Republic of Paraguay

International Atomic Energy Agency

Country Programme Framework

2023-2028

This Country Programme Framework for the Republic of Paraguay (2023– 2028) has been signed on behalf of the Government of the Republic of Paraguay and the International Atomic Energy Agency

On behalf of the Government

HE Mr Juan Francisco Facetti

Resident Representative of the Republic of Paraguay to the IAEA

31. May 2023.

Date

On behalf of the International Atomic Energy Agency

Mr Hua Liu

Deputy Director General
Head of the Department of Technical Cooperation

31/5-2023

Date

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LIST OF ABBREVIATIONS

ARCAL	Regional Agreement in Latin America and Caribe
ARRN	Radiological and Nuclear Regulatory Authority
BCP	Central Bank of Paraguay
CEMIT	Multidisciplinary Scientific and Technological Research Centre National
CENQUER	National Centre for Burns and Reconstructive Surgery
CODENA	Permanent Secretariat of the National Defence Council (Integrated Nuclear Security Plan)
CONACYT	National Council of Science and Technology
CONAPREB	National Commission for Prevention of and Response to Biological Emergencies
CNEA	National Atomic Energy Commission
CPF	Country Programme Framework
CPPNM	Convention on the Physical Protection of Nuclear Material
DGICT	General Directorate of Scientific and Technological Research (National University)
FCQ	Faculty of Chemical Sciences
FIUNA	Faculty of Engineering of the UNA
GDP	Gross Domestic Product
HPP	Hidrovia Paraguay–Paraná
IICS	Research Institute for Health Sciences
IMS	Integrated Management Strategy
INAA	Instrumental Neutron Activation Analysis
INSSP	Integrated Nuclear Security Support Plan
IPM	Integrated Pest Management
IPS	Social Security Institute
IPTA	Paraguayan Institute of Agricultural Technology
INCAN	National Cancer Institute
INAM	Instituto Nacional de Alimentación y Nutrición
IAEA	International Atomic Energy Agency
MADES	Ministry of Environment and Sustainable Development
MAG	Ministry of Agriculture and Livestock
MOPC	Ministry of Public Works and Communications
MSPBS	Ministry of Public Health and Social Welfare

NPCs	National Participation Costs
NSB3A	Laboratory complex NSB3A–NB4OIE
PROCIENCIA	Paraguayan Programme for the Development of Science and Technology
PRONAC	National Cancer Control Programme
PRONII	National Incentive Programme for Researchers
SENACSA	National Animal Health Service
SENAVE	National Plant and Seed Quality and Health Service and National
SENEPA	National Malaria Eradication Service
SIT	Sterile Insect Technique
SMEs	Small and medium-sized enterprises
TC	Technical Cooperation
TCF	Technical Cooperation Fund
TCP	Technical Cooperation Programme
TSA	Thematic Safety Area
UNA	National University of Asuncion
UNDAF	United Nations Development Assistance Framework
VMME	Vice-Ministry of Mines and Energy and National Transport Directorate
XRF	X-ray fluorescence

EXECUTIVE SUMMARY

As defined in the White Paper on Nuclear Energy and its Applications (2020–2025) for the next three programme cycles, the following five areas have been identified as medium-term priorities of the IAEA Technical Cooperation (TC) programme with Paraguay:

- **Nuclear and radiation safety:** legal framework, regulatory infrastructure, transport safety, public and environment protection, radioactive waste management, protection of workers, protection of patients, education and training, emergency preparedness and response and exposures to naturally occurring materials.
- **Food and agriculture:** genetic improvement of seeds and germplasm
- **Health and nutrition:** nuclear medicine, radiation therapy, zoonosis control
- **Water and the environment:** soil management, water resource management and environmental contamination.
- **Energy and industry:** energy planning to address climate change, improvement of industry competitiveness through NDT

For each area and as appropriate, projects will be proposed to address them within future national TC programme with the IAEA for the 2023–2028 period. It has been determined that the Government of Paraguay will be responsible for proposing selected projects within the framework of the technical cooperation programme of the IAEA in eligible thematic areas.

The below main proposed outcomes under this CPF are expected to be supported through the TC programme:

On Nuclear safety: A strengthened nuclear and radiation national legal and regulatory framework and a consolidated national infrastructure for the use of nuclear energy in industry, medicine, natural resource management and research applications, with the adequate level of protection of people and the environment, and for the prevention of and response to radiological emergencies.

On Food and agriculture: Creation of national capacities for the use of gamma irradiation technology for the country's agriculture and food security and strengthening the national capacities for the preservation of productively superior animal germplasm in livestock and plant germplasm.

On Health and nutrition: Improved and updated infrastructure for the diagnosis and treatment of cancer patients in Paraguay, creation of national capacities in the use of the sterile insect technique (SIT) to control *Aedes aegypti* and other vectors and strengthened capacities for the implementation of nutritional studies using nuclear techniques.

On Water and environment: improved Infrastructure for the use of nuclear technologies in the analysis of environmental samples, and national capacities created for environmental monitoring of facilities with irradiators and radioactive sources and of the uranium mining industry and strengthened capacities for the implementation of environmental studies and carbon analysis in soils using nuclear techniques.

On Energy and industry: Updated national capacities to use NDT and created national capacities through knowledge of Paraguay's uranium potential and increased national capacities in the knowledge of the potential development of nuclear energy in Paraguay.

1. INTRODUCTION

Paraguay has been a member of the IAEA since its creation in 1957. The country engages actively and constructively with the Agency to ensure the peaceful use of nuclear energy and to promote international cooperation in this field.

The assistance provided by the Agency has contributed to the establishment of national infrastructure and the training of staff in the nuclear field. Subsequently, projects have contributed to the solution of problems of national importance.

The Paraguayan Government and the IAEA signed this Country Programme Framework (CPF), thereby, demonstrating joint engagement, shared responsibility, and solid commitments regarding the implementation of a medium-term strategy.

The objective of the CPF is to define priority areas for cooperation between Paraguay and the International Atomic Energy Agency (IAEA), in which nuclear science and technology can make a significant contribution to socio-economic development in addressing national needs with potential positive economic and social impact.

The document sets out to foster clear communication between all those directly involved in Paraguay's development priorities and in managing them. The aim is to focus cooperation in those areas identified by the Government as being of high priority and where nuclear science and technology can make a contribution to addressing socio-economic challenges.

The present socioeconomic situation in Paraguay is taken into consideration in this CPF, as it determines the country's ability to implement projects that require a substantial contribution of national funds and commitment.

This document is based on the White Paper on Nuclear Energy and its Applications (2020), and reflects the current situation. It identifies areas for future cooperation between the IAEA and Paraguay and serves as a reference framework for planning the TC programme between Paraguay and the IAEA, in support of the country' s efforts to achieving its development objectives

This document was developed based on close interaction and engagement with the following institutions and representatives of the Paraguayan Government:

a. Ministry of the Interior: National Police, Fire Brigade
b. Ministry of Foreign Affairs
c. Ministry of Agriculture and Livestock (Vice-Ministry of Livestock)
d. Paraguayan Institute of Agricultural Technology (IPTA)
e. National Plant and Seed Quality and Health Service (SENAVE) and National Animal Health Service (SENACSA)
f. Ministry of Public Works and Communications (MOPC) — Vice-Ministry of Mines and Energy (VMME) and National Transport Directorate
g. Ministry of National Defence: National Commission for Prevention of and Response to Biological Emergencies (CONAPREB)
h. Permanent Secretariat of the National Defence Council (CODENA)
i. Ministry of Public Health and Social Welfare (MSPBS): National Cancer Institute (INCAN), National Malaria Eradication Service (SENEPA), Instituto Nacional de Alimentacion y Nutricion-INAM)

j. Ministry of Environment and Sustainable Development (MADES)
k. Radiological and Nuclear Regulatory Authority (ARRN)
l. National University of Asunción (UNA): Rectorate, General Directorate of Scientific and Technological Research (DGICT), National Atomic Energy Commission (CNEA), Multidisciplinary Scientific and Technological Research Centre (CEMIT), Health Science Research Institute (IICS) and academic departments.

This document also details the development of future applications of nuclear technology, uranium mining for nuclear fuel, and the needs of the various sectors that are involved in developing institutional and legal structures and a radiation protection and safety culture.

The effectiveness of this CPF is linked to the achievement of the following main strategic axes:

- *Promotion of nuclear sector policy*: to incorporate the potential of uranium mining into the national electricity mix, promote the use of nuclear applications in public health, agriculture, stockbreeding, industry, water resources management, environmental research, etc.
- *Radiation safety*: for effective regulation and control to ensure the safe use of ionizing radiation in Paraguay, and to protect the public and the environment from the damage that can be caused by its misuse.
- *Forecasting and forward planning:* Considering, and working on, opportunities and risks yet to be explored or to which scant attention has been paid, namely:
  - ✓ Using nuclear and nuclear-derived technologies for the monitoring, surveillance and prompt detection and control of animal and zoonotic diseases such as COVID-19, bird flu and Zika to avert future pandemics.
  - ✓ Managing radioactive material from when it enters Paraguay, its transport and proper disposal, and strict compliance with the Code of Conduct on the Safety and Security of Radioactive Sources
  - ✓ Potential of uranium deposits and appropriate management of Paraguay's associated energy resources.
  - ✓ Interface between nuclear security and radiation safety.

A wide range of institutions working together presents a new challenge, where each needs to making its best public servants available and make concerted efforts to support planned activities. There is a need to improve coordination, the lack of which is a threat to the achievement of the goals, and to remedy the unfocused nature of current efforts, which affects efficiency and effectiveness. The institutions must therefore conclude administrative agreements needed to optimize results.

All institutions in each sector will need to cooperate to achieve the CPF objectives, each playing its specific role.

Stakeholders in the nuclear energy sector will have to be constantly kept up to date to achieve an optimal radiation safety and nuclear security culture, as well as the legal and institutional framework, which is the responsibility of State leaders. The same is true of promoting scientific and technical research and ensuring the provision of sufficient resources of strategic interest for Paraguay.

2. SITUATION ANALYSIS

2.1 OVERALL SITUATION ANALYSIS

The State is responsible for protecting national interests and the permanent national objectives established to uphold those interests. In accordance with Paraguay's Constitution, the permanent national objectives[1] in this sector are:

- The welfare of the Paraguayan people
- Political stability, economic predictability, and comprehensive national security, which are imperative for the proper development of national life
- Sustainable development balancing human development, the economy and preservation of the environment
- The prosperity of the entire country rooted in the participation of all, mutual respect, and dignified work
- Integration into the international community, in particular the regional community, in the context of the legal equality of States and respect for the principles and tenets of international law.

The TC projects previously implemented in the framework of the technical cooperation programme of the IAEA were designed in relation to the following areas:

- Human health
- Food and agriculture
- Water and the environment
- Industrial applications
- Safety and radiation protection

Since 1976, this assistance was provided through 50 national, 172 regional (ARCAL and projects outside ARACAL agreement) and 12 interregional projects implemented from the early 1970s to the present day. The regional and interregional projects covered all thematic areas of the programme, including human resource development, human health (e.g. nuclear medicine), food and agriculture (e.g. soil, water and plant management, diagnosis of animal diseases), safety and regulatory infrastructure, water and the environment.

An important aspect is the training through the IAEA in the form of fellowships, scientific visits, workshops, training courses and expert visits, which has benefited the CNEA and several institutions nationwide.

Management of the nuclear energy sector depends, firstly, on a legal framework in line with the Constitution, the international instruments that apply to Paraguay and the laws governing radiation and environmental safety, nuclear security, and safeguards compliance. Secondly, it is based on the existence of adequate institutional capacity for effective and efficient management with properly trained human resources, infrastructure, and equipment, so as to minimize the risks from ionizing radiation, with adequate measures for emergency preparedness and response in cooperation with State officials and their objectives. Thirdly, nuclear safety, security and radiation protection are the exclusive responsibility of the State

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[1] Also defined in the National Defence Policy 2019–2030.

and its institutions with the task of fulfilling this function, in line with Paraguay's constitutional and legal framework, always ensuring full and effective safety and security with regard to all types of radioactive material and facilities holding such material.

The strategic environment of the nuclear energy sector in the national and international context is primarily characterized by constant and rapid change, driven by technological progress in the applications of nuclear energy, the challenges concomitant with energy management and the evolving threats to the security of facilities and sensitive material and the trafficking of radioactive or nuclear material, or of material out of regulatory control.

The programme framework for the nuclear sector, with its strategic orientations and its strands of action, is flexible enough to adapt to these changes by means of resolutions issued by the authorities promoting energy policy and nuclear applications, by those conducting technical cooperation, and by the regulatory authority, which will need to be modernized by future governments.

2.2 Nuclear Legal Framework

The nuclear legal framework in Paraguay is mainly contained in Law 5169 of 8 May 2014 on Establishing the Radiological and Nuclear Regulatory Authority (ARRN). However, Law 5169 contains no specific provisions dealing with relevant aspects of safety, security, and safeguards in a comprehensive manner. For instance, it does not provide for the fundamental principles of radiation protection, the prime responsibility for safety, the principles of radioactive waste management, etc.

Consequently, Paraguay is seeking to strengthen the existing legislative framework and benefited from bilateral legislative drafting assistance in 2019, as well as other forms of assistance such as capacity-building. Moreover, six officials participated in IAEA supported training events on nuclear law including the annual Nuclear Law Institute (NLI).

Paraguay will continue to avail itself of legislative assistance available under the IAEA Legislative Assistance Programme which is primarily implemented under the relevant TC regional project. Such assistance will include requesting the IAEA to review a draft nuclear law, the raising of awareness of policymaker and decision-makers and hosting a national workshop on nuclear law, as well as nominating candidates to participate in the NLI.

2.3 Nuclear and Radiation Safety

Paraguay's independent regulatory authority - ARRN - was established in 2014, but gaps in its legal framework render challenges for effective interinstitutional relations resulting in overlaps of institutional functions. Despite the Agency's assistance over the past five years, consolidation of the system of nuclear-related institutions is far from complete: there is a need to strengthen the legal framework (regulations such as decrees and resolutions) and legislation (adapting the Criminal Code to the CPPNM Amendment) about nuclear safety and security. It is imperative to raise awareness among relevant officials who negotiate revisions to nuclear-related conventions. Such assistance is available through the IAEA Legislative Assistance Programme.

Meanwhile, public, and private institutions are planning to make increased use of nuclear applications in medicine, agricultural production, industry, and natural resource management. The retirement of officials trained in emergency response has reduced institutional capacities. The national legal and regulatory framework relating to radiation therefore needs to be modernized, and the capabilities of institutions responsible for emergency response need to be updated. Work has been planned to begin in 2023 and end in 2025.

Given the need to ensure that all aspects regarding radiation, transport and waste-related safety are thoroughly and consistently covered, Paraguay's ability to ensure that its information in the Radiation Safety Information Management System (RASIMS) and Emergency Preparedness and Response Information Management System (EPRIMS) is accurate, comprehensive, and up to date must be strengthened. The Thematic Safety Areas (TSAs) arising out of the IAEA's safety standards where assistance is required are regulatory infrastructure (TSA-1), occupational radiation protection (TSA-2), radiation protection in medical exposure (TSA-3), public and environmental radiation protection, radioactive waste management and decommissioning (TSA-4), emergency preparedness and response (EPR), education and training in radiation protection and safety (TSA-6), and transport safety (TSA- 7).

The Ministry of Foreign Affairs and CODENA have identified two areas where cooperation will be of paramount importance for activities related to nuclear energy to be carried out properly:

- Training of staff: strengthen both institutions by promoting the appropriate training of talented persons in nuclear law and the technical, administrative and negotiation aspects related to the Convention on Nuclear Safety, the Convention on the Physical Protection of Nuclear Material, the Treaty on the Non-Proliferation and comprehensive safeguards agreements, etc. To that end, cooperation could take in the form of supporting the participation of officials at the Nuclear Law Institute, and OECD/NEA International School on Nuclear Law; courses, conferences, and workshops; .
- Advisory service: within the framework of the IAEA Legislative Assistance , the IAEA support is expected to provide assistance in the form of guidance and advisory services to public institutions involved in the different processes relating to agreements or initiatives on nuclear-related topics.

Outcomes:

1. A more effective nuclear-related national legal and regulatory framework established

Indicative Outputs

1.1 Legal regulatory basis in connection with nuclear medicine and radiotherapy updated and implemented (2023)

1.2 Legal and regulatory framework for E&T in radiation protection and safety strengthened and National education and training curriculum on radiation safety designed, and developed for the relevant categories of personnel (2023-2024)

1.3 Services and protocols for the radiation protection of cancer patients improved (2024)

1.4 CNEA capabilities updated (2023).

1.5 Human resources for authorization, inspection and enforcement strengthened 2023

1. 6 Capacities to control irradiators, radioactive material of natural origin in food, and non-destructive testing (NDT) strengthened (2023)

Outcome

2. Consolidated national infrastructure for prevention of and response to radiological emergencies

Indicative outputs

2.1 National Environmental Radiation Monitoring Network fully equipped (2024)

2.2 Staff trained in measurement and assessment for more agile emergency response (2023)

2.3 National radiological emergency plan (PLAN RER) updated (2023)

2.4 Radiation safety culture strengthened (2023).

2.4 FOOD AND AGRICULTURE

Since the 1980s, Paraguay has carried out extensive work in the area of outbreaks and emergencies related to transboundary animal and zoonotic diseases, such as foot-and-mouth disease and brucellosis. Recently, laboratories in the agricultural sector have been mobilized to join the National Health System and support the Ministry of Public Health and Social Welfare (MSPBS) in containing the COVID-19 pandemic. The sector is linked with SDGs: 1, 2, 3, 4, 8, 9, 12.

Previous episodes of severe acute respiratory syndrome, Middle East respiratory syndrome and other zoonotic diseases have shown that such outbreaks, and their consequences, are occurring with greater frequency. There must be an integrated approach, involving all relevant stakeholders, to prevent, control and mitigate zoonotic diseases. This approach, involving research, development and innovation, is founded on the following principles: focus on the competitive and comparative advantage of nuclear and nuclear-based molecular and immunological techniques; development of laboratory-led research and technology, including the inclusion of modern biotechnologies (omics and genomics); and broadening of the scope to include research and epidemiological studies in relation to the wildlife-domestic animal-human interface.

Under the auspices of the CNEA and with the support of the VMME, a bilateral and multilateral cooperation strategy is being devised so that, through the IICS, SENACSA and the laboratories of the Faculty of Veterinary Sciences, the country can strengthen its capacities for the rapid detection and prevention of zoonotic diseases in order to control outbreaks and respond to potential pandemics. Institutions such as SENACSA and SENAVE can benefit from strengthening their capabilities to ensure food safety and quality to safeguard consumers and enhance trade. National laboratories can be improved for screening ad confirmatory analysis of a range of chemical and microbiological hazards; national residue/hazard monitoring programmes and attainment of ISO 17025:2017 accreditation.

In order to be better able to meet the challenges posed by zoonotic diseases, Paraguay is preparing a project to continue providing assistance to the private and public sectors and to integrate them with institutions such as the IICS of the MSPBS with a view to strengthening national capacities to prepare for and respond to threats and outbreaks of zoonotic diseases.

The project will include measures to strengthen national capacities for the surveillance and early detection of and intervention against emerging/re-emerging zoonotic diseases; provide access to innovative technologies for early detection of emerging zoonotic diseases; and provide access to data on the impact of zoonotic diseases on animal and human health.

Institutions linked to Food and Agriculture policy (see annex 2)

- Ministry of Agriculture and Livestock (MAG)
- National Plant and Seed Quality and Health Service (SENAVE)
- National Animal Health Service (SENACSA)
- Laboratory complex NSB3A–NB4OIE

Improving agricultural food production and safety

Genetic improvement of crops through induced mutations using nuclear technology, implemented by CEMIT–UNA. The aim is to obtain improved varieties that are tolerant to biotic and abiotic stresses in order to address the effects of climate change. Paraguay is currently establishing an irradiation facility to support relevant activities in mutation breeding, human health and food safety. A new national project has also started this year with specific focus on crop improvement for stable productivity under stresses created by biotic factors (eg., pests, diseases, weeds) and abiotic factors (eg., drought, heat etc) through the use of induced genetic variation and associated biotechnologies. Both seed crops and vegetative crops are cultivated over large areas in the country, including soybeans, wheat, maize, rice, beans, sesame and sunflower under seed crops, and cassava, sugarcane etc under the category of vegetative crops. Improvement of yield of major crops and stabilization of the yield under biotic and abiotic stress are critical for SDGs 2 (zero hunger), 3 (nutrition), 1 (no poverty) and 13 (climate action) for the country.

Phytosanitary surveillance programmes are being coordinated by SENAVE for fruit flies of agricultural concern, fruit export work plans, and fruit fly management and control programmes (SENAVE Laboratory). As phytosanitary irradiation is becoming used more widely on a commercial scale world-wide, there is also scope for work to investigate the use of ionizing radiation as a phytosanitary measure for traded fresh commodities.

Improve the control of plant pests such as fruit flies and the New World Screwworm (NWS), a devastating livestock pest, through the transfer and adoption of the sterile insect technique.

Genetic improvement of livestock is a powerful tool for increasing the efficiency of animal production, enabling conservation programmes for management of the germplasm of genetically superior breeds and individuals. Nuclear and related technologies such as DNA analysis for genetic characterization and reproductive biotechnologies for multiplication of valuable genetic resources will play a significant role in this activity. Development of a national gene bank would form the foundation of this work. Staff of the gene bank and of livestock research institutes of the UNA, MAG and SENACSA would benefit from capacity building in the application of these nuclear and related technologies.

Paraguay participates also in improving land and water management, especially combatting soil erosion and sedimentation. The Agronomy Faculty of National University in Asuncion participated in Regional TC project RLA5076 aimed on soil erosion and sedimentation in water reservoirs (2018–2022). Paraguay is advancing also in implementation of soil conservation

strategy. It is among few countries with highest proportion of not tillage land management worldwide.

Planned and expected support:

- Training in pilot schemes for the surveillance management of fruit flies through the implementation of an integrated pest management (IPM) strategy, which includes a trapping system, chemical, biological, physical, and cultural control, and the use of sterile insects for population, suppression and eradication and pest risk mitigation schemes such as systems approaches in different fruit production areas of Paraguay.
- Expert advice in the design of mass- rearing and fly emergence and release facilities, training sterilization facilities, in sterile insect production for fruit fly control, and in the application of the sterile insect technique (SIT), with the purpose of including this technique in the IPM strategy of control programmes for this pest.
- Training for laboratory and field technicians in the taxonomic identification of in case quarantine fruit flies (*Bactrocera spp. Drosophila suzukii*) and others of quarantine significance.
- Supplies, for the implementation of fruit fly phytosanitary surveillance programmes, such as traps, attractants (pheromones and hydrolyzed protein) and provision of sterile flies for use as part of fruit fly control programmes.
- Supplies and equipment for the SENAVE Plant Health Laboratory and for CEMIT.
- Training in improved technique for surveillance and control of the New World Screwworm (NWS) including the sterile insect technique (SIT).
- Expert advice in the design of mass-rearing and sterilization facility, training in sterile insect production for NWS and in the application of the SIT, with the purpose of including this technique in the IPM strategy of control programmes for this pest.
- Supplies and equipment for the National Animal Health Service (SENACSA) Laboratory
- Continuing in land and water conservation research and implementation of sustainable land management.
- Awareness training on the practicalities of phytosanitary irradiation as a post-harvest phytosanitary measure for trade in fresh commodities.

Planned Outcome

1. National capacities created for the use of gamma irradiation technology in services required for the country's agriculture and food security.
2. National capacities strengthened for the conservation of productively superior animal germplasm in livestock.
3. National capacities further enhanced on the use of fallout radionuclides for addressing soil erosion and land degradation.
4. National food safety capabilities strengthened.

Indicative outputs

1.1 Staff trained in the use of radio-mutagenesis (2023);

1. 2 Mutation induction, related biotechnologies and selection protocols for seeds established (2024);

1.3 National regulations related to the detection of radioactivity in food, its handling and consumption updated (2025).

1.4 Staff trained in the use of IPM integrated pest management including the sterile insect technique for the control and prevention of fruit fly pests (2024).

1.5 Increase production and commercialization of horticultural products (2027).

1.6 Staff from the veterinary services trained in the use of integrated pest management including the SIT for the control of the NWS (2024).

1.7 Increase sustainable livestock production and commercialization (2027).

1.8 Installation of the civil and technological infrastructure for irradiation (2025)

2.1 Professionals and technicians of the UNA, MAG and SENACSA trained in process-related nuclear technologies for the characterisation, conservation and genetic improvement of livestock genetic resources (2023).;

3.1 Staff trained in the use of fallout radionuclides (caesium-137, lead-210 and beryllium-7) techniques and compound specific stable isotopes (CSSI) to measure the extend of short and long-term erosion and their sources (2024).

3.2 Staff trained in resampling techniques to apportion erosion due to natural occurring or anthropogenic processes.

3.3 Laboratory equipped with needed facilities for the above studies (e.g. gamma detector, gamma ray sensor).

4.1 Functional and accredited laboratories strengthened; high competent analysts improved; and operational hazard surveillance programmes implemented.

2.5 HEALTH AND NUTRITION

Nutrition

In terms of health, zoonosis and nutrition, the Paraguay 2030 National Development Plan focuses on the following main areas: poverty reduction, social development, inclusive economic growth and Paraguay's integration into the world in an adequate manner. To this end, projects are being proposed that combine the incorporation of technologies that use ionizing radiation or nuclear derivatives and the training of experts in the field through the

development of teaching, research and laboratory capacity-building programmes. The sector is linked with SDGs: 1, 2, 3, 12.

Measures in this area are also aimed at achieving the SDGs, which refer to the following: ensure healthy lives and promote well-being for all at all ages, in order to help achieve the goal of reducing deaths from non-communicable diseases by one third, through assistance to countries in the fight against cancer by helping them design comprehensive cancer control programmes, establishing nuclear medicine, radiation oncology and radiology facilities, and supporting the education and training of specialized health professionals.

Statistical data from the General Directorate of Statistics, Surveys and Censuses (DGEEC) for 2018 show a decrease in the population of children and adolescents, while the population of young adults has increased. There has been an increase in the proportion of older adults, although this has occurred at a slower rate than the decline in the number of children and adolescents. The average annual growth rate of the Paraguayan population was estimated at 1.43% in 2018 and is expected to fall to 1.33% by 2024.

In terms of health care, Paraguay increased public spending from 1.5% in 2003 to 3.3% of GDP in 2016. The increase in spending is largely due to the greater number of pharmaceutical products and medical supplies purchased. Although total health expenditure represents almost 10% of GDP, it should be noted that only 45.9% corresponds to the public sector and more than half (54.1%) to private sector expenditure (out-of-pocket). Even though public sector insurance coverage through the Social Security Institute (IPS) has increased as a result of economic growth, health outcomes remain inadequate. Although Paraguay is one of the countries with the highest percentage expenditure on health in relation to GDP, an analysis of its per capita health expenditure shows that it is just US $461, below the Latin American average of US $718.

The burden of disease is shifting to chronic and non-communicable diseases, which put additional financial pressure on the health care system. The availability and adoption of new diagnostic technologies and treatment options can improve patient care and outcomes.

Nutritional situation of vulnerable groups[2]

In Paraguay, the Nutritional Food Surveillance System-SISVAN is implemented. Its objective is to determine the nutritional situation of the most vulnerable population, including pregnant women, children under five years who attend public health services, in addition to schoolchildren and adolescents from selected educational institutions.

The data for the year 2021 are presented below. Graph 1 shows that the figures for both low weight and obesity are high (23.7% and 36.3%, respectively), which in pregnant women translates into higher risk of morbidity and mortality for the mother-child binomial.

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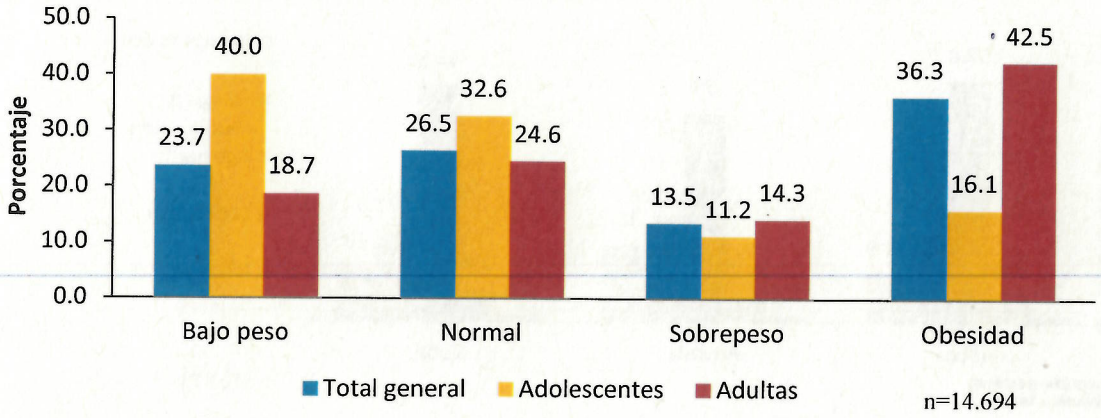
[2] Provided by Dra. Elsi Ovelar. Director of INAM

Graph 1. Nutritional status of pregnant women attending public health services by age group. SISVAN 2021

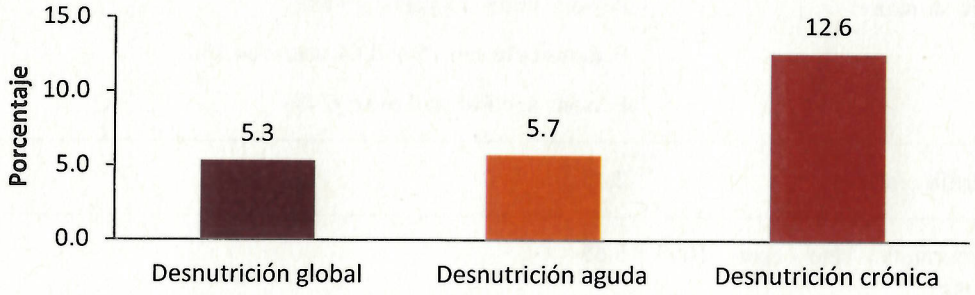


Weight/High/Gestational age-Rosso Mardones.

Source: SISVAN/INAN/MSPBS.

The first thousand days of life are fundamental in the growth and development of children. Graph 2 shows the prevalence of the different types of malnutrition, with chronic malnutrition being more prevalent.

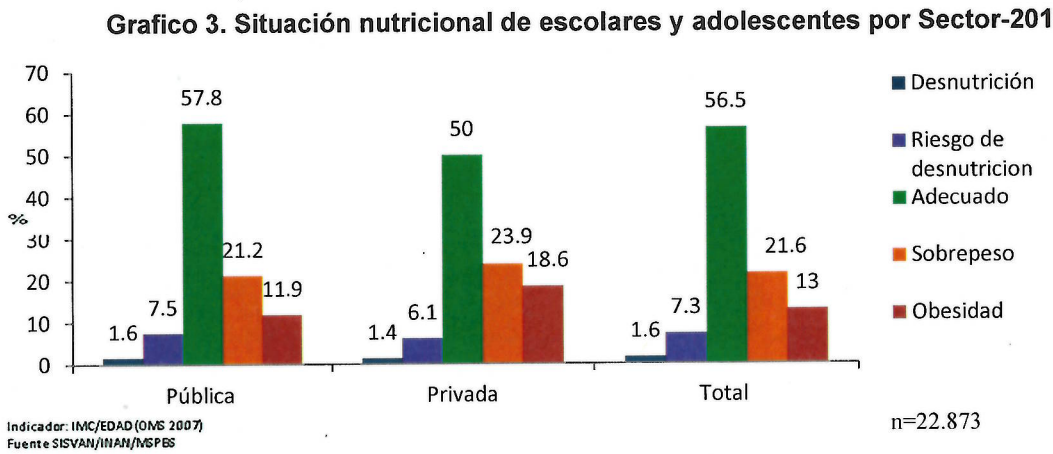
Graph 2. Prevalence of malnutrition in children under 5 years of age who attended public Health Services. SISVAN 2021.



Indicators: Global Malnutrition: Weight/Age <-2SD; Acute Malnutrition: Weight/Height <-2SD; Chronic Malnutrition: Height/Age <-2SD. WHO 2006. Source: SISVAN/INAN/MSPBS.

Graph 3 shows the prevalence of excess weight (overweight 12.6% and obesity 13%) in schoolchildren and adolescents from public and private institutions in 2019.

Graph 3. Nutritional situation of schoolchildren and adolescents by Sector-2019



Based on the data, it can be concluded that the double burden of malnutrition is present throughout the life cycle, so it is essential to strengthen the implementation of nutrition programs and strategies.

Total population:	2018: approx. 7,052,983 inhabitants Female: 49.5%; Male: 50.5%
Population density:	17.3 inhabitants/km2
Population structure:	Persons under 15 years: 29.6% Persons between 15 and 64 years: 64.1% Persons aged 65 and over: 6.4%
Global fertility rate:	2.47
Crude mortality rate (per 1000 inhabitants):	5.65
[3] Maternal and infant mortality indicators:	Neonatal mortality rate per 1000 live births: 9.5 Early neonatal mortality rate (0–6 days) per 1000 live births: 7.2 Late neonatal mortality rate (7–27 days) per 1000 live births: 2.3 Infant mortality rate per 1000 live births: 13.7 Perinatal mortality rate per 1000 live births: 16 Mortality rate for children aged 1–4 years (per 100 000 population): 47.5

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[3] PAHO/WHO. *Basic Health Indicators.* Vital Statistics Information Subsystem (SSIEV). Asunción, Paraguay: Ministry of Public Health and Social Welfare, PAHO/WHO, 2017, p. 24.

	Maternal mortality ratio per 1,000,000 live births: 86.4
Life expectancy at birth:	Female: 77.2 Male: 71.4
Population with IPS health insurance:	19.43%
Population with other health insurance:	7.53%
[4] Population without health insurance:	73.04%
Total health expenditure per capita:	US $461
[5] Total health expenditure as a % of GDP:	9.8

Institutions linked with Health and Nutrition policy (see annex 2 for more details)

- Ministry of Public Health and Social Welfare (MSPBS)
- National Cancer Institute (INCAN)
- National Centre for Burns and Reconstructive Surgery (CENQUER)
- National Malaria Eradication Service (SENEPA)
- Social Security Institute
- General Directorate of Scientific and Technological Research (DGICT)
- Health Science Research Institute (IICS)
- National Institute for Food and Nutrition (INAM)

Cancer

Overview on the cancer burden in Paraguay

According IARC GLOBOCAN estimates, 12,920 new cases are registered each year with a mortality of 6,565 people per year. By 2030 cancer incidence and mortality will face a respective increase of 31.8% and 35.7%, which will result in 17,032 new cancer cases and 8,909 cancer deaths. The five most frequent types of cancer in Paraguay are breast, prostate, colorectal, cervix uteri and lung cancer. These four cancers are responsible for almost half of all cancer deaths in Paraguay. Cervical cancer is the second most frequent cancer in women, after breast which is accountable for the 15% of new cancer cases.

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[4] GENERAL DIRECTORATE FOR STATISTICS, SURVEYS AND CENSUS. *Main results: permanent household survey 2017 country total: includes Boquerón, Alto Paraguay and the entire indigenous population.* [Online]. Asunción, Paraguay: DGEEC, 2017. Available at: http://www.dgeec.gov.py/Publicaciones/Biblioteca/Resultados%20EPH/PRINCIPALES%20RESULTADOS%20EPH%202017.pdf

[5] BENÍTEZ, G. *Paraguay: Distribution of Health Expenditure and Out-of-Pocket Expenses. Main results based on Permanent Household Survey. Asunción, Paraguay:* Centre for Analysis and Dissemination of the Paraguayan Economy (CADEP), *2014.*

With regard to diseases whose diagnosis and treatment are facilitated by nuclear technology, such as thyroid, renal, cardiac, haematological, gastric, oncological and bone metastasis pathologies, the National Cancer Institute (INCAN), reported at the time of this CPF that it was difficult to estimate treatment costs owing to the number of different types of cancer, but he pointed out that early detection of the disease lowered costs and increased the chances of treatment success.

In the private sector, three-dimensional conformal radiotherapy (3D-CRT) treatments, delivered by a linear accelerator, cost on average 15,000,000 guarani (US $2,500)[6]. Although this treatment is also provided at INCAN, there are no accurate data on costs per patient as it is a public institution and a free service. Since the institute currently has only one functioning linear accelerator[7], patients are referred to private clinics when it is not possible for patients to bear the high cost, and thus the costs are absorbed by the State. As an average of more than 80 sessions are required daily, the remaining useful life of the device is limited.

The main types of cancer treated with radiation therapy are cancers of the oesophagus, lung, lymph nodes and rectum. It is also used to treat patient relapses and in certain cases for palliative pain treatment. The most common types of cancer in the country are cancers of the breast, cervix, lung, prostate, colon, and rectum.

In terms of early detection of the disease, although there is no diagnostic tool that uses nuclear technology for the early detection of cancer, there is one for the subsequent prognosis of the disease — the positron emission tomography–computed tomography (PET-CT) scanner. This equipment can conduct a more accurate study, which optimizes subsequent treatment by making it more effective. This study (PET-CT) is carried out solely in private sector institutions and costs on average 7,000,000 G (approx. $1,200). While it is not compulsory in the treatment of cancer in general, it is required in the case of lymphoma and oesophageal and lung cancer.

Since it is a prognostic procedure rather than a treatment, the high cost of the study means that it is used only in the most severe cases or that it is accessible only to those who can afford it. Its accuracy, as already pointed out, increases the efficacy of treatment, reducing its cost and optimizing results and reducing its invasiveness for the patient.

Under the auspices of the CNEA and with the support of the VMME, a bilateral and multilateral cooperation strategy is being developed so that, through the IPS, the country can complete the preparation of a project to establish nuclear medicine at the Central Hospital

The IICS was awarded and is implementing the national TC project for the 2018–2020 biennium: PAR6017 entitled 'Providing Patients from the Public Sector with Early and Effective Diagnosis of Cancer through Positron Emission Tomography Technology', which will enable the early and effective diagnosis of oncological diseases, regarded as the second leading cause of death in the country. There has so far been little to no access to this technology

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[6] Dr Julio Rojas, Head of the INCAN Radiation Oncology Department and tutor for interns at the National University of Caaguazú.

[7] The institute has two linear accelerators, but one is obsolete. Since it has sufficient infrastructure (bunker) for both devices, part of that infrastructure is currently idle.

for patients in the public health sector, since only the private health sector provides this diagnosis.

With the support under this project, the IICS/UNA will be the first public health institution to have at its disposal molecular diagnostics using PET–CT, in line with the recommendations received from the imPACT/IAEA missions in 2011 and 2016. The objectives of these missions were to produce a comprehensive report on the cancer problem in Paraguay, in terms of its priorities and shortcomings, in order to examine relevant project proposals, raising the awareness of health professionals and strengthening their respective training in the signs and symptoms of cancer in order to detect cases early, refer them as quickly as possible and increase the chances of survival.

These two missions have been conducted through the Programme of Action for Cancer Therapy (PACT), in partnership with the Pan-American Office of the World Health Organisation (PAHO/WHO) and the International Agency for research on Cancer

Consequently, the Ministry of Health of Paraguay requested in September 2021 the PACT to support the development of the National Cancer Control Plan (NCCP). The process is actually ongoing, and an in-country mission conducted in February 2022 allowed the National Program for Cancer Prevention and Control (PRONAC) to identify the main strategical axes and objectives to address within the NCCP 2023-2027:

Diagnostic

1) Reduce the diagnostic waiting time to a maximum of 15 days. It is recommended to (i) support the development of a Nuclear Medicine Service within the National Cancer Institute (INCAN); (ii) design and implement development plans for the pathology, endoscopy and medical imaging specialties; (iii) introduce a PACS Imaging Information System in the radiology/medical imaging department.

2) Apply minimum quality criteria in all diagnostic services. It is recommended to (i) design and implement a standardized imaging and endoscopy procedure and reporting system; (ii) develop continuing education and specialized training programs for pathology, imaging and endoscopy professionals; (iii) ensure the implementation in each laboratory of the recommendations of the national anatomic pathology regulations of the Ministry of Health.

Treatment

1) Reduce the wait time between diagnostic and treatment initiation to a maximum of 30 days. It is recommended to (i) strengthen the triage and classification system; (ii) implement multidisciplinary groups in all centres that treat oncology patients; (iii) implement fast lanes of care to prioritize staging studies according to the criteria of the multidisciplinary groups; (iv) design and implement the electronic oncology medical record in the main oncology care centres.

2) Strength the quality if all treatment services. It is recommended to (i) ensure the application of the existing guidelines for the management of oncology patients; (ii) design and implement a Continuing Education program for cancer care professionals; (iii) approve and implement the "Development Plan for Radiotherapy in Paraguay; (iv) design, approve and implement a program for the development of "Cancer Surgery" and "Systemic Cancer Treatment" using a methodology similar to that used in radiotherapy.

3) Design and implement the "National Network for Oncology Care" including all sectors, different levels of care and accreditation/certification of care centres.

Tissue banking activities

In 2021, with support of the IAEA, the CENQUER centre will, for the first time, have at its disposal a self-contained irradiator for sterilization of tissue grafts as part of the Tissue banks activities.to treat all the above-mentioned tissues. This is in closed collaboration, working in coordination with the UNA Clinical Hospital, San Jorge Hospital and Acosta Ñu Hospital. The expected outcomes, which will result in increased integration rates of the transplanted tissues by reducing the chance of infections and rejection due to immunogenicity.

Sterile Insect Technique

Paraguay was one of the countries in the Americas to have reduced the number of indigenous malaria cases to zero by 2012 through the National Malaria Eradication Service (SENEPA). The country achieved the Certification of Elimination of Transmission in 2018 by complying with the WHO Global Technical Strategy for Malaria 2016–2020 in the framework of the E-2020 initiative. Currently, the main objective is to prevent the re-emergence of malaria transmission throughout the territory of the Republic of Paraguay by means of a surveillance model based on detection, diagnosis and timely treatment in health networks, using an entomological monitoring and vector control system with comprehensive measures, in line with the national action plan for 2019–2021 following the elimination of malaria.

Dengue Vector Control Programme: The programme is based mainly on health promotion and the search for new partnerships and is being implemented in several countries of the region. It includes the design of the Integrated Management Strategy (IMS) for the prevention and control of dengue in Paraguay, which takes a multisectoral approach and where emphasis is placed on identifying interventions that achieve behavioural changes in populations in order to make the current strategy sustainable, thereby replacing the traditional programmes, which were essentially top-down.

The national IMS integrates six key components for the control and prevention of dengue: environmental sanitation, health promotion and social communication, entomological surveillance, epidemiological surveillance, laboratories, and patient care. The IMS will contribute to reducing risk factors for the presence of the disease by strengthening measures in border areas, which are considered to be more vulnerable, and allowing for inter-institutional and intersectoral work.

In compliance with the guidelines established in the national IMS, within the vector control component, the National Entomological Surveillance Plan has been strengthened and is operational; the National Entomological Network was established on the basis of the assessment made, identifying three levels according to the degree of capacity, above all in terms of human resources, covering the entire country.

The insectarium of the Entomology Department has been installed and is operational. This will contribute significantly to maintaining stable colonies of vectors such as *Aedes aegypti* and to

having specimens available for bioassays and resistance and efficacy tests of the insecticides currently used in SENEPA.

Under the auspices of the CNEA and with the support of the VMME, a bilateral and multilateral cooperation strategy is being developed so that, through the IICS and SENEPA and with the support of CONACYT, the country can complete the preparation of a sterilization project for the dengue mosquito vector *Aedes aegypti*.

SENEPA–IICS Joint Project: Sterilization of the *Aedes aegypti* mosquito

The project profile is in the design phase: use of the sterile insect technique (SIT) on *Aedes aegypti* where the roles of the participating institutions are primarily defined. The IICS will be involved in irradiation, breeding of male mosquito larvae and food production, while SENEPA will implement the strategy of disseminating/releasing the sterile male mosquito in urban and rural areas.

Implementation of this strategy requires training in the design of an irradiation plant for sterilization purposes and a mass rearing facility for the production of sterile insects to control the *Aedes aegypti* mosquito and for the application of the SIT, so that this technique can be included within the National Programme to Combat Dengue and as part of measures to control this pest.

Planed Outcome

1. Improved and updated infrastructure for the diagnosis and treatment of cancer patients in Paraguay.

Indicative outputs

1.1 Comprehensive cancer control services implemented in Asunción (2023).

1.2 Staff trained in hybrid techniques (2023 and 2024).

1.3 Equipment acquired and a Nuclear Medicine Service with hybrid technology in operation (2024 and 2025).

1.4 Comprehensive cancer diagnosis and treatment services implemented at the IPS (2026).

Outcome

2. National capacities created for the use of SIT to control *Aedes aegypti* and other vectors.

Indicative outputs

2.1 Staff trained in SIT techniques (2023).

2.2 Technological capacities available in specialized laboratory for sample analysis (2024).

2.3 Laboratory in operation with sterile insect production capabilities for application in urban and rural areas with high levels of mosquito infestation (2025).

Planned Outcome

3.National capacities strengthened for the implementation of nutritional studies using stable isotopes techniques (2025 - 2026).

Indicative outputs

3.1 Methodology for body composition studies standardized and the standards obtained for infants and children (2024).

3.2 Technological infrastructure of laboratories strengthened for nutritional analysis and to detect and control organic contaminants in food (2025).

2.6 WATER AND THE ENVIRONMENT

The Development Plan for 2030 includes three key areas linked to environmental resources and environmental management: poverty reduction, water management and land management. The SDG linked to this sector are: 3, 4, 5, 6, 11, 12, 13, 15. The shortcomings identified are primarily related to the weakness of institutions in applying restrictions or sanctions and also the problem of governance that exists at the regional and local levels.

The following needs have been identified: modern infrastructure and metrology laboratories for environmental analysis, strengthened capacities for the environmental licensing of facilities that use irradiators or radioactive sources, strengthened capacities for environmental regulation in uranium mining and for the regulation of radioactive waste transport and disposal, and baseline data on radionuclide activity levels in the soil, aquifers and atmosphere. There is also a lack of tools for measuring the environmental parameters of ionizing emissions, which requires capacity-building in relation to human resources, climate change and variability (floods, risk management, early warning), transboundary pollution (water, air, hazardous solid waste) and chemical safety and soil deterioration, among other things.

Under the auspices of the CNEA and with the support of the VMME and MADES, a bilateral and multilateral cooperation strategy is being developed to:

a. Strengthen radiation safety capacities and culture, which is crucial for the protection of the environment against the use of ionizing radiation.
b. Update the environmental regulatory framework for ionizing radiation, for the special case of uranium mining and for the effective and safe disposal of disused radioactive materials.
c. Strengthen the capacities of the MADES carbon laboratories to carry out studies on carbon in soils in order to develop climate change adaptation strategies.

Strengthen the capacities of the UNA to participate in national and regional projects in the area of environmental quality monitoring. All these activities are intrinsically related to section 2.3. NUCLEAR AND RADIATION SAFETY, with the IAEA Safety Standards related to public and environmental radiation protection, radioactive waste management and decommissioning (TSA-4).

Policy considerations The Republic of Paraguay has incorporated into article 7 of the Constitution provisions to promote and guarantee the right to a healthy environment. According

to that article, the priority objectives of social interest are 'the preservation, conservation, restoration and improvement of the environment, and also its reconciliation with comprehensive human development. These objectives will guide the relevant legislation and government policy'. In addition, Paraguay has enacted numerous laws and designed plans and programmes aimed at protecting the environment, in order to ensure the sustainability of development for present and future generations.

Major international agreements. - Paraguay signed and ratified the United Nations Framework Convention on Climate Change in 1993 and the Kyoto Protocol to the United Nations Framework Convention on Climate Change in 1999. It also ratified the Paris Agreement in 2016. Furthermore, it has signed numerous agreements on biodiversity, persistent organic pollutants, species conservation, desertification, hazardous waste, wetlands and the ozone layer.

Governing and environmental regulatory body - MADES.- The objective of the Ministry of Environment and Sustainable Development (MADES) is to design, establish, supervise, monitor and evaluate the national environmental policy in order to ensure that the right to a healthy environment and environmental protection is pursued nationwide.

Legal framework: Act No. 1561 establishing the Secretariat of the Environment and its amendment establishing MADES.

Act No. 3239-07 on water resources.

Act No. 294-93 on environmental impact assessment and its regulatory decrees.

Act No. 1561-2000 and the international agreements. The main areas are the characterization and preservation of water resources at the soil and subsoil levels in the eastern and Chaco regions, where the country's major aquifers are located; and the management of water bodies contaminated with metals, mainly as a result of gold mining in the Departments of Guairá and Caazapá.

Chapter 1 of **Act No. 5211/14** sets as its objective the protection of the quality of the air and atmosphere by preventing and controlling the emission of chemical and physical pollutants into the air in order to reduce the deterioration of the environment and the health of living beings, to improve their quality of life and to ensure the sustainability of development.

The purpose of **Act No. 3956/09** on the Integrated Management of Solid Waste in the Republic of Paraguay is to establish and apply a legal regime for the responsible production and management of solid waste, the normative content and practical value of which should lead to the reduction of such waste to a minimum and avoid situations of risk to human health and environmental quality.

Deforestation. - Paraguay has an area of 406,752 km². A total of 15% of this territory is made up of protected zones (some 60,662 km²), which are distributed across 60 areas. In the middle of the 20th century, Paraguay had approximately 280,000 km² of forest, both in its western (Chaco) and eastern regions. However, since the middle of the 20th century, various policies, including the expansion of agricultural areas, the sowing of pasture for livestock and illicit trafficking in virgin wood have led to the deforestation of the eastern region.

The Upper Paraná Atlantic Forest is one of the 200 most important ecosystems in the world in terms of biodiversity. Despite its significance as a region, Paraguay has retained only 12% of

its original ecosystem. The Zero Deforestation Law for the Eastern Region was enacted and extended to remain in force until 2020, with the urgent objective of protecting the last remaining forests in this ecoregion. In recent years, the same problem has been observed in the Chaco, which, because of its land type, is used more for livestock farming.

Climate change. -Paraguay is ranked 162nd among the countries that emit greenhouse gases and has one of the lowest per capita carbon footprints in the world. According to Paraguay's National Greenhouse Gas Inventory, time series 1990–2015 and updated in 2018, net emissions are measured at 75,099.89 Gg CO_2eq., of which 53% is produced by the agriculture sector, 30.7% by the land use and land-use change and forestry sector, 12% by the energy sector, 2% by the product use sector and 2.5% by the waste sector. A total of 100% of the energy mix is clean (zero greenhouse gas emissions). Even though Paraguay has a carbon analysis laboratory, there is a limited critical mass of technicians for the analysis of forest and agricultural soils, which impedes decision making on climate change adaptation policies and to implement effectively carbon offset mechanisms.

Environmental pollution. -The incorporation of new land into agriculture and the technologies used have generated a large amount of toxic waste that contaminates not only soil but also watercourses (and even groundwater), which also threatens the country's fauna and flora.

Also, in urban areas, pollution processes caused by unregulated urbanization and industrialization are a growing threat to the environment owing to the proliferation of open-air landfills, untreated sewage, nitrates and fuel-based pollutants. For example, the outlook concerning the Patiño aquifer, the main source of water for the entire metropolitan area of Asunción, does not look positive for the reasons mentioned. This has a marked effect on the quality of water for drinking and consumption, used by almost three million Paraguayans.

With coordination provided by MADES, several programmes and projects are being implemented in the country, as follows:

1- Rio de la Plata Basin Project

2- PMSAS Water Improvement and Sanitation Project

3- ONU-REDD Project

4- Ozone Project

5- Persistent Organic Pollutants Management Project

6- ARCAL project RLA5064

7- ARCAL project RLA5069

8- ARCAL project RLA7024, among others.

The **Multidisciplinary Scientific and Technological Research Centre** (CEMIT) is a research and specialized services centre whose mission is to share with the community the knowledge obtained through its own research or acquired from other reference bodies.

The activities of CEMIT are based on laboratory services provided to public and private entities related to the following areas: pharmacy, chemistry, veterinary medicine, biotechnology, agro-

livestock, food, water, hydrobiology and environmental sciences, among others. It is accredited in line with quality standards and is in the process of re-accreditation and expanding its scope. Since November 2019, it has been certified by the MSPBS for compliance with good laboratory practices. It has top researchers from CONACYT (PRONII) and conducts research in eutrophication and development of genetic improvement of crops of economic and nutritional importance using nuclear or nuclear-derived techniques.

Academic Units of UNA. They are responsible for the development of basic and applied research, including environmental research, and also undergraduate and graduate training. Academic units with training courses in the following areas: Engineering, agricultural sciences, polytechnics, exact and natural sciences, chemical sciences, medical sciences, veterinary sciences, etc.

Planned Outcome

1. Improved infrastructure for the use of nuclear technologies in the analysis of environmental samples in Paraguay.

Indicative outputs

1.1 Upgraded CNEA laboratories for X-ray fluorescence (XRF) analysis (2023) and Faculty of Chemical Sciences (FCQ) laboratory for INAA (2023).

1.2 Laboratory staff trained in nuclear analytical techniques (2023).

1.3 Upgraded specialized environmental laboratories of the MADES Soil Laboratory (2023).

1.4 Determination of the carbon content of different ecosystems and ecoregions in the country and the emission factors of different sectors (2023).

Planned Outcome

2. National capacities created for environmental licensing and monitoring of facilities with irradiators and radioactive sources and of the uranium mining industry.

Indicative outputs:

2.1 Staff trained in environmental licensing procedures (2023).

2.2 Facilities authorized under Act No. 294/92 on environmental impact assessment (2023).

2.3 Routine environmental monitoring procedures for facilities (from 2023).

2.7 ENERGY AND INDUSTRY

Energy

Crude oil. -While Paraguay produces a great deal of clean electricity, the consumption of petroleum products accounts for approximately 40.1% of its energy mix. Paraguay is entirely dependent on imports to meet its demand for crude oil and petroleum products — on average, some 51,876 barrels per day (2017). In 2005, the State-owned refiner Paraguayan Petroleums

(Petropar) stopped operating its refinery in Villa Elisa and started to import all refined petroleum products. The sector is linked with SDG 1, 4, 8, 9, 12

Biomass. -Biomass accounts for 44.2% of the energy consumed in Paraguay. Charcoal and firewood are the main products used in residential, commercial, industrial and agricultural settings. As these resources are still part of an informal economy, it is difficult to calculate exactly how much is consumed. Firewood is consumed mostly by rural families for domestic purposes, but it is also used in agro-industry, to heat silos.

Paraguay is under pressure in view of the scarcity of solid biomass facing all sectors, given that the supply of sustainable wood cannot meet current demand. Whereas, according to VMME data, there is an annual biomass deficit of 10–13 million tonnes, the same source suggests that Paraguay's natural conditions are highly amenable to reforestation projects.

Electricity. -Paraguay generates almost all its electricity at two hydroelectric dams, Itaipú and Yacyretá, with smaller amounts at the Acaray power plant and thermal plants; the latter are concentrated in the Chaco region. The binational Itaipú and Yacyretá plants, located on the Paraná river on the border with Brazil and Argentina respectively, generate 94% of the electricity consumed in Paraguay. The capacity of the two dams is over 17,000MW.

Paraguay is the region's main major net exporter of electricity. In 2014, it exported 41,400GWh of electricity. According to VMME data, the installed capacity for thermal electricity production is 6.1MW and the Acaray dam generates 210MW; this power plant will be modernized in order to boost its available capacity.

Similarly, the installed capacity of the Yacyretá hydroelectric power plant will increase with the mechanization of the Añacua tributary, as part of the dam's original construction plans. This will boost the hydroelectric complex's electricity generation capacity by 8.8% or 276MW. Under the plan bids will be assessed and work begun during the first half of 2020.

There are also projects to install small hydroelectric power plants on inland rivers and watercourses as a response to the rise in energy demand under the energy policy 2040. The development of small hydroelectric power plants with available capacity of 1,500MW would require private sector investment of US$1,400 million

Under the auspices of the CNEA and with the support of the VMME and MADES, a bilateral and multilateral cooperation strategy is being devised to study nuclear power as an alternative option starting in the 2030s in order to tackle climate change, with the support of researchers from the Faculty of Engineering of the UNA (FIUNA).

Energy policy 2016–2040. -Paraguay's current energy policy was approved by Decree No. 6092/16. The policy was framed by a multidisciplinary team coordinated by the Cabinet of the VMME, with the approval of the National Energy Board. In accordance with the policy five strategic objectives are set:

- Guarantee energy security, applying the criteria of self-sufficiency, efficiency, minimal cost and socio-environmental responsibility, alongside the country's productive development.
- Ensure the entire population's access to high quality energy, with a view to respecting consumer rights.

- Make use of national sources of energy (hydroelectricity, bioenergy and other alternative sources), and encourage the production of hydrocarbons, as strategic resources to reduce foreign dependence and increase national added value.
- Raise people's awareness of the importance of energy efficiency and its sustainable use as a factor of all-round development.

These strategic objectives are grouped around three principal axes — Management and Security, Efficiency and Sustainability, and Cross-cutting Aspects — and specific action plans for each energy sector have been drafted. The VMME[8] indicated that its office oversees the monitoring of the National Energy Policy. To that end, meetings were held in February 2022 with international bodies, such as the Bariloche Foundation, on appraising the energy policy, to provide the Government with an up to date forecast of the country's energy situation in the years to 2050.

In relation to the energy generation mix, consideration is being given to quantifying uranium ore deposits in Paraguay, the potential of which still needs to be determined. There would appear to be significant reserves in the Paraguayan town of Yuty, amounting to 4500 t of uranium oxide, and there is an estimated 22,000t in the Caazapá department.

Under the auspices of the CNEA and with the support of the VMME, a bilateral and multilateral cooperation strategy is being devised to explore Paraguay's uranium mining potential and determine the reality on the ground.

Services. - The Hidrovía Paraguay–Paraná waterway (HPP) is of vital geostrategic importance for Paraguay's development, given that 80% of its exports and around 65% of its total imports travel along this route. Paraguay possesses one of the largest fleets in the region, with a total of 2,585 crafts (motorized vessels, tugboats and barges), 83% of the total crafts used for international freight transport on the HPP. In Paraguay, the sector has an annual turnover of 450 million dollars and it provides direct and indirect employment to some 25,000 people.

According to the Centre for Maritime and River Shipowners, river-borne cargo is projected to exceed 20million tonnes in the coming 15 years. Given this potential scenario, the 13 existing shipyards in Paraguay expect to manufacture new craft for shipping companies. In recent years, the sector has invested some US$600million in developing this area.

Fuel production	No (quality testing of gaseous hydrocarbons in mineral deposits)
Annual hydrocarbon consumption (2017)	3,010,644,331litres
Daily hydrocarbon consumption (2017)	51,876 barrels per day
Production/consumption of natural gas	No
Production/consumption of charcoal (2010)	Production: 725,000 t Consumption: 505,000 t

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[8] Dr. Ing. Felipe Mitjans — Director of Primary Energy Resources

Electricity generating capacity (2017)	60,000 GWh per year, of which 99.5% is hydroelectricity
Gross electricity generation	(2017): 15,648,021 GWh (2018): Itaipú generated more energy than any hydroelectric power plant in the world
Electricity delivered to the market (2017)	15,574.996GWh
Types of energy consumed (2017)	Petroleum products (40.1%) Biomass (44.2%) Electricity (15.7%)

Non-Destructive-Testing (NDT)

FIUNA. -Although FIUNA possesses an NDT laboratory with X-ray sources, it cannot meet current demands owing to the significant development of Paraguay's metallurgical industry over the last 20 years. The capacities of this laboratory are therefore to be strengthened.

Main objectives:

- Establish certain criteria needed to perform external services, once certified equipment and inspectors are available.
- Equip the laboratory with five principal testing techniques— three superficial: visual testing, penetrant testing and magnetic particle testing; and two volumetric: ultrasonic testing and radiographic testing.
- Prepare the laboratory for stationary and portable radiographic testing together with training of level II inspectors, and arrangements to renew the laboratory's licence from the ARRN.
- Improve radiation safety measures in accordance with the IAEA's Radiation Safety Standards and Safety Guides so that the five forms of testing listed can be properly performed. Expand the premises and facilities.
- Train and certify laboratory technicians at the level of American Society for Non-destructive Testing inspectors, or similar, to carry out the five principal testing techniques listed above to improve the conditions of the degree-level instruction and the materials used at FIUNA, and to strengthen possible links with other related faculties. Similarly, build and maintain a pool of staff with the appropriate level of training for FIUNA to become as an institution of national reference, which is currently lacking in Paraguay. Training and certification is planned to be conducted with the cooperation of external agencies and organizations, given the dearth of relevant counterparts in the country.

Under the auspices of the CNEA and with the support of the VMME and MADES, an academic–private sector cooperation strategy is being developed to improve the capacities of the FIUNA NDT laboratories in terms of the services provided to national shipyards.

Planned Outcome

1. Updated national NDT capacities

Indicative outputs

1.1 Analytical and processing capacities of FIUNA specialized laboratories strengthened (2023-2025)

1. 2 Staff trained in NDT techniques (2025)

1. 3 Results of NDT analyses carried out in small-, medium- and large-scale metallurgical enterprises in Paraguay (2025)

Planned Outcome

2. Updated capacities for definition of uranium mining policies

Indicative outputs

2.1. Staff trained in techniques for determining uranium potential 2023 – 2024

2.2 Results of the analysis of uranium ore samples from the eastern region of Paraguay (2023). 2023 – 2024

Planned Outcome

3. Updated capacities for inclusion of nuclear energy in the energy matrix of the country

Indicative outputs

3.1 Determination of the country's electricity generation needs (by region) after 2030.

2023 – 2024

3.2 Staff trained in the advantages of the use of nuclear energy

2023 – 2024

3.3 Creation of the Chair of Nuclear Technology at the UNA Faculty of Engineering

2023 – 2024

3. RESULTS MATRIX

Nuclear and Radiation Safety (See appendix 7 for a clearer formulation of base line and assumptions)

Nuclear and Radiation Safety Outcome[s]	Baseline	Indicators	Means of Verification	Assumptions/risks
1.Strengthened effectiveness of the nuclear- and radiation-related national legal and regulatory framework	Current gaps render effective interinstitutional relations impossible and cause institutional functions to overlap	Legal framework updated and radiation protection services for new technologies implemented in accordance with international standards	National legal and regulatory framework updated ARRN and VMME reports RAIS 3.3 Web	None. The political decision to carry out amendments rests solely with the Executive
2. Consolidated national infrastructure for prevention of and response to radiological emergencies	Limited capabilities of staff in institutions constituting CONAPREB and the UNA	Over 70% of the national radiological emergency plan implemented (2023)	National radiological emergency plan ARRN, CONAPREB and UNA official reports	Limited resources owing to the pandemic None in terms of training. The political decision to carry out training rests solely with the Executive and the UNA

Indicative Outputs	Indicative Timeframe (Future TC cycle)	Relevant national counterpart(s)/ institute(s)	Approximate Cost in € (A)	Estimated resources* available in € (B)	Resources to be identified/mobilised in € (A-B)
1.1 Legal regulatory basis in connection with nuclear medicine and radiotherapy updated and implemented	2023 - 2024	Ministry of Foreign Affairs, VMME, ARRN, CNEA, Parliament staffers	€15,000	*€0,0*	€15,000
1.2 Legal and regulatory framework for E&T in radiation protection and safety strengthened and National education and training curriculum on radiation safety designed and developed, for the relevant categories of personnel	2023 – 2024	UNA, UNE, Catholic University (Villarrica and Encarnación)	€18,000	€5,000	€13,000

3. RESULTS MATRIX

Nuclear and Radiation Safety (See appendix 7 for a clearer formulation of base line and assumptions)

1.3 Services and protocols for the radiation protection of cancer patients improved	2024 – 2025	INCAN, IPS, ARRN, private institutions	€14,000	€5,000	€9,000
1.4 CNEA capabilities updated, thanks to a calibration bench for dosimeters and sources for the purposes of radiotherapy	2023 - 2024	CNEA	€37,000	€5,000	€32,000
1.5 Human resources for authorization, inspection and enforcement strengthened		ARRN	20,000	4,000	16,000
2.6 Capacities to control irradiators, radioactive material of natural origin in food, and non-destructive testing (NDT) strengthened (2023)	2024-2025	ARRN	40,000	0	40,000
2.1National Environmental Radiation Monitoring Network fully equipped	2023 – 2024	ARRN/FIUNA/FCQ	€45,000	€15,000	€30,000
2.2 Staff trained in measurement and assessment for more agile emergency response	2023-2024	Ministry of National Defence — CONAPREB (21 institutions	€18,000	12,000	€6,000

3. RESULTS MATRIX

Nuclear and Radiation Safety (See appendix 7 for a clearer formulation of base line and assumptions)

2.3 National radiological emergency plan (PLAN RER) updated	2023 – 2024	Ministry of Defence, CONAPREB, ARRN.	10,000	4000	6000

Nuclear and Radiation Safety Subtotals		
Approximate Cost in € (A)	**Estimated resources available in € (B)**	**Resources to be identified/mobilised in € (A-B)**
€115,000	**€30,000**	**€85,000**

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Food and agriculture (See appendix 7 for a clearer formulation of base line and assumptions)

Food and Agriculture Outcome[s]	Baseline	Indicator	Means of Verification	Assumptions/risks
1.National capacities created for the use of gamma irradiation technology in services required for the country's agriculture and food security.	Outdated capabilities owing to the retirement of professionals trained in the 80s and 90s. Absence of physical and technological infrastructure	Irradiator installed and operating licence approved by ARRN (2023	Official report by MAG, the MSPBS, the Faculty of Veterinary Sciences (FCV), the FCQ and ARRN. National R&D programme reports. Publications presented at international conferences.	Limited capacity of the State to hire new technical staff
2.National capacities strengthened for the conservation of productively superior animal germplasm in livestock.	Growing market demand for quality food production	Gene bank installed and in operation.	Official report from the competent body. Publications presented at international conferences	Limited transfers of Treasury resources
3. National capacities further enhanced on the use of fallout radionuclides for addressing soil erosion and land degradation.	Soil erosion and poor nutrient and water management	Increasing the acreage of land under no tillage land management	National agricultural statistics on land use and management	Limited resources of large scale agricultural enterprises
4. National food safety capabilities strengthened.	Functional and accredited laboratories strengthened; High competent analysts improved; operational hazard surveillance programmes implemented	Number of functional and accredited laboratories; number of analysts trained; number of surveillance programmes implemented	Reports from SENACSA and , SENAVE	Availability of financial resources of the laboratories and technical staff concerned.

Indicative Outputs	Indicative Timeframe (Future TC cycle)	Relevant national counterpart(s)/ institute(s)	Approximate Cost in € (A)	Estimated resources* available in € (B)	Resources to be identified/mobilised in € (A-B=C)
1.1 Staff trained in the use of radio mutagenesis and associated biotechnologies .	2023 – 2024	MAG SENAVE	€1,200,000	€450,000	€750,000

1.2 Established mutation induction and selection protocols for seed and vegetative crops and the development of improved plant germplasm for major crops of the country.	2023-2024	MSPBS -INAM	15,000	3,000	12,000
1.3 Updated national regulations related to the detection of radioactivity in food and its handling and consumption.	2023 – 2024	INAM, UNA: FCQ and FCV	20,000	5,000	15,000
1.4 Staff trained in the use of integrated pest management including the sterile insect technique for the control and prevention of fruit fly pests.	2024-2025	MAG SENAVE	€40,000	5,000	55,000
1.5 Staff from the veterinary services trained in the use of integrated pest management including the SIT for the control of the NWS (2023).	2023-2024	MAG SENACSA	€50,000	5,000	45,000
1.6 Licensing of the civil and technological infrastructure for irradiation.	2023 – 2024	ARRN	€50,000	€0	€50,000
2.1 Professionals and technicians trained in process-related to nuclear technologies to enhance food production and support post-harvest safety and quality	2023 – 2024	UNA — FCV MAG-SENACSA	€122,000	€22,000	€100,000
3.1 Staff trained on the analysis of fallout radionuclides (caesium-137, lead-210 and beryllium-7) techniques and compound specific stable isotopes (CSSI) to measure the extend of short and long-term erosion and their sources.	2024 - 2025	MAG SENACSA	€50,000	6,000	44,000
3.2 Staff trained in resampling techniques to apportion erosion due to natural occurring or anthropogenic processes.	2024- 2025	MAG SENACSA	€20,000	4,000	16,000

3.3 Laboratory equipped with needed facilities for the above studies (e.g. gamma detector, gamma ray sensor).	MAG SENACSA	€200,000	15,000	185,000
4.1 National laboratories infrastructure strengthened, analysis capacities improved and operational hazard surveillance programmes implemented.	SENACSA and , SENAVE	165,000	0	165000

Food and Agriculture Subtotals		
Approximate Cost in € (A)	**Estimated resources* available in €** (B)	**Resources to be identified/mobilised in €** (A-B)
€1,350,000	**€450,000**	**€900,000**

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Health and nutrition (See appendix 7 for a clearer formulation of base line and assumptions)

Health and Nutrition Outcome[s]	Baseline	Indicator	Means of Verification	Assumptions/risks
1.Infrastructure for the diagnosis and treatment of cancer patients in Paraguay improved and updated.	Growing demand from the sector. Absence of physical and technological infrastructure	Hybrid studies conducted on 10% of patients undergoing radiotherapy (2024). IPS staff trained in latest technologies in nuclear medicine (2024). Specialized equipment acquired for the IPS (2026). Diagnostics and treatment conducted at IPS facilities (2026).	Ministry of Public Health and Social Welfare (INCAN) report. IPS reports.	Insufficient staff for the sector.
2.National capacities created in the use of the sterile insect technique (SIT) to control Aedes aegypti and other vectors	Recurrent dengue epidemics with high cost to public health. 177 000 cases were reported in 2019.	Specialized equipment acquired and put into operation (2024).	Joint Report of the Ministry of Health (SENEPA) and the IICS. Documents presented at IAEA conferences.	Limited transfers of Treasury resources.
3.National capacities strengthened for the implementation of nutritional studies using nuclear techniques.	Limited baseline and uncertainties regarding nutritional health status Growing demand from local competent authorities and the academic and research sector. INAM has a laboratory for food analysis but with limited capacities to carry on analysis of emergent organic pollutants.	Nutritional studies (including detection of organic contaminants in food) conducted in at least two municipalities of Central and Asunción (2025).	INAN Ministry of Health report. Scientific publications.	Limited transfers of Treasury resources

Indicative Outputs	Indicative Timeframe (Future TC cycle)	Relevant national counterpart(s)/ institute(s)	Approximate Cost in € (A)	Estimated resources* available in € (B)	Resources to be identified/mobilised in € (A-B=C)
1.1 Comprehensive cancer control services implemented in Asunción	2023- 2025	INCAN-IPS	€800,000	€100,000	€700,000
1.2 Staff trained in hybrid techniques.	2023 – 2025	IPS	180.000	60.000	120.000
1.3 Equipment acquired and a Nuclear Medicine Service with hybrid technology operating	2024 - 2025	IPS	1,400,000	200,000	1,200,000
1.4 Comprehensive cancer diagnosis and treatment services implemented at IPS.	2025 – 2026	IPS	800,000	200,000	600,000
2.1. Staff trained in SIT techniques	2024 – 2025	IPS, SENEPA, IICS	150,000	15,000	135,000
2.2 Technological capacities available in specialized laboratory for sample analysis	2024 – 2025	SENEPA, IICS, IPS	80,000	10,000	70,000
2.3 Laboratory in operation with sterile insect production capabilities for application in urban and rural areas with high levels of mosquito infestation (2025).	2024 -2025	SENEPA, IICS, IPS	€1,100,000	€250,000	€850,000
3.1 Methodology for body composition studies has been standardized and standards obtained for infants and children (2025).	2024 -2025	INAN	€25,000	2,500	€22,500

3.2 Technological infrastructure of laboratories strengthened and human resources trained for nutritional analysis and to detect and control organic contaminants in food (2025).	2024 -2025	INAN	90,000	80,000	10,000

Health and Nutrition Subtotals		
Approximate Cost in € (A)	Estimated resources* available in € (B)	Resources to be identified/mobilised in € (A-B)
€5,250,000	**€1,250,000**	**€4,000,000**

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Water and the environment (See appendix 7 for a clearer formulation of base line and assumptions)

Water and Environment Outcome[s]	Baseline	Indicator	Means of Verification	Assumptions/risks
Infrastructure for the use of nuclear technologies in the analysis of environmental samples in Paraguay improved	Growing demand from competent authorities and the academic and research sector. MADES has a laboratory of carbon analysis but with limited capacities to carry on carbon fixation studies. Insufficient technological capacities for the determination of GHG emission factors in the sectors of transport, agriculture, etc. Limited critical mass of technicians for the analysis of the environment and of forest and agricultural soils, which impedes decision making on climate change adaptation policies	50% increase of the national research in water, and soil quality using analytical techniques in the laboratories of CNEA (XRF), FCQ (INAA, inductively coupled plasma, AAS), and MADES (2023). Specialized equipment acquired and in operation (2023). Environmental studies conducted on the soils of the Cerrado, Chaco-Pantanal and Gran Chaco forests, of Misiones and of the Alto Paraná Atlantic forests. (2024)	Reports by CNEA, FCQ, FIUNA, MADES and CONACYT. Publications in international scientific journals	Limited transfers of Treasury resources.
2.National capacities created for environmental licensing and monitoring of facilities with irradiators and radioactive sources and of the uranium mining industry.	MADES - Directorate of Environmental Assessment and Quality Control lack of technical staff with insufficient skills and capabilities to carry on its responsibilities in licensing radiological facilities. Lack of Generic Terms of Reference for construction, operation and dismantling of facilities with irradiators and radioactive sources	Training of the evaluators of the Directorate of Environmental Assessment and of Environmental Quality Control. Generic terms of reference updated for the construction, operation and dismantling of facilities with irradiators and radioactive sources. Strengthening of the technological infrastructure of the MADES Directorate of Environmental	*MADES report.* *MADES resolution on approval of the generic terms of reference.* *Annual report on the results of the inspections carried out by the MADES Environmental Monitoring Directorate.*	Limited transfers of Treasury resources.

	Lack of basic portable equipment for detection of alpha, beta and gamma emissions	Assessment and of Environmental Quality Control.			
Indicative Outputs	**Indicative Timeframe** (Future TC cycle)	**Relevant national counterpart(s)/ institute(s)**	**Approximate Cost** in € (A)	**Estimated resources available in €** (B)	**Resources to be identified/mobilised** in € (A-B=C)
1.1 CNEA and FCQ laboratories for XRF analysis and INAA upgraded.	2023 – 2024	FCQ, CNEA	€2,450,000	€450,000	€2,000,000
1.2 Laboratory staff trained in nuclear analytical techniques (XRF, INAA, Analysis)	2023 – 2024	CNEA, MADES	140,000	120,000	20,000
1.3 Upgraded specialized environmental laboratories of the MADES - Soil Laboratory.	2023 – 2024	MADES	450,000	30,000	420,000
1.4 Map of the carbon and nutrient content in soils of the main ecoregions of Paraguay published; and emission factors of fuels of different sectors transport, agriculture, biomass, published.	2024 -2025	MADES	20,000	2,000	18,000
2.1 Staff trained in environmental licensing procedures	2023-2024	MADES	€25,000	19,000	€6,000
2.2 Protocol of licencing Facilities under Law No. 294/92 on environmental impact assessment	2023 – 2024	MADES	12,000	10,000	2,000
2.3 Portable equipment for environmental monitoring for licensing facilities	2023 - 2024	MADES	40,000	30,000	10,000

Water and Environment Subtotals		
Approximate Cost in € (A)	Estimated resources* available in € (B)	Resources to be identified/mobilised in € (A-B)
€2,925,000	**€450,000**	**€2,475,000**

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Energy and industry (See appendix 7 for a clearer formulation of base line and assumptions)

Energy and Industry Outcome[s]	Baseline	Indicator	Means of Verification	Assumptions/risks
1.Updated national capacities to use NDT	FIUNA technical and laboratory staff 'out of date' High demand for services	NDT equipment installed and operating licence approved by the ARRN (2023)	Six-monthly and annual FIUNA and ARRN reports	Limited transfers of Treasury resources
2.National capacities created through knowledge of Paraguay's uranium potential	Market demand. Preliminary studies with favourable results in Yuty	Studies carried out to determine the uranium potential in the eastern region (2023). Certification of the uranium deposit in Yuty (2023).	Report by the VMME	Limited recruitment of professionals in the sector
3. Updated capacities to evaluate the inclusion of nuclear energy in the energy matrix of the country	Lack of knowledge of the benefits and challenges posed by a State that resorts to the nuclear power option	Training of the members of the Energy Committee of the Executive Branch (2024)	*Joint reports by MADES and the VMME. FIUNA resolution on the creation of the Chair in Nuclear Technology with the academic curriculum.* *FIUNA reports on the performance of the Chair.*	Limited recruitment of professionals in the sector

Indicative Outputs	Indicative Timeframe (Future TC cycle)	Relevant national counterpart(s)/ institute(s)	Approximate Cost in € (A)	Estimated resources* available in € (B)	Resources to be identified/mobilised in € (A-B=C)
1.1Analytical and processing capacities of FIUNA NDT specialized laboratories strengthened	2023 – 2024	FIUNA — private sector — ARRN	€770,000	€40,000	€730,000

1.2 Staff trained in NDT techniques	2023 – 2024	FIUNA — private sector — ARRN	100,000	14,000	86,000
1.3 NDT analyses carried out in small-, medium- and large-scale metallurgical enterprises in Paraguay made known	2024 – 2025	FIUNA — private sector	20,000	2,000	18,000
2.1. Staff trained in techniques for determining uranium potential	2023 – 2024	VMME, FACEN, MRE	€395,000	€40,000	€355,000
2.2 Results of the analysis of uranium ore samples from the eastern region of Paraguay (includes sampling & monitoring).	2023 – 2024	VMME, FACEN, MRE	30,000	5.000	25,000
3.1Determination of the country's electricity generation needs (by region) after 2030.	2023 – 2024	VMME, MADES, MRE FIUNA	€18,000	12,000	€16,000
3.2Staff trained in the advantages of the use of nuclear energy	2023 – 2024	VMME, MADES, MRE FIUNA	20,000	15,000	5,000
3.3 Creation of the Chair in Nuclear Technology in the UNA Faculty of Engineering	2023 – 2024	VMME, MADES, MRE FIUNA	5,000	1,000	4,000

Energy and Industry Subtotals		
Approximate Cost in € (A)	Estimated resources' available in € (B)	Resources to be identified/mobilised in € (A-B)
€571,000	**€80,000**	**€491,000**

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3.1. Resources Summary Table

Thematic Area	Approximate Cost in € (A)	Estimated resources* available in € (B)	Resources to be identified/mobilised in € (A-B)
Nuclear and Radiation Safety	€115,000	€30,000	€85,000
Food and agriculture	€1,350,000	€450,000	€900,000
Health and nutrition	€5,250,000	€1,250,000	€4,000,000
Water and the environment	€2,925,000	€450,000	€2,475,000
Industry and Energy	€571,000	€80,000	€491,000

Total estimated overall cost for CPF	Total estimated resources* available for CPF	Total resources to be identified/mobilised
€10,211,000	**€2,260,000**	**€7,951,000**
Estimated government cost sharing (included in the above total of resources* available -B)		**€2,310,000**
Other estimated extrabudgetary contributions from donors/partners who have expressed interest (included in the above total of resources* available - B)		**€0**
Estimated in-kind contributions from the Government and other partners/donors that have expressed interest (included in the above total of resources available - B)**		**€0**

(*)-The above stated figures are indicative. Signing of the CPF does not commit to funding of the CPF implementation by the Member State or the IAEA, nor does it suggest the expectation of continued levels of Agency funding. The main purpose is to assist planning and prioritization of the Country Programme Framework.

(**)-This estimate should reflect the total estimated value (in Euros) of in-kind contributions provided by the Member State to carry out the planned programme (in-kind examples: time of staff, infrastructure, materials, equipment, repairs, construction work, sampling costs, shipment costs, etc.)

4. Programme Implementation and Support

4.1 CPF Coordination

The preparation of this CPF started in January 2019 and was coordinated and monitored by the VMME, as the lead authority on Paraguay's energy policy, with the support of the CNEA as the institution promoting the applications of nuclear energy in different areas of sustainable development.

The Directorate of International Cooperation of the Ministry of Foreign Affairs of Paraguay also assisted with this document. The following institutions were consulted:

- MSPBS (INCAN, SENEPA, INAM)
- MOPC — VMME
- Ministry of Foreign Affairs (DOI, DGAE, UGRE, Directorate of International Cooperation)
- CODENA Permanent Secretariat
- Ministry of the Interior and National Police, Ministry of National Defence (CONAPRELAB)
- Ministry of Agriculture and Livestock — SENAVE, SENACSA
- MADES
- ARRN
- IPS
- UNA: DGICT, CNEA, CEMIT, IICS, FIUNA, FCQ, FCV and FACEN

Ministerial office-holders will identify and nominate focal persons in the relevant ministries such as health, energy, agriculture and environment, and the CODENA Permanent Secretariat. MADES has appointed a national climate change focal point. The same procedure will be followed for the institutes and laboratories listed in the Results Matrix participating in the preparation process. All stakeholders involved in the development of the CPF and the relevant senior managers of the focal persons were kept informed to ensure ownership.

4.2 Future Review of CPF

Progress assessments under this CPF will be ongoing throughout the lifetime of this CPF and will be conducted shortly before the end of each TC programme cycle. The knowledge gained from the review of the CPF will serve to better inform the formulation of new project proposals for the following TC programme cycle. During the review consideration will be given to evolving development priorities at the national level, including the consideration of any significant changes (positive or negative) that have affected the programme.

Owing to the fact that the CPF will expire in 2028 and some of the listed policy documents that have been taken into account for the development of the CPF will expire before the completion

of the CPF, their successor editions will be reviewed and incorporated, as appropriate, during the CPF mid-term review process in 2023.

The review will be led by the Programme Management Officer for Paraguay at the IAEA's Department of Technical Cooperation and the lead authority on Paraguay's energy policy. The final review and update towards the following CPF will be made at the latest in 2027, one year before the expiration of this CPF.

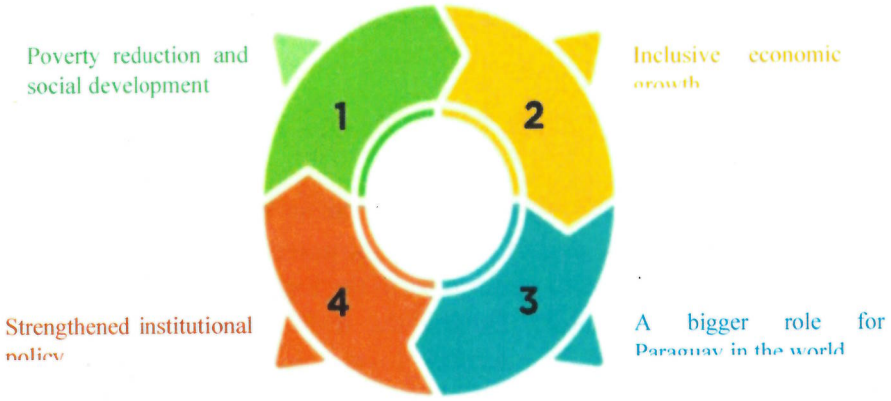
4.3 Partner Coordination

Programme framework for national development: 2030 Agenda for Sustainable Development and the 17 SDGs

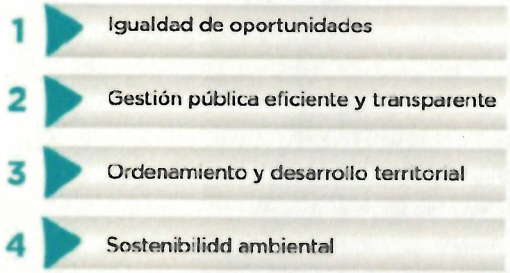
In late 2014, by Decree No. 2794, the Government approved the 'Paraguay 2030' National Development Plan (PND2030), following a national-level consultation process involving over 2000 stakeholders from central Government, subnational administrations, civil society, the private sector and academia; consultations were held in 10 Paraguayan departments. In 2015, following eight rounds of intergovernmental negotiations with a wide variety of stakeholders, the 2030 Agenda for Sustainable Development and the 17 SDGs were launched. The PND2030 document was updated in March 2020; the changes are reflected in this CPF.

Most of the goals of the two documents are directly or indirectly linked. The PND2030 has four axes: poverty reduction and social development; inclusive economic growth; strengthened institutional policy; and a bigger role for Paraguay in the world. It also has four cross-cutting strands: equality of opportunity; efficient and transparent public administration; land use and territorial development; and environmental sustainability.

The axes of the strategy. Public policies will concentrate on four major strategic axes in order to build the Paraguay of 2030:

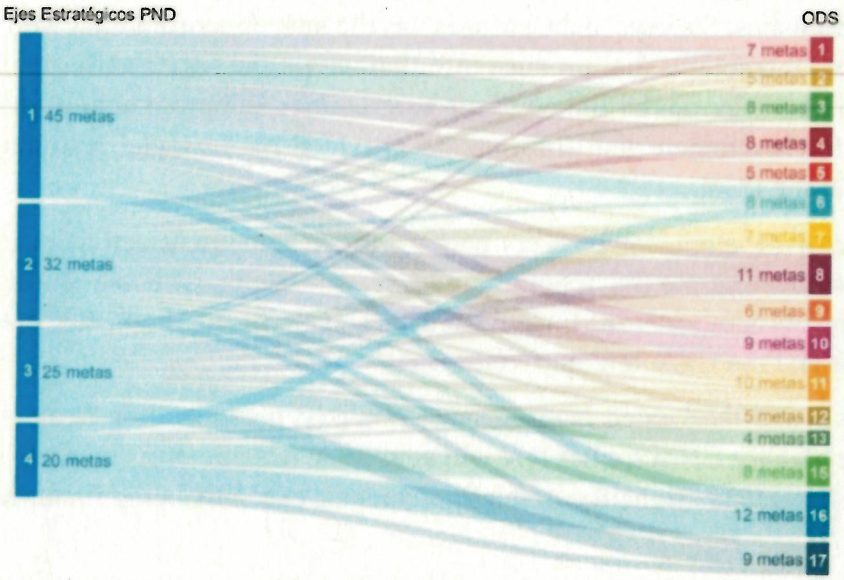


Each strategic axis will incorporate four cross-cutting strands



The four strategic axes multiplied by the four cross-cutting strands produces 16 strategic objectives to guide public policies in order to build the Paraguay of 2030.

Vinculacion PND 2030 con los ODS



The PND2030 participatory process reflects important areas of social consensus in Paraguay that are in line with the SDGs. The Results-Based Planning System is the main instrument for implementing [illegible] orth noting the efforts m[illegible]n the National Expenditure Budget (PGN) with the PND2030 and the SDGs. Just as the 2030 Agenda contains a human rights approach, the PND2030 also prioritizes human rights in a holistic and cross-cutting fashion.

An important step in terms of institutional arrangements was the creation of the Interinstitutional Commission for Coordination to Implement, Follow up and Monitor the International Commitments of Paraguay under the United Nations Sustainable Development Goals. It is coordinated by the Ministry of Foreign Affairs and consists of a representative of the Ministry of Finance, the Technical Secretariat for Economic and Social Development Planning and the Social Cabinet of the Presidency of the Republic.

Signature of agreements with civil society at the Ministry of Foreign Affairs (16 September 2019)

The General Directorate of Statistics, Surveys and Censuses has the task of coordinating work to put together indicators with institutions that produce information via the SIGOB (Systems for Governance) platform. The SDGs can be linked to all programmes, subprogrammes and projects implemented by the Government and information provided on financial resource allocation for the SDGs under the PGN.

The main donor countries and development partners helping for development activities in Paraguay in relation to implementing the TC programme as set out in this CPF are among others, the Andean Development Corporation, Inter-American Development Bank, the EU, Japan, the Republic of Korea and the USA, and the World Bank.

The Government of Paraguay and the United Nations have finalized a cooperation strategy with a view to setting out the plan for UN activities that will contribute to achieving Paraguay's priority objectives under the PND2030. Signature of this agreement is currently being finalized by each agency in Paraguay.

To implement the programme proposed by this CPF, the following key partners have been identified at national level, i.e., within central Government:

Ministry of Public Health

- IPS
- Ministry of Agriculture and Livestock
- Ministry of Mines and Energy
- Ministry of Foreign Affairs
- Ministry of Agriculture and Livestock (Vice-Ministry of Livestock)
- MADES
- Ministry of National Defence (CONAPRELAB)
- CODENA Permanent Secretariat
- ARRN
- VMME

Planned projects will be implemented at:

- INCAN, National Centre for Burns and SENEPA
- IPTA
- National Plant Health Service and SENACSA
- MADES
- UNA: CNEA, IICS, CEMIT and academic departments FIUNA, FACEN, FCQ and FCV

ANNEX 1: PARTNERSHIP MATRIX

Thematic Area	Outcome in National_Plan or Sector Strategy	CPF Outcomes	Links with SDGs	Links with UNDAF Outcomes	Relevant Partners
Food and Agriculture	Specific objective 2: Create the conditions for competitiveness and innovation. Specific objective 2.2.2: Improve the competitiveness of family agriculture and its integration into national and international markets. Specific objective 2.2.3: Strengthen universities in the field of research and outreach. Specific objective 2.2.4: Achieve and maintain an average economic growth rate that is conducive to sustainable and inclusive development Specific objective 2.2.5: Improve the safety/quality of food stuff for local consumption and export	1.National capacities created for the use of gamma irradiation technology in services required for the country's agriculture and food security. 2.National capacities strengthened for the conservation of productively superior animal germplasm in livestock. 3. National capacities further enhanced on the use of fallout radionuclides for addressing soil erosion and land degradation. 4. National food safety capabilities strengthened.	SDG 1: No Poverty SDG 2: Eradication of Hunger SDG 3: Good Health and Well-Being SDG 4: Quality Education SDG 8: Decent Work and Economic Growth SDG 9: Industry, Innovation and Infrastructure SDG 12: Responsible Consumption and Production SGDs 1, 2 and 3	1) Sustainable and Inclusive Economic Growth; 2) Social Development;	National: Ministry of Agriculture IPTA, SENACSA SENAVE IICS–UNA Ministry of Public Health and Welfare INAM FCQ–UNA International: FAO OIE EU JICA JBIC IDB

Thematic Area	Outcome in National_Plan or Sector Strategy	CPF Outcomes	Links with SDGs	Links with UNDAF Outcomes	Relevant Partners
Health and nutrition	Specific objective 1.1: Achieve equitable social development.	1. Infrastructure for the diagnosis and treatment of cancer patients in Paraguay improved and updated.	SDG 1: No Poverty SDG 2: Eradication of Hunger	1) Sustainable and Inclusive Economic Growth; 2) Social Development;	National: Ministry of Public Health IPS INCAN
	Specific objective 1.1.8: Reduce the prevalence of AIDS, tuberculosis, neglected tropical diseases and hepatitis.	2. National capacities created in the use of the sterile insect technique (SIT) to control *Aedes aegypti* and other vectors.	SDG 3: Good Health and Well-Being SDG 12: Responsible Consumption and Production		Ministry of Agriculture SENEPA SENACSA
	Specific objective 1.3: Provide quality social services.				IICS–UNA FCV–UNA
	Specific objective 1.2.3: Decrease premature deaths from non-communicable diseases, promote wellness and mental health.	3. National capacities strengthened for the implementation of nutritional studies using nuclear techniques.			International: PAHO OIE

Water and the environment	2.3.- Expand the regionalization and diversification of production[9]. 2.4.- Enhance environmental capital. Promotion of the environment as an economic and cultural heritage asset within the framework of a sustainable economy. Specific objective 2.4.2: Stimulate the market for environmental service certificates. Specific objective 2.1 Promote employment and social security Specific objective 2.3.4: Increase the contribution of mining to the gross domestic product Specific objective 2.1.2: Step up participation in high quality vocational technical education and training, focusing on younger and vulnerable people	1. Infrastructure for the use of nuclear technologies in the analysis of environmental samples in Paraguay improved. 2. National capacities created for the use of nuclear analytical techniques. 3. National capacities created for environmental licensing and monitoring of facilities with irradiators and radioactive sources and of the uranium mining industry. 4. National capacities improved for the determination of carbon content in agricultural, forest and pasture soils.	SDG 3: Good Health and Well-Being SDG 4: Quality Education SDG 5: Gender Equality SDG 6: Clean Water and Sanitation SDG 11: Sustainable Cities and Communities SDG 12: Responsible Consumption and Production SDG 13: Climate Action SDG 15: Life on Land	1) Sustainable and Inclusive Economic Growth; 2) Social Development;	National: Ministry of Environment and Sustainable Development Vice-Ministry of Mines and Energy *International:* Republic of Korea *Green Fund*

Thematic Area	Outcome in National_Plan or Sector Strategy	CPF Outcomes	Links with SDGs	Links with UNDAF Outcomes	Relevant Partners
Energy and industry	Specific objective 2.4.3: Increase the share of electricity consumption for industrial use. Specific objective 2.2.8: Consolidate a multimodal transport network for efficient logistics Specific objective 2.4.4: Increase the generation of alternative renewable energies (solar, wind and biogas, small hydroelectric power plants, etc.).	Updated national capacities to use NDT	SDG 1: No poverty SDG 4: Quality education SDG 8: Decent work and economic growth SDG 9: Industry and innovation	1) Sustainable and Inclusive Economic Growth; 2) Social Development;	*National:* Faculty of Engineering Ministry of Industry and Commerce Centre for Metallurgical Industries

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[9] **Climate change**. In 2015, Paraguay presented its commitments to reduce greenhouse gases through nationally determined contributions until 2030. These commitments are being updated with the most recent data obtained in the Third National Communication and the Second Biennial Update Report. The emissions reduction target is 20% for the 2000–2030 period, of which 10% is conditional on international cooperation in terms of financing, technology transfer and capacity building. Recently, in 2017, Paraguay prepared the National Climate Change Mitigation Plan and action plans.

The Plan covers ten Main Strategic Lines and five Transversal Strategic Lines.

The Main Strategic Lines addressed are: Optimization of the Sustainable Use of Biomass; Diversification of the Energy Matrix and Energy Efficiency; Sustainable Renewable Energies; Clean Technologies; Fuel Quality; Biofuels; Improvement of the Public Transport System; Forestry Plantations; Silvicultural and Agricultural Practices and Waste Management.

Meanwhile, the Transversal Strategic Lines include: Socialization and Education; Institutional Strengthening and Gender Focus.

ANNEX 2: LIST OF PARTICIPATING INSTITUTIONS

Lead authority on energy policy. - Ministry of Public Works and Communications (MOPC) — Vice-Ministry of Mines and Energy (VMME): Article 25 of the Organic Law of the MOPC No. 167/93, on the establishment of the Cabinet of the VMME, defines its functions as lead authority on energy policy and alternate national liaison for IAEA TC programmes.

Authority promoting the peaceful applications of nuclear energy. - National Atomic Energy Commission (CNEA): In order to promote nuclear technology and monitor (regulate) the peaceful use of ionizing radiation, the CNEA was established by Act No. 1081/65 of the Executive. Article 34 of Act No. 5.169 stipulates that the CNEA has ceased to exercise a regulatory function and has acquired the role of **promoting nuclear technology, training staff and conducting research in the regulated area (radiation** protection).

Regulatory authority for the peaceful applications of nuclear energy. - Radiological and Nuclear Regulatory Authority (ARRN): Established by Act No. 5169/2014 as an autonomous body responsible for regulation and control to ensure the safe use of ionizing radiation in Paraguay, and to protect the public and the environment from the damage that can be caused by its misuse.

General Directorate of Scientific and Technological Research (DGICT): It conducts coordination and research at the UNA. It is the ARCAL national coordinator. The DGICT, in turn, supervises the CNEA, the Health Science Research Institute (IICS) and the Multidisciplinary Scientific and Technological Research Centre (CEMIT).

Body responsible for nuclear safety. - The **National Defence Council (CODENA)** is the supreme authority responsible for drawing up the National Defence Policy and coordinating its implementation by the State authorities with that task. It published the National Defence Policy in 2019, incorporating the security of radioactive material and of facilities holding such material into the Policy's approach and management strategy.

Body responsible for radiological emergency response. - Ministry of National Defence — National Commission for Prevention of and Response to Biological Emergencies (CONAPREB): Established by Decree No. 20.997/2003. CONAPREB heads a group of 21 public and private institutions. Efforts are configured by means of coordination among these organizations, and each participant has responsibilities or capacities that are particular to the different types of potential emergency that may occur and are specified in the Organization and Functions Manual.

Institutions involved in nuclear energy applications

National University of Asunción (UNA) — academic departments. Faculty of Exact and Natural Sciences (FACEN)

Within the framework of the development of the natural and exact sciences, FACEN has turned its attention to the use and promotion of the applications of ionizing radiation in medicine, research and radiation protection. FACEN has three priorities: providing quality control services for radiodiagnostic equipment; disseminating nuclear science; and conducting research into radiotherapy and nuclear medicine.

UNA — academic departments.

Faculty of Chemical Sciences (FCQ): offers teaching and research at its Department of Nuclear Techniques established in 2010. The FCQ has participated as a counterpart in a number of ARCAL projects in areas such as the environment and food security via the Department of Nutritional Biochemistry; the Department of Nuclear Techniques conducts neutron activation analysis, principally to determine Si, Al, Cu, Fe, Mn, Na, I, V, Mg and Ba.

Faculty of Engineering — UNA (FIUNA): FIUNA offers seven undergraduate courses — including electronic, electromechanic, mechatronic, civil, industrial, and geographic and environmental engineering — and a number of master's programmes. It runs a joint programme with Supélec in Paris to develop a doctorate course, and another programme with the Federal University of Rio Grande do Sul for a doctorate in water resources engineering. In the early 1980s, it established an NDT laboratory with X-ray sources, providing services to the private sector and conducting training in metallurgy and electromechanics. Additionally, it has carried out research with the University of Antwerp into heavy metals found in sediments of the Paraguay River.

Health Science Research Institute (IICS): Teaching and training of professionals, technical advisory services, provision of materials, instruments and equipment, and support related to radiation safety and quality assurance via the Programme of Action for Cancer Therapy. Upgrading the IICS/UNA nuclear medicine service building to incorporate PET/CT (the institution currently has SPECT/CT technology). The radiopharmaceutical laboratory is currently categorized at operational level 2b for handling ^{99}Tc-labelled radiopharmaceuticals.

Multidisciplinary Scientific and Technological Research Centre (CEMIT–UNA):

In 2010, CEMIT began researching the application of nuclear technology in agriculture by participating in project RLA5056 to induce variability in economically significant crops so as to address climate change (biotic and abiotic stress). The institution is currently conducting R&D projects to produce mutant varieties of both commercial and indigenous crops. Work is also under way to optimize water resources by making use of nitrogen and hydrogen isotopes. CEMIT possesses two analytical atomic absorption devices to detect and quantify heavy metals in various materials (water, sediment, food). It also has a liquid scintillation device on its premises and an FTIR to identify and quantify isotopes.

Challenges

- Water quality: Upgrade the laboratory to perform isotopic characterization of the entire country's water resources and establish a stable monitoring network.
- Air quality: Strengthen capacities in air quality control.
- Equip laboratories with, and conduct training on, gas chromatography with tandem mass detector.
- Establish a stable monitoring network throughout the country.

Assets:

- Atomic absorption device
- Liquid chromatograph with mass detector
- HPLC with various detectors
- UPLC MS/MS

- ELISA
- FTIR
- Scintillation detector (managed under PAR9006)
- Staff trained in the above techniques.

Projects: RLA6079, RLA5064, PAR9006

CNEA

It has three departments

Laboratory Services Department

Research Management Department

Radiation Protection Promotion and Training Department

Five laboratories

External and internal dosimetry

Isotope hydrology

X-ray fluorescence

Radionuclides in food

Technical services

Temporary store for disused sources

Needs

- Secondary standards calibration laboratory: to be covered in part under PAR9007 and the 2020–2021 cycle

- Support for incorporating lens dosimetry and patient dosimetry
- Strengthening technical services, primarily quality control and area monitoring
- Projects with participation: Radiation safety and protection: PAR9006, PAR9007, RLA9075, RLA9078, RLA9085.
- Knowledge management and promotion: RLA062, RLA0057

Ministry of Agriculture and Livestock (MAG): Its responsibilities include two institutions working on improving the quality of agricultural output: the National Plant and Seed Quality and Health Service (SENAVE) and the National Animal Health Service (SENACSA).

National Plant and Seed Quality and Health Service (SENAVE): Created by Act No. 2459 of 4 October 2004. SENAVE is an autonomous body established to support the State's agricultural production policy, contributing to a more competitive, sustainable and equitable agricultural sector by improving the quality, phytosanitary health and genetic purity of production resources and preventing them from affecting people, animals, plants and the environment, ensuring that they are safe. It is the body responsible for the implementation of international conventions and agreements to which Paraguay is a State party that relate to plant quality and health, seeds and the protection of plant varieties, and plant species produced using biotechnology.

SENAVE carries out control functions by granting or cancelling import registrations of companies involved in the production or import of agrochemicals; it registers and cancels the inscription of seeds; it certifies the quality and health of natural, organic and conventional plant products and subproducts and seeds. It registers, licenses and monitors natural or legal persons and public or private persons responsible for certifying organic plant products. It also registers, monitors and audits accredited laboratories, warehouses and means of transport for pesticides

National Animal Health Service (SENACSA): Its mission is to support the national livestock policy, contributing to a more competitive, sustainable and equitable agricultural sector by promoting productivity growth through the protection, maintenance and improvement of animal health, preventing the emergence of zoonoses and promoting the quality and safety of animal products and subproducts. The Public Veterinary Service seeks to be efficient, reliable, and transparent, ensuring animal health and the safety of its products. SENACSA possesses a complex of high quality laboratories where testing is performed to ensure that products, foodstuffs and other consumables are fit to be used in all cases. During the COVID-19 crisis, the SENACSA laboratories have been instrumental in aiding the National Health System in the early detection of cases of coronavirus among the population.

Its strategic objectives are as follows: Maintain and gain access to new markets, offer efficient, uniform and stable services, ensure animal health and veterinary public health, manage innovation and technology, promote the development of human talent and optimize the availability of financial resources.

SENACSA possesses a complex of high-quality laboratories where testing is performed to ensure that products, foodstuffs and other consumables are fit to be used in all cases.

Laboratory complex NSB3A–NB4OIE: This laboratory is designated as Biosafety Level 3A and is equipped with high-tech instruments that make it possible to carry out laboratory control tests efficiently and effectively while reducing or eliminating exposure to potentially hazardous biological agents for the staff involved, other persons and the external environment.

As part of primary containment, work is carried out on the basis of rigorous safety procedures that provide protection to staff and of close adherence to good laboratory practices and biosafety.

In addition, as secondary containment, the design and location of the building allow staff to carry out their activities in a safe environment. During the COVID-19 crisis, the SENACSA laboratories have been instrumental in aiding the National Health System in the early detection of cases of coronavirus among the population.

Laboratory controls	
National Programme for Microbiological Control in Cold-Storage Facilities • Enterobacteriaceae • Salmonella • Escherichia coli • Aerobic mesophilic counts • Control of pathogens in food (salmonella, listeria monocytogenes, E.coli 0157 H7, shigella, staphylococcus aureus)	**Vaccine control** • Foot-and-mouth disease • Newcastle disease • Rabies • Brucellosis • Botulism • Clostridiosis • Anthrax • Leptospirosis
National Food ResidueProgrammeResidue • Antibiotics/ antimicrobials • Antiparasitics • Hormones	**Antigen production** • Equine infectious anaemia • Brucellosis • Bovine leukosis

• Pesticides • Other pollutants	• Leptospirosis • Bovine Tuberculin PPD • Newcastle disease
Veterinary diagnosis • Reproductive diseases (leptospirosis, campylobacteriosis, trichomonosis) • Parasitic diseases • Deficiency diseases • Bovine diseases (botulism, listeriosis, leucosis, anthrax, clostridiosis, mastitis, metritis) • Goat diseases (arthritis and encephalitis) • Swine diseases (porcine reproductive and respiratory syndrome, Aujeszky's disease, cysticercosis, trichinellosis, erysipelas) • Avian diseases (salmonellosis, colibacillosis) • Equine diseases (equine infectious anaemia, contagious equine metritis)	**Veterinary product control** • Antiparasitics • Antibiotics • Reconstituents
Bromatology • Bromatology in food for human consumption • Bromatology in food for animal consumption • Detection of animal proteins in feed (Bovine Spongiform Encephalopathy Prevention Programme)	**Support areas** • Cell culture • Media preparation • Experimental animal room • Isolation station • Quality management • Biosafety

Institutions linked with Human Health and Nutrition

Ministry of Public Health and Social Welfare (MSPBS): The regulations governing the MSPBS place particular emphasis on the leading role of human and environmental health and social welfare and they outline its tasks as follows:

- It is the governing body for human and environmental health policy and social welfare policy.
- It is responsible for establishing and steering the policy, plans and programmes (National Cancer Control Programme) related to the prevention, detection and treatment of cancer.
- It is also responsible for establishing and steering the policy, plans and programmes related to the prevention, detection and treatment of diseases transmitted by vectors such as *Aedes aegypti* (dengue, chikungunya, etc.).
- It conducts monitoring to ensure that resources are being used in the intended way.

National Cancer Institute (INCAN): It implements the National Cancer Control Programme (PRONAC). Its mission is to design cost-effective cancer-related strategies to improve health, prevention, diagnosis, treatment, palliative care, and epidemiological monitoring and surveillance of the population with regard to cancer.

National Centre for Burns and Reconstructive Surgery (CENQUER): It is to have a tissue bank (skin, amniotic membrane, bones, tendons, cornea, heart valves) in order to improve the survival rate of patients with major burns and other related pathologies by means of temporary skin coverings.

National Malaria Eradication Service (SENEPA): Its principal aim is to prevent the re-emergence of malaria transmission throughout Paraguay by means of surveillance based on detection, diagnosis and rapid treatment by health networks, using an entomological monitoring and vector control system with comprehensive measures, in line with the national action plan for 2019–2021 following the elimination of malaria; SENEPA also has a programme to combat dengue and other vectors.

Social Security Institute (IPS): It is an integral part of the National Health System as an autonomous institution under public law and as such is governed by: the National Health Policy 2015–2030 approved by Executive Decree No. 4541-2015; Act No. 5189/14, which establishes the mandatory provision of information on the use of public resources for remuneration and other payments to public servants of the Republic of Paraguay; and Act No. 5282/2014 on free access by citizens to public information and government transparency. The Social Security Institute has 78 health care establishments, of which 41 have inpatient facilities. They provide all types of services to diagnose and treat various illnesses. This strategic approach requires the strengthening of capacities in the field of nuclear medicine in order to contribute to the national Government's efforts in the framework of PRONAC.

General Directorate of Scientific and Technological Research (DGICT): It conducts coordination and research at the UNA. It is the ARCAL national coordinator. The DGICT, in turn, supervises the CNEA, the IICS and CEMIT.

Health Science Research Institute (IICS): It pioneered the use of nuclear medicine in the country in the 1980s, with the support of the IAEA and bilaterally with Argentina. Since its implementation, the IICS nuclear medicine service has provided support to insolvent patients who visit the UNA Clinical Hospital and other institutions in and outside the country's capital, by conducting bone, thyroid, renal, and cardiological studies and radioactive iodine therapy for the treatment of thyroid cancer. The IICS is supported by researchers from the National Incentive Programme for Researchers (PRONII) and receives funding from CONACYT through the Paraguayan Programme for the Development of Science and Technology (PROCIENCIA). It is notable for being the centre for advanced research in the study of Chagas' disease, leishmaniasis and the Triatoma infestans parasite.

ANNEX 3: LEGAL FRAMEWORK AND IAEA-RELEVANT TREATIES

National Legal Framework

The National Constitution establishes citizens' rights and the State's obligations in various areas relating to the management of the sector:

Article 6 — Quality of life: Quality of life shall be promoted by the State through plans and policies that recognize conditioning factors, such as extreme poverty and the impediments of disability or of age. The State shall also promote research on population factors and their links with socioeconomic development, with the preservation of the environment and with the population's quality of life.

Article 7 — Right to a healthy environment: Everyone has the right to live in a healthy and ecologically balanced environment. The preservation, conservation, restoration and improvement of the environment, together with its reconciliation with all-round human development, are priority objectives that benefit society. These objectives shall guide the relevant legislation and government policy.

Article 8 — Environmental protection: The law shall regulate activities liable to produce environmental changes. Similarly, it may restrict or prohibit those activities that it qualifies as dangerous. The manufacture, assembly, importation, commercialization, possession or use of nuclear, chemical and biological weapons, and the introduction of toxic waste into the country, shall be prohibited. Ecological crime shall be defined and sanctioned by the law.

Article 68 — Right to health: The State shall protect and promote health as a fundamental right of persons and benefiting the community. No one shall be deprived of public assistance to prevent or treat illnesses, pests or diseases, or of aid in the case of disasters or accidents. All persons shall be required to submit themselves to the health measures established by law, within respect for human dignity.

Article 72 — Quality control: The State shall control the quality of food and chemical, pharmaceutical and biological products when they are produced, imported and commercialized. Similarly, it shall facilitate the access of sectors with scarce resources to medicines considered essential.

Organic Law of the Ministry of Public Works and Communications — VMME: No. 167/93, Article 25. Establishment of the Cabinet of the VMME, defines its functions as lead authority on energy policy.

Lead authority and environmental regulator — MADES. The objective of MADES is to design, establish, supervise, monitor and evaluate the national environmental policy in order to ensure that the right to a healthy environment and environmental protection is pursued nationwide.

Legal framework: Act No. 1561 establishing the Secretariat of the Environment and its amendment establishing MADES.

Act No. 294-93 on Environmental Impact Assessment and its regulatory decrees.

Act No. 5211/14 sets out the objective of protecting the quality of the air and atmosphere by preventing and controlling the emission of chemical and physical pollutants into the air in order to reduce the deterioration of the environment and the health of living beings, to improve their quality of life and to ensure the sustainability of development.

Act No. 3239-07 on protecting and conserving water resources.

The purpose of **Act No. 3956/09 on the integrated management of solid waste** is to establish and apply a legal regime for the responsible production and management of solid waste, the normative content and practical value of which should lead to the reduction of such waste to a minimum and avoid situations of risk to human health and environmental quality.

Act No. 5169/14 establishing the Radiological and Nuclear Regulatory Authority (ARRN). With amendments to the initial project, this originated in Executive Decree No. 3414 (September 2004), which established an interinstitutional commission to review the current legal and institutional framework regulating the use, control, transport and procedures with regard to radioactive and ionizing material, with the goal of establishing a single national-level regulatory authority. The plan is to review and amend this law so as to remedy gaps and overlaps. IAEA legislative assistance will be sought in this regard.

1. Treaties adopted under IAEA auspices

	Title	In force	Status
P&I	Agreement on the Privileges and Immunities of the IAEA	2019-02-15	Acceptance: 2019-02-15
VC	Vienna Convention on Civil Liability for Nuclear Damage		Non-Party
CPPNM	Convention on the Physical Protection of Nuclear Material	1987-02-08	Signature: 1980-05-21 Ratification: 1985-02-06
CPPNM/A	Amendment to the Convention on the Physical Protection of Nuclear Material	2016-05-08	Ratification: 2016-03-11
NOT	Convention on Early Notification of a Nuclear Accident	2013-03-08	Signature: 1986-10-02 Ratification: 2013-02-06

ASSIST	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	1987-11-02	Signature: 1986-10-02 Ratification: 2013-02-06
JP	Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention		Non-Party
NS	Convention on Nuclear Safety	2014-04-09	Accession: 2014-01-09
RADW	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management	2018-11-14	Accession: 2018-08-16
PVC	Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage		Non-Party
SUPP	Convention on Supplementary Compensation for Nuclear Damage		Non-Party

2. Technical Cooperation Agreements

	Title	In Force	Status
RSA	Revised Supplementary Agreements Concerning the Provision of Technical Assistance by the IAEA (RSA)	1989-02-07	Party
RCA	Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology, 2017		Non-Party
AFRA	African Regional Co-operative Agreement for Research, Development and Training Related to Nuclear Science and Technology (AFRA)		Non-Party

	Title	In Force	Status
ARCAL	Agreement to further extend the Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL)	2020-09-05	acceptance: 2020-09-02
ARASIA	Co-operative Agreement for Arab States in Asia for Research, Development and Training Related to Nuclear Science and Technology (the 2017 ARASIA)		Non-Party

3. Safeguards Agreements

	Title	Signature	Status
1346	Application of safeguards in connection with the Treaty on Non-Proliferation of Nuclear Weapons and the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (with Protocol)	1979-03-20	Signature: 1978-01-18
1776	Protocol Additional to the Agreement between the Republic of Paraguay and the International Atomic Energy Agency for the Application of Safeguards in connection with the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Treaty on the Non-Proliferation of Nuclear Weapons	2004-09-15	Signature: 2003-03-24

ANNEX 4: DETAILS OF PAST TC PROGRAMME ACHIEVEMENTS

Paraguay joined the IAEA TC programme in 1972.Thirty-two TC projects have been carried out under the TC programme.

Since the 1970s, the IAEA has worked closely with Paraguay on enhancing capacities in the field of nuclear analytical techniques for the measurement of contaminants in the environment and food, in research that has benefited from total reflection X-ray fluorescence and EXRED equipment, instrumental neutron activation analysis (INAA), X-ray diffraction, electron microscopes, non-destructive testing, radioimmunoassay techniques, and in scholarships for the education of master's and doctoral students abroad (SENACSA, IICS, IPS).

This assistance has also supported the fight against vector-borne diseases and zoonoses (SENACSA, IICS).

Capacities have also been created in the field of electronics for analytical equipment, detectors, sources, etc. (FACEN).

National capacities have been created in the field of radiation protection with undergraduate and postgraduate programmes (FACEN).

On the other hand, since the 1980s, nuclear applications have been used for the study of nutrients in soils and the genetic improvement of seeds for agriculture, benefiting the laboratories of the National Agronomy Institute (IAN).

Keys areas and impacts include:

Thematic Area	Results of past technical cooperation	Main counterpart institutions and partners
Food and agriculture	Improved agricultural production with better knowledge of soils and plant nutrient biochemistry.	MAG, SENACSA, IAN, Vice-Ministry of Livestock.
Health and nutrition		MSPBS, IPS, IICS, private laboratories and radiation

	Strengthened disease diagnosis capacity using radioimmunoassay, strengthened cancer-fighting capacity.	and nuclear medicine centres. ICB, FACEN, FCQ.
Water and environment	Strengthened capacities for determining the fallout from nuclear explosions in the Pacific. Strengthened capacities of UNA laboratories to perform environmental analysis in air, water, and soil.	
Energy and industry	Strengthened capacities of the national metallurgical industry and the academy to carry out NDT.	FIUNA, Centre of Metallurgical Industries of Paraguay.

ACTIVE NATIONAL PROJECTS:

- PAR1005: Establishing National Capabilities in Irradiation Technologies for the Treatment of Patients with Burns and the Introduction of Mutation Breeding for Enhanced Quality and Productivity of Crops
- PAR1006: Strengthening of National Forensics Capabilities to Support the Analysis of Crime Evidence
- PAR5011: Improving the Conservation of Germplasm of High-Performance Livestock and Native Cattle
- PAR5012: Evaluation of Varieties and Advanced Mutant Lines against Biotic and Abiotic Stress Conditions to Mitigate the Effects of Climate Change in Crops

- PAR6016: Providing Patients with Access to Public Nuclear Medicine Services for Early Diagnosis and Treatment; this project is intended to improve the quality of life of patients through efficient diagnosis and therapy in the public nuclear medicine service.
- PAR6017: Providing Patients from the Public Sector with Early and Effective Diagnosis of Cancer through Positron Emission Tomography Technology
- PAR6018: Strengthening the Infrastructure for Diagnostic and Treatment of Patients with Cancer
- PAR6019: Developing and implementing Hypofractionated Radiotherapy for Treatment of Patients with Cancer
- PAR7002: Ensuring Availability of Groundwater Resources in Paraguay using Isotopic Techniques
- PAR9008: Strengthening the National Infrastructure for Radiation Safety
- PAR9009: Strengthening the National Infrastructure for Radiation Safety

ACTIVE REGIONA/INTERREGIONAL PROJECT

Project Number	Project Title
INT2022	Supporting Capacity Building in Member States for Uranium Production and Safety of Naturally Occurring Radioactive Material Residue Management
INT6064	Supporting Member States to Increase Access to Affordable, Equitable, Effective and Sustainable Radiation Medicine Services within a Comprehensive Cancer Control System
INT6065	Contributing towards Improved survival in childhood Cancer Using Radiation Medicine and Nutrition.
Project Number	**Project Title**
RLA0054	Strengthening the Planning, Design and Review of the Programme to Support the Implementation of Strategic Activities for Nuclear Technology and its Applications
RLA0056	Strengthening Regional Cooperation (ARCAL CXLVII)
RLA0057	Enhancing Nuclear Education, Training, Outreach and Knowledge Management

RLA0059	Strengthening Regional Cooperation (ARCAL CLXII)
RLA0060	Strengthening Regional Capacity Building in the Application of Nuclear Technology in Priority Areas
RLA0062	Promoting the Sustainability and Networking of National Nuclear Energy Institutions (ARCAL CLXIII)
RLA0065	Furthering Knowledge Management Implementation in Nuclear Organizations and Strengthening Nuclear Education
RLA0066	Strengthening the Planning, Design and Monitoring of the Programme to Support the Implementation of Strategic Activities for Nuclear Technology and its Applications
RLA0067	Establishing and Enhancing National Legal Frameworks
RLA0068	Strengthening Regional Cooperation (ARCAL CLXXIII)
RLA0070	Strengthening Tegional Cooperation (ARCAL CLXXXVI)
RLA0072	Establishing and Enhancing National Legal Frameworks in Member States
RLA1017	Applying Nuclear Analytical Techniques to Forensics for Analyzing Firearms Crime Evidence
RLA1018	Strengthening Capacities for Irradiating Tissues as Scaffolds for Tissue Engineering to Use in Regenerative Medicine
RLA1019	Strengthening Capabilities for the Utilization of Nuclear and Radiation Technology to Characterize, Conserve and Preserve the Cultural Heritage (ARCAL CLXVII)
RLA2017	Supporting the Preparation of Sustainable Energy Development Plans at a Regional Level (ARCAL CLXVI)
RLA5075	Strengthening the Regional Capacities in the Prevention and Progressive Control of Screwworm
RLA5076	Strengthening Surveillance Systems and Monitoring Programmes of Hydraulic Facilities Using Nuclear Techniques to Assess Sedimentation Impacts as Environmental and Social Risks (ARCAL CLV)

RLA5077	Enhancing Livelihood through Improving Water Use Efficiency Associated with Adaptation Strategies and Climate Change Mitigation in Agriculture (ARCAL CLVIII)
RLA5078	Improving Fertilization Practices in Crops through the Use of Efficient Genotypes in the Use of Macronutrients and Plant Growth Promoting Bacteria (ARCAL CLVII)
RLA5079	Applying Radio-Analytical and Complementary Techniques to Monitor Contaminants in Aquaculture (ARCAL CLXXI)
RLA5080	Strengthening the Regional Collaboration of Official Laboratories to Address Emerging Challenges for Food Safety (ARCAL CLXV)
RLA5081	Improving Regional Testing Capabilities and Monitoring Programmes for Residues/Contaminants in Foods Using Nuclear/Isotopic and Complementary Techniques (ARCAL CLXX)
RLA5082	Strengthening Food Security through Efficient Pest Management Schemes Implementing the Sterile Insect Technique as a Control Method
RLA5083	Enhancing Capacity for the Use of the Sterile Insect Technique as a Component of Mosquito Control Programs
RLA5085	Strengthening the Capacity of Official Laboratories for Monitoring and Response to an Outbreak of Priority Animal and Zoonotic Diseases (ARCAL CLXXIV)
RLA5087	Validating the Sterile Insect Technique for the Control of the South American Fruit Fly (ARCAL CLXXVI)
RLA5088	Advancing Surveillance and Progressive Control of the New World Screwworm Using the Sterile Insect Technique
RLA6079	Using Stable Isotope Techniques for Monitoring and Interventions to Improve Young Child Nutrition (ARCAL CLVI)
RLA6082	Strengthening Regional Capabilities in the Provision of Quality Services in Radiotherapy (ARCAL CLXVIII)
RLA6083	Strengthening Nuclear Medicine Capabilities Focusing on Hybrid Imaging for Diagnosis and Therapy of Diseases Including Oncological, Cardiological and Neurological Pathologies (ARCAL CLXIV)
RLA6084	Strengthening Regional Human Resource Development in Different Areas of Radiopharmacy (ARCAL CLXIX)
RLA6086	Integrating Nuclear Medicine Techniques in a Multimodality Approach in Cardiology for Early Diagnosis and Risk Stratification of Cardiovascular Disease in Latin American Women (ARCAL CLXXXV)

RLA6090	Strengthening Radiotherapy Management for the Treatment of Cervical Cancer in Latin America and the Caribbean (ARCAL CLXXXII)
RLA6091	Enhancing Capacity Building of Medical Physicists to Improve Quality and Safety in Medical Practices
RLA7023	Assessing Atmospheric Aerosol Components in Urban Areas to Improve Air Pollution and Climate Change Management (ARCAL CLIV)
RLA7024	Integrating Isotope Hydrology in National Comprehensive Water Resources Assessments
RLA9084	Strengthening the Regulatory and Radiation Safety Infrastructure
RLA9085	Strengthening Regional Capabilities for End Users/Technical Support Organizations on Radiation Protection and Emergency Preparedness and Response in Line with IAEA Requirements
RLA9088	Strengthening Regional Capabilities of End Users and Technical Support Organizations on Radiation Protection as well as Emergency Preparedness and Response in Line with IAEA Requirements
RLA9091	Strengthening Regional Capabilities for End Users and Technical Support Organizations on Radiation Protection and Emergency Preparedness and Response in Line with IAEA Requirements

ANNEX 5: INSTITUTIONAL POLICY OF PARAGUAY

The State is organized into institutions and bodies which, in developing the sector, are to safeguard Paraguay's vital interests and strategic resources, in line with the special functions assigned to them under the Constitution and specific laws.

The Ministry of Foreign Affairs, along with the country's embassies and missions to the organizations of the UN system, are responsible for foreign relations, the negotiation of bilateral or multilateral agreements, and the management of international cooperation, in keeping with the aims of the promoters of energy policy and the applications of nuclear energy.

For matters of security of facilities and radioactive material, and about the obligations under both the CPPNM and the CPPNM Amendment, and the Code of Conduct, the White Paper sets out the specific courses of action to be taken, in coordination with CODENA.

Institutions with primary or complementary responsibilities, such as the VMME, the UNA and the regulator (ARRN), must coordinate their plans so that activities do not overlap, resources are used efficiently, and goals are accomplished. Fundamental institutions are those which, by playing an institutional role, determine or have a direct effect on the ability to meet policy and programmatic objectives.

Officials who act as focal points both domestically and for organizations of the UN system, discussion forums and interinstitutional cooperation agreements etc. must be managed in such a way that improves coordination.

Related institutions:

- Ministry of the Interior
- Ministry of Foreign Affairs
- Ministry of Agriculture and Livestock
- MOPC: VMME
- Ministry of National Defence — CODENA
- MSPBS: INCAN, National Centre for Burns (CENQUER), INAM and SENEPA
- Ministry of Industry and Commerce
- MADES
- ARRN
- UNA: IICS, CNEA, CEMIT and academic departments
- CONACYT

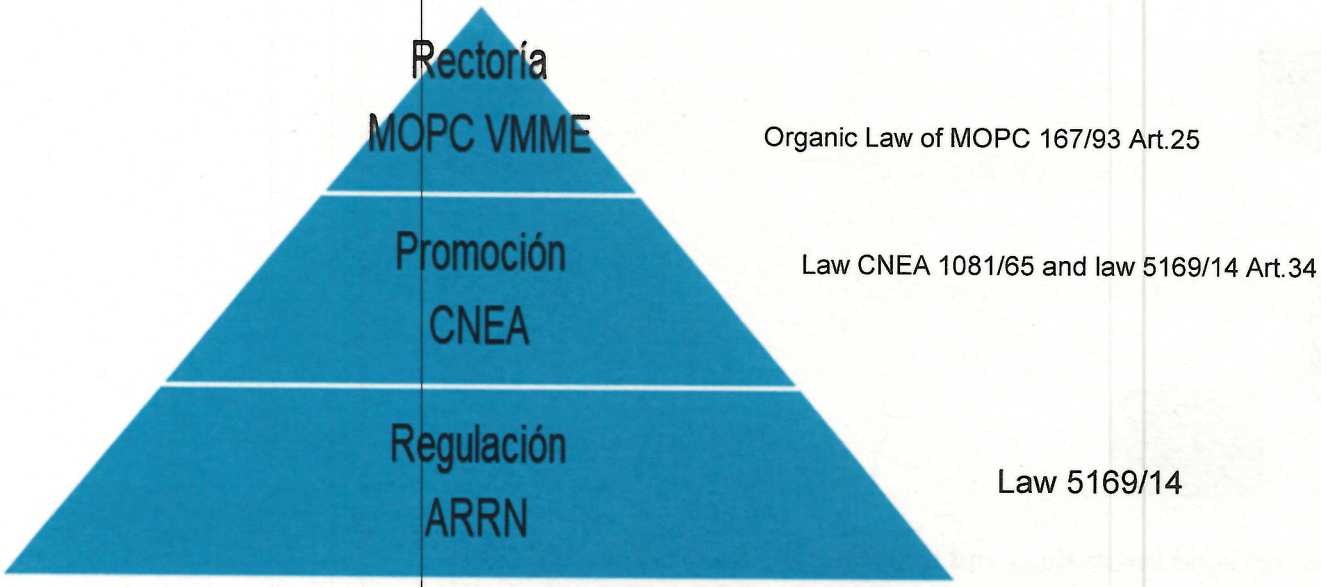

Figure 1. **Institutional and governance structure in the sector**

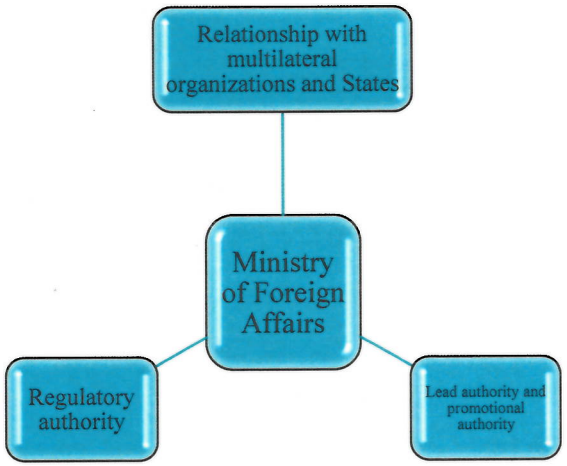

Figure 2. **Diagram of relationship between national institutions and multilateral organizations and States**

Lead authority on energy policy.- Ministry of Public Works and Communications (MOPC) — Vice-Ministry of Mines and Energy (VMME): Article 25 of the Organic Law of the MOPC No. 167/93, on the establishment of the Cabinet of the VMME, defines its functions as:

- Lead authority on energy policy and alternate national liaison authority for IAEA TC programmes.
- It develops and steers policy relating to the use and management of mineral and energy resources.
- It studies the technical, economic, financial and legal aspects in order to promote the industrial use of Paraguay's resources. It conducts monitoring to ensure that resources are being used properly and for their intended purpose.
- As it promotes the use of Paraguay's mineral and energy resources, it serves as the alternate national liaison with the IAEA. MOPC Resolution No. 61 of 13 March 2019.

Lead authority on promoting the peaceful applications of nuclear energy. -CNEA: In order to promote nuclear technology and monitor (regulate) the peaceful use of ionizing radiation, the CNEA was established by Executive Act No. 1081/65. It was initially subordinated to the Ministry of Foreign Affairs.

In 1991, it was subordinated to the Rectorate of the UNA and began working with the IAEA on projects to strengthen its capacities as regulatory authority for the peaceful use of ionizing radiation and to train staff. In 2005, the CNEA was subordinated to the DGICT at the UNA.

Pursuant to Article 34 of Act No. 5.169/2014, the CNEA has ceased to exercise a regulatory function and has acquired the role of **promoting nuclear technology, training staff and conducting research in the regulated area (radiation protection)**. It has begun work on implementing the ISO/IEC 17025 standard for dosimetry laboratories, with a view to accreditation thereunder.

Body responsible for nuclear security. - CODENA is the supreme authority responsible for framing the National Defence Policy and coordinating its implementation by the State authorities entrusted with that task. Since 2007, it has been taking forward the revision of the nuclear security guides drawn up by IAEA Member States. It published the National Defence Policy on three occasions, in 1999, 2012 and 2019. In the case of the latter, the security of radioactive material and of facilities holding it was incorporated into the Policy approach and management strategy.

Body responsible for radiological emergency response. - Ministry of National Defence — National Commission for Prevention of and Response to Biological Emergencies (CONAPREB). - This body was set up under a Government policy responding to the need for a 'multidisciplinary technical authority' able to provide a specific response to biological, chemical or radioactive agents or other weapons of mass destruction. Established by Decree No. 20.997/2003, CONAPREB heads a group of 21 public and private institutions. Efforts are configured by means of coordination among these organizations, and each participant has responsibilities or capacities that are particular to the different types of potential emergency that may occur and are specified in the Organization and Functions Manual.

Regulator. - ARRN: Established by Act No. 5169/2014 as an autonomous body responsible for regulating and monitoring to ensure the safe use of ionizing radiation in Paraguay, and to protect the public and the environment from the damage that can be caused by its misuse. It cooperates with other national institutions on matters related to the prevention and detection of and response to criminal acts targeting facilities holding radioactive material, and radiological threats to major public events. It also strengthens the environmental radiation monitoring system.

ANNEX 6: ECONOMY AND COMPETITIVENESS

In recent years, Paraguay's economic growth has accelerated markedly, largely as a result of the good performance of the agricultural sector and exports of raw materials. That growth has fluctuated greatly, however, under the influence of external factors such as climate and international commodity prices. Physical capital is making the largest contribution to gross domestic product (GDP) growth, whereas human capital has grown at a slower rate. According to statistics the potential GDP growth rate over the period under consideration was 4.9% a year on average.

There are various constraints on economic growth. On the one hand, human capital's contribution to growth is relatively low, perhaps owing to the large proportion absorbed by the informal sector and to the low quality of education. On the other, the lack of investment needed for infrastructure creates a competitive disadvantage, significantly curbing the growth and diversification of production. Given the State's limited ability to finance public sector, the resources it earmarks for investment in infrastructure have been relatively low, despite a marked upturn from 2014 to 2018. This suggests that opening the participation of the private sector in such projects could be a way to seize opportunities. Moreover, Paraguay's fledgling financial system and capital market are such that alternative mechanisms of long-term financing need to be created10 11.

Economic growth averaged 4.5% per year (2004–2017), a faster rate than in most comparable regional instances. This economic growth went hand in hand with a reduction in poverty. Since 2003, total and extreme poverty have fallen by 49% and 65% respectively. Overall, the rate of poverty reduction in Paraguay exceeded the regional average. There was also a rapid increase in income among the poorest 40% of the population — it

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[10] Climate change. In 2015, Paraguay presented its commitments to reduce greenhouse gases through nationally determined contributions until 2030. These commitments are being updated with the most recent data obtained in the Third National Communication and the Second Biennial Update Report. The emissions reduction target is 20% for the 2000–2030 period, of which 10% is conditional on international cooperation in terms of financing, technology transfer and capacity building. Recently, in 2017, Paraguay prepared the National Climate Change Mitigation Plan and action plans.
The Plan covers ten Main Strategic Lines and five Transversal Strategic Lines.
The Main Strategic Lines addressed are: Optimization of the Sustainable Use of Biomass; Diversification of the Energy Matrix and Energy Efficiency; Sustainable Renewable Energies; Clean Technologies; Fuel Quality; Biofuels; Improvement of the Public Transport System; Forestry Plantations; Silvicultural and Agricultural Practices and Waste Management.
Meanwhile, the Transversal Strategic Lines include: Socialization and Education; Institutional Strengthening and Gender Focus

rose by 4.5% annually in 2003–2017. The middle class almost doubled in size since 2003, reaching 38% of the total population and becoming the second largest group, just under the vulnerable population[12].

Special section: Impact of the pandemic on Paraguay's economy

Scenarios: severe economic crisis versus rapid economic recovery. - While the pandemic has been a severe global shock, the economy is expected to gradually recover with the loosening of lockdown measures and the implementation of suitable hygiene measures to limit any infections. On the other hand, economic forecasts for 2023 point to a positive annual growth rate for the global and local economy.

Paraguay tackled the health crisis by taking timely social distancing measures in order to limit the speed at which the disease spread; the results speak for themselves (few deaths in comparison to other countries). Nevertheless, the health measures involved constraints on economic activity, which were particularly palpable in April, as a total lockdown was imposed for that entire month. The tax authorities, the State's financial institutions and the Central Bank of Paraguay (BCP) rolled out a series of measures to help cushion the impact on families and businesses. It is also important to note that the primary sector, in particular agriculture, is having a good year, which also helped to mitigate the impact on overall activity and on the financial system. Lastly, the Government recently announced an economic recovery package which, together with the gradual lifting of lockdown measures, will help to stimulate economic activity in the coming months. This, of course, depends on the reopening of the remaining economic sectors not causing a major spike in viral infection.

The policies of the Paraguayan Government have helped to reduce the negative economic impact of the COVID-19 pandemic

The measures it has taken have successfully mitigated the economic impact. Under national emergency legislation the Government approved a package of loans totalling up to US$1,600million (4% of GDP); the financing is earmarked for the health sector, social protection, the functioning of the State, temporary subsidies for certain public services, and loans to micro, small and medium-sized enterprises (SMEs).

The social protection measures implemented include the 'Ñangareko' programme, which provides support related to food security in the form of emergency monetary transfers of 500,000 guarani (US$75) for the subsistence sector, the part of the economy most severely affected, reaching a total of 330 000 people. The broader 'Pytyvõ' programme was established later and provides for up to two transfers of 548,210 guarani (US$84), reaching some 1,500,000 people.

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[12] World Bank Group. Ibid.

The BCP has taken a series of steps — monetary measures and action to provide liquidity support for the financial system — to mitigate the economic impact of the COVID-19 pandemic. It has also loosened the regulations to make it easier for businesses and households to acquire loans.

For example, the BCP lowered the monetary policy rate by 275 basis points between March and April 2022 to 1.25%, offering the financial system lower-cost access to liquidity (standing liquidity facility rates). Additionally, the BCP made available US$967million deposited as legal reserve in both local currency and dollars, while establishing a liquidity portal, the Special Credit Facility (FCE), to grant loans to SMEs. These two measures (drawdown of legal reserve and the FCE) come to approximately 4% of GDP.

The BCP has also taken measures to make financial dealings more flexible, such as enabling the calculation of arrears for renegotiated loan portfolios to be suspended, so that customers do not lose their creditworthiness and can continue borrowing thanks to the maintenance of their credit rating. Moreover, the loan portfolios can be renegotiated without the need for customers to provide additional documentation for operations of up to US$155,000, offering them financial relief.

The liquidity from the drawdown of legal reserve, the FCE and BCP resources, outlined above, amounts to some US $2662 million, and the financial system will not face difficulties in finding resources. That said, stakeholders' perception of risk has risen in the face of heightened uncertainty, which has led them to conduct a rigorous study of risk profiles when granting loans. Nonetheless, lending has continued to rise, especially in local currency, with a 7.5% increase in the year to April 2020.

Relaunch of economic activities after reopening. Development prospects. –

The reopening of the economy is clearly a positive factor and in Paraguay it could be implemented relatively quickly owing to the satisfactory results of the public health measures. Nonetheless, it should be noted that the coronavirus outbreak dealt a severe blow to demand and also restricted supply. While reopening has reduced the constraints on production, the pandemic is not over and some economic sectors — such as restaurants, hotels and other tourism-related sectors — will continue to experience lower demand, or at best the recovery will take longer. The belief in Paraguay is that the recovery will be gradual over the coming months, while heightened uncertainty, constraining consumption, and investment decisions, is expected to persist.

Preparing Paraguay's economy for a possible second and third wave of coronavirus

A fresh spike in viral infections leading to the re-imposition of strict health measures (lockdown) will hit an already weakened global economy hard. Moreover, tax revenues have significantly contracted in many countries around the world, limiting their capacity to respond to a second round of widespread lockdowns and closures. Authorities will therefore have to urgently strike a balance that stops the virus from spreading widely

while preventing another economic collapse. Health authorities will probably have to insist on and monitor strict compliance with hygiene measures at workplaces, businesses, and restaurants, with teleworking continuing where suitable, etc. But the re-imposition of a total lockdown does not seem viable given the risks to an already damaged economy.

Currency	guarani
Exchange rate	(7 January 2019) US$1 = 6,019.38 guaranis
GDP	(2016): US$36,345 million (2017): US$39,406 million (2018 — estimated): US$39,836 million
Real GDP growth rate	(2016): 4.3% (2017): 5.0% (2018 — estimated): 4.0%
Inflation rate	(2016): 3.9% (2017): 4.5% (2018): 3.2%
Unemployment	(2018 — third quarter): 6.0%
Exports of goods	(2018 — third quarter): US$10,444,193 million
Imports of goods	(2018 — third quarter): US$9,466,626 million
Trade balance (2018 — third quarter)	US$977,567 million
Current account balance (2018 — third quarter)	US$-339 million

Foreign debt (2018 — first half of the year)	US $7761.3 million
Principal export products	Cereals and oilseeds, meat, leather and other animal products, soya pellets, vegetable and animal oils, electricity
Principal export markets (2017)	Brazil, Chile, Russia, Argentina, Turkey
Paraguay's world ranking for the production of certain commodities	fourth in soybeans (2016) sixth in beef and veal (2016) fourth in soybean oil (2016)[13] fifth in electricity (2016)14
Principal import products	Crude oil and petroleum products, cellular and mobile telephones, vehicles, automatic data processing machines, mineral or chemical fertilizers
Principal import markets (2017)	China, Brazil, Argentina, United States of America, Republic of Korea
Principal export markets (blocs)	MERCOSUR, European Union, Latin American Integration Association (ALADI), NAFTA, rest of the world

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[13] FAO. *Countries by commodity* [online].*Países por producto* [en línea]. Sede de la FAO Headquarters, Viale delle Terme di Caracalla

Rome, Italy.FAO. *Países por producto* [en línea]. Sede de la FAO Viale delle Terme di Caracalla.Roma, Italia : FAO, 2017. Available atDisponible en: http://www.fao.org/faostat/enes/#rankings/countries_by_commodity_exports;

[14] Central Intelligence Agency.AGENCIA CENTRAL DE INTELIGENCIA. *The World Factbook* [online]. Available aten línea]. Disponible en: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2234rank.html

Principal import markets (blocs)		Rest of the world, MERCOSUR, NAFTA, European Union, ALADI

GLOSSARY

Government Cost Sharing (GCS): is funding where the donor is the recipient.

In-kind contributions: are non-monetary contributions to a project or programme. Examples of in-kind contributions include free-cost experts/lecturers, logistics and local supporting activities, time of staff assigned to the project, infrastructure, materials, equipment, repairs, construction work, sampling costs, shipment costs, gasoline, etc.

National Participation Costs (NPCs): Costs that are charged to Member States (Excluding Least Developed Countries) who receive technical cooperation. The costs are assessed at 5% of the Member State's national project or programme, which includes national projects and fellows and scientific visitors funded under regional or interregional projects.

Technical Cooperation Fund (TCF): The main fund for financing the IAEA's technical cooperation activities. It is funded by the voluntary contributions of Member States, National Participation Costs, assessed programme cost arrears and miscellaneous income.