuclides. This type of liquid Radioactive Waste may be discharged to the environment if its level of activity does not exceed the discharge values authorised by the Nuclear Regulatory Authority (ARN). Until June 2001, the liquid radioactive waste that could not be discharged was directed for disposal to the AGE Semi Containment System for Liquid Radioactive Waste. Since then, changes have been implemented in the processes of the Radioisotope Production Plant and in the radioactive waste management of the plants, so that the residence time in the storage decay tanks is sufficient for their subsequent discharge into the environment.

### H.2.7 Pilcaniyeu Technological Complex (CTP)

This centre includes facilities devoted to uranium enrichment. Solid waste generated by previous campaigns conducted in these facilities and those generated eventually in the future are and will be stored in containers located in the CTP Low-Level Radioactive Waste Deposit.

[1] At present this facility does not transfer its liquid effluents to this installation.

### H.2.8 Uranium Dioxide Production Plant

Operating waste is that waste generated in different sections of the plant and with a radioactivity level higher than the limit established by the ARN for clearance. This waste are mainly gloves, clothes, plastics, disposable material from laboratories, hoses, gutter cleaning and filter and prefilter dismantling.

They are consolidated inside 200-litres drums, previously reduced in volume by pressing, and stored temporarily in the Raw Material Deposit, controlled by the Uranium Control Division – CNEA. This deposit was built with brick walls and a flagstone roof, cement floor, one overhead large door and one fixed large door, with ventilation from the windows located in the upper part.

## H.3 Site of Projected Facilities

Considerations related to this point are the same developed in Section G.3.

## H.4 Design and Construction of New Facilities

### H.4.1 Atucha Nuclear Power Plant - Unit I

As mentioned in the Fifth National Report, a New Interim Storage Deposit for process filters has been created. This project, proposed by the PNGRR, is operative since May 2013. It is a new concept in terms of interim storage of this kind of waste because it improves the safe storage for individuals and for the environment, and also an easy way to recover them with a mechanical facility that increases radiological protection for the operator.

During the informed period, a new interim storage deposit, known as DATIII, was projected to increase the radioactive waste interim storage capacity of both units.

A Radioactive Waste Exclusion Area was designed which will delimit with a perimeter fence the area of radioactive waste deposit area. It will have an only controlled access in order to improve radiation safety and physical security in the plant and to comply with new safety standards required by the ARN.

The building with mentioned access will have a new gamma characterization area with a modern piece of spectrometry instrument recently acquired.

### H.4.2 Embalse Nuclear Power Plant

Embalse Nuclear Power Plant has a set of deposits or interim facilities within the security perimeter of the plant that allow compactable, non compactable or structural radioactive waste storage.

Within the framework of the PLEX (Life Extension Project of the Plant), storage facilities for waste were built. Such waste was generated as a consequence of dismantling component tasks to undertake the PLEX and also the adjustment and extension of storage facilities for

waste storage that will be generated during the plant operation by contemplating thirty additional years of operation after PLEX tasks were concluded.

Such facilities have an approximate total capacity of 3000 $m^3$ and are made by:

Radioactive Waste Storage Facility No. 2 (DRRN2) which has:

Square Silos: used to store structural and non compactable unprocessed waste as contingency in terms of processing capacity and stored volume. It has five reinforced concrete deposits of 0.50 m thick with an internal dimension of 3.00 by 3.00 m and 3.00 m depth, standing out 0.20 m above the surface. They have concrete covers designed for protection against rainwater. Other five deposits of the same dimensionswere modified and adjusted resulting in the linners mentioned below.

Linners for mechanic filters from different plant systems: this storage facility consist of 16 carbon steel tubes with a galvanized treatment that guarantees its integrity over 30 years. They are 12'' diameter and 3 m long, widened in its upper part to support its plug, armed on a metal frame made up of L beams of 50 mm and closing plug perfectly sealed. Moreover it has a gantry crane as a facility for this storage.

Cylindrical Silos: used for structural and non-compactable unprocessed waste. Intermediate level radioactive waste is specially stored. It consists of ten circular storage facilities with a useful internal diameter of 1.00 m and 0.85 m depth in reinforced concrete, arranged in two parallel structures of five facilities per line, standing out 0.20 m above the surface. These ditches are internally covered with 10 mm galvanised sheet steel set to concrete walls of 0.70 m thickness and have a set reinforced concrete plug of 1.20 m and above a plate lid and have a reinforced concrete lid of 1.20 m and above a plate lid to avoid rainwater.

Storage site: it is used for storage of unprocessed structural waste.

Storage Facility for Intermediate and Low Level Radioactive Waste of the Retubing (Feeders Deposit): it was built to store intermediate radioactive waste generated during the PLEX, specially to store feeders, feeders cabinet and other non-compactable and structural waste. Containment of radioactive waste there stored is guaranteed by their matrix, which is intrinsically safe, and by the storage characteristics both from containment and the building. The facility was built in reinforced concrete with external dimensions of 18.54 m width and 18.54 m length and 6.3 m high and 0.4 m wall thickness. Radioactive waste is stored in two types of airtight container built in carbon steel for low and intermediate level waste without previous volume reduction. This deposit was designed by NASA.

The DRRN2 has a footprint of about 2,250 $m^2$. Containment of stored radioactive waste is guaranteed by the matrix, intrinsically safe with only solid, dry waste without removable contamination and by storage characteristics in trenches with recovery capacity of such waste for its later processing.

Storage Facility for Radioactive Waste No. 3 (DRRN3): this deposit is used almost exclusively for compactable and non-compactable processed waste as well as to store non-compactable and structural waste prior to its processing. It consists of a closed and sealed deposit which currently stores a total of around 1,070 drums with compactable radioactive waste.

Storage Facility for Radioactive Waste No. 4 (DRRN4): this deposit is used almost exclusively for storage of compactable and non compactable processed waste. Also, it is used to store non compactable and structural waste prior to their processing. It consists of a closed and sealed deposit currently storing about 3,500 drums with compactable radioactive waste and currently it does not have more storage capacity.

Storage Facility for Radioactive Waste No. 5 (DRRN5): this storage facility is used almost exclusively to store compactable and non-compactable processed waste as well as to store non compactable and structural waste prior to their processing. Such facility includes access to DRRN3 and DRRN4. It consists of a closed deposit with an estimated storage capacity of approximately 3,500 drums.

Interim Storage Facility for Unprocessed Compactable Radioactive Waste: This facility consists of a room at the level of 93.9 m of the Services Building. This has HEPA filters and depression through the ventilation system plant. It is a room with walls and floors painted in epoxy paint, which turns it into an area easy to decontaminate.

Storage Facility for Steam Generators and Moderator Exchangers: this deposit will store the abovementioned pieces of equipment guaranteeing its containment during the lifetime of the facility. In order to do that, the deposit has specially designed foundations for them inside of it, considering four supports that will distribute 200 tons of each SG cartridge. The facility is made out of pre-assembled concrete and its construction followed the guidelines of the Regulation INPRES-CIRSOC 103 (Argentine Regulations for Earthquake Resistant Constructions). Both SG and exchangers will become a sealed source with a very low dispersion risk of contamination.

The facility is delimited by a perimeter fence with wiring of 2.00 m high, crowned with six barbed wires and has a vehicle entrance gate with 7.00 m width double doors, which is closed with a chain and a lock. It also has a parking access of 30.90 m by 19.00 m by 8.50 m (without taking the parking access into account).

The place of the site of deposits previously described is located within a wired perimeter fence part of the supervised area of the ASECQ system. Therefore to enter such area personal dosimeters are required and a permit from the Safety and Radioprotection Area. This guarantees a low rate of occupational exposure.

Radiation protection of workers, members of the public and the environment regarding radioactive waste stored in all the deposits is guaranteed by the design of the containers, of each building and its location.

High Level Retubing Storage Silos (Canister): four ERC (Embalse Retubing Canisters) are used to store pressure tubes, pieces of callandria tubes, callandria tubes, endfittings and other high level waste. It is a supervised area. In order to have access to it, it is required to have personal dosimeters and the authorization of the Safety and Radioprotection Area.

This will guarantee a low dose of occupational exposure. Radiation protection of workers, members of public and the environment regarding radioactive waste stored in the deposit is guaranteed by the design of containers of silos and its location. Radioactive waste is stored within silos in two types of containers built in carbon steel for high level waste with volume reduction for small containers and without volume reduction for big containers. The design of silos was acquired by NASA through Candu Energy. These comply with radiation protection and anti-seismic design conditions.

All the deposits of the retubing as well as SGare designed so that its integrity is guaranteed under normal conditions of use during a period of not less than 50 years.

### H.4.3 Ezeiza Waste Management Area (AGE)

#### H.4.3.1 Treatment and Conditioning Plant of Radioactive Waste (PTARR)

A project is under development and about to be concluded which, by using building facilities of the original plant (Low Level Solid Radioactive Waste Treatment Plant), will allow for the infrastructure necessary for the treatment and conditioning of solid, wet and compactable low and intermediate level radioactive waste.

This new facility known as PTARR will enable to treat and condition low and intermediate solid and liquid institutional waste generated in Argentina as a result of any productive activity, medical applications and R&D will be treated and conditioned in the PTARR, complying with the acceptance criteria specified for each facility and the conditioned product quality.

Waste originated within nuclear power plants will continue to be treated and conditioned in their facilities.

The following are the main processes to be conducted in the PTARR:

- Compaction
- Cementing
- Volume reduction of structural solid waste
- Thermal processes

#### H.4.3.2 Cementing and Compacting Pilot Plant

This plant was constructed due to the need to continue with the solid radioactive waste treatment sent to AGE while the Low Level Solid Radioactive Waste Treatment Plant was remodelled and extended in the same way liquid cementation started. On 4 April 2016, the Nuclear Regulatory Authority granted the Start Up License that enabled to verify concrete operating conditions. It also enabled to train the personnel and to obtain Specific Authorizations for each specified task. During this period, 500 $dm^3$ of liquid waste and 30 $m^2$ of compacted waste were cemented. It is expected that the ARN should grant the Operating License during the year 2017.

### H.4.3.3 Characterization Lab (LABCAR)

This new Characterization Lab was created to improve information about radionuclides present in waste stored in the AGE in the DAP, and in the newly generated waste, in order to determine the treatment and conditioning techniques, control conditioned waste quality, and provide a complete and updated radiological inventory, for all waste complying with the new ARN requirements. This lab will also be used to control characterization performed by the NPPs to the RW generated in them.

During 2016, ventilation system tests of radiochemistry hoods of this new facility and the documentation for its licensing presented to the ARN was completed. It is foreseen that the lab will start operating in 2017.

### H.4.4 Research and Development Lab at CAC

This new laboratory is being built at the Constituyentes Atomic Centre, in order to develop new processes for radioactive waste treatment and conditioning, using radiotracers to simulate the different types of waste. During 2015 and 2016, the Ventilation and Air Conditioning System was finished and the lab furniture was installed. The preparation of the Lab Mandatory Documentation continues to be submitted to the ARN in order to obtain the operating authorization.

### H.4.5 CAREM-25 NPP

Section G includes the detailed features of this new facility. The main aspects associated with the safety measures of the radioactive waste management systems design of CAREM-25 are described in the following paragraphs.

The design of the solid radioactive waste management system complies with the ALARA principle. It includes collection, segregation, characterization, conditioning and interim storage processes of the radioactive waste generated by the operation and maintenance of CAREM-25. Radioactive waste will be managed so that an acceptable level of radiological protection of workers and public is achieved, as well as the preservation of the environment.

Radioactive waste to be generated in normal conditions in CAREM-25 will be low or intermediate level RW. The Solid Waste Management System will include equipment to perform tasks such as pressing, drying and immobilization. CAREM-25 design provides long interim storage for radioactive waste within the CAREM site.

Waste shall be characterized when generated in accordance with the PNGRR guidelines. During radiological characterization, radionuclides will be determined by direct methods (Gamma Scanner), semi-empirical methods (representative sampling, scale factors, correlation factors) or analytical methods (calculation software).

Radioactive waste shall be kept isolated, far from humans, during the necessary period of decay, using adequate multiple barriers in the future repositories.

### H.4.6 RA-10 Reactor

This facility has been described in G.4.3. The Facility Radioactive Waste Management System has been designed in order to ensure safety for workers and for the public in general, and also to minimize the occurrence of potential impacts to the environment.

Waste generation has been considered since the design stage choosing the appropriate materials, taking into account all the ways in which waste is produced and providing waste management systems with all the necessary facilities.

Liquid radioactive waste volume minimization is part of the reactor design criteria, so water will be recycled every time possible. The system will comprise three circuits: Liquid Radioactive Waste Collection, Recycling Water Collection and LOCA Water Collection.

Solid waste will be segregated according to their classification as follows: inactive waste, low level waste and intermediate level waste. Some waste treated by this system will be the spent ion exchange resin, used components from reactor systems, filter elements from the ventilation system, etc.

Radioactive waste will be characterized and transferred to AGE site, fulfilment acceptance criteria established by PNGRR.

## H.5 Mining Waste and Processing of Uranium Minerals

### H.5.1 Uranium Mining Environmental Restoration Project (PRAMU)

The Argentine Atomic Energy Commission, within its program to protect the environment, conducts the Uranium Mining Environmental Restoration Project (PRAMU) with the aim of restoring the sites where uranium mining activities have taken place in the past.

Its purpose is that in all sites in which uranium mining activities were carried out the environment may be the object of the best possible restitution in terms of economic and technical feasibility. In the first place, studies are conducted to identify the problem of each site, determining the potential and the real impacts, the possible contamination routes, the existing elements, etc. On the basis of internationally accepted techniques, the possible specific solutions to manage the tailings and the restoration of each site are being developed.

As mentioned in the previous National Reports, the sites under study are:

- MALARGÜE (Mendoza Province)
- HÜEMUL (Mendoza Province)
- CÓRDOBA (Córdoba Province)
- LOS GIGANTES (Córdoba Province)
- PICHIÑÁN (Chubut Province)
- TONCO (Salta Province)
- LA ESTELA (San Luis Province)
- LOS COLORADOS (La Rioja Province)

These sites are the result of the uranium mining activity that took place from 1951 to 1996, once tasks to keep their radiological conditions had been performed. Both CNEA and ARN conduct periodic environmental surveys in the areas around the industrial mining complexes that process uranium mineral.

By means of Decree No. 72 on January 14th, 2010, the Argentine President approved the modelling Contract of Loan No. 1583-AR to be entered into by and between the ARGENTINE REPUBLIC and the INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT (IBRD) for THIRTY MILLON AMERICAN DOLLARS (USD 30,000,000) and the modelling Subsidiary Execution Agreement between the MINISTRY OF ECONOMY AND PRODUCTION and the ARGENTINE ATOMIC ENERGY COMMISSION.This agreement was executed by the parties on March, 30th and the loan was ratified by the World Bank on April 28th, 2010.

The aim is to ensure environment protection, health and other rights of current and future generations making a rational use of resources. As part of this, PRAMU intends to improve current conditions of uranium mining tail deposits, considering that although those sites are currently controlled, in the long-term different environment restoration actions have to be performed so as to ensure the protection of the environment and the citizens.

The project development entails different stages. The first one includes the continuity of building works at the Malargüe site and the studies necessary for environmental restitution engineering of the following sites: Córdoba and Los Gigantes, Tonco (Salta Province), Pichiñán (Chubut Province), La Estela (San Luis Province), Los Colorados (La Rioja Province) and Huemul (Mendoza Province).

In 2016, the project activities aimed primarily to make progress in the restitution of the former Malargüe Industrial Complex, which are about to be concluded, to continue with engineering for the management projects of the former Los Gigantes Mining and Milling Complex and El Chichón, environmental liabilities deposited in Córdoba. Moreover, environmental characterization studies of environmental liabilities of the uranium mining of the other five Sites and continues with the execution of the monitoring plan and promotion of PRAMU in different areas.

### H.5.2 San Rafael Mining and Milling Complex (CMFSR)

This Complex operated until 1995, when for technical and financial reasons, it was suspended. As the infrastructure of the site is still preserved and it can be reactivated, it is not one of the sites considered for PRAMU. CNEA, as operator, presented in June 2004 an Environmental Impact Evaluation document (EIA) as required by the Province Legislation in order to restart its productive activity. In response to this, current authorities requested CNEA to present a new Environmental Impact Evaluation related to the “Management of Waste in Interim Disposal”, taking into account the treatment of quarry water and solid waste management. The possibility of starting production again is under evaluation.

This study was submitted in 2006 and the proposal was technically approved through reports from different sectors without attaining the Environmental Impact Declaration (EIA) since the Public Hearing required by law was not conducted.

Later on, the authorization to rebuild effluent dikes DN 8 and 9 was granted to enable safe and environmentally correct handling of effluents, even in these non-operational conditions. Also a permit was obtained to seal off an auxiliary dike for evaporation of effluents DN 3b.

Currently, advisory services to update the submitted Environmental Impact Statement is under the process of public bidding in order to complete the environmental evaluation process and obtain the EIA. This will allow starting quarry water and uranium purification solid waste management tasks. This update, called “Environmental Impact Statement: San Rafael Mining and Milling Complex - Remediation Stage - Phase I”, has already been approved by CNEA and will soon be submitted to the authorities of the Province. It also entails the remediation of quarry water and solid waste.

In order to manage the rest of waste at interim disposal, another EIA has to be conducted or the current one has to be updated.

## H.6 Safety Evaluation of the Facilities

The considerations corresponding to this point are the same as those that have been described in Section G.5.

## H.7 Operation of the Facilities

The considerations corresponding to this point are the same as those that have been described in Section G.6.

## H.8 Institutional Measures after Closure

The institutional measures to be applied after the foreseen closure of the low level radioactive waste disposal systems have been described in the previous National Reports.

The Standard AR-10.12.1 Radioactive Waste Management describes the safety criteria to be complied with by the facilities in all phases of disposal, including after their closure.

At present, there are no Radioactive Waste management facilities under Institutional Control.

Disposal facilities located in the AGE are under radiological assessment, in safe conditions, waiting to have more accuracy in historical waste inventory in order to establish the conditions for the closure and the period of institutional control.

## SECTION I TRANSBOUNDARY MOVEMENTS

In Argentina Revision 3 of the Standard AR 10.16.1 *Transport of Radioactive Materials*, which agrees with the 2012 Edition in its Spanish version of the *IAEA Regulation for the Safe Transport of Radioactive Materials: Specific Safety Requirements No. SSR-6"* is already in force. The revision of this standard was approved by Resolution of the Directory No. 14/16 on 25 January 2016. This standard determines the regulations with reference to the transboundary movements of radioactive waste and spent fuel.

There are also national and international standards in force that regulate the transport of dangerous materials by land, air and water. The transport by road and railway is ruled by the following legal instruments:

- *National Transport and Transit Regulation*, enacted by Decree No. 692/92
- *Law on Transport* No. 24449, regulated by Decree No. 779/95
- Resolution No. 195/97 on *Technical Standards for the Transport of Dangerous Goods by Road*, issued by the National Public Works and Transport Secretariat
- Other regulations determined by the National Transport Secretariat

For maritime, river and air transport, the Argentine Republic has adopted the regulations of the *International Maritime Organization* (*IMO)*, of the *International Civil Aviation Organization (ICAO),* incorporating the abovementioned *Regulation for the Safe Transport of Radioactive Materials* of the IAEA No. SSR-6.

The agreements signed by Argentina and ratified by the law on transboundary movements are the following:

- The Chicago Agreement on Transport of Dangerous Goods by Air, in the framework of the International Civil Aviation Organization (ICAO).
- SOLAS Agreement, MARPOL, International Maritime Code, International Code for the Safety in the Transport of Irradiated Nuclear Fuel, Plutonium and High Activity Waste in Packages on Board of Vessels (INF Code), under the International Maritime Organization (IMO).
- Convention on the Physical Protection of Nuclear Materials, in the framework of the International Atomic Energy Agency (IAEA) and its amendment approved by Law No. 26,640, enacted on 13 October 2010.
- Agreement between the Argentine Republic and the Federative Republic of Brazil, the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials and the International Atomic Energy Agency for the application of Safeguards (Four Parties Agreement).

As previously mentioned (see Section B.1), the only transboundary movements that have taken place were associated with exports of SF containing HEU to the United States of America in the framework of the A*cceptance Program of Spent Nuclear Fuels from Foreign Research Reactors.*

As at the moment the Argentine Republic does not contemplate the reprocessing of spent fuel, no transboundary movements are expected in connection with said process.

For the case of the transport of radioactive sealed sources, see further details in Section J.

# SECTION J DISUSED SEALED SOURCES

## J.1 Introduction

Although the activities involving radioactive materials and sources started at the beginning of the fifties, it was Decree No. 842/58 that approved the *Regulation for the Use of Radioisotopes and Ionising Radiations* and made it effective to govern the use and application of radioactive substances and radiations emitted by them or from nuclear reactions and transmutations. At present, this decree has been replaced by the legal and regulatory framework determined by the ARN and described in Section E.2.

The Standard AR-10.1.1, “Basic Radiological Safety Standard” determines the basic radiological safety requirements for nuclear activities performed in the country, including the sealed sources. This standard classifies the facilities in three levels. Such classification determines the regulatory control models based on a gradual approach related to the radiological hazards associated with the practices involved in such facilities.

The Regulation determines that the license holder is responsible for complying with regulations, requirements, licenses, authorizations and permits issued by the ARN. The operation licenses / authorizations issued by the ARN expressly include responsibilities and conditions of operation. Some of them state that the Operation License Holder is responsible for radioactive waste management generated in the facility under its responsibility (which is the case of disused sealed sources in some facilities).

Likewise, the Operation License Holder, when applying for an authorization, assumes responsibility over those sources once they have reached the end of their operating and specific life. The ARN performs regulatory inspections and audits to verify that license holders comply with their responsibilities, in order to detect failures to comply with the standard and avoid situations that might derive in radiological accidents.

Furthermore, the procedure to grant licenses for the management of radioactive sources, in any of the utilization cycles, allows the ARN to control that the persons making use of them have the necessary qualifications and work in accordance with the responsibilities related to radiological safety. These qualifications are re-evaluated with regulatory inspections and audits every time the corresponding either specific authorisation or individual permit is renewed.

Therefore, the existing regulatory system for the control of radioactive sources in use or in disuse acts preventively to avoid the loss of control thereon and, subsequently, to minimize the existence of orphan sources.

It may be underlined that since the Argentine Republic has voluntarily and non-bindingly adhered to the “*Code of Conduct on Safety and Security of Radioactive Sources*” in the 2003-2004 period, the country complies with the recommendations formulated in it, a fact that reinforces the determination of exercising an effective control of radioactive sources.

## J.2 Basic Requirements for Radiological Safety

The basic radiological safety requirements for the use of radioactive sources are described in the Standard AR-10.1.1. Additionally, the ARN determines that:

- Radioactive sources cannot be purchased, imported, owned, transferred, stored, used, sold, exported or disposed of unless the source owner has previously obtained a license or authorization granted by the ARN for these purposes.
- Only facilities having appropriate resources may handle radioactive sources and the members of staff require adequate knowledge and training.
- License holders shall keep a detailed and updated inventory of radioactive sources and their movements, taking the necessary security measures to prevent human intrusion in storage sites and/or the loss of radioactive sources.

The specific requirements for the storage of radiation sources are shown in Section J.4.

## J.3 Actions Aimed at Carrying out an Adequate control of Disused Radioactive Sources

The criteria determined by the ARN for disused radioactive sources for long periods of time are the following:

- The storage of disused radioactive sources is allowed only in the facility as long as the holder of the license is able to demonstrate that they have a specific program for its reuse or to use it in replacement of another source existing at the site.

- In this case, the holder of the license must provide a temporary storage area qualified as deposit, over which they have adequate control to prevent non-authorized access, and appropriate security measures to avoid the theft thereof. He must also keep auditable records of the regular controls made in the place of temporary storage.

In case the license holder does not have an adequate place for temporary storage of the radioactive sources or in case of any other situation determined by the ARN, the sources must be sent to a safe storage site. The ARN requires the source to be sent to CNEA in custody, so that it is safely stored in the AGE, area especially prepared for this purpose. In extreme cases, in order to have the source under control, it can also be transferred to other facility nearby, licensed for this purpose and, with an adequate deposit, accepting the responsibility.

## J.4 Special Actions Aimed at Maintaining an Appropriate Control of the Radioactive Sources

The ARN has agreements with security forces and with organizations responsible for the control of the borders and airports to prevent undeclared radioactive sources from entering or leaving the country.

Within this context, the ARN has entered agreements with the customs authorities to ensure that:

- All imports or exports of radioactive materials should be performed with ARN's authorization.
- Industrial plants, measurement instruments and laboratory equipment that could include radioactive sources to be imported shall previously submit a declaration to the ARN stating the content of such type of sources.
- In the case that radioactive sources deposited in custom premises for more than 30 days exceed the time allowed by its internal procedures, the ARN must intervene in order to arrange for the storage at CNEA's authorized facilities.

The ARN pays special attention to cases where it is not possible to ensure the control of radiation sources, as for example, when a company having sources goes bankrupt and/or when a legal action orders a company an attachment on their assets. In such cases, the ARN and the Justice act together to confiscate the involved sources and send them to a safe storage, preventing accidental situations. This safe storage may derive in radioactive waste management of confiscated material provided the custody storage period exceeds the time determined previously by CNEA.

In the case of exports of radioactive sources and before granting the authorization for the pertinent export, the ARN interacts with the Regulatory Authorities of the countries involved. In the case of Type I and II sources, the procedures recommended by the IAEA's *Guidelines on Imports and Exports of Radioactive Sources* are applied. In the case of sources of other categories, authorization procedures used by the Regulatory Authorities of the importing countries are considered.

## J.5 Security of Sealed Sources in Use or in Disuse

The security systems for radioactive sealed sources involve security measures. These measures are aimed at preventing intentional acts resulting in the loss of control of these radiation sources.

In October 2003, CNEA issued the Directive PF-02 *Security of Radioactive Sources*, in accordance with the Standard AR-10.13.1, Security of Nuclear Materials and Facilities, issued by the ARN in 1995. Said Directive was established as mandatory for all facilities developing activities that involved use and/or storage of radioactive sources in use or in disuse, under their responsibility.

In January 2007, the ARN issued the Standard AR-10.13.2 “Security Standard for Sealed Sources”. In said standard, the following measures are contemplated:

- In the case of a facility with high radioactive inventory (above the threshold mentioned for Type I, in accordance with the IAEA Safety Guide, No. RS-G-1.9 “Categorization of radioactive sources”), it is required to create a Security System similar to the physical protection systems implemented in facilities with nuclear material.

- In the case of radioactive sources not contemplated in the IAEA Type I Security Guide No. RS-G-1.9, but implying a radiological risk, the ARN requires the implementation of a Security System to ensure the early detection of any event that could involve the theft of those sources. Such security measures are compatible with the ones included in IAEA TECDOC-1355 “Security of Radioactive Sources”.

For the transport of sealed radioactive sources, extra security measures, equivalent to those required for transportation of nuclear materials under the Standard of Physical Protection AR-10.13.1, are applied. These measures, in addition to the radiological safety measures, were specifically created to prevent fraudulent acts, and include corrective actions in case of events involving Type 1sources or sources implying a radiological risk.

- The ARN is paying special attention not only to the early detection of potential sabotages to facilities containing nuclear materials, but also in case of robbery and theft of radioactive sources, and the early detection of fraudulent acts in facilities with radioactive inventories entailing radiological risks.

In this regard, the ARN is carrying out different activities in the areas of prevention, legislation, response, training and exchange of information; including not only the control of nuclear material but also the security aspects of radioactive sources.

Among the most effective additional security measures for early prevention or detection of nuclear and/or radioactive material illicit traffic are the permanent contact and exchange of essential information between the ARN, border control organizations, intelligence services and security forces; which implies full knowledge and the assumption of responsibilities by all organizations that constitute the “Control System”.

Equally important is the coordination of inspection activities, which are planned according to the associated radiological risks.

## J.6 Penalty System

The sections E.2.2.5 and E.2.2.6 describe the regulatory actions and the applicable penalty system for the use of radiation sources.

## J.7 Abnormal Events and Emergencies

Argentine regulations determine that people or organizations using radiation sources must implement emergency plans or procedures. The criteria determined by the ARN to be used in case of emergencies includes the evaluation of scenarios for situations such as: theft or loss of the source, breakage of the integrity of the shielding containing the radioactive source, fire, explosion or any other event that could affect the safety of the radiation source.

The ARN is in contact with all organizations that could intervene in case of a radiological emergency and provides training activities related to such interventions.

ARN's *Intervention System in Radiological Emergencies* (SIER) is a passive guard system for those cases of radiological emergencies in facilities or on the street where radioactive material is involved coming from regulated companies or from orphan sources. This system operates 24 hours, 365 days a year.

The ARN has cooperation agreements with organizations that intervene in case of an emergency, such as the Argentine Army, the National Gendarmerie and the Argentine Navy.

## J.8 Readmission of Decayed Sealed Sources to the Country

The import of decayed sealed radioactive sources, as well as the import of any other radioactive source, is authorized by the ARN when all the requirements related to radiological safety and security determined by the regulations are fulfilled, the practice is justified and the importer complies with the legal provisions in force and the obligations determined by its import license.

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# SECTION K GENERAL EFFORTS TO IMPROVE SAFETY

## K.1 Introduction

This section describes the safety improvement actions in matters related to SF and RW management, in regular activities as well as for those in execution stage or for those that have been completed in the period between the presentation of the Fifth National Report and the present date.

## K.2 Regular Activities

The permanent activities for the improvement of safety are common to all management facilities and include the following topics:

- ❖ Documentation updating
- ❖ Organization updating
- ❖ Operative inspection programs
- ❖ Emergency Plans
- ❖ Education, training and re-training of operating staff
- ❖ Quality assurance program
- ❖ Preventive, predictable and corrective maintenance program

## K.3 Management Safety Improvements

In addition to the regular activities projects mentioned above, other projects and modifications have been developed and put into practice, which contribute to improve safety. Some of them are listed below:

### K.3.1 Actions Taken in the Light of the Fukushima Daiichi Accident

As a consequence of the Fukushima accident and with the purpose of applying the corresponding lessons learned, the Regulatory Body requested to perform a stress test to each Argentine NPP in operation, which consisted of a new assessment of the safety margins, assuming the existence of a sequential loss of lines of defense in depth caused by the loss of heat sinks, lines of external electricity supply and finally the simultaneous loss of both resources which could eventually lead to severe accident scenarios of core damage. Among other safety-related topics, such evaluation includes:

- ✓ Describing the accident management measures currently available to address the successive steps in a scenario of failure in the cooling fuel pool (for example, evaluation of available times under the conditions for planned scenarios, radiation protection, eventual failure and fuel degradation).
- ✓ Identifying any possible cliff edge effect.
- ✓ Assessing the adequacy of accident management strategies (guidelines and procedures developed to meet a serious accident, analyzing the possibilities of additional actions to be taken, suitability/availability of the

required instrumentation, habitability and accessibility of essential areas, accumulation of hydrogen in different containment buildings).

- ✓ Organization (staff, resources and shifts; use of external technical assistance; and procedures, training, education and exercises).
- ✓ Availability of existing equipment.
- ✓ Planning for the use of mobile equipment.
- ✓ Management of supplies and their availability.
- ✓ Management of radioactive emissions and the possibility of reducing them.
- ✓ Management of potential doses to workers and provisions to limit them.
- ✓ Communication and information systems.
- ✓ Activities planned for the long term (after the accident).

The description of the ARN's requirements in the "stress test" requested as a result of the Fukushima accident are described in detail in the 2013 Report to the Convention on Nuclear Safety. The summary included in this report highlights the actions related to issues within the scope of this Convention.

Safety of reactors is periodically evaluated, including safety of spent fuel storage pools. These evaluations entail the operating experience as well as what happened in Fukushima. It should be noted that updating the seismic evaluation of Atucha and Embalse sites was in an advanced state when the accident happened. The progress of the analysis programs for the safety of the plants to earthquakes are described in the relevant chapters of the Convention on Nuclear Safety. The main results have been completed in CNA I and CNA II and the resulting changes are being implemented. Foreseen updates will be implemented during CNE refurbishment outage.

In response to the regulatory requirement mentioned, the Entity Responsible for the Operator of CNA I, CNA II and CNE (NA-SA) has conducted the required stress test and the reports were submitted to ARN.

The Nuclear Regulatory Authority conducted an evaluation of these reports. As a result, opportunities for improvements related to incorporation of systems and additional actions of the operator which tend to prevent sequences leading to severe accident scenarios.

Improvements and modifications required to the Entity Responsible for the operation of NPPs include an implementation schedule consisting of short, medium and long term actions, which were considered acceptable by the Regulatory Body. The improvements required as a result of the stress tests are the following:

### K.3.1.1 Loss of Safety Operations Functions Analysis

#### K.3.1.1.1 Loss of Offsite Power (LOOP)

As a result of the LOOP evaluation the Operator has decided to implement the following improvements:

***CNA I***

- **Restoration of External Power Supply**
  In case of a network collapse, the company responsible for the supply management (CAMMESA) has a supply procedure for NPPs that states its priority due to the safety requirements of nuclear facilities.

- **Passive Components Control**

  The proper functioning of the program for the verification of the vacuum breakdown/siphons associated with guaranteeing cooling. In addition, the control of the vacuum breakdown/siphon system associated with the pipes of the cooling systems and the inventory control of the spent fuel storage pools was added to the periodic inspections program. Including the above mentioned issues, a procedure related to passive components control increasing the frequency of tests and inspections was implemented.

- **New Emergency Power Supply System (EPS)**

- **Electrical Interconnection Between of CNA I / CNA IInormal rods**

- **External Electrical Supply Lines Availability Assessment**

***CNA II***

- **Restoration of External Power Supply**

As previously mentioned, in the event of the electrical network, the company responsible for the offer management (CAMMESA) has a procedure to supply NPPs, which imposes its priority owing to the safety requirements of nuclear facilities.

- **Emergency Procedures Review and Improvements**

  Procedures review to extend the life of emergency diesel generators using an additional fuel tank, including maintenance programs and repetitive tests reviews, as well as ensuring the minimum reserves are conducted through the inspection and testing program. The update guarantees the operation during a minimal of 72 hours without the external backup to the facility.

- **Electrical Interconnection Between CNA I / CNA II normal rods**

- **Availability of the External Power Lines Assessment**

***CNE***

During the refurbishment outage (2016 to 2018) for the plant’s life extension, some power supply improvements will be implemented. The most important are listed below:

- **External Power Supply Protection Devices**

  500 kV station protections, bars, lines, switches failure and Class III Diesel Generators will be improved.

  Diesel Generators (Class III) belonging to the uninterruptible power supply system will be replaced, including modifications to the building, will be conducted during life extension shutdown (2016 to 2018).

- **New System Emergency Power Supply (EPS)**

  50 kW / 75 kVA diesel generators will be replaced by new higher power diesel generators. The new generator groups will have 1.6 MW nominal power (2,000 kVA) and 6.6 kV nominal tension. All of the system will be seismically qualified.

- **Extension of battery availability**

### K.3.1.1.2 Station Blackout (SBO)

As a result of the SBO studies, the Entity Responsible for the operation of nuclear power plants planned to implement the following improvements:

***CNA I***

- **Alternative Power Sources**

  A mobile diesel generator (MDG) to meet the power demand required in a severe accident caused by a SBO was implemented as to provide alternatives to the existing sources to secure electricity supply.

  A nearby and safe storehouse for MDGs and the associated devices to allow a quick connection between MDGs and the connection board is available in order to ensure the core and the spent fuel storage pools are refrigerated in the long term.

- **Fuel Assemblies Integrity Assessment**

  The SBO impact on the fuels that could be located inside the refueling machine, considering its full load, is being assessed. The study is planned to be implemented by the end of 2014.

  The measures necessary to ensure the integrity of the fuel located inside the refueling machine were implemented through several instructions and procedures, operational guidelines within the Severe Accident Management Program.

- **Batteries Availability Extension**

- **Instrumentation & Control (I&C)**

  The implementation of the means to ensure power supply to the instrumentation of representative signals of the variables needed to monitor the status and evolution of the plant in a SBO scenario.

  Currently an MDG enables to feel certain loads in case the facility completely loses internal and external energy supply. Among the loads taken into account are the following:

  - 220 V and 24 V battery rectifiers feed the instrumentation necessary to monitor the state and evolution of the plant.

***CNA II***

- **Alternative Power Sources**

  Since after a blackout, the plant does not have electricity feeding to supply certain key components to keep the core cooling, it is necessary to implement the modifications to the facility to feed electrically these components and in this way to take the plant to a safe and stable condition.

  Power supply for key components is possible by means of a Mobile Auxiliary Generation System which has an only Diesel Generator Auxiliary System connected to one or more busbars of 6.6 kV of the Emergency System (supply bars BDA, BDB, BDC and BDD).

  The objective of this modification is to supply water to VG and vent steam to the atmosphere. Power delivered by the Mobile Diesel Generator is also enough to feed KBA volume control system components and to inject water into the moderator primary system.

  In particular, a modification was implemented to supply water to fuel assemblies pools by means of the system of purification of pools of fuel assemblies storage by using the firefighting system. This system will be supplied from the firefighting system of the operator that has a diesel pump.

- **Fuel Assemblies Integrity Assessment**

  Similar to CNA I case, a detailed assessment was conducted of the evolution of the conditions in the exchange machine of CNA Unit II in case of total SBO.

  The necessary measures to guarantee the integrity of the fuel placed inside the top-up machine were implemented through a guide inside PGAS.

- **Connection among the DGs of CNA I and CNA II**

  There is no electricity connection between bars guaranteed in both plants. Only does an electricity connection exists between normal bars to supply CNA Unit I and CNA Unit II.

- **Batteries Availability Extension**

  Through a specific guide of PGAS, there is a possibility of extension of electricity supply time from batteries.

***CNE***

During the plant shutdown for the refurbishment activities (from 2016 to 2018), required for the plant life extension, some improvements related to the SBO scenarios will be implemented. The main activities are the following:

- **Abnormal Event Procedure**

  An abnormal event procedure to respond to the loss of cooling and / or loss of water inventory from the spent fuel storage pool was elaborated. This procedure includes the actions required to monitor the coolant level and the pool temperature from the secondary control room, assuming that the main control room and the pool building are inaccessible. Besides, to deal with a loss of cooling or inventory in the long term, suitable actions have been included to refill with water from alternative sources. These improvements are planned to be implemented by the end of 2014.

- **Fuel Assemblies Integrity Assessment**

  For the final safety report, the impact of events of loss of cooling function of the refueling machine with spent fuels that could be located inside the machine, when it is decoupled from the reactor. An operating procedure will be included to deal with these scenarios set for its operation after the refurbishment outage.

- **Alternative Power Sources**

  A MDG to meet the power demand required in a severe accident caused by a SBO will be implemented as to provide alternatives to the existing sources to secure electricity supply. A nearby and safe storage for MDGs and the associated devices to allow a quick connection between MDGs and the supply lines will be available in order to ensure the core and the spent fuel storage pools are cooled in the long term. This improvement shall be implemented before the restart and after the refurbishment outage.

- **Batteries Availability Extension**

### K.3.1.1.3. Loss of Heat Sinks

As a result of the assessment above mentioned, the Entity Responsible for the Operation will implement the following improvements:

***CNA I***

- **Alternative Water Sources**

  Providing alternative water sources to the existing ones for reserve secured water supply (such as reservoirs, pools, tanks, etc.) in order to deal with severe accident situations caused by the loss of heat sinks. It must also have the appropriate accessories/devices to connect these water sources to the respective pumps and supply lines in order to ensure the cooling of the core and the spent fuel storage pools in the long term by implementing the following:

  - An alternative system was implemented to supply storage pools of spent fuel that consists of a pump using water from the groundwater and with connections for each pool with their valves. The system enables its operation and level monitoring in a local way from the external part of the building independently from the control room. Electricity supply in the case of the electrical submersible pump and the instruments is redundant from a guaranteed bar and MDG.

  - Water inventory replenishment in the steam generators (SGs) through the SHS system in case of simultaneous loss in the tank, the residual heat removal chain and the water injection secured system to the SGs. It should also provide water inventory replenishment to the SHS tank in those cases where the SHS integrity is not affected.

    Water inventory replenishment for the above cases must be implemented by injecting groundwater using one of the pumps belonging to the water supply system, considering the involved components must be fed through a MDG in case a SBO coincides with the unavailability of the DGs belonging to the SHS system.

  - Water replenishment in the SHS system, to ensure its operation during a minimum of 72-hours without external actions.

  In relation to the two previous points, a water replenishment inventory system was installed in steam generators to keep them as a cold source in accidents where no supply tank is available or where the later cooling chain and the guaranteed system of water injection for steam generators and their tank or supply pump are not available.

  It consists of supplying water with a UJ pump to UA pools and, from these pools by means of another pump, UA10 D020 and/or UA10D21 to the RX tank or independently to boost a RX feeder. Pumps can be supplied from MDG.

***CNA II***

- **Alternative Water Sources**

  Providing alternative water sources to the existing ones to secure water supply (such as reservoirs, pools, tanks, etc.) to deal with severe accidents caused by the loss of heat sinks. There must also be appropriate accessories/devices to connect these water sources with the corresponding pumps and supply lines in order to ensure core and spent fuel storage pools cooling in the long term by implementing the following:

  - Providing an alternative water reservoir to keep water supply active to remove heat through the SGs and to keep the spent fuel storage pool cooling in the long term.
  - Implementing an additional system to replenish water in the spent fuel storage pools from an alternative reservoir, such as groundwater, existing tanks or other sources.

For these two points: different modifications in the facility are in progress to increase water supply sources and in this way to achieve the cooling of the core and fuel assemblies stored in pools that are:

- Water supply to fuel assemblies pools by means of the SGA firefighting system (interconnection between the purification system of storage pools of fuel assemblies FAL and the firefighting system SGB). End date: planned outage 2017.
- Supply to GHC system storage tanks by means of the firefighting system SGA. End date: 31 August 2017.
- Water supply to the SGA system by means of the fire network of the worker management unit – nuclear projects. End date: 31 August 2017.

***CNE***

During refurbishment activities foreseen in the facility (from 2016 to 2018), required for the plant life extension, some improvements related to the loss of heat sinks will be implemented. The more relevant are the following:

- **Alternative Water Sources**

  Providing alternative water sources to the existing ones to secure water supply (such as reservoirs, pools, tanks, etc.) to deal with severe accidents caused by the loss of heat sinks. There must also be appropriate accessories/devices to connect

these water sources with the corresponding pumps and supply lines in order to ensure core and spent fuel storage pools cooling in the long term by implementing the following:

- Spent fuel storage pool water replenishment through a connection from outside the building pool including an isolation valve and a hose coupling from the fire extinguishing system.

- A facility to connect a fire truck from outside the building pool to replenish water in the spent fuel storage pool in case of events of cooling loss, flow loss or SBO. This improvement has already been implemented.

- Two mobile cisterns containing 8,000 liters of stored water each. This improvement has been implemented.

- A water supply line to the calandria vessel from outside the reactor building. This improvement is expected to be implemented before the restart and after the reconditioning outage.

- A connection through a hose line from a fire truck to the ECCS pipes to allow water addition to the dousing tank for feed water replenishment to the SGs to allow cooling for at least 72 hours. This improvement is expected to be implemented before the restart and after the reconditioning outage.

- An additional fire truck containing 11,000 liters of water. This truck has already been purchased.

- **Modifications to the Emergency Water Supply (EWS) System**

Modifications will be made in order to improve the general reliability of the system and increase the availability of the Core Emergency Cooling System (ECCS). In relation to the improvement of reliability, emergency supply pneumatic valve, together with its local air tanks. In order to increase the ECCS availability, a line will be added for EWS water supply, seismically qualified, towards the secondary side of the ECCS exchanger. This flow will return to the low pressure service water system. Pumps, buried pipes and pump test circuit pipes will be replaced. Moreover, diesel generators are replaced by electric motors supplied by the Emergency Energy Supply (EPS).

- **Abnormal Event Procedure**

Procedures for abnormal event management and its recovery are under revision and updated for its operation after a refurbishment outage. An abnormal event procedure must be implemented in order to respond to the cooling loss and/or inventory loss of spent fuel storage pool. Also, a Severe Accident Management Program will be completed.

### K.3.1.2. Accident Management and Severe Accidents Management Program

***CNA I***

- **Severe Accident Management Guidelines (SAMG)**

  The Severe Accident Management Program (SAMG) have approved the following guidelines to mitigate accidents exceeding design bases:

  - Guidelines AG 01 (Rev. 1) Use Regulations of Guidelines A
  - Guidelines A CE 01 (Rev. 1) Assessment of the Plant Condition
  - Guidelines A SC 01 (Rev.1) Main Guidelines for the Control Room
  - Guidelines A CE 02 (Rev. 1) Monitoring in the long term
  - Guidelines A CE 03 (Rev. 01) End of A Guidelines
  - Guidelines A CE 04 (1), A SC 04-1 (0) y A SC 04-2 (Rev. 1) Electricity supply failure
  - Guidelines A CE 05, A SC 05-1 y A SC 05-2 (Rev. 2) Water supply to steam generators by means of RX system in different scenarios
  - Guidelines A CE 06 (Rev. 0) Depressurization of the primary system
  - Guidelines A CE 07, A SC 07-1 y A SC 07-2 (Rev.2) Water injection to the primary system
  - Guidelines A CE 08 (Rev. 0) Water injection to containment sinks
  - Guidelines A CE 09 (Rev. 1) y A SC 09-1 (Rev.0) Reduction of fission product release
  - Guidelines A CE 10 (Rev. 1), A SC 10-1 (Rev. 0) and A SC 10-2 (Rev.0) Control of containment conditions
  - Guidelines A CE 12 and A SC 12-1 (Rev,2) water injection to the spent fuel pools
  - Guidelines A CE 13 (Rev. 1) y A SC 13-1 (Rev. 0) Cooling of refueling machine

- **WANO SOER 2011-2 Recommendations**

  The availability of the existing SSCs for different accident scenarios was checked to meet the recommendations arising from the WANO SOER 2011-2.

  The Licensee compiled a list of 253 components that needed to be verified to deal with events included in the design basis, which were reviewed in expert inspections conducted during 2011.

- **Procedure for Operation in Perturbations and Accidents**

  The procedure for "Operation in Perturbations and Accidents" was modified in order to include the control of critical parameters of the spent fuel storage pools.

- **Accident Management Procedures Review and Improvement**

The review of the procedures was carried out to ensure the operation of the systems that are necessary in the proposed scenarios to ensure the proper functioning and demand of the safety systems required in extreme events for at least the initial 72 hours:

*SBO:* Manual action to inject the SHS in a short period of time with a cooling ramp of 100°C/h and manually deactivation of the boric acid injection shutdown system.

*Inventory Replenishment of the SHS* with an increase in the capacity of the SHS feed water tanks, using the two pumps of the water conditioning system (UA10 D20/D21) and replenishing those pools with groundwater using one of the pumps of the drinkable water supply.

*Low Level River:* This will allow systematic handling to conduct a plant outage and secure the cooling system.

The following PGAS are taken into account:

A CE 05 “Water injection to steam generators”.
A SC 05 – 1 “Water injection to steam generators –high pressure path”
A SC 05 – 2 “Water injection to steam generators – low pressure path”

- **Severe Accident Management Program**

An emergency operating procedure to deal with an event of loss of cooling or water inventory of the spent fuel storage pools intended to monitor water level and the temperature of the pools during an emergency, as well as the possibility of recovering its water inventory even in scenarios of SBO, earthquakes and flooding or low water level.

To complete the severe accident management program including the corresponding guidelines for prevention and mitigation, considering the lessons learned from Fukushima. This includes the strategies to deal with extreme external events beyond the design basis, which may lead to a loss of the safety functions and the conditions of severe accident.

The following guidelines PGAS are taken into account:

- Guideline A CE 12 and A CS 12 – 1: Water injection to spent fuel pools.
- A CE 04 Rev. 1 Electricity Supply
- A SC 04-1 Rev. 0 Electricity Supply: Manual Electricity Interconnection, supply from Unit 2 to Unit 1
- A SC 04-2 Rev. 1 Electricity Supply with Mobile Diesel Generator (SEGDM).

- **Filtered Containment Venting System**

- **Instrumentation and Control**

- **DGs Alternative Cooling Mode**

- **Disconnection of Electrical Loads**

  The procedure of disconnection of electrical loads to increase the batteries duration in the actual plant condition has to be reconsidered once the new EPS be installed.

- **Procedure to Passive Components Control**

  This procedure was already incorporated to the Operations Manual to make possible for example to verify during each operational shift the vacuum breakdown / siphons piping associated with the spent fuel pool cooling as well as to increase the frequency of the corresponding tests and inspections.

- **Safety System Trip Parameters**

- **Operating Procedure for Abnormal Events**

- **Measures for Accident Management to Deal with Loss of Cooling in the Fuel Storage Pools**

  These two points are included in the Severe Accident Management Program in the Guidelines A CE 12 and A SC 12-1: Water injection to spent fuel pools.

  An alternative system was implemented to supply burn-up fuel storage that has a water well pump and branches to each pool with its valves. The system enables its operation and level monitoring in a local way from the external part of the building, being independent from the control room. Electricity supply for the submersible motor pump and the instruments is redundant from a guaranteed bar and the MDG. It only has a level measurement in case the main control room is not available.

***CNA II***

- **Severe Accident Management Program**

  The Severe Accident Management Program has the following guidelines approved to mitigate accidents exceeding design basis:

  - A CE 01 Assessment of the plant condition
  - A SC 01 Main guidelines for the control room
  - A CE 02 Long Term Monitoring
  - A CE 03 End of Guidelines A
  - A CE 04 Loss of Electricity Supply

- A SC 04-1 Restart of Emergency Diesel
- A SC 04-2 Electrically assisted cooling system of the plant
- A SC 04-3 Recovery of the plant after a total loss of electricity supply
- A SC 04-4 Electricity interconnection-supply from Unit I to Unit II
- A SC 04-5 Optimization of fuel management for diesel generators
- A SC 04-6 Time extension of electricity supply from chargers
- A SC 04-7 Preservation of fuel assemblies in the refueling machine in the event of a black out
- A CE 05 Supply and Vent of Steam Generators
- A SC 05-1 Supply and Vent of Steam Generators
- A CE 06 Depressurization of the primary circuit
- A CE07 Isolation of the containment vent
- A SC07-1 Isolation of the containment vent
- A CE 08 Unavailability of principal water cooling systems (PA) and guaranteed cooling (PE)
- A SC 08-1 Unavailability of principal water cooling systems (PA) and guaranteed cooling (PE)
- A CE 10Manual dosage of boron
- A SC 10-1 Manual dosage of boron
- A CE 11 Lack of cooling in spent fuel pools
- A SC 11-1 Lack of cooling in spent fuel pools
- A CE 12 Control Room Habitability
- A SC 12-1 Control Room Habitability

***CNE***

- **Severe Accident Management Guidelines (SAMG)**

  The Severe Accident Management Guidelines (SAMG) has been re-evaluated. In December 2012, CANDU Energy performed a Severe Accident Management Guidance (SAMG) Training and Validation Exercise for the Severe Accident Management Program. The overall objectives of the SAMG validation exercises were to evaluate the effectiveness of SAMG framework, processes and training for emergency response. SAMG are currently under a revision process and revision 1 of all the severe accident documentation is expected to be issued after the restart of the plant after the refurbishment outage that will include the lessons learned from the Fukushima accident.

- **Procedure to Passive Components Control**

  This procedure was already incorporated to the Operations Manual in to verify during each operational shift the vacuum breakdown/siphons piping associated with the spent fuel pool cooling as well as to increase the frequency of the corresponding tests and inspections.

- **Operating Procedure for Abnormal Events**

  An Operating Procedure for Abnormal Events that covers response to loss of cooling in the spent fuel pool and / or loss of inventory will be developed. This procedure includes actions to verify the coolant level and temperature of the pool from the secondary control room in the event that the main control room and the pool room are not accessible. It includes actions to replenish water from alternative systems (e.g. fire hydrants or fire engines) in the event of sustained loss of cooling or loss of inventory.

- **Facility to Connect a Fire-truck from Outside the Spent Fuels Storage Pool Building**

  A fire-truck from outside the spent fuel storage pool building was installed. It will replenish water to the pools in the events of loss of cooling, circulation or SBO.

### K.3.2 R&D Activity Program

In order to achieve the goals of safety, efficiency and continuous improvement, the PNGRR develops various R&D activities in compliance with the PEGRR. Section L includes a list of activities being conducted at present and those carried out jointly with the IAEA.

### K.3.3 Public Communication Program

During the period 2014-2016 both the National Program for Radioactive Waste Management —PNGRR— and the Environmental Restoration Project of Uranium Mining —PRAMU— have implemented in various communication activities. These actions, destined to provide information and to establish communication channels both with the personnel of CNEA and citizenship, are framed in the communicational policy established by the institution in its Strategic Plan and is managed by the Social Communication Department.

The development of communication activities is crucial, as the fulfillment of the objectives of PNGRR and PRAMU depends not only on the positions taken by the technical and political decision makers, but to the perception of the public opinion on the nuclear activity in general.

In that context, CNEA participated in general public displays, such as the Exhibition of Art, Science and Technology known as *Tecnópolis* from 2011 till 2015. Over a million visitors could visit the stand of nuclear activities conducted in Argentina.

Aside from Tecnópolis, other activities were held destined to the general public, such as the exhibition of science and technology “La brújula”, held in the city of Mendoza between April and June 2015. Within this context, PRAMU presented the advancements of environmental remediation of Malargüe site with scale models of the stages of the park and soil encapsulation in the final stage of the restitution.

These activities gave the possibility of a face-to-face interaction among CNEA technicians and scientists and visitors and, therefore, of dealing in a personalized way with consultations and enquiries related to radioactive waste management and spent fuel, as well as activities conducted by PRAMU.

Another Project during the period 2013-2015 was the “Mobile Film Festival”. The itinerant film festival was presented in several provinces around Argentina and, aside from screening 3D audiovisual works on the nuclear fuel cycle and its daily life applications, there were talks and outreach material was handed out, including about topics of environmental management and radioactive waste management as well as spent fuels, which enabled towns distant from big cities to be in contact with these topics through new supports such as 3D animations.

There were routine events destined to the community, such as the exhibition in Bariloche Atomic Centre and Institute Balseiro, which offers annual workshops and public lectures to the community; or seminars at the “Open Constituyentes Atomic Centre (CAC)” in which CAC opens its door to the community. The PNGRR and PRAMU actively participate in this type of outreach activities.

From a more technical viewpoint, in the annual meeting of the International Radiation Protection Association (IRPA) held in Buenos Aires in 2016, there was a stand focused on radiation protection activities in the scopes of spent fuel and radioactive material management.

Within the framework of the Program “School Visits”, activities in different secondary schools were conducted where workshops and lectures were delivered which include a practical experience simulating at a small scale the radioactive waste compacting and cementing. This initiative also included teachers, who attended Seminars on Training in Nuclear Energy, held jointly by the Cero Lab of the Constituyentes Atomic Centre and the Department of Social Communication. Moreover, as part of the routinely activities of PRAMU and PNGRR, visits from teachers and students were organized both to the facilities related to remediation processes (mainly located in Malargüe, province of Mendoza) and the dedicated to waste management (in the Management Area, within the Ezeiza Atomic Centre, in the province of Buenos Aires).

As part of the outreach and training activities, different training courses were organized, much of which are destined to generators of different types of radioactive waste, for example the ones related to the diagnosis and treatment of diseases through nuclear techniques applications in the health facilities dependent on the Government of the City of Buenos Aires.

By focusing on the institutional employees, CNEA personnel could visit the different labs located in Ezeiza Atomic Centre thanks to the “Visits to Intercentres” Program.

Specific modules related to radioactive waste management and uranium mining environmental remediation were made for internal training courses (known as “ABC of Nuclear Energy”) for newcomers to CNEA.

Both PNGRR and PRAMU develop different type of information and outreach materials (infographics, catalogs, brochures, audiovisual products, scale models, etc.) in line with general guidelines and with the institutional visual identity.

A major point is the systematization of a Citizenship Perception Survey at a national level conducted by CNEA every three years and is valuable input for the design and implementation of institutional communicational policies that aim at fostering knowledge and acceptance of the nuclear energy by the society.

From the results obtained to date, it can be inferred that it is important to keep working to show the work that the institution does for the environment and for the safe management of radioactive waste and spent fuel[1].

In what is specifically related to the Joint Convention, CNEA has adopted it as a practice since the First National Report published on the internet (available at the CNEA and IAEA websites), to publish on the web Reports and Q&A. This information has also been published in the Management Report CNEA 2015.

In compliance with national legislation, the PNGRR and PRAMU annually inform the Honourable Congress of the Nation on their main management activities.

These reports are available for the public and can be accessed through CNEA website (www.cnea.gov.ar).

## K.4. Commitments of Previous Revision Meetings

The commitments made by Argentina in previous meetings and its state of progress are described below:

1) ***Complete in time the ongoing projects to guarantee enough storage capacity of spent fuel in the CNA Unit I and Unit II NPPs.***

   There are two projects conducted by NA-SA:

   a) Transfer of spent fuels from the pool building in Unit I to the pool building in Unit II: this project has been implemented and most spent fuels have already been transferred.

   b) Construction of the Interim Dry Storage Building of Burned Fuel Assemblies annexed to the Pool Building in Unit I. This project registers a 50% advancement. The completion of civil and electro mechanic works have been hired.

   In G.4.1 the detail related to these projects is included.

[1] The survey shows that nuclear waste treatment and its effect on the environment is one of the main concerns by the citizenship. In this sense, 84.5% of the interviewed ones consider it as an “important” topic even though they are not aware of the specificity of the topic. Citizenship-Policies Perception study of atomic energy in Argentina – CNEA 2015.

***2) Reach progress in public communication to support the proposal of possible repository sites.***

Public acceptance in relation to siting of repositories is a common concern for all countries and is seen as a top priority challenge and as a continuous process, regarding which CNEA has ongoing plans.

CNEA increased its efforts in the public communication activities.
The details are included in K.3.3.

***3) Remaining Mining Sites Remediation***

The remediation of Malargüe site is almost finished. The current challenge is to complete the characterization and to define the engineering for the remediation of remaining sites where, beyond technical limitations, it will be necessary to comply with the social aspects of each particular project (see details in H.5.1).

It is an ongoing activity in CNEA through the PRAMU project. Given the complexity and transcendence of this task, both in technical and associated social aspects, it is an objective that will require a major effort for its correct completion and it is expected to be a positive example in terms of sustainable development in the nuclear industry.

## K.5 IAEA Review Missions

The IAEA has implemented an advisory program on all aspects of spent fuel management called IFMAP (Irradiated Fuel Management Advisory Program).

In this framework, the IAEA conducted a mission called "Peer Review Mission IAEA IFMAPCNA I Spent Fuel Dry Storage Project", from 12 to 16 March 2012.

***Application for an IRRS (Integrated Regulatory Review Service) Mission***

In December 2014, the ARN informed the IAEA about the decision to start a process to receive an IRRS mission in the future. In December 2016, Argentina submitted to the IAEA Secretary the formal request for the last quarter of 2018.

During this year, the ARN Board informed the ARN personnel of the priority assigned to the preparations of a future IRRS mission in the institution. In this context, the Ad-hoc group was identified (known as IRRS Group in the rest of the text) to coordinate the self-assessment process prior to the Mission. The performed tasks are the following:

- Meetings of an IRRS Group as responsible for the area to inform of the objectives of the IRRS mission and the diagnostic self-assessment.
- Definition of the work method of working groups and their responsibilities for the self-assessment.

- First diagnostic self-assessment and specific self-assessments of technical areas to identify strengths, weaknesses, opportunities and vulnerabilities.
- Outreach in the intranet of the important information organization of tasks.
- Visit of a Spanish expert to share experiences from the Spanish Nuclear Safety Council about the organization of the self-assessment and organization previous to an IRRS mission.
- Meetings of the IRRS Group with area responsible for the ARN for AE findings.
- Distribution of the self-assessment surveys developed by the IAEA in support of the IRRS missions (SARIS - Self-Assessment of Regulatory Infrastructure for Safety Tool).

In conclusion, the process is developed in sequential stages: assessment and integration of self-assessment, definition of actions of improvement to be implemented in 2017 and proposal of future action plan in order to discuss it with the mission revisers.

## K.6 Synoptic Summary

In agreement with the determinations of the document *Guidelines relative to the Form and Structure of the National Report (item 12, part II of Annex to INFCIRC 604/Rev1)*, a synopsis of the present conditions in Argentina in relation to the contents of this Fifth National Report is included in the next page.

# ARGENTINE SIXTH NATIONAL REPORT – OVERVIEW

| Type of Liability | Long Term Management Policy | Funding of Liabilities | Current Practices/ Facilities | Planned Facilities |
|---|---|---|---|---|
| **Spent Fuel** | ▪ Reprocessing decision deferred (dead line 2030)<br>▪ Final Disposal 2060 | ▪ Facility Operator (Argentine State)[1] | ▪ CNA I: NPP Wet Storage<br>▪ CNA II: NPP Wet Storage<br>▪ CNE: NPP 6 years Wet Storage<br>▪ CNE: NPP Dry Storage<br>▪ RRII: Wet Storage (DCMFEI/FACIRI) | ▪ CNA I: Dry Storage<br>▪ Deep Geological Repository (feasibility) |
| **Nuclear Fuel Cycle Waste** | ▪ Final Disposal | ▪ Facility Operator (Argentine State)[1] | ▪ LLW: Storage + Final Disposal<br>▪ LLW: Treatment and Conditioning Facility<br>▪ ILW: Storage | ▪ LLW: Centralized Repository<br>▪ ILW &HLW: Deep Geological Repository (feasibility)<br>▪ LLW: Treatment and Conditioning Facility (PTARR) |
| **Non - Nuclear Fuel Cycle Waste** | ▪ Final Disposal | ▪ Waste Generator when it is a private owner<br>▪ Argentine State when the generator is the State | ▪ LLW: Storage + Final Disposal<br>▪ LLW: Treatment and Conditioning Facility<br>▪ ILW: Storage | ▪ LLW: Centralized Repository<br>▪ LLW: Treatment and Conditioning Facility (PTARR) |
| **Decommissioning** | ▪ Decommissioning Plan (regulatory requirement) | ▪ Argentine State when the facility is state-owned<br>▪ Facility operator when it is a private owner. | ▪ No Facility in Decommissioning Process | ▪ LLW: Centralized Repository<br>▪ VLLW: Centralized Repository |
| **Disused Sealed Sources** | ▪ Reuse or Recycling<br>▪ Final Disposal | ▪ Source User | ▪ Re-encapsulation: Co-60 Sealed Source Plant<br>▪ Storage + Final Disposal (short-lived)<br>▪ Storage (long-lived) | ▪ LLW: Centralized Repository<br>▪ ILW & HLW: Deep Geological Repository (feasibility) |

(1) At present, all nuclear reactors and other nuclear fuel cycle facilities are operated by Argentine State Organizations, being the Argentine State responsible for their funding.

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# SECTION L ANNEXES

## L.1 National Laws

### L.1.1 Law No. 24804/97 National Law of Nuclear Activity

**CHAPTER I**
**Nuclear Activity. Duties of the National Government**
**Criteria for Regulations.Jurisdiction.**

**ARTICLE 1.-** The National Government, through the Argentine Commission of Atomic Energy and the Nuclear Regulatory Authority, shall define the policy and be responsible for research and development, regulation and surveillance functions in the nuclear field.

All productive oriented nuclear activities related to research and development, which may be commercially organized, shall be performed by the National Government or by the private sector.

The nuclear policy shall meet all the obligations assumed by the Argentine Republic as a party to the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Tlatelolco Treaty), the Treaty on Non-Proliferation of Nuclear Weapons (NPT), the Agreement between the Argentine Republic and the Federative Republic of Brazil through the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) and the International Atomic Energy Agency (IAEA) for the Application of Safeguards, in addition to the commitments signed by Argentina as a member of the Nuclear Suppliers Group and the National Regime for the Control of Sensitive Exports (Decree No. 603/92).

**ARTICLE 2.-** The Argentine Atomic Energy Commission created by Decree No. 10936 dated May 31st, 1950 and reorganised by Decree-Law No. 22498/56,which was ratified by Law No. 14467, shall continue operating as an autarchic organism within the jurisdiction of the President of the Nation [1], and shall be responsible for:

a) Advising the Executive Power on nuclear policy issues.

b) Promoting training of highly specialised human resources, and scientific and technological developments in the nuclear field, which include the promotion and development programs for technological innovations.

c) Fostering technology transfer programs for technologies acquired, developed and patented by the Institution in compliance with the non-proliferation commitments signed by the Argentine Republic.

d) Exercising the responsibility of radioactive waste management activities in compliance with the specific legislation.

e) Defining the procedures for decommissioning of nuclear power plants and any other relevant radioactive facility.

f) Providing the services requested by nuclear power plants and other nuclear facilities.

g) Exercising the property rights of the National Government on special fissionable materials included in irradiated fuel elements.

h) Exercising the property rights of the National Government on special fissionable materials, which might be admitted or developed in the country.

i) Developing, building and operating experimental nuclear reactors.

j) Developing applications for radioisotopes and radiation in biological, medical and industrial uses.

k) Performing mineral prospecting for nuclear use, without excluding the private sector from said activity.

l) Developing materials and manufacturing processes for fuel elements to be used in advanced cycles.

ll) Developing basic and applied research programs in basic sciences of nuclear technology.

m) Subscribing cooperation programs with third countries, through the Ministry of Foreign Affairs, International Trade and Worship, for the programs mentioned in the above item, and for fusion technology research and development programs.

n) Fostering and developing any other study and scientific application for nuclear transmutations and reactions.

ñ) Continuously updating of technical information on nuclear power plants during all their lifetime, and ensuring its optimum use.

o) Establishing direct relations with other foreign institutions that share similar goals.

p) Signing agreements with nuclear power plant operators in order to carry out research.

**ARTICLE 3.-** The Argentine Commission of Atomic Energy shall manage its administrative, financial, proprietary and accounting matters in accordance with the contents of this Law and the regulations issued for such purpose by its Board of Directors. The Commission shall be subject to the public control regime.

The staff of the Commission shall be subject to the Labour Contracts Law and to the special conditions established in the regulations.

**ARTICLE 4.-** The duties of the Board of Directors of the Argentine Atomic Energy Commission shall be:

a) To perform the necessary actions in order to comply with the objectives and functions established in this Law.

b) To approve general work plans, strategic projects and annual budgets to be submitted to the National Executive Power.

c) To approve the annual activities report.

d) To advise the National Executive Power on matters related to atomic energy and its applications.

e) To establish relations with foreign institutions or with regional or international agencies that share similar goals, including the participation of the Ministry of Foreign Affairs, International Trade and Worship.

f) To accept assets and donations.

g) To sign agreements with public or private entities for the execution of the plans aimed at the achievement of the Commission's goals.

h) To propose the Commission's organisational structure to the Executive Power.

**ARTICLE 5.-** The Chairman of the Board of Directors of the Argentine Commission of Atomic Energy shall be vested with every necessary executive power to comply with the laws and regulations ruling the Institution and the resolutions issued by the Board of Directors. The Chairman shall:

a) Undertake the legal representation of the Argentine Atomic Energy Commission for all administrative, judicial and extrajudicial matters.

b) Manage and administer the Institution.

c) Summon and chair the meetings of the Board of Directors.

d) Present general work plans, strategic projects and annual budget drafts to the Board of Directors to be submitted to the National Executive Power.

e) Grant general and special mandates.

f) Integrate, either by himself or through representatives, national, provincial or sectorial commissions dealing with the tasks of the Institution, including environmental matters.

g) Inform the Board of Directors about the general distribution of the annually granted budget.

h) Inform the Board of Directors about the compliance with plans, projects and other scheduled activities.

i) Propose to the Board the Commission's organisational structure at the levels not defined by the Executive Power.

j) Appoint, promote, sanction and dismiss staff according to the applicable laws and regulations.

k) Appoint and promote staff that will perform hierarchical and co-ordination activities.

l) Appoint and send representatives, and nominate on assignment qualified personnel, to participate in regional or international conferences, meetings or congresses.

m) Partially delegate, to the internal bodies he may designate, the faculties entrusted to him by this Law.

**ARTICLE 6.** Resources of the Argentine Atomic Energy Commission shall be made up by the following revenues:

a) Contributions from the National Treasury as determined for each fiscal year and by special laws.

b) Proceeds resulting from its own activities in the field of production and from the services rendered.

c) Subsidies, legacies, inheritances, donations and transfers received for any concept.

d) A royalty fixed by the Executive Power aimed at financing research and development activities performed by the Argentine Commission of Atomic Energy, calculated as a percentage of the income obtained from the sale of electric power generated by nuclear power plants in charge of Nucleoeléctrica Argentina S.A. (corporation) or by whoever legally substitutes it.

e) Interests and benefits accrued from the management of its own funds.

**ARTICLE 7.-** The Nuclear Regulatory Authority shall be responsible for regulating and controlling nuclear activities regarding radiological and nuclear safety, security and controlled use of nuclear materials, licensing and surveillance of nuclear facilities, and compliance with international safeguards. The Nuclear Regulatory Authority shall also be an advisor to the Executive Power on issues within its field of expertise.

**ARTICLE 8.-** The Nuclear Regulatory Authority shall have regulatory and control responsibilities, as stated in this Law in order to:

a) Protect human beings from harmful effects of ionising radiation.

b) Ensure that nuclear activities carried out in the Argentine Republic comply with radiological and nuclear safety requirements.

c) Ensure that nuclear activities are not to be performed for purposes other than those authorised by this Law, and that regulations issued in the future comply with international commitments and Argentina’s policy on non-proliferation of nuclear activities.

d) Prevent intentional actions that could lead to severe radiological consequences or to unauthorized withdrawal of nuclear materials or other materials, or equipments subject to regulation and control, as stated in this Law.

**ARTICLE 9.-** To develop any type of nuclear activity, all individuals and legal persons shall:

a) Comply with regulations issued by the Nuclear Regulatory Authority within its jurisdiction and, in order to operate, to apply for a license, permit or authorisation.

b) Comply with all the safeguards and non-proliferation agreements subscribed or to be subscribed in the future by the Argentine Republic.

c) Accept civil liabilities of nuclear power plant operators, as defined in the Vienna Convention on Civil Liability for Nuclear Damage, ratified by Law No. 17048, for a total amount of eighty million US Dollars (USD 80,000,000) per nuclear accident in each nuclear facility. This amount shall be guaranteed by an insurance policy or a financial warranty, to the satisfaction of the Executive Power or whoever shall be appointed by the Executive Power; the National Government shall be responsible for the remaining liability.

The Executive Power is hereby authorised to adjust the amount of the liability above mentioned if the conditions stated in the Vienna Convention on Civil Liability for Nuclear Damage are amended, provided said amendment is ratified by law.

Nuclear damages, as defined in the Vienna Convention on Civil Liability for Nuclear Damage, ratified by Law No. 17048, shall mean loss of human lives, bodily injuries and material damages directly or indirectly caused by radioactive properties, or by radioactive properties in combination with toxic, explosive or other hazardous properties of nuclear fuels, or by radioactive products or radioactive waste in a nuclear facility or nuclear products **arising from or originated by said facility or sent to it,**or other ionising radiation released from any other source of radiation within a nuclear facility.

It is considered that the operator of a nuclear facility shall be liable for nuclear damages in case of:

i) Damages caused to the operator’s employees and to the contractor and subcontractor’s employees as a result of the nuclear accident at a nuclear facility that is operated by said company;

ii) Damages caused by the nuclear accident to International Atomic Energy Agency’s officials while developing tasks to comply with the safeguards stated in the international agreements signed by the Argentine Republic;

iii) Damages caused by nuclear products when such accidents do not occur within a facility or during transportation, if at the time of the nuclear accident, said products were stolen, lost, jettisoned, or abandoned.

All operators of nuclear power plants shall contribute to a Fund for Decommissioning of Nuclear Power Plants. The funding, management and control of this Fund shall be determined by the National Executive Power.

**ARTICLE 10.-**As established in SECTION 11 of this Law, regulation and surveillance of nuclear activities concerning matters defined in SECTION 7 are submitted to the national jurisdiction.

**ARTICLE 11.-**Every new site for a relevant nuclear facility shall require a construction license authorizing its location issued by the Nuclear Regulatory Authority and approved by the Provincial Government in whose jurisdiction the new facility is scheduled to be built.

**ARTICLE 12.-**The Argentine Atomic Energy Commission shall suggest the location of the repositories for high, intermediateand low levelwaste. The site shall be approved by the Nuclear Regulatory Authority regarding radiological and nuclear safety, and the Provincial Government in whose jurisdiction the suggested site is located shall pass a law approving the site. Said requirements shall be prior and essential for any approval requests.

**ARTICLE 13.-**The location of radioactive waste treatment plants and of their corresponding temporary and final repositories managed by the Argentine Atomic Energy Commission or by the Corporation Nucleoeléctrica Argentina S.A. have in operation at the time this Law is enacted, including their expansion and routes of access by land, sea, air and river, shall require no additional authorization to continue operating, and all deliveries to, or shipments from said repositories, shall not require any special approval from the National Congress or from Municipal or Provincial authorities in whose jurisdiction the repository or routes of access are located.

**CHAPTER II**
**Nuclear Regulatory Authority**

**ARTICLE 14.-**The Nuclear Regulatory Authority shall operate as an autarchic entity within the jurisdiction of the President of the Nation. Said Authority shall succeed the National Board of Nuclear Regulation.

**ARTICLE 15.-**The Nuclear Regulatory Authority shall hold autarchy and shall have full juridical capacity to act both in Public and Private Law.

Its property shall be constituted by assets to be transferred to the National Board of Nuclear Regulation and by those acquired in the future for any concept. It shall have its headquarters in the City of Buenos Aires. The Authority shall approve its own organisational structure with prior intervention of the Public Functions Secretariat of the Presidency of the Nation.

**ARTICLE 16.-**The Nuclear Regulatory Authority shall have the following duties, attributions and obligations:

a) Issuing regulatory standards related to radiological and nuclear safety, security and control of the use of nuclear materials, licensing and surveillance of nuclear facilities, international safeguards and transport of nuclear materials as far as radiological and nuclear safety and security are concerned.

b) Granting, suspending and revoking construction licenses, commissioning, operation and decommissioning of nuclear power plants.

c) Granting, suspending and revoking licenses, permits or authorisations concerning Uranium mining and concentration, safety of research reactors,

relevant accelerators, relevant radioactive facilities, including the facilities for waste or radioactive waste management, and nuclear applications in medical and industrial activities.

d) Performing regulatory inspections and evaluations of facilities subject to regulation of the Nuclear Regulatory Authority, with the periodicity it deems necessary.

e) Proposing to the Executive Power the transfer, extension or replacement of a concession for the use of a State-owned nuclear facility whenever there exist elements that advise to do so, or its expiration when based on non-compliance with the rules issued regarding radiological and nuclear safety matters.

f) Bringing civil or criminal lawsuits before the competent courts when licensees or authorisation or permit owners do not comply with what is ruled by this Law, as well as requesting for search warrants and for the aid of the security forces whenever such actions are deemed necessary to duly exercise the faculties granted by this Law.

g) Applying sanctions, which shall be graded according to the severity of the infringement; such as warnings, fines to be applied according to the severity of the fault and regarding the potential damage involved, suspension of a license, permit or authorisation or their revocation. Said sanctions shall be appealable only for returnable effect before the National Administrative Contentious Court of Appeals.

h) Establishing procedures for the application of sanctions corresponding to the violation of rules issued while exercising its competence, thus ensuring the principle of due process of Law.

i) Disposing the seizure of nuclear or radioactive materials, as well as the preventive closure of facilities subject to regulations of the Nuclear Regulatory Authority, whenever they lack the due license, permit or authorisation, or whenever gross negligence is detected regarding the compliance with radiological and nuclear safety standards or with the protection of facilities.

In this context, gross negligence means acts involving a serious threat to the safety of the population or to the environmental protection, or whenever the application of security or safeguards measures cannot be guaranteed.

j) Protecting restricted information in order to ensure a trustworthy preservation of technological, commercial or industrial secrets, and an appropriate application of safeguards and of security measures.

k) Establishing, in accordance with international parameters, radiological and nuclear safety standards for overland, river, sea or air transport of nuclear and radioactive materials, and for security of transported materials.

l) Establishing, in accordance with international parameters, radiological and nuclear safety standards related to staff working in nuclear facilities and granting specific licenses, permits and authorisations that qualify for performance of functions subject to licenses, permits or authorisations.

ll) Defining a procedure for consultation with owners of licenses for relevant nuclear facilities whenever new regulatory standards are proposed or the existing ones are modified.

Such procedure shall foresee that modifications to the existing standards and the issuing of new ones are supported by an evaluation criterion based on the cost/benefit ratio arising from the application of the new standard.

m) Evaluating environmental impact produced by any licensed activity, which involves monitoring, analysis and follow-up activities concerning the incidence, evolution or possibility of environmental damage that may arise from the licensed nuclear activity.

n) Submitting an annual report to the National Executive Power and the Honourable National Congress on activities performed, including suggestions about measures to be adopted for the benefit of public interest.

ñ) Requesting information to all license, permit or authorisation owners on topics subject to regulation.

o) In general, performing any other action aimed at achieving a better performance of duties and at accomplishing the purposes of this Law and its regulations.

**ARTICLE 17.-**The Nuclear Regulatory Authority shall be managed and administered by a Board of Directors of six (6) members as follows: a Chairman, a Vice-Chairman and four (4) voting members.

**ARTICLE 18.-**Members of the Board of Directors of the Nuclear Regulatory Authority shall be appointed by the Executive Power, two of them as proposed by the House of Deputies and the Senate, respectively. Said members must have a technical and professional background in this field. They shall be entitled to a six (6) year period, and one third of them shall be renewed every two (2) years. They shall only be removed on ground basis by the Executive Power and they may be successively and indefinitely appointed.

In the case of the first appointment, the Executive Power shall fix the term of duration by drawing lots.

**ARTICLE 19.-**Members of the Board of Directors of the Nuclear Regulatory Authority shall have full-time dedication and shall be subject to incompatibilities in force for public officials. License, permit or authorisation owners as per this Law and individuals with any direct interest connected with this matter cannot be appointed as members of the Board.

**ARTICLE 20.-**The Chairman of the Board shall be entitled to such position during a six (6) year period and may be appointed successively and indefinitely for legal periods. He shall be the legal representative of the Nuclear Regulatory Authority. In case of impediment or temporary absence, the Vice-Chairman shall replace him.

**ARTICLE 21.-**The Board of Directors shall be legally competent with a quorum of four (4) of its members, while one of them must be its Chairman or Vice-Chairman. Its resolutions shall be adopted by simple majority. In case of a draw, the Chairman or the person replacing him shall have a double vote.

**ARTICLE 22.-**The duties of the Board of Directors of the Nuclear Regulatory Authority shall be:

a) To exercise and to control the fulfilment of statutory rules and regulations governing the Authority's activities.

b) To issue the Board's regulations for its performance.

c) To administer all matters related to the Authority's staff.

d) To prepare annual budgets and to estimate resources to be submitted to the Honourable National Congress through the Executive Power for its approval along with the general budget of the Nation.

e) In general, to perform any other action aimed at a better fulfilment of its duties and at accomplishing the purposes of this Law and its regulations.

**ARTICLE 23.-**The Nuclear Regulatory Authority shall manage its administrative, financial, proprietary and accounting matters in accordance with the contents of this Law and the regulations issued for such purpose by its Board of Directors. The Authority shall be subject to the public control regime.

**ARTICLE 24.-**The Nuclear Regulatory Authority shall draft an annual budget proposal that shall be published and submitted to individuals bound to pay the regulatory rate foreseen in SECTION 26 of this Law, who shall be able to formulate grounded objections within thirty (30) calendar days after such publication.

**ARTICLE 25.-**Resources of the Nuclear Regulatory Authority shall be made up by the following revenues:

a) Regulatory rate created by SECTION 26 of this Law.

b) Subsidies, inheritances, legacies donations and transfers received for any concept.

c) Interests and benefits accrued from the Management of its own funds.

d) National Treasury contributions as determined for each fiscal year.

e) Any other funds, assets or resources assigned to it by virtue of applicable laws and regulations.

**ARTICLE 26.-**Licensees, owners of an authorisation or permit, or legal persons whose activities are subject to the control of the Authority shall pay in advance an annual regulatory rate to be approved through the general budget of the Nation.

In the case of nuclear power plants, such annual regulatory rate shall not be higher than a sum equivalent to the annual average price of one hundred megawatt-hour (100 MW/h) at the Wholesale Electric Power Market, fixed on the basis of prices in force during the previous year. Said sum shall be paid for every megawatt of nuclear nominal power

installed capacity until withdrawal of irradiated fuel from the reactor is finished during its decommissioning by the operator in charge of the facility.

Furthermore, new nuclear power plants shall also pay, annually and in advance, regulatory rates corresponding to construction and licensing process, which shall be approved by the Executive Power.

For the rest of licensees that are owners of an authorisation or permit subject to regulation, the Nuclear Regulatory Authority shall establish the corresponding regulatory rates for licensing and inspection, which shall not exceed zero point five percent (0.5%) of their income, or an equivalent indicator of the activity subject to regulation of the previous fiscal year.

Arrears of payment of the rate or fines foreseen in SECTION 16, item g) shall be automatic and shall accrue punitive interests as established by the enforcement authority. A debt certificate indicating lack of payment issued by the Nuclear Regulatory Authority shall be sufficient to bring an executive lawsuit before the Civil and Commercial Federal Courts.

**ARTICLE 27.-**Staff of the Nuclear Regulatory Authority shall be submitted to the Labour Contracts Law and to special conditions established in the regulations, while the Basic Juridical Regime for Public Function shall not be applicable.

**ARTICLE 28.-**The Nuclear Regulatory Authority shall rule according to procedures established in the Administrative Procedure Law and its regulatory provisions as regards its relations with individuals and with Public Administration.

**ARTICLE 29.-**Whenever, as a result of instituting legal procedures on own initiative or as a result of denunciation by third parties, the Nuclear Regulatory Authority considers that any act by a nuclear facility licensee, by an authorisation or permit owner, or by a legal person somehow subject to regulation and control as well as by those using or producing nuclear technology or managing nuclear wastes violate this Law, its regulations or resolutions issued by the Nuclear Regulatory Authority, it shall notify all interested parties, being said Authority empowered to take preventive actions as deemed necessary prior to solving the existence of such violation.

## CHAPTER III
## Definitions

**ARTICLE 30.-**As used in this Law, the following terms shall have the definitions assigned to them hereunder:

a) ***Nuclear activities:*** Use of nuclear transmutations at a macroscopic scale.

b) ***Nuclear material:*** Plutonium 239, Uranium 233, Uranium 235, Uranium enriched in Isotopes 235 or 233, Uranium containing an isotopic mix equal to the one found in nature, Uranium depleted in Isotope 235, Thorium with nuclear purity or any material containing one or more of the above.

c) ***Nuclear facility:*** Concept understood in the terms defined by SECTION 1, item j, of the Vienna Convention on Civil Liability for Nuclear Damage approved by Law No. 17048.

d) ***Relevant nuclear facility:*** It includes nuclear reactor, critical facility, relevant radioactive facility and relevant accelerator, as defined or to be defined by the Nuclear Regulatory Authority.

e) ***Restricted information:*** Any information delivered by an applicant or by a license, permit or authorisation owner to the Nuclear Regulatory Authority that is to be treated confidentially in virtue of legal or contractual obligations assumed by them or related to:

I. Processes and technologies for the production of special fissionable material;

II. Specific application of safeguards;

III. Specific security systems applied in nuclear facilities.

f) ***Special fissionable material:*** Plutonium, Uranium 233, Uranium enriched in Isotopes 235 or 233 and any other material containing one or more of the above mentioned elements.

g) ***Production of special fissionable material:*** Chemical separation of special fissionable material from other substances or production of special fissionable materials by means of isotopic separation methods.

**CHAPTER IV**
**General Provisions**

**ARTICLE 31.-**The responsibility for nuclear and radiological safety, safeguards and security remains unfailingly with the license, permit or authorisation owner. Fulfilment of this Law and of rules and requirements arising from them do not exempt him from such liability or from doing everything that may be reasonable and consistent with his possibilities in favour of radiological and nuclear safety, safeguards and security.
The license, permit or authorization owner may totally or partially delegate the execution of the tasks, but he still keeps the entire responsibility established in this SECTION.

**ARTICLE 32.-**The National Government shall be the sole owner of special fissionable materials contained in irradiated fuel elements when activities encompassed by this Law are performed, as well as of any special fissionable materials admitted or developed in the country.

**ARTICLE 33.-**SECTIONS 2, 5, 9, 11, 16 and 17 of Decree-Law No. 22498, dated December 19th, 1956, are annulled.

**CHAPTER V**
**Privatisations**

**ARTICLE 34.-**It is declared as subject to privatisation nuclear power generation activity performed by the Corporation Nucleoeléctrica Argentina Sociedad Anónima (Nucleoeléctrica Argentina S.A.), as an indivisible productive unity, either directly or in association with other entities, including its various aspects (construction, commissioning, operation, maintenance, and decommissioning of nuclear power plants), as well as management and execution of nuclear power plant construction being performed by the

Corporation Empresa Nuclear Argentina de Centrales Eléctricas Sociedad Anónima (ENACE S.A) [2].

This privatisation shall ensure the completion of the nuclear power plant, currently under construction, within a maximum term of six (6) years after the enactment of this Law.

**ARTICLE 35.-**"Nucleoeléctrica Argentina Sociedad Anónima (Nucleoeléctrica Argentina S.A.)", or corporation organized in furtherance of the execution of privatisation authorized in the previous SECTION, shall maintain up to twenty per cent (20%) of its capital and at least one (1) share as property of the National Government, and their possession as well as the exercise of corporate rights shall remain with the Ministry of Economy and Public Works and Services.

The company's employees shall receive from said capital the percentage that shall be fixed in the framework of the programme of participated property foreseen in Law No. 23696.

The National Government shall be the permanent owner of one (1) share of the society and its affirmative vote shall be required to take any decisions related to:

a) An expansion of capacity of an existing nuclear power plant and/or the construction of a new one.

b) Decommissioning for non-technical causes of a nuclear power plant, either temporarily or definitively.

**ARTICLE 36.-** Activities related to nuclear fuel cycle aimed at nuclear power generation, either at an industrial or research scale, and at the production and applications of radioisotopes and radiation presently performed by the Argentine Commission of Atomic Energy, either directly or in association with other entities, are declared as subject to privatisation, considering them both as a whole or as any of their constituent parts.

**ARTICLE 37.-** Corporations shall be constituted for the purpose of the privatisations mentioned in SECTION 36, and the National Government shall hold at least one (1) share and the right to veto any decisions involving discontinuation of such activities.

**ARTICLE 38.-** The licensee of the nuclear power plants or the corporation created for the purpose of privatisation authorised by SECTION 34 shall hire its supply of heavy water from the Industrial Plant for the Production of Heavy Water ("Planta Industrial de Agua Pesada - PIAP") installed in Argentina and shall be responsible for the restitution of heavy water hired for Embalse Nuclear Power Plant, according to technical quality features and prices of the international market.

**ARTICLE 39.-**Privatisation processes authorised in this Chapter shall be subject to conditions established by Law No. 23696, by SECTION 96 of Law No. 24065, by SECTION 14 of Law No. 24629 and by this Law.

**ARTICLE 40.-**Nuclear Power Plants shall use nuclear fuel originated or elaborated from radioactive minerals of mines located in the country [3].

**ARTICLE 41.-**This Law shall be enforced as from the date of its publication in the Official Bulletin.

**ARTICLE 42.-**Tobe communicated to the Executive Power.

[1] Jurisdiction of the President of the Nation was appealed by Decree No. 358/97 of the Executive Power enacting the present law.

[2] Law No. 26784 of 2012, in its Art. 61, repealed Art. 34 of Law No. 24804, by which the operation of the nuclear power plants cannot be privatised, the responsibility for financing the decommissioning of Nuclear Power Plants, research reactors, and other significant nuclear facilities would be assumed by the National Government with its own funds.

[3] Article 40 was appealed by Decree No. 358/97 of the Executive Branch enacting the present law.

### L.1.2 Law No. 25018/98 National Law on Radioactive Waste Management Regime

### General Provisions

**ARTICLE 1.-** This law sets forth the basic instruments for an adequate radioactive waste management that, in this aspect, assure the protection of the environment, public health and the rights of posterity.

**ARTICLE 2.-** For the purpose of the present law, Radioactive Waste Management means the ensemble of the necessary activities to isolate from the biosphere radioactive waste derived exclusively from the nuclear activity performed in the Argentine territory, the time required for the decay of its radioactivity to such a level that its possible re-entrance to the biosphere does not imply risks for man and his environment. Such activities will have to be performed in complete agreement with the limits established by the NUCLEAR REGULATORY AUTHORITY and with all the corresponding national, provincial and City of Buenos Aires regulations as well as with the international agreements.

**ARTICLE 3.-** For the purpose of this law, radioactive waste means all radioactive material, combined or not with non-radioactive material, which has been used in productive processes or applications, for which no immediate subsequent uses are foreseen in the same facility, and which, because of its radiological characteristics, cannot be dispersed in the environment in accordance with the limits established by the NUCLEAR REGULATORY AUTHORITY.

**ARTICLE 4.-** The ARGENTINE ATOMIC ENERGY COMMISSION (CNEA) is the enforcement authority of this law and will co-ordinate everything related to its application with the provinces or the City of Buenos Aires, as may correspond.

**ARTICLE 5.-** In all the activities of radioactive waste management the ARGENTINE ATOMIC ENERGY COMMISSION will have to comply with regulatory standards referred to radiological and nuclear safety, security and environmental protection and international safeguards established by the NUCLEAR REGULATORY AUTHORITY and with all the corresponding national, provincial and City of Buenos Aires regulations.

**Responsibility and Transference**

**ARTICLE 6.-** The National State, through the enforcement authority of the present Law, shall assume the responsibility of the radioactive waste management. The generators of radioactive waste will have to provide the necessary resources to undertake it in due time and manner. The generator shall be responsible for the safe conditioning and storage of the waste generated by the facility operated by him, in compliance with the conditions determined by the enforcement authority, until its transference to the ARGENTINEATOMIC ENERGY COMMISSION, and shall notify the NUCLEAR REGULATORY AUTHORITY immediately about any situation that could lead to an incident, accident or operation failure.

**ARTICLE 7.-** The ARGENTINE ATOMIC ENERGY COMMISSION shall establish the radioactive waste acceptance criteria and transference conditions that are necessary to assume its responsibility, and these will have to be approved by the NUCLEAR REGULATORY AUTHORITY.

**ARTICLE 8.-** The transference to the ARGENTINE ATOMIC ENERGY COMMISSION of radioactive wastes, particularly irradiated fuel elements, will be done at the time and according to the procedures determined by the ARGENTINE ATOMIC ENERGY COMMISSION with the prior approval by the NUCLEAR REGULATORY AUTHORITY. Under no circumstances the operator of the generating facility will be released from the responsibility in case of eventual civil and / or environmental damages until the transfer of radioactive waste has been accomplished.

**ARTICLE 9.-** The ARGENTINE ATOMIC ENERGY COMMISSION must prepare, within a term of SIX (6) months as from the enacting of the present Law, to be updated every THREE (3) years, a Strategic Plan for Radioactive Waste Management, which will include the National Programme of Radioactive Waste Management created by SECTION 10 of the present Law. This Plan and its updated versions will be forwarded to the EXECUTIVE, who, after consulting with the NUCLEAR REGULATORY AUTHORITY, will send it to the NATIONAL CONGRESS for its enactment.

Likewise, it will annually present to the National Congress a report on the tasks performed, the progress of the Strategic Plan and the need of its update.

**National Program of Radioactive Waste Management**

**ARTICLE 10.-**The ARGENTINE ATOMIC ENERGY COMMISSION through the National Programme of Radioactive Waste Management created by this Law must:

a. Design the strategy of radioactive waste management for the Argentine Republic and the places under its jurisdiction.
b. Propose the research and development lines related to technologies and methods of high, intermediate and low level radioactive waste management.
c. Plan, co-ordinate, execute and assign the necessary funds, and control the execution of research and development projects related to radioactive waste management.
d. Study the need to establish repositories and facilities for the management of high, intermediate and low level waste generated by the nuclear activity from the public or private sector.
e. Promote studies on safety and preservation of the environment.

f. Project and operate the systems, equipment, facilities and repositories for the management of high, intermediate and low level waste generated by nuclear activity from the public or private sector.
g. Construct, by itself or by third parties, the systems, equipment, facilities and repositories for the management of high, intermediate and low level waste generated by the nuclear activity from the public or private sector.
h. Propose the acceptance criteria and transference conditions of radioactive waste for high, intermediate and low level waste repositories.
i. Determine the procedures for the collection, segregation, characterisation, treatment, conditioning, transport, storage and final disposal of radioactive waste.
j. Manage the waste originated by the nuclear activity from the public or private sector, including those generated at the closure of facilities, those derived from uranium mining and those originated in abandoned mining sites and out-of-service industrial plants.
k. Implement, maintain and operate an information and recording system containing the documentation to allow the reliable and continuous identification of the waste generators and transporters and other participants in all management stages. It must also include the inventory of all radioactive waste existing in the country. Copies of the documentation, corresponding to their respective jurisdiction, must be forwarded to the competent authorities of the provinces and the City of Buenos Aires for their information.
l. Prepare contingency plans for incidents, accidents or operation failures and evacuation programmes for emergencies.
m. Permanently inform the community about the scientific and technological aspects of radioactive waste management.
n. Exercise the long term responsibility on the radioactive waste repositories.
o. In the case of a nuclear emergency, act as a support to the services of civil protection in the manner and circumstances that may be required.
p. Perform the necessary technical and financial studies, taking into account the deferred costs derived from radioactive waste management, with the objective to establish the adequate economic policy.
q. Perform any other activity needed to comply with the objectives of the management.

**ARTICLE 11.-**The National Programme of Radioactive Waste Management will incorporate the recovery of the sites affected by the activities of extraction, grinding, concentration, treatment and elaboration of radioactive minerals originated in operating mines sites and their respective manufacturing plants, as well as from abandoned mining deposits or out-of-service industrial plants.

The application of the principle “as low as possible environmental impact” must be integrated with complementary programmes of sustainable development for directly affected communities and shall continue under the evaluation procedures of environmental impact determined by the provinces or the City of Buenos Aires, as may correspond.

**ARTICLE 12.-** In the case that the ARGENTINE ATOMIC ENERGY COMMISSION proposes the need to locate facilities for the final disposal of high, intermediate or low level radioactive waste, the selected sites will have to be previously approved as an essential requisite by the law of the province or the City of Buenos Aires, as may correspond, in agreement with the NUCLEAR REGULATORY AUTHORITY.

For this purpose, the corresponding environmental feasibility studies will have to be undertaken, containing a description of the proposal and of the direct and indirect potential effects that it could cause to the environment, indicating in this case the adequate measures to avoid or minimise the risks and/or negative consequences, and informing about the scopes, risks and benefits of the project.

A public hearing shall be called with a notice of no less than TEN (10) calendar days, through a media of regional circulation giving the pertinent information related to the future site.

**Financing of Radioactive Waste Management**

**ARTICLE 13.-**This Law creates the Fund for the Management and Final Disposal of Radioactive Waste to be constituted when this Law is enacted and whose exclusive destiny will be the financing of the National Programme of Radioactive Waste Management under the responsibility of the ARGENTINE ATOMIC ENERGY COMMISSION.

Said Fund will be integrated with the contributions of the radioactive waste generators in the form to be determined by the regulation, according to Section 10, item p) of this Law respecting the principles of equity and equilibrium according to the nature, volume and other characteristics of the generation. Such contributions will be integrated at the shortest term as from the generation of the corresponding waste.

**ARTICLE 14.-**Taking into account the existence of deferred costs in the radioactive waste management, the National Congress will promulgate a law regulating the administration and control of the fund foreseen in Section 13 of this Law.

**ARTICLE 15.-**This Law revokes the Fund for Final Repositories of High Activity Nuclear Waste created by Decree No. 1540/94. The existing resources shall be transferred to the Fund established by this Law.

**ARTICLE 16.-** To be communicated to the Executive Power.

### L.1.3 Regulations governing the nuclear industry of the Argentine Republic: Organizational Structure (1950-2017)

- Creation of the Argentine Atomic Energy Commission
  **Decree No. 10936/50**
  31 May 1950
  Published: Argentine Republic Official Gazette, 7 June 1950
  Derogated by Decree Law No. 22498/56

- Organization of the Argentine Atomic Energy Commission
  **Decree Law No. 22498/56**
  19 December 1956
  Published: Argentine Republic Official Gazette, 28 December 1956
  Ratified by Law No. 14467. Partially derogated by Law No. 24804, arts. 2, 5, 9, 11, 16 and 17

- Ratification of decrees laws of the provisional Government
  (Issued between 23 September 1955 and 30 April 1958)
  **Law No. 14467**
  Sanctioned: 5 September 1958
  Enacted: 23 September 1958
  Published: Argentine Republic Official Gazette, 29 September 1958

- Reorganization of activities and modification of competences of the Argentine Atomic Energy Commission. Establishment of the National Nuclear Regulatory Entity. Establishment of the corporation Nucleoeléctrica Argentina S.A.
  **Decree No. 1540/94**
  30 August 1994
  Published: Argentine Republic Official Gazette, 2 September 1994

- National Law of the Nuclear Activity
  **Law No. 24804**
  Sanctioned: 2 April 1997
  Partially enacted: 23 April 1997
  Published: Argentine Republic Official Gazette, 25 April 1997

- Regulation of the National Law of Nuclear Activity No. 24804
  **Decree No. 1390/9827**
  November 1998
  Published: Argentine Republic Official Gazette, 4 December 1998

- Radioactive Waste Management Regime
  **Law No. 25018**
  Sanctioned: 23 September 1998
  Enacted: 19 October 1998
  Published: Argentine Republic Official Gazette, 23 October 1998

- The amendments to the Nucleoléctrica Argentina Sociedad Anónima By laws are ratified. Nucleoeléctrica S.A. is required to conduct the activities necessary to establish Atucha II NPP Management Unit. The corporation's purpose is to undertake the acts required to start up Atucha II NPP and to make the Argentine Atomic Energy Commission participate in it.
  **Decree No. 981/05**
  18 August 2005
  Published: Argentine Republic Official Gazette,
  22 August 2005

- The regime to conduct works for Atucha Nuclear Power Plant CNA Unit II is fully binding. It has been granted to the Argentine Atomic Energy Commission and it engulfs to the CNA Unit II Nuclear Management Unit of the corporation Nucleoeléctrica Argentina Sociedad Anónima.
  **Decree No. 1085/06**
  23 August 2006
  Published: Argentine Republic Official Gazette, 25 August 2006

- The Assignment of Stock Agreement subscribed by Nucleoeléctrica Sociedad Anónima and Argentine Atomic Energy Commission was ratified on 22 June 2006.
  **Decree No. 1760/09**

16 November 2009
Published: Argentine Republic Official Gazette, 19 November 2009

- The following activities are declared to be of national interest: those to conclude a fourth NPP, Embalse NPP life extension and CAREM Prototype Reactor.
  **Law No. 26566**
  Sanctioned: 25 November 2009
  Enacted: 17 December 2009
  Published: Argentine Republic Official Gazette, 24 December 2009

## L.1.4 Main International Treaties on Nuclear Energy subscribed by the Argentine Republic (1966-2017)

- Vienna Convention on Civil Liability for Nuclear Damage. Approved by the International Conference on Civil Liability for Nuclear Damage, held in Vienna, Republic of Austria in 1963.
  (This Convention was modified and complemented by a Protocol and a Supplementary Convention approved by Law No. 25313)
  **Law No. 17048**
  Sanctioned and enacted: 2 December 1966
  Published: Argentine Republic Official Gazette,
  16 December 1966.

- Convention on Prevention of Pollution of the Sea due to Discharge of waste and other substances, open for signature on 29 December 1972 in London, Mexico, Moscow and Washington.
  **Law No. 21947**
  Sanctioned and enacted: 6 March 1979.
  Published: Argentine Republic Official Gazette,
  9 March 1979.

- Convention Relating to Civil Liability in the Field of Maritime Carriage of Nuclear Material, subscribed in Brussels, Belgium on 17 December 1971.
  **Law No. 22455**
  Sanctioned and enacted: 27 March 1981
  Published: Argentine Republic Official Gazette, 6 April 1981

- Treaty on the Prohibition of the Emplacement of Nuclear Weapons and Other Weapons of Mass Destruction on the Seabed and Ocean Floor and in the Subsoil Thereof. Subscribed in London, Moscow and Washington on 11 February 1971.
  **Law No. 22507**
  Sanctioned and enacted: 7 October 1981.
  Published: Argentine Republic Official Gazette,
  13 October 1981

- Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and under Water, concluded in the city of Moscow on 5 August 1963.
  **Law No. 23340**
  Sanctioned: 30 July 1986

Enacted: 19 August 1986
Published: Argentine Republic Official Gazette,
25 February 1987.

- The Convention on the Physical Protection of Nuclear Material, subscribed in Vienna, Republic of Austria on 3 March 1980.
  **Law No. 23620**
  Sanctioned: 28 September 1988
  Enacted: 20 October 1988
  Published: Argentine Republic Official Gazette, 2 November 1988.

- Convention on Early Notification of a Nuclear Accident and Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency, approved by the General Conference of the International Atomic Energy Agency, Vienna, Republic of Austria on 26 September 1986.
  **Law No. 23731**
  Sanctioned: 13 September 1989
  Enacted: 6 October 1989
  Published: Argentine Republic Official Gazette,
  13 October 1989.

- Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Tlatelolco Treaty) adopted in Mexico on 1967 with the introduced amendments on 3 July 1990, on 10 May 1991 y on 26 August 1992 (Tlatelolco Treaty).
  **Law No. 24272**
  Sanctioned: 10 November 1993
  Enacted: 7 December 1993 (Application art. 70, National Constitution)
  Published: Argentine Republic Official Gazette,
  14 December 1993.

- Treaty on the Non Proliferation of Nuclear Weapons, open for signature in London, Washington and Moscow on 1 July 1968. (NPT)
  **Law No. 24448**
  Sanctioned: 23 December 1994
  Enacted: 13 January 1995
  Published: Argentine Republic Official Gazette,
  20 January 1995.

- Convention on Nuclear Safety adopted in Vienna, Republic of Austria on 20 September 1994.
  **Law No. 24776**
  Sanctioned: 19 February 1997
  Enacted: 4 April 1997(Application Art. 80, National Constitution)
  Published: Argentine Republic Official Gazette on 11 April 1997

- Comprehensive Nuclear Test Ban Treaty accepted by the General Assembly of the United Nations in New York, USA on September 1966.
  **Law No. 25022**
  Sanctioned: 23 September 1998
  Enacted: 20 October 1998
  Published: Argentine Republic Official Gazette,

28 October 1998.

- Joint Convention on Safety of the Spent Fuel Management and on Safety of Radioactive Waste Management, adopted in Vienna, Republic of Austria, on 5 September 1997.
  **Law No. 25279**
  Sanctioned: 6 July 2000
  Enacted: 31 July 2000 (Application of art. 80, National Constitution)
  Published: Argentine Republic Official Gazette, 4 August 2000.

- Protocol of Amendment to the Vienna Convention on Civil Liability for Nuclear Damage and Convention on Supplementary Compensation for Nuclear Damage, adopted in Vienna, Republic of Austria, on 12 September 1997 (amending and supplementing the Vienna Convention approved by Law No. 17048).
  **Law No. 25313**
  Sanctioned: 7 September 2000
  Enacted: 6 October 2000 (application of art. 80, National Constitution)
  Published: Argentine Republic Official Gazette,
  18 October 2000.

- Agreement on activities related to facilities of international surveillance at the service of the Comprehensive Nuclear-Test-Ban Treaty (CTBT), subscribed together with the Provisional Technical Secretariat of the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), on 9 December 1999 in Vienna, Republic of Austria.
  **Law No. 25837**
  Sanctioned: 26 November 2003
  Enacted: 19 February 2004
  Published: Argentine Republic Official Gazette,
  20 February 2004.

- Cooperation Agreement fostering of Nuclear Technology and Science in Latin America and the Caribbean adopted by the IAEA Board of Governors in Vienna, on September.
  **Law No. 25842**
  Sanctioned: 26 November 2003
  Enacted: 9 January 2004
  Published: Argentine Republic Official Gazette, 15 January 2004

- Amendment to the Convention on the Physical Protection of Nuclear Material.
  **Law No. 26640**
  Sanctioned: 13 October 2010
  Enacted: 13 November 2010
  Published: Argentine Republic Official Gazette,
  17 November 2010.

- International Convention for the Suppression of Acts of Nuclear Terrorism.
  **Law No. 26976**
  Sanctioned: 27 August 2014
  Enacted: 17 September 2014
  Published: Argentine Republic Official Gazette,
  24 September 2014

- Convention on the Privileges and Immunities of the Agency for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (OPANAL)
  **Law No 27.186**
  Sanctioned: 23 September 2015
  Enacted: 13 October 2015
  Published: Argentine Republic Official Gazette, 28 October 2015 Entered into force: 24/06/16 (Official Gazette 24/08/16)

## L.2 PNGRR R&D Program

### L.2.1 R&D Activities

The R&D Program was created in order to comply with the PEGRR objectives. It includes activities and lines of action regarding disposal, final disposal of radioactive waste and spent fuel. Listed below are all R&D activities conducted during the period 2014-2016:

- Development of instruments for the characterization of radioactive waste:
  - Development of a tomographic gamma scanner to verify conditioned radioactive waste quality by means of non-destructive tests
- Development of new characterization techniques of radioactive waste.
- Selection of radiochemical techniques for radioactive waste characterization.
- Development of new processes for conditioning and treatment of different waste flows generated in NPP or which may be necessary to be managed in the AGE.
- Studies of formulation about conditioning by cementation of liquid radioactive waste stored in the Ezeiza Management Area, AGE.
- Assessment of geopolymers as matrices for immobilization of radioactive waste.
- Studies of conditioning of spent ion-exchange resins in polymeric matrices.
- Studies of low temperature thermal processes for resin treatment of spent ion-exchange:
  - Studies of new inorganic polymer compounds for the spent ion-exchange resin thermally treated.
  - Study of the plasma processing of gaseous effluents coming from spent ion-exchange resin thermal treatments.
  - Study of biodegradation of spent ion-exchange resins through ligninolytic fungi.
  - Studies of inorganic adsorbents for the selective extraction of Cs-137 of aqueous effluents coming from the Mo-99 production process.
  - Studies of methods for conditioning of spent inorganic adsorbents generated during Mo-99 production.
  - Development of a process based on phenolic resin for in-situ immobilization of silicon titanium (Si-Ti) charged with Cs-137 generated during Mo-99 production.
  - Studies of hybrid adsorbents for selective extraction of lanthanides and actinides during the treatment of aqueous radioactive waste coming from the U-235 recovery used in the Mo-99 production.
  - Studies of new targets for Mo-99 production, which enable to decrease the radioactive waste generation.

- Studies of new polymers of coordination for selective extraction of lanthanides and actinides
- Studies of response of nanostructured materials radiation and its potential use as targets for the actinides destruction.
- Studies on radioactive waste vitrification.

❖ Studies on behaviour of different materials used as engineering barriers in disposal systems:

- Study of durability of cementitious materials, such as engineering barriers to build the construction of a repository for low level radioactive waste.
- Basic and applied studies of reinforced concrete degradation destined to the construction of radioactive waste repository.
- Assessment of behavior of cement based material in field conditions
- Development of microstructural models of Portland cements for its application to the assessment of behavior of materials to be used in engineering barriers.
- Study of metallic drums durability containing conditioned radioactive waste.

❖ Developments related to transport of radioactive waste and spent fuels:

- Development of a container for the transport of research reactors spent fuel (denominated RLA4018) and its certification by ARN

❖ Assessment of options for spent fuel treatment and conditioning of spent fuels of research reactors and radioisotope production.

❖ Review of the features of spent fuels generated from spent research reactors and evaluation for their future management.

❖ Development of treatment and conditioning processes of spent fuels of research reactors and radioisotope production.

❖ Study of a glass-ceramic process for the conditioning of spent fuels generated in research and production reactors.

❖ Studies of long-term behavior of spent fuels for nuclear power plants and research reactors and radioisotope production reactors.

- Study of aqueous corrosion mechanisms of aluminium alloys in spent fuel storage pools (FACIRI) and the research reactor RA6.
- Study about the possibility for microbiological corrosion of aluminium alloys in FACIRI.
- Study of degradation of spent fuels of the Atucha Unit I NPP during its dry long-term storage.
- Assessment of stainless steel welding corrosion in new dry storage silos of spent fuels in the CNA Unit NPP I.
- Assessment of corrosion of storage baskets of spent fuels in dry silos in Embalse NPP.

- Feasibility study of monitoring by means of tomographic images of dry silos of spent fuel storage of Embalse NPP.

❖ Studies related to selection and characterization of sites for disposal systems siting.

- Studies of hydrogeochemical, soil, hydrogeological and geomorphological in sedimentary environmental characterization, to be applied under the determination of the environmental base line of possible sites of interest for radioactive waste repository siting.
- Studies of modelling of hydric circulation in sedimentary environments and the unsaturated zone.
- Studies of physical properties of soils and monitoring techniques for the unsaturated zone.
- Electromagnetic characterization of the unsaturated zone in sedimentary soils for soils for the infiltration model
- Hydrogeological, hydrogeochemical and geophysical prospective studies in the Areco river basin (province of Buenos Aires)
- Hydrogeological studies in the Vallecitos river basin (province of Mendoza), as a generic site subject to an alleged glaciation.
- Modelling study of radioelements migration towards the biosphere by means of the AMBER informatics code.
- Study of the phreatic aquifer and soils of the Ezeiza Management Area.

❖ Development of a record and traceability information system related to the radioactive waste inventory.

❖ Development and implementation of STOReR application to update the database of radioactive waste managed in the Ezeiza Management Area.

❖ Development and implementation of PAGE to request radioactive waste management to AGE, which can be accessed from CNEA website.

### L.2.2 Joint Activities with the International Atomic Energy Agency

In the frame of the Technical Cooperation programs with the Agency, Argentina has participated in the following projects and activities:

❖ Technical Cooperation Project (TCP ARG9013): "Treatment of radioactive waste by thermal processes", 2014-2015.

❖ Technical Cooperation Project (TCPARG9014) “Vitrification”, 2016-2017.

- Coordinated Research Project (CRP): “Demonstrating Performance of Spent Fuel and Related Storage System Components (T13014)”: IAEA Contract No.17338. “Feasibility study of an emission tomography monitoring system for dry-stored spent nuclear fuel”.
- IAEA Contract No. 17339. "Materials degradation assessment of power reactors spent fuel and installations during long interim dry storage".

- Coordinated Research Project (CRP): “Options and Technologies for Managing the Back End of the Research Reactor Nuclear Fuel Cycle (T33001)”:

  - IAEA Contract No. 18855. “Storage and Conditioning Options for the Argentine Al-based Research Reactor Spent Fuel”.

- Coordinated Research Project (CRP): "Ageing Management Programs for Dry Storage Systems" (T21028).

- Coordinated Research Project (CRP):"Spent Fuel Performance Assessment and Research - Phase IV" (T13016).

- Project INT 9182 “Sustaining Cradle to Grave Control of Radioactive Sources”.

- Technical Cooperation Project (CRP RLA/9/078): “Enhancing the National Regulatory Framework and Technological Capabilities for Radioactive Waste Management”.

It seeks to improve regional real capacities for the safe quality technical management of radioactive waste in order to protect people and the environment in Latin American countries.

**End of the**

**Sixth National Report**

**of the Argentine Republic**

**in furtherance of the**

**Joint Convention**

**on the Spent Fuel Safety**

**and on the Radioactive Waste Management Safety**