

INTRODUCTION

The Nuclear Regulatory Authority (ARN) was created as an autonomous body under Act 24,804 known as Nuclear Activity National Act, which came into force on April 25, 1997, to succeed the National Nuclear Regulatory Board. The Nuclear Regulatory Authority reports to the Argentine President and is empowered to regulate and control the nuclear activity with regard to radiological and nuclear safety, physical protection and nuclear non-proliferation aspects.

The objective of the Nuclear Regulatory Authority is to establish, develop and enforce a regulatory system applicable to all nuclear activities within Argentina as well as to advise the Executive on issues under its purview. The goals of these regulatory system are:

- ✓ To provide the public with an appropriate level of protection against harmful effects of ionizing radiation.
- ✓ To ensure a reasonable degree of radiological and nuclear safety for nuclear activities performed in Argentina.
- ✓ To ensure that nuclear activities are not diverted from authorized and intended purposes and are performed in accordance with international agreements to which the Nation is a signatory.
- ✓ To establish criteria and standards in order to prevent deliberate actions from being committed which may either have severe radiological consequences or lead to the unauthorized removal of nuclear materials or other nuclear-related materials or equipment.

Articles 1, 7, 14, 15, 16, 18, 25 and 26 of Act 24,804 explain in detail the functions, powers and duties vested in the Nuclear Regulatory Authority. Decree 1390/98 implementing said Act defines its scope and procedures facilitating its enforcement.

The effective direction and management of the Nuclear Regulatory Authority is carried out by the Board of Directors. The Board of Directors is composed of six members appointed by the Executive, two of which shall be nominated respectively by the Senate and the House of Representatives. The term of office of each Director shall be six years, with one third of them being chosen every second year. Selection criteria for the Director's office are based upon the candidate's technical and professional qualifications in the specific field.

ARN Board of Directors



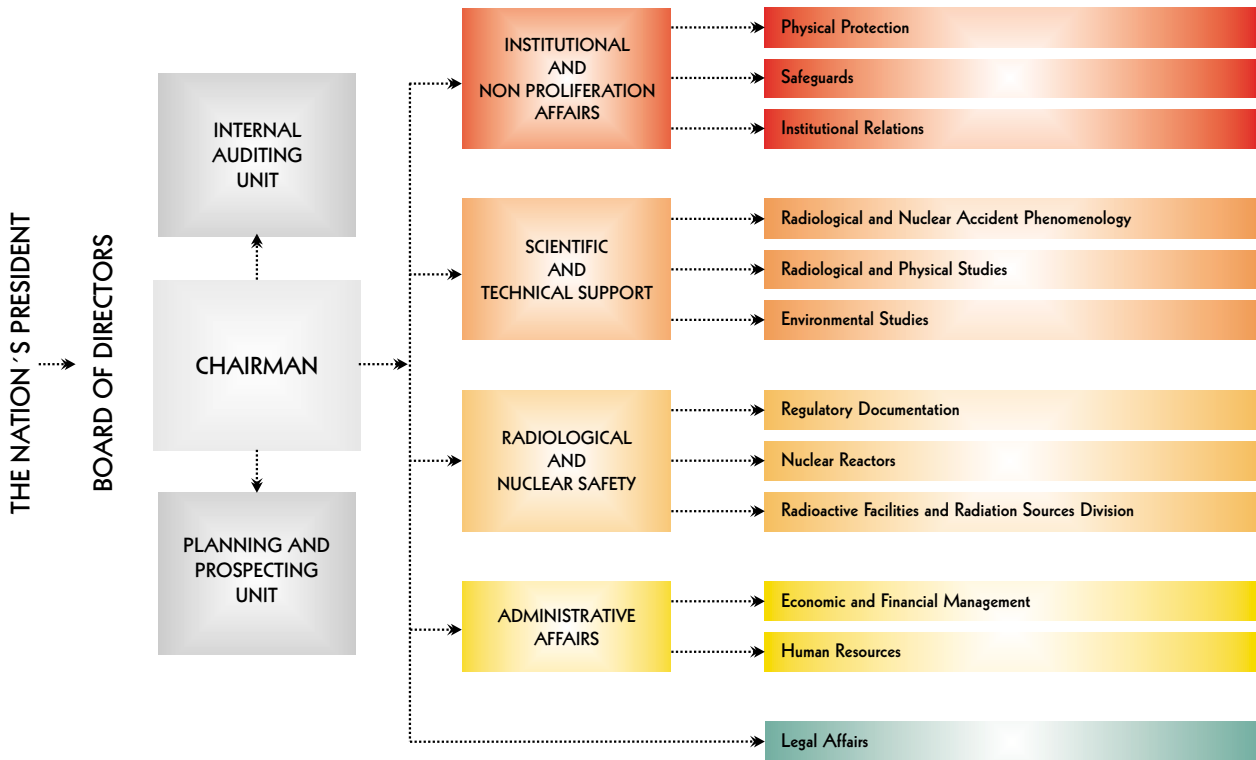
Norberto R. Ciallella
Member of the Board

Pedro M. Sajaroff
Vice-Chairman

Eduardo D'Amato
Chairman

Jaime Pahissa Campa
Member of the Board

The ARN organizational structure approved on 11 January, 1999, is shown in the organization chart below:



THE ARGENTINE REGULATORY SYSTEM

In its capacity as the national authority on radiological and nuclear safety, non-proliferation assurances and physical protection issues, the ARN grants authorizations, licenses and permissions, as appropriate, in connection with practices associated with radiation sources. In addition, the ARN performs control activities to ensure that persons responsible for each practice comply with the provisions set forth in regulatory documents and established standards. From the beginning of the country's regulatory activities it was recognized that to efficiently play this role an appropriate scientific and technological expertise was needed to assess, based upon independent criteria, the design, construction and decommissioning of the facilities subject to control. Within this framework, the global strategy contained in the Argentine regulatory system has focussed on the following basic principles:

- ✓ Adopting specific standards on radiological and nuclear safety, safeguards and physical protection;
- ✓ Conducting regulatory inspections and audits to verify compliance with granted licenses and authorizations.
- ✓ Carrying out studies and assessments on radiological and nuclear safety, safeguards and physical protection, for the purposes of the licensing process.
- ✓ Promoting scientific and technological development regarding radiological and nuclear safety, safeguards and physical protection;
- ✓ Providing personnel training in connection with radiological and nuclear safety, safeguards and physical protection, directed at both personnel responsible for the safety of the facilities and performing regulatory activities.

The Nuclear Regulatory Authority has the power to adopt regulatory standards related to radiological and nuclear safety, safeguards, physical protection and transport of nuclear materials, in accordance with the provisions of Act 28,804.

Radiological and Nuclear Safety

According to the Argentine regulatory system the organization (owner or operator) dealing with the design, construction, commissioning, operation and decommissioning stages of a nuclear facility shall take full responsibility for the radiological and nuclear safety of the facility in question. No event affecting radiological and nuclear safety shall relieve said organization, referred to as Responsible Entity, from its responsibility in each stage of the project. The compliance with the regulatory standards and requirements is to be considered as a minimum requirement which does not relieve said organization from its obligation to take any action necessary to ensure the radiological and nuclear safety of the facility.

From the licensing process standpoint, facilities are divided, according to the associated radiological risk involved, into two groups: major and minor facilities. For major facilities the ARN grants operating licenses while for minor facilities it grants operating authorizations. An application for a license or authorization will be accepted for examination provided that it is accompanied by an appropriate preliminary nuclear safety assessment, the depth of which shall be in accordance with the radiological risk associated with the facilities concerned.



The ARN building at the Ezeiza Atomic Center

Major facilities require three types of licenses: construction, operating and decommissioning licenses. Licenses shall be granted to the Responsible Entity, that is, the organization liable for the safety of such facilities. The construction license for a given facility shall be granted upon compliance with the

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standards and requirements applicable to location, basic design and expected safety level for future operation.

In order to be issued an operating license, the Responsible Entity shall prove compliance with the applicable specific conditions, standards and requirements.

As for the ARN, it performs an independent evaluation of the technical documents and detailed studies filed, the reports in connection with inspections conducted during construction, the results of preliminary operation activities, etc.

It should be particularly noted that since the beginning of the construction stage the ARN evaluates the ability of the Responsible Entity to take its responsibilities. Argentina has adopted performance-based nuclear safety regulations. This requires both the responsible Entity, as regards its proposals, and the ARN, in connection with its independent evaluation, to make every significant effort so as to attain a final satisfactory result. Accordingly, the interaction between the responsible Entity and the ARN shall be carried out on a permanent basis throughout the licensing process.

The evaluations prior to issuance of a license for the operation of a major facility include matters such as quality assurance, methods of construction, provisions for inspections during operation, methods of operation, etc. In addition, if a facility has a potential for accidents which may affect members of the public, it is required that emergency plans be implemented in co-ordination with the relevant federal, provincial and local organizations.

According to the ARN requirements, the entire staff of the Responsible Entity shall be properly trained and qualified and demonstrate an aptitude in accordance with their duties in a major facility. The Responsible Entity must also apply to the ARN for individual licenses for personnel whose activities could substantially affect safety. Applicants for an individual license are nominated by the Responsible Entity and are separately subjected to the independent evaluation of the ARN. Training and qualification requirements for staff members generally cover four areas: basic training, specialized training, in-job training and psychophysical fitness. Every function within the organization chart shall be fulfilled by staff members whose background meets the relevant requirements. Such required qualifications will include, if appropriate, basic university education in accordance with the nature of the responsibility to be taken. Both the specialized and in-job training shall be duly certified. Applicants shall be examined by ad-hoc examination boards.

Two types of regulatory documents are issued for the purpose of certifying the skills of the staff concerned. The first one consists in an individual license certifying that the applicant possesses the basic and specialized training suitable to take up a certain duty in a given type of facility. This document is issued at the applicant's request and does not expire. It is not, however, enough to certify the ability of an applicant to perform a given duty in a facility. Accordingly, to be accepted for performing a key safety-related responsibility in a given facility, the applicant needs in addition to the individual license a specific authorization which must be requested to the ARN by the Responsible Entity. For this purpose, the applicant shall prove a specific knowledge of the facility in question, as well as a suitable in-job training and an adequate psychophysical fitness. This specific authorization is valid for a period that shall not exceed two years.

As indicated above, for the operation of minor facilities the ARN has the authority to require that the organization liable for any practice involving material or ionizing radiation applies for an operating authorization. This document shall be issued by the ARN in favour of that organization upon assessment of the documents filed and the results of the preliminary operation-related inspections, provided that all applicable standards and prerequisites are met and qualified staff is brought in. In addition, for the operation of a minor facility, individuals involved are required to hold a specific individual permission applicable to a given practice. In order to be granted such a permission, the applicant shall meet several requirements, namely to possess a suitable basic training, an appropriate specialized training and sufficient in-job training, in accordance with the provisions of the relevant specific standards.

All individuals and legal entities desiring to apply to the ARN for licenses, operating authorizations, specific authorizations and individual permissions or radioactive material transport certificates shall pay a licensing or inspection fee in accordance with the provisions of article 26 of Act 24,804. Furthermore, Article 16 of the same Act empowers the ARN to impose sanctions and/or fines in the event of non-compliance with the radiological safety standards regarding medical and industrial applications, as well as with ionizing radiation research and teaching regulations. The corresponding regulations have been established under Decrees 256/96 and 236/98.

For nuclear power plants and major radioactive facilities the penalty systems have been respectively approved by Resolutions N° 9/99 and 24/99 issued by the ARN Board of Directors.

Safeguards and Physical Protection

Safeguards and nuclear non-proliferation assurances are an essential aspect in the Argentine regulatory system. They constitute a set of requirements and procedures applicable to both the nuclear materials and other nuclear-related materials, equipment and information aimed at ensuring, with a reasonable degree of certainty, that such elements are not intended for an unauthorized use, and that the international agreements signed in this matter are appropriately respected.

The safeguards may be national or international in nature, with the international safeguards being divided into regional and global. National safeguards are defined by the provisions set forth in the regulatory framework adopted by each State. In the case of Argentina, the ARN has established the guidelines of the Argentine Accountancy and Control System for nuclear materials and other materials, equipment and facilities of nuclear interest. As far as the international safeguards and non-proliferation assurances are concerned, their application proceeds in accordance with the provisions of the agreements on non-proliferation of nuclear weapons ratified by Argentina. In this case, the safeguards may be applied by regional or global international organizations and are aimed at detecting within reasonable time and a reasonable degree of certainty the diversion of "significant amounts" of nuclear materials for purposes banned by the agreements by virtue of which those safeguards are applied.

In this regard, it is worth mentioning the "Bilateral Agreement between the Argentine Republic and the Federative Republic of Brazil for the exclusively peaceful use of nuclear energy" signed in the city of Guadalajara in 1991. By virtue of this agreement an agency was created, designated as "Brazilian-Argentine Agency for Nuclear Material Accountancy and Control" (ABACC) whose

essential objective is the implementation of the “Common System for Nuclear Material Accountancy and Control”. The bilateral agency aims at ensuring that nuclear materials are not diverted for the manufacturing of nuclear weapons or other nuclear explosive devices.

Immediately after the bilateral agreement came into force, a multilateral agreement was concluded by Argentina, Brazil, the ABACC and the International Atomic Energy Agency (IAEA) for the application of safeguards (referred to as the Quadripartite Agreement). This agreement commits the IAEA to applying safeguards in both countries for nuclear materials in connection with all nuclear activities in Argentina and Brazil, based upon the “Common System for Nuclear Materials Accountancy and Control”.

The Argentine regulatory system also contemplates, with special attention focussed on the national regulatory function, the physical protection against robbery, removal or unauthorized use of nuclear materials, and sabotage against nuclear facilities. In this respect, the ARN takes full responsibility for requiring the Responsible Entity to implement a complete physical protection system applicable to nuclear facilities and materials in accordance with the regulatory requirements set forth by the ARN. In particular, the “Convention on Physical Protection of Nuclear Material”, regarding international transport of these materials, was opened to signature on March 3, 1980, in the IAEA’s Vienna headquarters and the United Nations New York headquarters; Argentina adopted this Convention under Act 23,620 and then ratified it.

Transport of Radioactive Material

The transport of nuclear material within Argentina shall be carried out in accordance with the provisions of the IAEA’s “Regulations for the Safe Transport of Radioactive Material” which 1985 edition (amended in 1990) came into force on December 11, 1993.



Type B (U) packages for cobalt 60 transport, referred to as GURI 01

All international, regional and national organizations responsible for regulation of land, air, river and sea transport of hazardous materials have endorsed the safety criteria contained in regulation AR 10.16.1. relating to “Radioactive Material Transport”, literally in accordance with the aforesaid IAEA Regulations. Regulation AR 10.16.1. provides persons, goods and environment with a suitable safety level during normal transport of radioactive material, as well as in the event

of any accident. In order to protect workers and public under normal transport conditions, this regulation sets forth prerequisites which essentially limit the dose rate in the environment of the packages to be transported and the non-fixed contamination in their external surface.

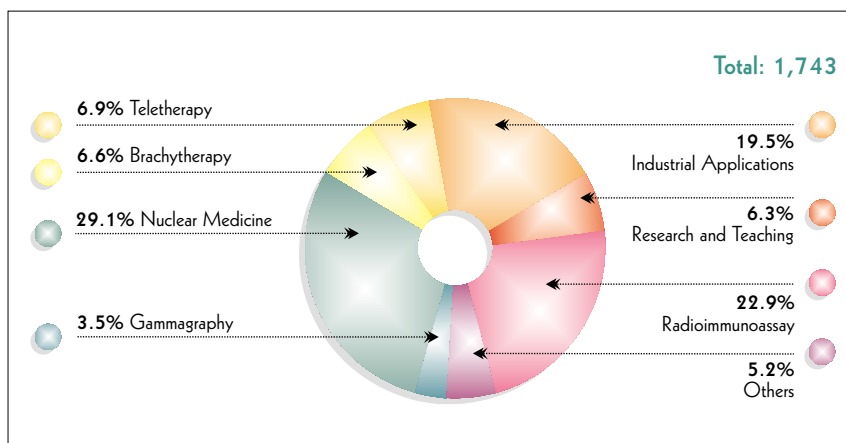
The annual average of total shipments of radioactive material within Argentina is estimated at 10,000, 5% of which is associated with the nuclear fuel cycle and 95% corresponds to radioactive materials used for research, industry and medicine. The ARN verifies compliance with the provisions of Regulation AR 10.16.1. A so-called "Approval Certificate issued by the Competent Authority" shall be delivered by the ARN to certify approval of type-B packages, packages containing fissionable substances, specially-packaged radioactive materials (sealed sources), certain shipments and specially-arranged shipments.

The importation of radioactive sources is a practice under regulatory control by the ARN. All importers must possess operating and specific import authorizations issued for each particular shipment.

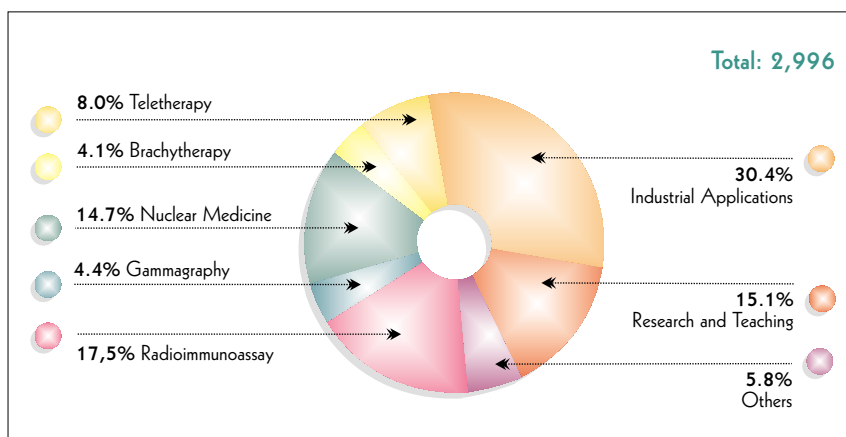
Regulatory documents issued

The following figures show the distribution of institutional and individual licenses as at 31 December, 1999, for the different medical, industrial, research and teaching activities.

Institutional licenses



Individual licenses



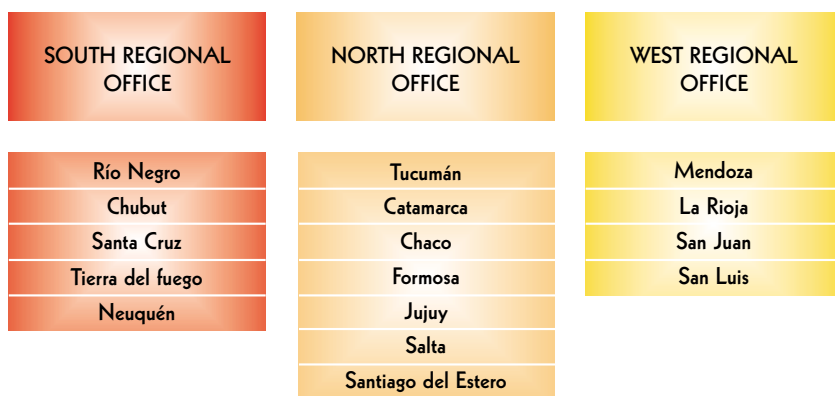
During 1999, the ARN issued the following licenses, permissions, authorizations and other documents:

Type of document	Quantity
Individual Licenses	22
Individual Specific Authorizations	173
Operating Authorizations	378
Individual Permissions	525
Transport Certificates	17
Radioactive Material Import Authorizations	966
Total	2081

Performing regulatory activities federally

Under Act 24,804, the ARN exercises federal jurisdiction for nuclear activity regulation and control as regards radiological and nuclear safety, physical protection and international safeguards. Within this context, the ARN Board of Directors created in 1999 the South Regional Office, the North Regional Office and the West Regional Office. The latter two will start performing their activities once all associated administrative and personnel related actions are taken.

These Offices will contribute to facilitate the direct interaction between the ARN and all individuals and legal entities situated in the corresponding geographic areas desiring to apply for or holding permissions, authorizations or licenses issued by the ARN.



INSTITUTIONAL RELATIONS

Within the context of its regulatory function, the ARN maintains a close and varied interaction with domestic and foreign, governmental and non-governmental organizations, as well as with international agencies. Such an interaction has the following objectives:

- ✓ To facilitate the exchange of experiences and information as well as the participation in developing international recommendations to address issues related to radiological and nuclear safety, nuclear non-proliferation assurances and physical protection.
- ✓ To establish and develop technical co-operation agreements.
- ✓ To promote cooperation in order to improve effectiveness and efficiency of the international safeguards system through the participation of experts and the development of specific techniques in the country.

Furthermore, the ARN is actively involved in negotiating international instruments in connection with the nuclear regulatory function and also in their subsequent implementation. In addition, the ARN contributes to the articulation of Argentine regulatory policies upheld in different international forums.

The negotiation of national and international agreements has always been one of the most important tasks within the framework of the institutional relations. The ARN is currently involved in numerous implemented agreements with national and foreign universities, public hospitals, the Argentine Federal Police and the Argentine Coastguard, as well as with American, Canadian, Spanish and Swiss regulatory authorities, among other countries. During 1999, within the international context, the agreement with the U.S. Department of Energy was extended and the co-operation with foreign institutions was further developed within the framework of existing agreements. Within the national sphere, agreements were signed with the Argentine Navy Health Foundation, the Atomic Energy National Commission (CNEA), the University of Buenos Aires' Faculty of Engineering and the Argentine Mining Geological Service.

NATIONAL AND INTERNATIONAL AGREEMENTS

UNIVERSITIES	SECURITY FORCES	HOSPITALS	OTHERS
University of Buenos Aires, Faculty of Exact Sciences	Argentine Federal Police, Department Firemen	"Hospital de Clínicas"	Province of Mendoza's Ministry of the Environment
University of Cuyo	Argentine Border Guard	"Hospital de Quemados"	CIHOY (Retina Network)
University of San Juan	Argentine Coastguard	"Hospital Naval"	CNEA (Legal Sector)
University of Buenos Aires, Faculty of Engineering			CNEA (Radiomedicine)
			IMPRESS (Seismic Survey)

FRAMEWORK AGREEMENT

COUNTRIES
Switzerland - HSK - Hauptabteilung für die Sicherheit der Kernanlage
United Kingdom - NRPB - National Radiological Protection Board
South Africa - CNS - Council for Nuclear Safety
Canada - AECB - Atomic Energy Control Board
U.S.A. - NRC - Nuclear Regulatory Commission
France - CEA - Commissariat à l'Energie Atomique
Spain - CSN - Consejo de Seguridad Nuclear
Armenia - ARNA - Autoridad Regulatoria Nuclear de Armenia
Egypt - NCNSRC - National Center for Nuclear Safety and Radiation Control
Germany - GRS - Gesellschaft für Anlagen und Reaktorsicherheit

SPECIFIC INTERNATIONAL AGREEMENTS

SAFEGUARDS
ABACC (Brazilian-Argentine Agency for Nuclear Material Accountancy and Control)
DOE (U.S. Department of Energy)
SAFETY SOFTWARE SECTOR
NRC (U.S. Nuclear Regulatory Commission)
EPRI (U.S. Electric Power Research Institute)
IPSN (France's Nuclear Protection and Safety Institute)
OTHERS
Canada's McMaster University - Co-operation in the field of Particle Accelerators

The ARN attaches great importance to its link with the International Atomic Energy Agency (IAEA). This link can be defined by three essential aspects:

- ✓ Attendance to regular meetings of the IAEA's "policy-making" organs;

- ✓ Participation in meetings of high-level expert committees advising the IAEA Director-General on issues in connection with nuclear safety and safeguards, as well as in activities related to negotiation or implementation of international agreements significant for nuclear safety; and
- ✓ Contributing experts for technical assistance missions in various countries, preparing safety-related publications and training foreign trainees.

The ARN forms part of the Latin American Forum of Nuclear Regulatory Organizations and the Network of regulators of Countries With Small Nuclear Programmes (NERS).

The ARN participates through its experts in the following programmes, commissions and committees devoted to the preparation of international radiation protection and safety standards.

- ✓ Advisory Commission on Safety Standards "ACSS" (OIEA)
- ✓ Waste Safety Standards Advisory Committee "WASSAC" (OIEA)
- ✓ Transport Safety Standards Advisory Committee "TRANSSAC" (OIEA)
- ✓ Radiological Safety Standards Advisory Committee "RASSAC" (OIEA)
- ✓ Nuclear Safety Standards Advisory Committee "NUSSAC" (OIEA)
- ✓ Standing Advisory Group on Safeguards Implementation "SAGSI" (OIEA)
- ✓ United Nations Scientific Committee on the Effects of Atomic Radiation "UNSCEAR" (United Nations Agency)
- ✓ International Commission on Radiological Protection "ICRP"
- ✓ International Nuclear Safety Advisory Group "INSAG"

Adherence to the Comprehensive Nuclear Test Ban Treaty (CTBT) adopted by the United Nations General Assembly in September, 1996, requires continuous work to be performed by different sectors in the ARN. In fact, with the purpose of verifying compliance with the essential obligations set forth in the Treaty, an International Surveillance System was established to observe the extensive use of detection techniques. In the case of radionuclide and infrasound safeguards, the ARN is the responsible organization.

REGULATORY INSPECTIONS

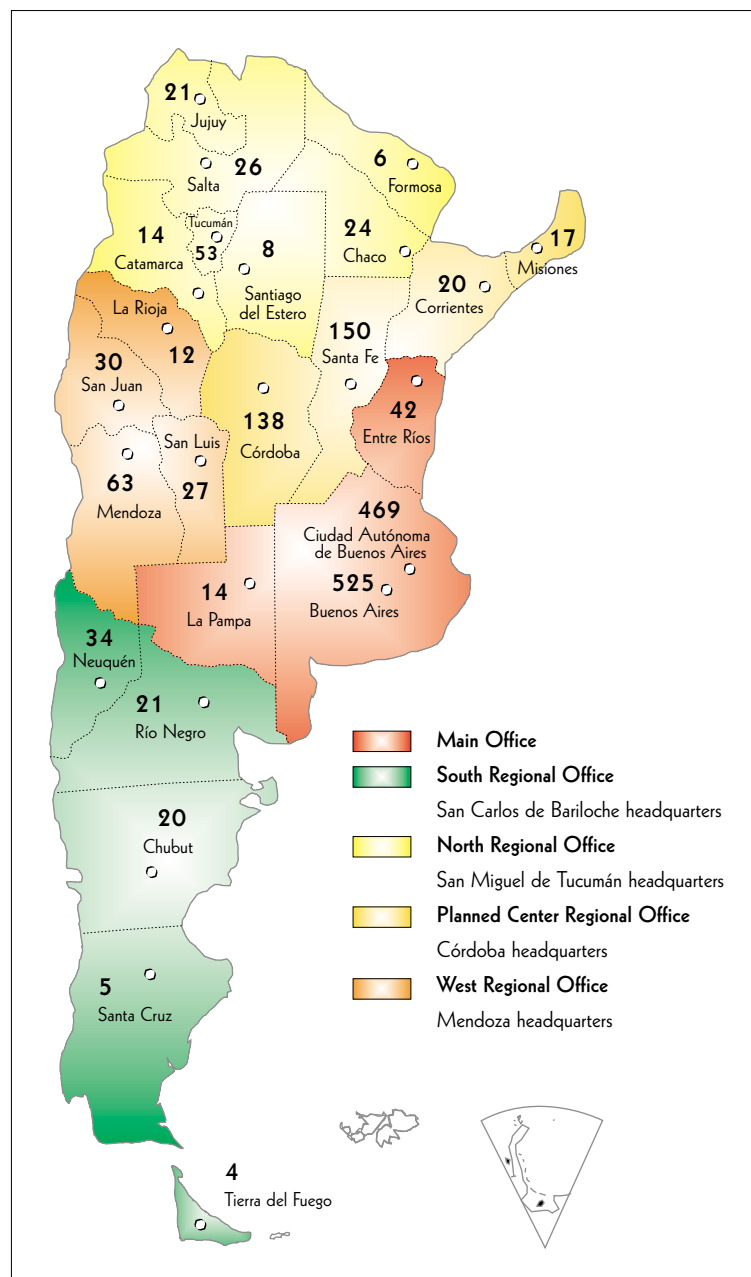
In Argentina, there are two nuclear power plants in operation, one under construction, three critical assemblies, three research and isotope production reactors, 25 major radioactive facilities and more than 1,700 facilities (for medical, industrial, research and teaching purposes) which utilize radioactive materials or sources and radiation-generating systems, the distribution of which is shown in the map below. Those facilities are devoted to various purposes such as electric power generation, basic and applied research, or the use of ionizing radiation in the field of medicine and industry. Such various facilities are located all around the country and their complexity varies substantially.

The ARN's regulatory functions aimed at controlling those facilities include analyzing design and operation-related documents, permanently assessing safety during operation, and verifying by means of regulatory inspections and audits the compliance with the provisions of the license concerned. The analysis and assessment duties are performed by staff members skilled in the field of radiological and nuclear safety who use modern information technology for data management and are acquainted with

the use of calculation codes, in order to validate documents supplied by the licensee based upon their own independent criteria.

The ARN's regulatory control action aimed at controlling the facilities also includes a program of routine and non-scheduled inspections for the follow-up of activities related to safety and verification of compliance with the provisions of the relevant license.

ARN Regional Offices and number of facilities under control



Routine inspections are aimed at a) supervising the facility's regular activities, b) evaluating the facility's monitoring process and c) verification of compliance with the provisions stipulated in binding documents. As far as nuclear power plants are concerned, inspections are basically conducted by ARN's resident inspectors relying on the technical support provided either by the ARN analysis and assessment teams or by teams working for the ARN under agreements or contracts.

Non-scheduled inspections are carried out either in the event of specific circumstances or when the need arises to increase the inspection effort. In these cases inspections are conducted by experts in a variety of disciplines, either from the ARN or other ARN-related institutions.

Facilities subject to regulatory control are listed in the following table:

Facilities under regulatory control	Number
Nuclear power plants in operation	2
Nuclear power plant under construction	1
Research reactors and critical assemblies	6
Particle accelerators	4
Radioisotope or radioactive sources production plants	5
High-dose irradiation plants	2
Fuel cycle facilities	13
CNEA's waste management area	1
CNEA's minor facilities	26
Teletherapy centers	121
Brachytherapy centers	116
Nuclear medicine and radioimmunoassay centers	909
Gammagraphy	62
Industrial applications	341
Research and teaching centers and other applications	194
Total facilities	1803

The distribution of the inspections carried out by the ARN in 1999 by area under regulatory control, as measured in man-days, is shown below.

Area under regulatory control	man-days
Radiological and nuclear safety	2166
Safeguards	618,5
Physical protection	171

The total number of major facilities subject to safeguard and physical protection control is 36.

Radiological and nuclear safety inspections

Type of facility	man-days
Nuclear reactors	1509
Major radioactive facilities	146
Medical applications	301
Industrial applications	156
Research and teaching and others	54

Safeguard Inspections

Type of facility	man-days
Nuclear reactors	427
Major radioactive facilities	157
Research and development facilities	34,5

Physical protection inspections

Type of facility	man-days
Nuclear reactors	70
Major radioactive facilities	90
Research and development facilities	11

With regard to the implementation of the "Common System for Nuclear Material Accountancy and Control", the ARN performed in 1999 its obligation to co-operate with the ABACC by contributing 14 inspectors who carried out a 175 man-days inspection work in Brazilian facilities.

OCCUPATIONAL SURVEILLANCE

Basic criteria supporting radiological safety establish that: all practices involving the use of ionizing radiation shall be adequately justified, radiological protection shall be optimized, dose limits and constraints shall be complied with, and the likelihood of accidents (potential exposure) shall be kept at a minimum level.

The ARN assesses information related to occupational exposure in the most important major and minor facilities. This work allows the ARN to define behavioral indicators for radiological protection systems, to identify tendencies, to verify compliance with dose limits, and to compare different practices to each other. In 1999, the total number of workers subjected to control in the different major facilities reached 1876, 79% of which pertained to the nuclear power plants.

The resulting collective dose to nuclear power plant workers was 11.5 man Sv. For Embalse nuclear power plant (CNE) the dose to workers in any case exceeded 15 mSv for 1999, while for Atucha I nuclear power plant (CNA I) 85% workers received individual doses of less than 20 mSv. No dose to workers in the latter power plant exceeded 50 mSv during the year.

The total number of workers in research reactors and critical assemblies reached 134. The annual collective dose to workers involved in the operation of these facilities was 0.1 man Sv.

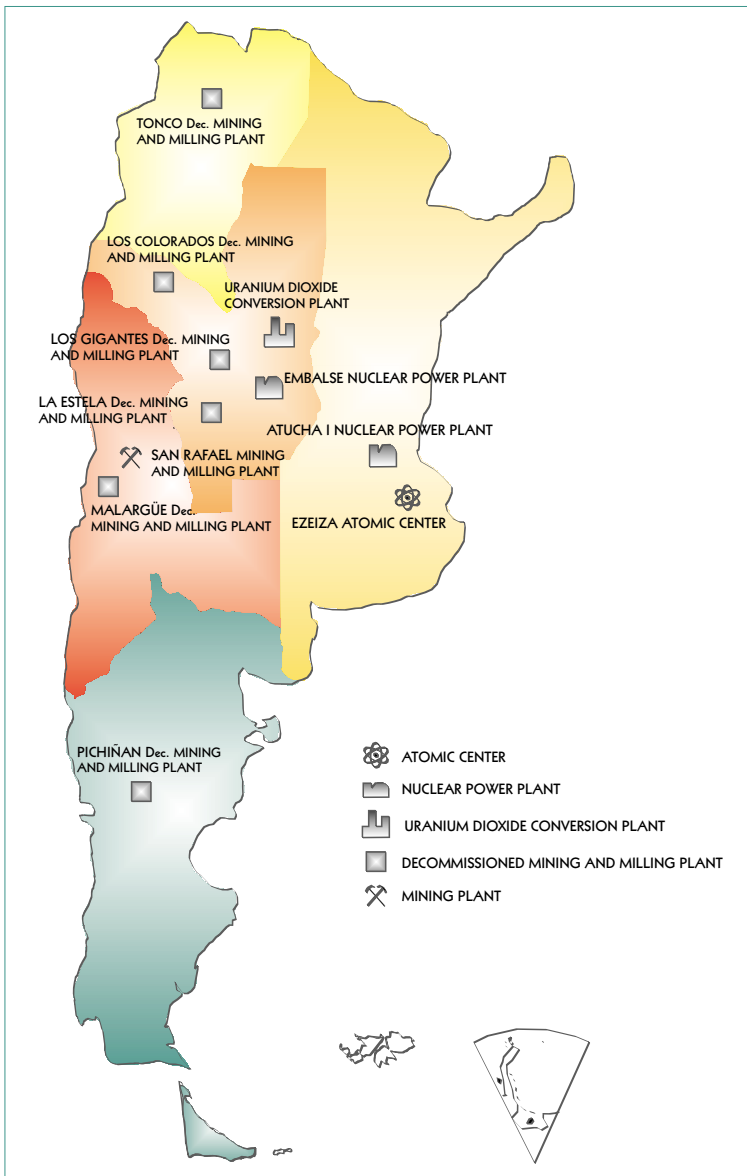
At the end of the first five-year period after the application of individual dose limits as set forth in the Radiological Safety Basic Standard, it may be concluded that individual doses to all workers subjected to control were less than 50 mSv for a single year and less than 100 mSv for the period 1995-1999. Therefore, such individual doses did not exceed the dose limits as set forth in the regulations currently in force; in particular 75% of those workers received doses lower than 10 mSv during 1999.

ENVIRONMENTAL SURVEILLANCE

The ARN performs environmental monitoring of contiguous areas to the different nuclear facilities in a manner fully independent from monitoring carried out by the facilities themselves. In 1999, such a monitoring was carried out in Atucha I and Embalse nuclear power plants, Ezeiza Atomic Center, San Rafael uranium ore mining center, Cordoba uranium ore milling plant and the following decommissioned plants for mining and milling of uranium ores: Malargüe, Los Gigantes and La Estela. The facilities under environmental control are shown in the map below.

In the surroundings of Atucha I and Embalse nuclear power plants, representative samples were taken of the different compartments within the radionuclide transfer environmental matrix. In order to assess the environmental impact of the liquid discharges, samples of river and lake water, sediments and fish were collected and analyzed. To assess the environmental impact of the gaseous effluents released into the atmosphere, samples of locally produced food, such as milk and vegetables, were taken and analyzed. Grass was analyzed as an indicator of radioactive material deposition. On ac-

count of their importance from the radiological point of view, radionuclides analyzed were mainly the radioactive fission products (cesium 137, strontium 90, iodine 131) and neutron activation products (tritium and cobalt 60).



No environmental pollution was detected in 1999 attributable to nuclear power plant operation, except for very low activity levels in some sediment samples.

Environmental monitoring was also carried out for CNEA's Ezeiza atomic center. As done for the nuclear power plants, representative samples of the different compartments of the environmental matrix were collected in the surroundings of the Atomic Center and then analyzed. No radionuclides were detected in the environment attributable to the operation of the atomic center, except for some sediment samples.

Facilities under environmental control

The ARN has continued to perform regular environmental monitoring in the areas surrounding the operating and decommissioned facilities for the mining and milling of uranium ores. Monitoring was conducted at currently operating Cordoba plant, San Rafael uranium ore mining center, as well as the following decommissioned plants: Malargüe, Pichiñán, Los Gigantes and La Estela. To assess the radiological environmental impact of the operation of the various facilities, surface water, sediment and ground water were sampled. Natural uranium concentration and radium 226 activity were determined, as was radon gas emission rate for uranium mill tailings, on account that uranium, radium 226 and radon maintain the highest potential to produce radiological exposure. The results obtained show that no environmental pollution exists attributable to the monitored facilities.

In the course of 1999, the ARN continued to carry out the radon concentration measurement program directed to monitor households in different cities of Argentina, so that exposure incurred by members of the public could be estimated. For households monitored from 1983 to 1999 all around the country, the radon concentration mean value was estimated at 34.1 Bq/m³. Studies undertaken show that in Argentina, radon levels in households are well within the permissible values.

**Environmental sampling at Aguirre watercourse
near Ezeiza Atomic Center**



Public Exposure

In 1999 the radioactive effluent release during operation of Atucha I and Embalse nuclear power plants accounted respectively for 14% and 7% of the annual dose constraints.

The resulting doses to individuals of the critical group for Atucha I and Embalse nuclear power plants reached respectively 0.004 and 0.005 mSv. These doses accounted for 2% of the annual dose constraints for a particular facility.

The resulting doses to individuals of the critical group in the remaining major facilities were lower than a tenth of the annual dose constraints for each particular facility.

SCIENTIFIC AND TECHNOLOGICAL ACTIVITIES

The ARN performs various kinds of scientific and technological functions to support its regulatory activity. For this purpose, the ARN relies on appropriate laboratories, equipment and skilled personnel whose tasks consist in implementing and validating the corresponding methodologies within different working sectors.

The ARN possesses various laboratories within the Ezeiza Atomic Center, located in Ezeiza, province of Buenos Aires. Those laboratories cover an area of 2,000 m² and are devoted to physical dosimetry, radiopathology and biological dosimetry, radiochemical analyses, uranium particle detection, iodine 129 detection, radon measurement, environmental sample processing, and internal contamination assessment. Those facilities also include measurement laboratories (whole body counter, gamma and alpha spectrometry laboratory, gross alpha and beta activity measurement laboratory, and low background activity counter), electronic support laboratories and laboratories for determining filter efficiency.

Supporting activities related to regulatory and development control functions are performed within the following specific areas:

- ✓ Physical dosimetry.
- ✓ Internal contamination.
- ✓ Biological dosimetry.
- ✓ Radon measurement techniques.
- ✓ Program of medical assistance on radiological protection.
- ✓ Diagnostic and prognostic indicators applicable to accidental overexposure.
- ✓ Prenatal irradiation effects on developing central nervous system.
- ✓ Nuclear tests detection.
- ✓ Use of thermohydraulic codes for assessment of nuclear power plant safety.
- ✓ Remote surveillance and monitoring system.
- ✓ Computer model development for assessment of nuclear power plant safety.
- ✓ Study on core material behavior in nuclear power plants during severe accidents.
- ✓ Filter tests.
- ✓ Development of techniques aimed at detecting undeclared nuclear activities.

Within the framework of the Comprehensive Nuclear Test Ban Treaty, a gamma spectrometry laboratory was in operation and served as a primary laboratory within the international network set forth in this Treaty.

For the purpose of developing application radionuclide identification and analysis techniques within the framework of the international safeguards, works are being carried out for the installation of an ion accelerator. Such electrostatic accelerator (FN model – High Voltage Electrostatic Corporation) was donated to the ARN by the University of McMaster, Ontario, Canada, and is currently being mounted at CNEA's Ezeiza Atomic Center.

The radiochemical laboratories processed samples obtained from environmental monitoring and inspections. Different types of samples are analyzed including waters, soils, sediments, vegetables, filters and biological samples such as urine, feces and nasal wipes, in order to determine different alpha and beta emitter radionuclides.

Radiation induced chromosomal aberration analysis

In the radiation measuring laboratories work routine and special measurements in thyroid, lungs and the whole body are performed. Measurements associated with environmental studies, inspections and audits are also conducted.

In the field of physical dosimetry, routine measurements of personnel dosimetry and special measurements in reactors, critical assemblies, and accelerators for medical use and research accelerators are carried out.

These laboratories are regularly involved in international quality assessment programs aimed at keeping up the required operating standards.



RADIOLOGICAL AND NUCLEAR EMERGENCIES

All ARN-regulated activities involving the use of ionizing radiation should rely on emergency procedures or plans. Licensees shall be responsible for implementing such procedures or plans which are subjected to control by the ARN.

The ARN determines the emergency criteria and evaluates the radiological and nuclear emergency plans and procedures developed in case of accident by facilities under control.

Which actions are to be taken, who will take them and how they will be taken are the highlights of the emergency plan on which intervention is based. This plan contains all procedures to be followed in the event of an accident condition. For major facilities, the licensee shall be responsible for implementing an emergency plan prior to commissioning.

For minor facilities, emergency procedures are required to contain accidents and minimize their consequences.

In the event of radiological emergencies occurred in facilities other than nuclear power plants accordance with its duties, the ARN will take the necessary steps through its own Radiological Emergency Intervention System (SIER). The SIER is intended to:

- ✓ Advise personnel in charge of major installations in the event of an emergency.
- ✓ Advise public authorities involved in radiological emergency control.
- ✓ To play a part as an intervening organization in the event of emergencies which may arise in minor facilities and practices where accidents can not be provided with adequate containment or affect the public, as well as in the event of radiological emergencies in public areas.

The SIER has a primary intervention group which is on duty in weekly shifts all year round. The SIER has the specific equipment and necessary logistic infrastructure to ensure a prompt and efficient intervention in the event of a nuclear accident or a radiological emergency.

In addition, the ARN has reached co-operation agreements with other organizations such as the Federal Police, the Border Guard and the Coast Guard, so as to take common actions in the event of an emergency.

In compliance with the provisions of Act 24,804 and its implementing decree, the ARN has created through Resolution 25/99 issued by the Board of Directors the Nuclear Emergency Intervention System (SIEN) which complements the previously created SIER.

The implementation of the SIEN coincides with the creation by Decree 1,250/99 of the Federal Emergency System (SIFEM). The SIEN's structure allows for the ARN to join the SIFEM as a participant organization.

The main features of ARN's SIEN and SIER emergency intervention systems are summarized in the following chart:

System	Objectives
SIEN Nuclear Emergency Intervention System	<ul style="list-style-type: none"> ✓ To intervene in emergencies resulting from accidents occurred in nuclear power plants, the consequences of which extend to the outside of the facility. ✓ To participate in planning and training stages aimed at intervention in emergencies. ✓ To take actions in conjunction with the Federal Emergency System (SIFEM)
SIER Radiological Emergency Intervention System	<ul style="list-style-type: none"> ✓ To intervene in radiological emergencies occurred in minor facilities. ✓ To intervene in radiological emergencies in public areas. ✓ To advise public authorities and users.

The responsibilities of the ARN in the event of nuclear emergencies are set forth under Act 24,804 and its implementing Decree 1,390/98. Within this context, the ARN should approve and establish guidelines for emergency plans as well as public and workers training on a national, provincial and local scale. The ARN should lead actions within the area covered by said emergency plans. As far as the Security Forces and the civil organizations are concerned, they should report to the officer as will be nominated by the ARN for such purpose.

In 1999 the ARN participated in emergency plan implementation practices for Atucha I and Embalse nuclear power plants. In the course of the year, the SIER also took part in 7 incidents involving radioactive material occurred in medical centers and industrial facilities.

TRAINING AND TECHNICAL INFORMATION

The ARN undertakes as a permanent activity the training of specialists in radiological and nuclear safety, safeguards and physical protection, by means of training courses and the participation in national and international congresses and expert meetings.

The training activity is carried out through the Training Department in charge of defining, organizing and coordinating courses, workshops and updating seminars.

The Postgraduate Course on Radiation Protection and Nuclear Safety organized in accordance with the provisions of an agreement with the University of Buenos Aires and the Ministry of Health under the auspices of the IAEA, has been uninterruptedly given on a yearly basis since its inauguration in 1980. Since then, a total number of 540 professionals have received a degree, a half of which are foreigners. The course consists of two modules respectively devoted to radiological protection and nuclear safety and running for 20 and 10 weeks. Both modules run on a daily seven-hour basis. 24 participants attended the course in 1999, eleven of them were from Argentina and 13 came from the rest of Latin America.



Participants in the 20th Postgraduate Course on Radiation Protection and Nuclear Safety

A course on radiation protection is offered to train technicians from public and private institutions. This course runs for eight weeks on a daily seven-hour basis. In the 1999 edition, participants belonged to: Federal Police Firemen, INVAP S.E. and CONUAR companies, CNEA and the National Radiotherapy Center of the Republic of Nicaragua.

In 1999, 5 specialized Workshops on various issues in connection with nuclear safety, radiation protection, safeguards and physical protection were held as forming part of a training and accreditation system for ARN inspectors.

The ARN possesses an Information Center consisting of two functional units where the public can have access to specialized literature on radiological and nuclear safety, safeguards and physical protection through either the ARN's own databases and remote data banks, or by means of periodicals and specific textbooks.

Training courses provided by the ARN during 1999 are shown in the following table:

Name of the course	Duration	Dates
Postgraduate Course on Radiation Protection and Nuclear Safety a) Module I "Radiation Protection" b) Module II "Nuclear Safety"	21 weeks 9 weeks	6/4 to 27/8 30/8 to 29/10
Radiation Protection (Technical Level)	8 weeks	4/10 to 26/11
Radiation Protection for Radioactive Material Users: - City of Salta - City of Resistencia - City of Cordoba	1 week 1 week 1 week	31/5 to 4/6 28/6 to 2/7 13 to 17/9
Radiation Protection for CNEA Personnel	1 week	April and December
Radiation and Nuclear Safety Module - Postgraduate Course on Nuclear Reactors (CNEA)	4 weeks	October/November
Radiation Protection Module – Course on Radioisotope Methodology and Application (CNEA)	4 weeks	October/November
Regional Training Course on Safe Transport of Radioactive Material	3 weeks	13/09 to 1/10
National Course on Medical Response in Case of Accidental Overexposure	3 days	8 to 10/9
Third Workshop for ABACC Inspectors Training in Physical Inventory Verification	1 week	7 to 11/6
Workshop for ABACC and IAEA Inspectors Training in Unannounced Inspections	1 week	20 to 24/9
Radionuclide Station Operator Regional Training Course	1 week	4 to 8/10
Introduction to Access 7.0	6 days	6 to 13/9
Introduction to Power Point	1 week	13 to 17/12
Inspectors Retraining	5 weeks	April to December

HUMAN AND ECONOMIC RESOURCES

The organizational structure of the ARN is made up of 215 established posts and 6 posts pertaining to the Board of Directors. In the course of 1999 ten specialized contract workers were engaged. By the end of the year the number of trainees at the ARN was 15.

Out of the total regular staff, 64% are university-degree holders. Out of the total regular staff, 85% is devoted to specialized scientific and technical functions within the ARN's sphere of activities, while the remaining 15% is assigned support and administrative work.

The total budget allocation approved by Administrative Decision 1/99 for the year 1999 for the ARN was \$ 18,048,108, funded by the Treasury Department contributions, Specific Resources and Specific-Allocation Resources. This initial budget was reduced by Administrative Decision 455/99 and then reinforced by means of external loans. Therefore, the ultimate budget allocation for the year 1999 was \$ 17,882,681.

Personnel expenditures accounted for 68.1% of the total current expenditure, including contributions from the employer, and social security allowances. Consumption expenditure and non-personnel services accounted for 19.6% of the total current expenditure.