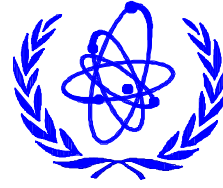




**GOVERNMENT OF THE
REPUBLIC OF COSTA RICA**



**INTERNATIONAL ATOMIC
ENERGY AGENCY**

COUNTRY PROGRAMME FRAMEWORK

2017–2023

On behalf of the Government:

**On behalf of the International Atomic Energy
Agency:**

Carolina Vásquez Soto
Vice Minister of Science and Technology

Dazhu Yang
Deputy Director General
Head, Department of Technical Cooperation

Place and date

Place and date

CONTENTS

EXECUTIVE SUMMARY	4
I. INTRODUCTION.....	5
I.1. AGRICULTURE AND ENVIRONMENT	6
I.2. RADIATION PROTECTION AND SAFETY	6
I.3. HEALTH SERVICES	7
I.4. INDUSTRY	7
II. NATIONAL DEVELOPMENT PRIORITIES AND ACTIVITIES RELEVANT TO THE AGENCY'S TECHNICAL COOPERATION PROGRAMME	7
II.1. AGRICULTURE AND ENVIRONMENT.....	8
II.2. RADIATION PROTECTION AND SAFETY.....	8
II.3. HEALTH SERVICES.....	9
II.4. INDUSTRY	10
III. RELEVANT INTERNATIONAL DEVELOPMENT ASSISTANCE.....	10
III.1. AGRICULTURE AND ENVIRONMENT	12
III.2. RADIATION SAFETY AND SECURITY AND HEALTH SERVICES	12
III.3. INDUSTRY.....	13
IV. GENERAL OVERVIEW OF AGENCY PAST AND PRESENT TECHNICAL COOPERATION ACTIVITIES IN THE COUNTRY	15
IV.1. PAST AND PRESENT INVOLVEMENT WITH THE TECHNICAL COOPERATION PROGRAMME	15
IV.2. LESSONS LEARNED FROM PAST CYCLES.....	15
IV.3. PARTICIPATION IN OTHER RELEVANT IAEA ACTIVITIES.....	16
V. ENVISIONED COUNTRY PROGRAMME OUTLINE	17
V.1. AGRICULTURE AND ENVIRONMENT.....	17
V.2. RADIATION PROTECTION AND SAFETY	18
V.3. HEALTH SERVICES.....	18
V.4. INDUSTRY.....	19
V.5. NEAR-TERM PROGRAMME.....	19
V.6. MEDIUM-TERM PROGRAMME.....	20
V.7. GENERAL ACTIVITIES	21
ANNEXES.....	24
ANNEX 1.1: LIST OF INSTITUTIONS	24
ANNEX 1.2: LIST OF EXISTING RESOURCES IN THE INSTITUTIONS.....	28
ANNEX 2. RESOURCE ESTIMATES AND FORECAST	31
ANNEX 3. DETAILED ACTION PLAN	32
ANNEX 4. LIST OF TREATIES UNDER THE AUSPICES OF THE IAEA SIGNED BY COSTA RICA.....	35
ANNEX 5. ACTIVE REGIONAL AND INTERREGIONAL PROJECTS IN WHICH COSTA RICA PARTICIPATES	37
ANNEX 6. NATIONAL PROJECTS THAT WERE APPROVED FOR COSTA RICA WITHIN THE LAST THREE TECHNICAL COOPERATION CYCLES	39

EXECUTIVE SUMMARY

Since 1957, Costa Rica has pursued the comprehensive development of nuclear energy for peaceful uses to promote innovation and catalyse emerging new technologies. Over the years, and ever since joining the International Atomic Energy Agency (IAEA) in 1965, Costa Rica has made progress in this field, including by adopting the Basic Law on Peaceful Uses of Atomic Energy which established the Atomic Energy Commission of Costa Rica in 1969.

This Country Programme Framework (CPF) builds on the efforts in this new field and lays out a road map for the next seven years (2017–2023).

This document reflects the combined efforts of an entire project implementation team and presents goals that could be achieved using nuclear energy for peaceful purposes in the areas of health (the Ministry of Health and the Costa Rican Social Security Fund), agriculture and environment, and industry (represented by universities such as the Technology Institute of Costa Rica).

This CPF focuses on proposals in four sectors, namely: (1) agriculture and the environment; (2) radiation protection and safety; (3) health services; and (4) industry, which are of particular strategic importance and in greatest need of investment and is aligned with the Alberto Cañas Escalante National Development Plan 2015–2018 and the Sustainable Development Goals (SDGs), reflecting the agreement reached between the Government of Solís Rivera and the IAEA.

It should be noted that this document is for reference purposes and, although it reflects a political and institutional commitment, it is not legally binding and will be subject to review, as necessary.

I. Introduction

The Alberto Cañas Escalante National Development Plan (NDP) for 2015–2018 outlines national development strategies under an integrated framework that identifies and responds with priority actions to foster sustainable development. It also presents the guiding principles of Costa Rica’s development model, in which risk management plays a central role in reducing the population’s vulnerability.

Guiding principles of the new development model



The NDP defines national priorities, which are the same as those articulated by the SDGs for 2016–2030 and are related to the work of the IAEA. Key elements of the country’s situation analysis include an explanation of national plans, programmes and objectives that relate to the IAEA’s programmes; a sectoral assessment of the advantages, risks, benefits, costs and constraints; a description of the technical, managerial and operating environment; and a strategy for linking SDG indicators and targets to identified priority activities. Reflecting national priorities, this CPF focuses on four sectors:

1. Agriculture and the environment;
2. Radiation protection and safety;
3. Health services;
4. Industry.

With this in mind, the priorities and the logic underpinning the design of the programme are discussed below in detail for each area within its respective scope.

I.1. Agriculture and environment

The main challenge that national agriculture faces, as identified in the NDP, is the need to increase productivity significantly in most agri-food production chains through more efficient and effective use of water and energy. Meeting this challenge requires a socially and environmentally responsible transformation of production processes that incorporates, for example, carbon and water footprint indicators (NDP, Section 5.7. Agricultural and Rural Development, p. 285). For this reason, within the context of the CPF, technical cooperation should be directed strategically in support of projects that both strive to increase agricultural productivity and lessen the environmental impact of the activity with respect to climate change.

This way of viewing technical cooperation projects in terms of both their agricultural and environmental impact has also been incorporated into the nation's agri-food policy (Sepsa/MAG [Executive Secretariat for Agricultural Sector Planning/Ministry of Agriculture and Livestock], 2011, Section 4.4.1., p. 59), which articulates and seeks to incorporate the following key elements: competitiveness, innovation and technological development, management of rural development and family farming, climate change and agri-environmental management.

Within this approach, agricultural policies are focused on the following five strategic areas: food safety and security, opportunities for young people in agriculture and in rural areas, mitigating actions and adaptation of agriculture to climate change, development of rural areas and strengthening of the agro-export sector (NDP, Section 5.7., p. 291). Thus, the peaceful use of nuclear technology should be organized around the development goals and priorities of mitigating actions and adaptation of agriculture to climate change and food safety and security.

I.2. Radiation protection and safety

The current Solís Rivera Administration has identified three basic pillars — based on negative, evolving and positive scenarios — on which the national goals are established. The Ministry of Health, as the competent authority in the field of radiation protection and safety, is bolstering its commitment to pursue human development with a shared vision of the nation's future and identify projects to achieve it, and is also exercising its responsibility for establishing appropriate requirements in order to protect the public and the environment from the harmful effects of ionizing radiation and ensure the safety and security of ionizing radiation sources.

Costa Rica's Constitution, the General Health Law and the Law on Peaceful Uses of Nuclear Energy and associated regulations form the legal framework that enables the Ministry to take the lead in promoting health and environmental protection using a three-tier management system.

The goals and objectives of the Ministry in its role as lead agency and advisor for radiological emergencies derive from the following basic documents, which underpin development in the proposed areas:

- Alberto Cañas Escalante National Development Plan 2015–2018;
- Dr Juan Guillermo Ortiz Guier National Health Policy 2015–2018;
- General Health Law;
- Regulation on Protection against Ionizing Radiation;
- Law on the Meritorious Costa Rican Fire Brigade;
- National Law on Emergencies and Risk Prevention;
- Manual of the Emergency Operations Centre of Costa Rica.

I.3. Health services

An analysis of Costa Rica's public health situation and epidemiological profile, as set out in the NDP, shows that there is a high prevalence of chronic non-communicable diseases (NCDs), with cancer accounting for one third of all deaths caused by NCDs in Costa Rica. Within the context of chronic non-communicable diseases and given the national contextual factor, cancer has become the second cause of death, positioned after cardiovascular diseases among Costa Ricans. For this reason, responding to NCDs, and cancer in particular, is a priority under the National Health Policy (NHP) (National Health Plan 2010–2021). The NHP states as a priority to strengthen the programme of chronic non-communicable diseases and obesity, based on a system of surveillance of non-communicable diseases with emphasis on cardiovascular and cancer.

This issue falls primarily under the responsibility of the Costa Rican Social Security Fund, which should expand health services to address NCDs. This CPF reflects these priorities by emphasizing projects that address the crucial role nuclear technology plays in the diagnosis, treatment and palliative care of cancer patients.

I.4. Industry

The use of ionizing radiation in industry is essential in industrialized and developing countries alike. Radiation dosimetry can assist in providing quality control for all types of irradiation processes, including:

- Sterilization of medical products;
- Food preservation;
- Wastewater treatment;
- Treatment of different types of plastics.

Thus, high dose dosimetry has become an important quality control tool in industry. This CPF cannot overlook the importance of this application for national development, as highlighted in the NDP: "Small and medium-sized enterprises (SMEs) have also suffered from the lack of accurate product measurements, without which they cannot improve their access to the international markets. There is a need to establish an integrated service to provide support to SMEs." Besides, the National Plan of Industry Policy establishes as its main objective to promote a competitive industrial sector with a significant component of technology innovation in the productive process.

Therefore, from a national perspective, it is crucial to strengthen the national quality control system through technical cooperation that strengthens national capacities in this field, in close cooperation with the Costa Rican Metrology Laboratory (LACOMET).

II. National Development Priorities and Activities Relevant to the Agency's Technical Cooperation Programme

The Government of Costa Rica, though its engagement in international activities, has reflected the current Sustainable Development Goals (SDG) National Development Plan. This international agenda is related to areas such as democratic governance, sustainable development, peace and climate resilience. The current government has therefore developed a National Plan that is capable of reaching in a comprehensive manner the SDGs by 2030.

II.1. Agriculture and environment

As per the NDP, agricultural and rural development has two key areas of development. The first area, mitigating actions and adaptation of agriculture to climate change, has an important strategic goal to increase the added value of agriculture by stimulating improvements in productivity and sustainable rural development, reflected throughout the agricultural and food industry sectors, while taking urgent action to combat climate change and its impacts (SDG 13). The second area, food safety and security, has the strategic goal to improve the competitiveness of key strategic products: rice, beans, white corn, cow's milk, beef, pork, potatoes and onions. It is also through projects in the agriculture and food industry sectors that the goals of ending hunger, achieving food security and improved nutrition and promoting sustainable agriculture can be achieved (SDG 2).

Mitigating actions and adaptation of agriculture to climate change

The country as a whole and the agricultural sector is embracing the climate change agenda as a national policy and the challenge of attaining carbon-neutrality by 2021. Efforts in mitigation and carbon sequestration could help to ensure competitiveness in international markets in view of the growing demand for climate-neutral products.

In order to significantly reduce greenhouse gas (GHG) emissions by the agricultural sector, better coverage needs to be provided by the sector's activities aimed at measuring its expansion and intensity of input use and its potential for increased GHG emissions.

Similarly, further research is needed on the capacity of each of these activities to capture atmospheric CO₂. Knowing the sectoral balance of CO₂ emissions and capture could help to kick-start at the sectoral level the designing of more appropriate methods for raising productivity, encouraging sustainable rural development and reducing GHG more efficiently and effectively in order to address climate change. Actions to meet these challenges should be promoted through climate-smart agriculture (NDP, Section 5.7. Agricultural and Rural Development, p. 288).

Food and nutritional safety and sovereignty

In food safety and security, improving competitiveness in key strategic products (rice, beans, white corn, potatoes for fresh consumption and onions) is contingent on the development of technical knowledge and the adoption of advanced technologies and other support services in order to successfully increase productivity and thus achieve food security and promote sustainable agriculture (NDP, Section 5.7., p. 292–294).

Costa Rica is pursuing a low-carbon livestock strategy, nationally appropriate mitigation actions (NAMA) for livestock and an agricultural technology research and transfer programme (PITTA) for low-carbon livestock and has recently established a national fodder network; each of these initiatives is supported through international cooperation. In addition, as part of the NAMA for livestock, a pilot plan to improve the livestock sector has been implemented in which 100 ranches participated in 2015. Given the above, in the context of IAEA technical cooperation, this strategic area should focus on non-livestock agricultural products.

II.2. Radiation protection and safety

According to the NDP, the Government of Costa Rica is committed to the environment by incorporating goals related to the supply of quality drinking water, wastewater treatment and

integrated solid waste management. Moreover, as per strategic goals set out in the National Health Plan, it is important contribute to sustainable development by protecting, remediating and improving the use of the environment, so as to ensure a decent quality of life. In this case, radiation protection is the main work area to ensure healthy lives and promote well-being for all at all ages (SDG 3).

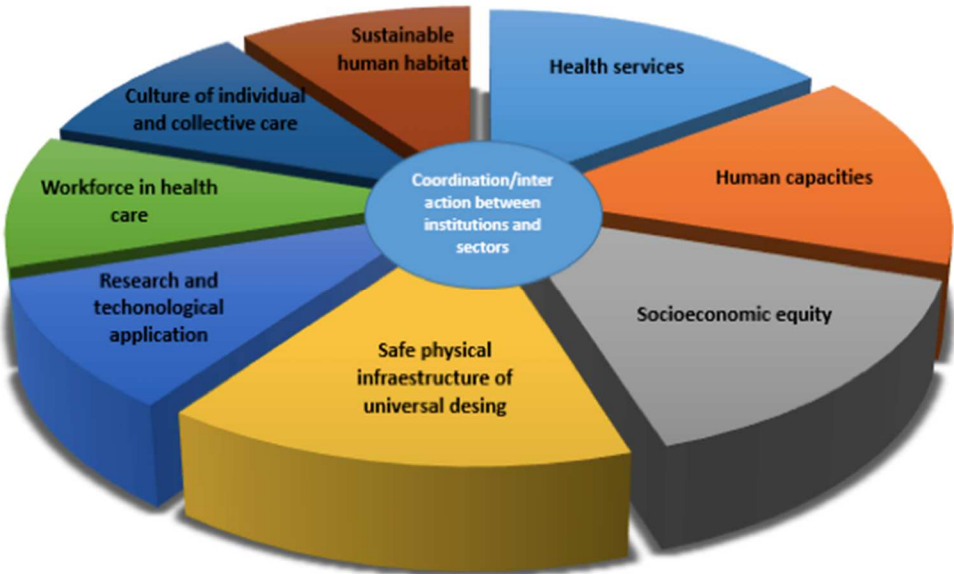
The Ministry of Health is responsible at the national level for establishing the necessary requirements for the protection of the public and the environment against the harmful effects of ionizing radiation. There has been a steady increase in the use of ionizing radiation in recent years and scientific and technological developments continue to open new possibilities for its use, making it necessary for the Ministry to strengthen its technical capacity through projects with the IAEA. In July 2014, a performance assessment of the Essential Public Health Functions (EPHF) was conducted using the methodology of the Pan American Health Organization (PAHO/WHO) and the country’s ability to reduce the impact of emergencies and disasters was found to be above average, indicating that there is ample room for improvement in this and other areas of radiation protection. In addition, the country’s National Health Plan 2010–2021 sets general objectives in nine thematic areas, of which two are directly related to radiation protection:

1. Safe physical infrastructure;
2. Sustainable human habitat that involves a culture of collective and individual care.

II.3. Health services

The area of health, nutrition and sports under the NDP related to two important fields: (1) early detection, management and treatment of cancer and (2) systematization of technologies relating to chronic non-communicable diseases. In the case of the first area, the strategic goal is to increase cancer survival rates through early detection, management and treatment. In the second area, the goal it is to promote research to develop technologies that guide and strengthen decision-making with respect to interventions on determinants and health issues. Both areas related to health services aim at generating treatment, ensuring healthy lives and promoting well-being for all citizens at all ages (SDG 3).

Chart 1. Main themes of the overall objectives of National Health Plan 2010-2021



Source: Technical unit, Ministry of Health

The National Plan for Prevention and Control of Cancer (2011-2017) underlines the actions and priorities of the public institutions to attain the agreements with WHO and UNDP regarding cancer as a second cause of death in Costa Rica. This Plan points out two areas of intervention:

1. Diagnosis, Treatment and Rehabilitation;
2. Palliative care.

Diagnosis has been successfully implemented in Costa Rica, for instance, with the screening of cervix cancer. But there are still many other potential techniques for early diagnosis and screening that could be implemented in the country. Palliative care is in line with SDG 3, well-being for all at all ages, and SDG10, reduction of inequality. An effort is required from Costa Rican institutions to deliver access to cancer care to all patients.

II.4. Industry

The NDP establishes in its guidelines for industry that the productive sector must have quality assurance for productive process measures advised by the National Metrology Laboratory. Manufacturers use radioisotopes to ensure and improve the quality of goods in many industrial processes, since they are used to measure the thickness and density of materials, as tracers in production processes, or in imaging devices to inspect finished goods. Radiation is also important in the sterilization, preservation and treatment of products. Therefore, nuclear technologies are essential for quality assurance, contributing for the specific chapter of the NDP on the promotion of a competitive industrial sector. Moreover, the creation of the Radiographic Control Laboratory in the Costa Rica Institute of Technology (TEC) in 2016 with a gamma irradiator for industry purposes provided by the IAEA and the TEC indicates a promising development for the industrial sector in the country.

Promoting inclusive and sustainable industrialization and fostering innovation (SDG 9) depends on transfer of new technologies as well as on quality assurance of existing processes and products, and the Costa Rican industrial sector requires critical support to appropriately train its personnel and safely apply nuclear technologies in order to achieve this goal.

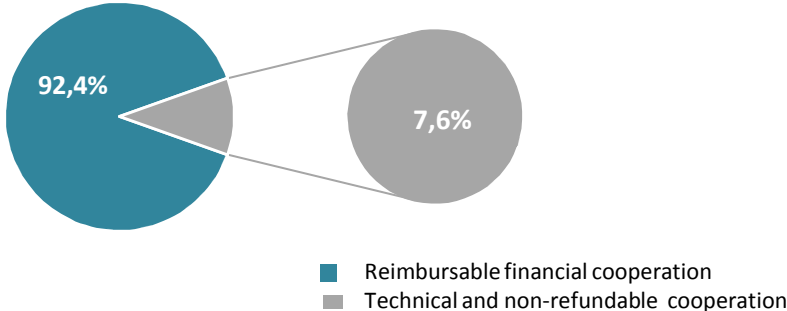
III. Relevant International Development Assistance¹

Costa Rica participates in international cooperation in various ways, primarily through bilateral and multilateral cooperation mechanisms. The objective of Costa Rica's Ministry of National Planning and Economic Policy (MIDEPLAN) is to coordinate, approve and evaluate cooperation programmes, projects and initiatives and handle all such requests taking into consideration the objectives and goals of the NDP. The Ministry of Foreign Affairs and Worship (MRREE) is responsible for ensuring the conformity of such requests with the country's foreign policy and will present them in a timely manner to the relevant governments and international organizations.

¹ Based on official information from the Ministry of National Planning and Economic Policy (MIDEPLAN).

On the whole, Costa Rica received a total of US \$5589.9 million in 2010–2014, with refundable financial resources (or foreign loans) accounting for US \$5161.9 million (92.4%) and non-refundable technical cooperation accounting for barely 7.6% of the funds (\$428.0 million). The chart 1 below shows the share of refundable financial resources versus technical cooperation received during this period.

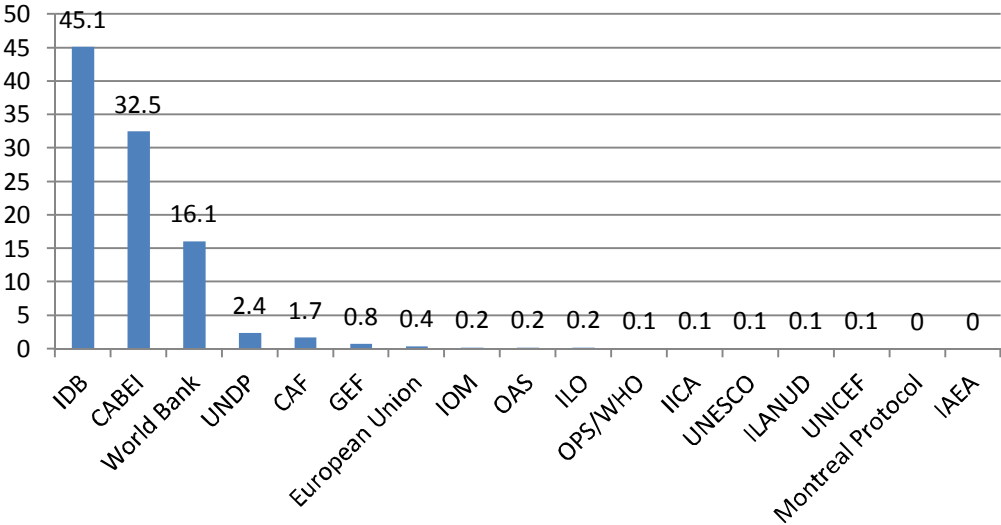
Chart 2. Reimbursable financial cooperation versus technical and non-refundable cooperation, 2010-2014



Source: ACI-MIDEPLAN, 2015

The chart below shows the shares of international organizations and banks in multilateral cooperation. The IDB accounted for 45.1% of the total, followed by CABELI (32.5%), the World Bank (16.1%), UNDP (2.4%) and CAF (1.7%). Together, these five multilateral sources accounted for 97.8% of all resources provided to Costa Rica between 2010 and 2014.

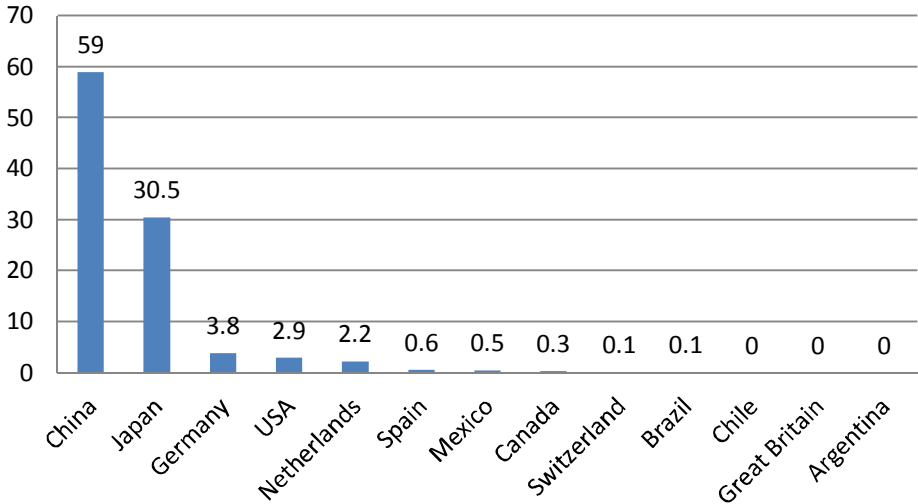
Chart 3. Percentages by source of multilateral participation, 2010-2014



Source: ACI-MIDEPLAN, 2015

In bilateral cooperation, the People’s Republic of China was the main partner, followed by the Government of Japan (30.5%), the Federal Republic of Germany (3.8%), the United States of America (2.9%) and the Republic of Korea (2.2%). Together, these five bilateral sources accounted for 98.4% of all bilateral resources, as shown in the chart below.

Chart 4. Percentages by source of bilateral participation, 2010-2014



Source: ACI-MIDEPLAN, 2015

During the period between 2010 and 2014 there were no significant changes with regards to the main sectors or thematic development areas receiving cooperation funds. For Costa Rica, the historical trend has been financial support for development projects requiring large investments. During this period, and throughout the country’s history, the resources were concentrated in three major thematic areas, namely:

1. Environment, energy and telecommunications;
2. Infrastructure and transportation;
3. Finance, economics and industry.

III.1. Agriculture and environment

Costa Rica is very active in climate change and agriculture issues and works in cooperation with many partners in this regard, such as the World Bank, UNEP (United Nations Environment Programme), CIAT (International Centre for Tropical Agriculture), the GEF (Global Environment Facility) and UNIDO (United Nations Industrial Development Organization). Moreover, within the framework of the UNFCCC (United Nations Framework Convention on Climate Change), Costa Rica has set its own Intended Nationally Determined Contributions to become a Carbon Neutral economy starting year 2021.

III.2. Radiation Safety and Security and Health Services

The Ministry of Health, as the Regulatory Authority, has received international support in the form of multilateral cooperation which has complemented cooperation in areas that fall within the purview of the IAEA, such as:

- Medicine: UNDP, PAHO/WHO;

- Security and emergencies: GTRI (United States of America).

In relation to the advisory role regarding radiological emergency, Costa Rica has received assistance from a variety of countries and organizations. These include the Governments of the United States and Spain and international organizations such as: WHO, PAHO and USAID.

III.3. Industry

The Ministry of Economy, Industry and Commerce is in charge to create, promote and support public policies for the industrial sector. National Metrology Laboratory under this Ministry is the reference laboratory in Costa Rica for BIPM (Bureau International des Poids et Mesures) and SIM (Inter-American Metrology System). Nevertheless, there is currently limited collaboration in nuclear technologies specific for industry.

Table 1. Summary United Nations Development Assistance Framework (UNDAF) in Costa Rica and United Nations Country Team (UNCT) projects related to IAEA's fields of activities

<i>UNDAF Summary 2013-2017</i>	<i>UNCT Projects</i>	<i>Possible IAEA contribution</i>
<p><u>Sustainable environment</u></p> <p>Consolidate the sustainability pillars by balancing social, environmental and economic dimensions of sustainable development.</p>	<p>Implementation of the national climate change strategy to move towards a low economy carbon and reduce vulnerability to climate change. (UNDP, UN HABITAT, UNESCO, FAO, UNEP, UNIDO)</p> <p>Incorporation and implementation of national policies and strategies to consider management environmental quality and integrated natural resources management, as well as the valuation of environmental goods and services, protection, conservation and use sustainable use of biodiversity. (UNDP, UNESCO, FAO, UNIDO, UNEP, UN-HABITAT)</p> <p>Implementation of the National Risk Management Plan and measures for a better use of the territory. (UNDP, UN HABITAT, UNESCO, IOM, FAO, PAHO / WHO)</p>	<p>Isotope applications in the areas of agriculture and food</p>
<p><u>Food safety</u></p> <p>Produce synergies and influence those determinants of development such as food security</p>	<p>Implementation of public policies to coordinate and guide research, innovation and technology transfer in sustainable production. (UNDP, UNESCO, UNIDO, ILO, FAO)</p> <p>Improving food and nutrition security in the country with participation of the micro and small enterprises in the productive, service and commercial sectors. (UNIDO, ILO, FAO, PAHO / WHO, UN HABITAT)</p>	<p>Radiation applications in the areas of agriculture and food</p>

<p><u>Productive development and employment</u></p> <p>Taking extraordinary or temporary measures to enable the economy to optimize the use of available resources and invest them with efficiency and agility in strategic aspects linked to job creation</p>	<p>Implementation of strategies and programs for sustainable productive development, generating opportunities and decent working conditions, with emphasis on micro-small-medium enterprises, young people and women. (UNDP, UNFPA, UN HABITAT, UNESCO, UNIDO, IOM, ILO, FAO).</p>	<p>Strengthening of capacity of staff in industrial and health areas</p>
<p><u>Promoting equality, equity and access to opportunities for human development</u></p> <p>Achieve an effective impact on the conditions of inequality, discrimination and exclusion that affect the population</p>	<p>Strengthening institutions for the exercise of human rights and improve human development conditions, with priority in vulnerable populations (UNDP, UNFPA, UNHCR, IOM, ILO, UNICEF, PAHO / WHO, UNESCO, UNIDO).</p>	<p>Increasing knowledge and infrastructure in Health area</p>
<p><u>Strengthening democratic governance</u></p> <p>Determination to address contemporary challenges, so their coverage and working style required to be covered by a comprehensive development cooperation strategy</p>	<p>Strengthened institutional and citizen capacities at national and local level to the articulation and implementation of legal frameworks, program and mechanisms chargeability. (UNDP, UN HABITAT, UNHCR, UNICEF).</p>	<p>Strengthening of National Regulatory Authority's capacity</p>

IV. General Overview of Agency Past and Present Technical Cooperation Activities in the Country

IV.1. Past and present involvement with the Technical Cooperation Programme

Costa Rica has maintained a close relationship with the IAEA since it became a member in 1965. The involvement of the IAEA has made a significant difference in the acceptance of nuclear energy and applications in Costa Rica, in the light of the many benefits at the national, regional and global levels resulting from the Agency's promotion of the peaceful uses of nuclear technologies.

The country began to receive assistance through the IAEA's Technical Cooperation Programme a few years after its accession to the IAEA. This assistance was provided in the form of equipment purchases, human resources capacity-building, expert technical assistance and in-country scientific visits in the context of over 70 completed national projects and over 130 completed regional and interregional projects.

IAEA's direct involvement in Costa Rica has provided direction for the implementation of a fully-fledged technical cooperation framework, producing visible results in the agricultural sector, where the sterile insect technique has been used to suppress pest populations, and in the health sector, where support was provided for national cancer control and prevention plans. In addition, this cooperation benefited more than 300 Costa Rican scientists through fellowships and scientific visits.

Currently, the National Liaison Office and the National Liaison Officer (NLO) are placed under the responsibility of the Ministry of Science, Technology and Telecommunications (MICITT), which is the national authority responsible for paying Costa Rica's assessed contribution, monitoring and verifying the payment of national participation costs and managing the technical cooperation programme and other activities connected with the IAEA. Both the Embassy of Costa Rica in Austria and the National Liaison Office were designated as official points of contact for Technical Cooperation Activities in the country.

Costa Rica is currently participating in four national projects approved for the 2016-2017 cycle, one project for strengthening national capacities for the early and rapid detection of Zika virus infections and several regional and interregional projects in different areas of activities, such as human health, the environment and radiation safety (see Annex 5 for more information). Over the next two years, with the completion of ongoing projects, the country will benefit from the establishment of a biological dosimetry laboratory at the University of Costa Rica, strengthening of radiation therapy and nuclear medicine units in the nation's hospitals and management of water supplies using isotope tracers. Annex 6 lists the national projects that were approved for Costa Rica within the last 3 Technical Cooperation cycles.

The national counterpart institutions currently involved in national projects are: the Costa Rican Institute for Research and Training in Nutrition and Health (INCIENSA) at UCR; the Laboratory of Chemical Hydrology and Physics at the National University of Costa Rica; the Environmental Pollution Research Centre (CICA) at UCR; the Technical Coordinating Unit for Cancer, Medical Management Unit, Costa Rican Social Security Fund and the National Groundwater, Irrigation and Drainage Service (SENARA).

IV.2. Lessons learned from past cycles

Positive and negative lessons learned emerged as a result of the development of the Technical Cooperation Programme in Costa Rica with the IAEA. The following points are important to highlight

for the development of future Programmes, which were expressed by end-users of cooperation resources:

1. Administrative authorities of the institutions that maintain technical cooperation projects with the IAEA should know well the regulatory framework that govern these relations. One possible solution is an ongoing dissemination of the IAEA's work and how it relates to the country. Country officials responsible for the regulatory function should be continuously trained on this issue.
2. In the agriculture field, IAEA's cooperation has strengthened phytosanitary control strategies to improve crop productivity, prevent pollution of water resources, decrease the use of synthetic fertilizers and increase the use of natural fertilization methods. Isotopic and nuclear techniques as well as special training provided have been an instrument to implement precision farming. It has generated a closer relationship between productive sectors and academia, strengthening the scientific and technological capabilities of the country.
3. As part of the country's development, the IAEA has managed various programmes for national and regional technical cooperation that allowed for the capacitation and training of human resources, assimilation of technologies through expert advice; audits and guidance. This has enabled Costa Rica to optimize the management processes of peaceful use of radiation with progressive improvements in application quality to human health. That has led Costa Rica (to a progressively position in the continent) in the region as an emerging country in the use of ionizing radiation on human health and another important areas.
4. Fluent communication between Programme Management Officers (PMOs) and Designated Team Members (DTMs) are of paramount importance for the success of regional projects. Moreover, the introduction of certain requirements for participant institutions could be beneficial for projects, such as minimum infrastructure capacities as well as background and commitment of participant institutions.
5. Since the Technical Cooperation Programme with the IAEA started, certain experiences have been important for Cost Rica:
 - Knowing that the country can count with the support from International Organizations is very beneficial;
 - Some processes may be lengthy, but platforms such as "In Touch" of the IAEA can facilitate management and monitoring of projects;
 - The IAEA is open in supporting the management of regional issues.

IV.3. Participation in other relevant IAEA activities

Besides technical cooperation activities, research institutions in Costa Rica are active in participating in the IAEA Coordinated Research Activities (CRA). Currently, Costa Rican Institutions have signed 6 research contracts with the IAEA in the fields of Food and Agriculture, Human Health and Radioisotope Hydrology. While not all Coordinated Research Projects (CRPs) lead to technical cooperation projects, the two are complementary. By advancing national knowledge and expertise in a particular field, Member States are better equipped to carry out technical cooperation projects. CRP findings, once tested and proven, can be applied practically through technical cooperation projects.

In the realm of nuclear security, Costa Rica has developed a draft Integrated Nuclear Security Support Plan (INSSP) with the IAEA / Division of Nuclear Security, under which all assistance activities related to strengthening Costa Rica's nuclear security regime will be coordinated. The INSSP is expected to be finalized in 2017, after which its implementation will be facilitated.

V. Envisioned Country Programme Outline

The following areas are of national interest and a source of national technical cooperation projects and initiatives for the period covered by this Country Programme Framework.

V.1. Agriculture and environment

The main national challenges in the area of agriculture and environment that should be addressed are:

- Yields are low in sensitive strategic agricultural products (rice, beans, coffee, white corn, potatoes and onions) due to limitations such as the lack of better crop variety; poor management of resources (soil, fertilizers, water and other inputs) and environmental factors associated with climate change (pests and drought in production areas).
- Difficulties with the control of transboundary animal diseases, reducing animal mortality, enhancing reproduction and feeding to improve productivity.
- Water is used inefficiently due to poor irrigation practices or flooding and the high cost of more efficient irrigation systems.
- Fertilizers are not used efficiently and follow-up is needed on the introduction of innovative practices that mitigate nitrogen loss but capacity is lacking for studies of soil nitrogen dynamics.
- There is a lack of field studies evaluating the cross-cutting effects of greenhouse gas emission mitigation strategies in various fertilization and irrigation practices.
- Carbon sequestration in soil is not encouraged as a means of competitiveness owing to a lack of capacity for studies of soil carbon dynamics.
- Rice and other strategic crops have low resilience against droughts caused by climate change.
- Emerging contaminants are affecting food safety and food security.

Based on the above, Costa Rica's envisaged Country Programme Framework for the near, medium and long terms should address all the key items outlined below under each category for each of the priority sectoral development areas:

- The cooperation projects under this heading must address issues related to climate change and food security in the context of environmental sustainability.
- There is interest in promoting climate-smart agriculture by building the country's capacity to continue work on soil carbon dynamics and sequestration and introduce practices to improve fertilizer use.
- Improvement of crops using mutation breeding to make them resilient to climate change related stresses such as newly emerging diseases and abiotic stresses.
- Improving irrigation practices to increase soil organic carbon and using fertilizer and soil amendments more efficiently are important to Costa Rica as a means of improving water quality and reducing soil degradation, erosion and acidification and the release of greenhouse gases from farmland.
- Isotopic and nuclear techniques can be useful in measuring impacts in these areas. There is a need to boost yields in sensitive and strategic non-livestock agricultural products by developing new varieties and optimizing irrigation in areas affected by climate change.
- Work must continue on detecting pesticides and other emerging contaminants in food and studying vectors of diseases affecting humans.

- Developing a cooperation programme emphasizing isotopic and nuclear techniques is crucial to ensuring sustainable agriculture. Creating analytical capacity in research laboratories using stable and radioactive isotopes is paramount in that regard.
- Striving for environment friendly animal farming and sustainable increase in production of food from animal origin by controlling transboundary animal diseases, enhancing reproduction, strategizing appropriate breeding and optimisation of feeding system.

V.2. Radiation Protection and Safety

Even though Costa Rica has achieved significant milestones in the strengthening of the national infrastructure of radiation protection and safety, support is still needed. Regulatory activities in Costa Rica are affected by:

- Limited human resources and limited training in new uses of nuclear technologies;
- Control and monitoring activities are not carried out in coordination with other government institutions and related services do not cover the needed spectrum to ensure adequate protection to the population.

The three priority areas for radiation protection and safety in the near, medium and long-term are:

- Improving the National Regulatory Authority's radiation protection programme;
- Strengthening dosimetry and calibration infrastructure;
- Strengthening the National Regulatory Authority's advisory role in radiological emergency response.

V.3. Health services

The main national challenges in the area of health are outlined below:²

- Fecundity is low compared with estimates for Central America, which, coupled with increasing life expectancy, has led to an ageing of the population and higher incidence of cancer.
- There has been a significant increase in poverty rates since 2018 and unemployment stands at 9.6%.
- While exclusion from the education system had fallen by 2008, it remained a very serious problem, particularly in secondary education, where it stands at 12%.
- While the country sought to make strides in innovation and technology, including in the area of diagnosis and treatment of non-communicable diseases, efforts in this area remained very weak owing to a poorly organized system in the fields of science and technology.

Based on the above, Costa Rica's envisaged Country Programme Framework for the near, medium and long term should address all the key items outlined below:

- Improvement of living standards towards a sustainable human environment, comprehensive health care, socio-economic equity, safe physical infrastructure of universal design, scientific research and innovative uses of technology that could benefit Costa Ricans.

² Some data has been taken from the National Health Plan 2010–2021.

- Strengthening of networks for cancer care, prevention, early diagnosis, treatment, and palliative care.
- Improvement of efficiency and quality of diagnosis and treatment of neoplastic diseases.

V.4. Industry

Establishing capacity (through a properly equipped laboratory and well-trained human resources) in dosimetric monitoring of irradiated products is sought. Within this framework, the following specific objectives are pursued:

- Improve capacities to develop Quality Assurance techniques in industry sector
- Increment competitiveness of Costa Rica manufacturers with better processes and better tracing of the process.
- Industrial application of nuclear technology, for example: gamma irradiation for sterilising food as well as medical supplies with a medical devices manufacturer sector growing in Costa Rica.
- Radiation protection at facilities where open and sealed gamma radiation sources and X-ray equipment are used.

V.5. Near-term programme

V.5.1. Agriculture and environment

Area of Interest	Desired results	Planned time frame
Capacity building to support the development of climate-smart agriculture in rice	Capacity enhanced for further work on carbon sequestration in rice fields and practices introduced to improve fertilizer use, promoting climate-smart agriculture	2018–2019
Improving technical capacities in food safety surveillance by the analysis of contaminants and residues of veterinary drugs using nuclear, isotopic and conventional analytical techniques	Food safety and security surveillance systems improved	2018-2019

V.5.2. Radiation Protection and Safety

Area of Interest	Desired results	Planned time frame
Strengthening of the National Regulatory Authority, laboratories and advisory body that provide services in radiation safety and emergency response	Inspection, biodosimetry, calibration and external dosimetry services improved, and national authorities better prepared in emergency response and radiation safety.	2018–2021

V.5.3. Health services

Area of Interest	Desired results	Planned time frame
Improving cancer care through training in new techniques of radiotherapy and nuclear medicine	Ability improved to assimilate new radiotherapy techniques as well as nuclear medicine therapies and technologies	2018–2019

V.6. Medium-term programme

V.6.1. Agriculture and environment

Area of Interest	Desired results	Planned time frame
Application of isotopic techniques and conventional tools to mitigate the impact of climate change and emerging contaminants on the agricultural production and water resources	Availability of water resources and impact of contaminatns on agricultural production determined.	2020-2023
Enhancing food safety through the creation of promising crops strains	Promising crop lines selected for drought resistance and efficient nutrient use, etc.	2020–2021
Optimisation of feeding, strategic breeding and enhancing reproduction to improve productivity	Livestock productivity increased through the optimisation and utilisation of local feed resources and animal breeding.	2020-2021
Optimization of irrigation in potato and onion cultivation areas affected by climate change and reduced rainfall	Technical capacity enhanced to optimize water use in the irrigation of potatoes and onions.	2022–2023
Application of nuclear and related techniques for the control of transboundary animal diseases	Technical capacity increased for early rapid diagnosis of transboundary animal and zoonotic diseases.	2022-2023

V.6.2. Radiation Protection and Safety

Area of Interest	Desired results	Planned time frame
Strengthening the infrastructure of laboratories providing external personal dosimetry and calibration services at the national level to meet ionizing radiation metrology needs and comply with regulatory requirements	Capacity improved in calibration and external dosimetry services in order to meet regulatory requirements and contribute to decision making by the National Regulatory Authority.	2020–2021
Strengthening the Nuclear Regulatory Authority’s advisory role in radiological emergency response, along with infrastructure improvements for support institutions	Capacity improved to offer timely radiological emergency response.	2021–2023

V.6.3. Health services

Area of Interest	Desired results	Planned time frame
Developing hybrid modalities in nuclear medicine through optimization of planning for external and internal radiotherapy	Achievement of optimal handling of ionizing radiation sources and dosimetric planning in nuclear medicine and internal radiotherapy for cancer patients.	2022-2023

V.6.4. Industry

Area of Interest	Desired results	Planned time frame
Developing gamma irradiation capacities for sterilising products	Industrial sector processes developed for sterilising products, application of best practices and QA. Competitiveness availability of technology for industry increased.	2020-2023
Developing irradiation processes using ionizing radiation sources for the in vitro co-cultivation of human cells	Capacity to do in vitro co-cultivation of human cells (e.g. skin) developed for treatment and medical services.	2022-2025

V.7. General activities

V.7.1. Agriculture and environment

Knowledge transfer is paramount importance and underlines all project proposals. This requires effective networks for the training of competent personnel. The IAEA shall assist with the provision of resources to be channelled towards the RALACA network, which continues in providing a mechanism and a suitable platform to ensure that developed capacities are exploited in Latin America and the Caribbean. The risk of loss of knowledge and its implications for future generations must be avoided through training built on available capacity. Some specific goals include:

- Organize training workshops for environmental experts of the Ministry of Environment and Energy for the conscientization of the importance of control and risks of nuclear technologies.
- Develop a program with the Ministry of Economy, Industry and Commerce to carry out awareness raising of the relevance of nuclear technologies in the competitiveness of enterprises, especially for the industrial food sector.
- Raise awareness within the public sector regarding techniques for the management of water resources.

V.7.2. Radiation Protection and Safety

The programme of activities required to maintain or conclude ongoing activities include:

- Plan training workshops and courses to increase the Regulatory Authority's know-how in relation to new technologies used in industry, medicine, veterinary medicine and research.

- Put the necessary tools in place for the standardization and evaluation of quality control in relation to new technologies used in medicine, veterinary medicine, industry and research.
- Support the development of educational units with a view to preserve the knowledge acquired through IAEA training and educational activities.
- Strengthen the dosimetry reference laboratory through capacity building of human resources, procurement of equipment and standards, as well as intercomparison activities with laboratories in other countries, to satisfy the requirements of the national accreditation body.
- Strengthen the external personal dosimetry laboratory through capacity building of human resources and procurement of equipment.

V.7.3. Health services

The programme of activities required to maintain or conclude ongoing activities include:

- Establish and consolidate the service for intracranial stereotactic radiosurgery.
- Conduct stereotactic radiosurgery training for parts of the body other than the brain.
- Establish training and implementation strategies for the optimization of external and internal radiation therapy planning.
- Establish quality control projects for comprehensive cancer treatment through planning based on hybrid modalities and dosimetric calculations.
- Draft national procedures for the use of new radiation therapy planning tools based on studies in nuclear medicine for the improvement of patients' quality of life.
- Continue building on the knowledge of all professionals involved in the multidisciplinary treatment of cancer patients and finalise the national strategic plan for cancer services.
- Develop a national approach to promote radiation protection in human health services.

V.7.4. Industry

Assistance is required in the establishment of capacity in various areas of irradiation for industrial purposes, as well as in the development and documentation of quality processes, such as:

- Reduce the microbial load in dried products, aromatic herbs, medicinal plants, natural colourings, spices, condiments etc.
- Eliminate insects in grains, cereals, legumes and dried fruits.
- Use quarantine treatment of fresh fruit and vegetables.
- Inhibit sprouting in tubers and bulbs.
- Slow the ripening and/or senescence of fruit and vegetables.
- Employ radiation-induced mutation to obtain improved plant varieties.
- Sterilize medical and pharmaceutical equipment, cosmetics, biological tissue etc.
- Develop real-time digital radiography systems for the quality control of metal bridge structures.

V.7.5. Legal Framework

Costa Rica will continue to address in the near and medium-term, as necessary, the enhancement of its national legal framework for the safe, secure and peaceful uses of nuclear technology, including

through activities that may be supported in the context of the Agency's regional project for legislative assistance, such as:

- Revision of current laws and developing comprehensive legislation covering safety, security and safeguards.
- Gaining an understanding and considering adherence to the international legal instruments adopted under the auspices of the IAEA to which it is not yet a party (see Annex 4).
- Training of national officials in nuclear law to enhance national capabilities in assessing, revising and drafting nuclear legislation.

Annexes

Annex 1.1: List of institutions

Field of activity	Institution
General development of atomic energy	Costa Rica Atomic Energy Commission (CEA) San Feo. de Goicoechea, de la Escuela Claudio Cortés, 25 m west of the El Solar de la Abadía building, premises 4 and 5 Apartado 6681-1000 San José, Costa Rica Tel.: 2248-1591 Fax: 2221-8680 E-mail: coatom@racsaco.cr
Atomic and nuclear physics	Physics Department National University Ornar Dengo Campus 86-3000 Heredia, Costa Rica Tel.: 2272-3545; 8998-9734 Cosmos13dr@gmail.com
Nuclear engineering and technology	School of Science and Materials Engineering Costa Rica Technological Institute 1 km south of the Basilica of Our Lady of the Angels, Apartado 159-7050 Cartago, Costa Rica Tel.: 8357-7454 E-mail: mconejo@itcr.ac.cr Radiation Section Tel.: 2277-3318 Fax: 2277-3344 Mobile: 8360-7478 E-mail: jaguero@una.ac.cr Tel.: 2277-3718; 2277-3344 E-mail: Carlos.rodriguezaguilera@gmail.com
Use of isotopes and radiation in food and agriculture	University of Costa Rica Environmental Pollution Research Centre (CICA) Rodrigo Facio Campus, 2060 San Pedro de Montes de Oca Tel.: 00506 2511-8214; 2511-8303 Website: http://www.ucr.ac.cr http://www.cica.ucr.ac.cr E-mail: ana.perezcastillo@ucr.ac.cr juan.chin.pampillo@gmail.com State University for Distance Learning School of Exact and Natural Sciences Agronomic Engineering Programme 474-2050 San Pedro de Montes de Oca Tel.: 00506 2202-1842; 2202-1900 Website: http://www.uned.ac.cr E-mail: wpena@uned.ac.cr National University School of Agricultural Sciences (ECA) Omar Dengo Campus

	<p>Tel.: 2277-3949; 2277-3948 Website: http://www.una.ac.cr E-mail: rafael.orozco.rodriguez@una.cr juan.arguello.delgado@una.cr</p> <p>Costa Rica Technological Institute Apartado 159-7050 Cartago, Costa Rica Fax: 00506 2551 5348 Tel.: 00506 2552 5333 Website: http://www.itcr.ac.cr</p> <p>Fruit Fly Programme State Phytosanitary Service Ministry of Agriculture and Livestock Facing south-west side of La Sabana park, formerly La Salle College San José, Costa Rica Tel.: 2549-3400; 2549-3629 E-mail: asaborio@sfe.go.cr</p> <p>National Groundwater, Irrigation and Drainage Service (SENARA) Apartado 5262-1000 San José Calle Blancos, Goicoechea, 300 metres west of the Administrative Court, formerly Bayer Tel.: 2257-9733 Fax: 2222-8785 E-mail: cromero@senara.go.cr; lagudelo@senara.go.cr; rramirez@senara.go.cr</p> <p>Faculty of Agronomy Agronomy Research Centre San Pedro de Montes de Oca 2060 San José Costa Rica Fax: 00506 2207 1627 Tel.: 00506 2207 3061 Website: http://www.cia.ucr.ac.cr</p> <p>Ministry of Agriculture and Livestock Department of Plant Protection and Animal Health National Fruit Fly Programme Apartado Postal 70-3006 Barreal de Heredia, Costa Rica E-mail: xcarro@protecnet.go.cr Fax: 00506 2553 22202732 Tel.: 00506 2553 22202732</p> <p>Agricultural School of the Humid Tropical Region (EARTH) Apartado postal 4442 1000 San José, Costa Rica Website: http://www.earth.ac.cr</p>
Radiation in medicine and health	<p>Strengthening Comprehensive Cancer Care Project Implementation Unit Network of the Costa Rican Social Security Fund Avenidas 3 and 5, Calle 5, facing Morazán Park, Suite 5F, Floor 5</p>

	<p>Tel.: 8835-0063 E-mail: ejimeva@ccss.sa.cr</p> <p>Nuclear Medicine Service San Juan de Dios Hospital Costa Rican Social Security Fund Paseo Colón San José, Costa Rica Tel.: 8365-4402 E-mail: Erick.mora.ramirez@gmail.com</p>
Isotopes and radiation in biology and environmental studies	<p>Cellular and Molecular Biology Research Centre (CIBCM) Research Campus 2060 San Pedro de Montes de Oca San José, Costa Rica Tel.: 2511-3193; 2511-2275 E-mail: eduardo.hernandez@ucr.ac.cr</p> <p>Biotechnology Research Centre Costa Rica Technological Institute 1 km south of the Basilica of Our Lady of the Angels, Apartado 159-7050 Cartago, Costa Rica Tel.: 2550-2479; 8893-6397 E-mail: mirojas@iter.ac.cr</p> <p>Faculty of Microbiology Rodrigo Facio Campus San Pedro de Montes de Oca San José 2060, Costa Rica E-mail: Eugenia.quintana@ucr.ac.cr Fax: 00 506 2231 1746 Tel.: 00 506 2511 4388 Website: http://www.micro.ucr.ac.cr</p>
Isotope hydrology and applications of radiation in industry	<p>Environmental Hydrology Laboratory School of Biological Sciences Omar Dengo Campus 86-3000 Heredia, Costa Rica Tel.: 2277-3494 E-mail: helgamadrigal@yahoo.com</p> <p>Marine and Limnological Research Centre (CIMAR) Research Campus 2060 San Pedro de Montes de Oca Tel.: 2511-2200; 2511-2203 E-mail: alvaro.morales@ucr.ac.cr</p> <p>Environmental Hydrology Laboratory School of Biological Sciences Omar Dengo Campus 86-3000 Heredia, Costa Rica Tel.: 2277-3494 E-mail: helgamadrigal@yahoo.com</p>
Radiation and nuclear	Ministry of Health

safety	<p>Avenidas 5 and 8, Calle 16, Edificio Norte, 2nd floor, Apartado 10123 - 1000 San José, Costa Rica Tel.: 2222-7887; 8855-4007 E-mail: cmadrigal@ministeriodesalud.go.cr Tel.: 2222-9115; 8823-5523 E-mail: dbenitez@ministeriodesalud.go.cr</p> <p>Costa Rican Social Security Fund</p> <p>National University</p> <p>University of Costa Rica:</p> <p>Laboratory of the Atomic, Nuclear and Molecular Scientific Research Centre (CICANUM) Atomic, Nuclear and Molecular Scientific Research Centre (CICANUM) Carretera Sabanilla San Pedro Montes de Oca San José 2060, Costa Rica E-mail: patricia.mora@ucr.ac.cr Fax: 00506 22713538 Tel.: 00506 25113245</p> <p>Cytogenetic Laboratory of the Health Research Institute (INISA)</p> <p>Rodrigo Facio Campus San Pedro de Montes de Oca Apartado Postal 267 San José 2060, Costa Rica E-mail: rsierra@cariari.ucr.ac.cr Fax: 00506 2207 5130</p> <p>Private hospitals</p> <p>Costa Rica National Commission for Risk Prevention and Emergency Management</p> <p>Office of the President</p> <p>Merited Fire Brigade Apartado Postal 4329 - 1000 San José, Costa Rica Tel.: 2547-3711 Fax: 2547-3789 Mob.: 8878-8396 E-mail: lsalas@bomberos.go.cr</p> <p>Munitions Directorate Ministry of Health Dulce Nombre de Coronado San José, Costa Rica Tel.: 2294-0373 E-mail: racarvajal@msp.go.cr</p>
--------	--

Annex 1.2: List of existing resources in the institutions

Agriculture and environment sector

Application of isotopes and radiation in food and agriculture

University of Costa Rica. Environmental Pollution Research Centre (CICA)

- Cavity ring-down spectrometer for the analysis of $^{13}\text{CO}_2$ and $^{13}\text{CH}_4$
- Cavity ring-down spectrometer for the analysis of $^{15}\text{N}_2\text{O}$, $\alpha\text{-}^{15}\text{N}_2\text{O}$ and $\beta\text{-}^{15}\text{N}_2\text{O}$
- Real-time analyser of greenhouse gases and ammonium
- Chromatograph configured for greenhouse gases with an electron capture detector (ECD)
- Gas chromatographs with simple mass spectrometry detectors (GC-MS) and triple quadrupole (GC-MS/MS) systems
- High resolution liquid chromatographs coupled with simple mass (LC-MS) and triple quadrupole (LC-MS/MS) spectrometers
- Inductively coupled plasma mass spectrometry (ICP-MS)
- Carbon (total organic, purgeable and inorganic carbon) and total nitrogen analyser
- Liquid scintillation counter
- Mid-infrared spectroscopy system (MIRS)
- Analyser of ^{18}O and ^2H stable isotopes in water

State University for Distance Learning

- Neutron probe
- Flame and graphite furnace atomic absorption spectrometer
- Visible ultraviolet light spectrophotometer

National University, School of Agricultural Sciences

- Tissue culture laboratory: autoclaves, water distillers, analytical balances, ultrasonic bath, pH meter, laminar flow chambers
- Molecular Biology Laboratory: two thermocyclers for endpoint polymerase chain reaction (PCR) (96 wells), one thermocycler for real-time PCR (48 wells), LI-COR 4300 genetic analyser for fragment analysis (amplified fragment length polymorphisms (AFLPs, microsatellites), electrophoresis chambers of different sizes, ultraviolet light spectrophotometer, refrigerated and non-refrigerated centrifuges, ELISA microplate reader and washer.
- Genetic resources laboratory: seed storage chamber, seed germination chamber, seed moisture analyser, seed counter, and electronic scales.

Radiation protection and safety and health services sector

List of existing equipment and capacity in CICANUM-UCR

- 1.2 Ci Cs-137 calibration sources
- Am-241 and Sr-90 planar sources
- 1-litre PTW ionization chamber
- 10-litre PTW ionization chamber

- Keithley electrometer
- Positioning rail
- Positioning lasers
- Hygro-thermobarometer
- Web cameras
- Personal dosimetry phantoms (whole body, wrist and ring-type)
- Laboratory forming part of the CICANUM management system
- Human resources

Personal dosimetry laboratory

- 6600 Plus Harshaw reader (with radioactive source for self-calibration)
- Harshaw 4500 reader
- Personal dosimeter cards and holders
- Software to generate dosimetric reports
- Human resources
- ISO17025 accreditation
- Adequate facilities for expansion of the laboratory

Institute of Health Research (INISA) Biological Dosimetry Laboratory

Upon conclusion of the current (2016–2018) IAEA project to establish a dosimetry laboratory, in 2018 automated equipment will be available for dicentric analysis and it is hoped also to have available the basic documentation needed for work under a quality control system using IAEA biological dosimetry standards.

Biological dosimetry will form an integral part of the INISA human cytogenetic laboratories at the University of Costa Rica, which currently has three well-established laboratories equipped to carry out these tasks: one tissue culture laboratory, one laboratory for the preparation of material undergoing analysis and one microscope laboratory. The infrastructure is very good and the cytogenetics tests have been accredited with ISO/IEC standard 17025:2005. Work is carried out with high-quality equipment and reagents and by qualified personnel.

Equipment used by the laboratories

- Class II type A biosafety cabinet
- Gas extraction hoods
- CO₂ incubators
- Benchtop centrifuges
- Inverted microscopes
- Phase microscope
- Epifluorescence microscope

- High-quality research microscopes
- Karyotyping system
- Digital balance
- pH meter
- Drying oven for chromosome spreads
- Bain marie (water bath)
- Refrigerators
- Deep freeze
- By the end of 2016, automated dicentric counting equipment will be available, specifically designed for work in biological dosimetrics.

Other general facilities at INISA:

- Washing and sterilization room and its equipment
- Deep freeze room
- Incubator room (CO₂-free)

Annex 2. Resource Estimates and Forecast

National programme 2017–2023

	Euro €
<p>Historic reference amount obtained for the last three national programmes:</p> <ul style="list-style-type: none"> • Assistance approved from TC Fund during the last 6 years (2012-2017): ~ € 2,116,719 • Average per year: ~ € 352,786 <p>As an indicative planning figure³ for the period under consideration (2017–2023).</p>	€ 2,116,719
1. Expected government cash contribution⁴ and in-kind contribution⁵ for the planning period.	€ 2,100,000
2. Preliminary estimates for the agreed programme/projects reflected in the CPF	
Preliminary estimates for the proposed program/projects reflected in the CPF for TC cycle 2018-2019	€ 1,500,000
Preliminary estimates for the proposed program/projects reflected in the CPF for TC cycle 2020-2021	€ 2,000,000
Preliminary estimates for the proposed program/projects reflected in the CPF for TC cycle 2022-2023	€ 1,600,000
Total estimate with IAEA for the period of 2017-2023	€ 5,100,000
Estimate Grand Total	€ 7,200,000

³ The country's indicative planning figure does not obligate the Agency to provide such funding, nor does it suggest the expectation of continued levels of Agency funding. The sole purpose is to assist planning and prioritization of the country framework.

⁴ The cash contribution indicated by the Government does not commit it to providing the stated amount but indicates the intent and likelihood of such support.

⁵ In-kind contributions represent the value assigned to non-monetary contributions, such as provision of experts, training and infrastructure. Planning for in-kind contributions may also include bilateral trade agreements and intergovernmental cooperation agreements in the respective programme areas.

Annex 3. Detailed action plan

CPF Planning Opportunity	Proposed Action	Action Party	Objectives	Time Frame
Climate change mitigation	Capacity building to support the development of climate-smart agriculture in rice	Environmental Pollution Research Centre (CICA) University of Costa Rica (UCR)	Promote mitigation and adaptation to climate change in agriculture and foster research on activities conducive to the sequestration of atmospheric CO ₂ .	2018-2019
Promotion of food safety and security	Improving technical capacities in food safety surveillance by the analysis of contaminants and residues of veterinary drugs using nuclear, isotopic and conventional analytical techniques	National Laboratory of Veterinary Services (LANASEVE) National Service of Animal Health (SENASA)	Enhance capacities in monitoring/controlling chemical/natural contaminants and residues in foodstuffs of animal origin.	2018-2029
Strengthening of radiation safety and emergency response	Strengthening of the National Regulatory Authority, laboratories and advisory body that provide services in radiation safety and emergency response	Ministry of Health (MS)	Improve the regulatory capacity through training of officials involved in the control of establishments using ionizing radiation and accreditation of inspectors who carry out regulatory activities, support in the field of radiation safety at nuclear applications end users, improve the capacity to respond to radiological emergencies through support to Biodosimetry Laboratory.	2018-2021
Improvement of cancer treatment	Improving cancer care through training in new techniques of radiotherapy and nuclear medicine	Technical Cancer Coordination Unit. Medical Management Section. Costa Rican Social Security Fund	Promote training in the following techniques: brachytherapy for different oncological pathologies; Stereotactic Body Total Radiotherapy; application of alpha emitters and beta metabolic therapies. Implement and use hybrid technology in Nuclear Medicine.	2018-2019
Climate change and management of water resources	Application of isotopic techniques and conventional tools to mitigate the impact of climate change and emerging contaminants on the agricultural production and water	Environmental Pollution Research Centre (CICA) University of Costa Rica	Assess the stress, identify the recharge area caused, prepare a physic-chemical description of the groundwater, determine the susceptibility, to prepare an inventory of the pollutants, identify the principal sources of pollution, determine the risk of	2020-2023

	resources		over-exploitation and pollution and raise awareness among the communities in the study areas of the problem of the availability of water resources and to disseminate the findings to the management and regulatory institutions.	
Promotion of food safety and security	Enhancing food safety through the creation of promising crops strains	National University (UNA) School of Agricultural Sciences (ECA) Programme on biotechnology and genetic resources for plant breeding (BIOVERFI)	To induce genetic variability in the rice crop (<i>Oryza sativa</i>) in order to select variants that are adaptive to climate change and are conducive to food security. Obtain a segregating population (M ₂) from seed and subsequently select for biotic and abiotic factors. Select promising lines of crops tolerant of abiotic (drought, salinity and nutrient use efficiency).	2020-2021
Livestock productivity	Optimisation of feeding, strategic breeding and enhancing reproduction to improve productivity	National University, Veterinarian Medicine School	Increase livestock productivity through the optimisation and utilisation of local feed resources and animal breeding.	2020-2021
Climate change adaptation	Optimization of irrigation in potato and onion cultivation areas affected by climate change and reduced rainfall	University of Costa Rica (CICA)	Build national capacity to optimize water use in the irrigation of potatoes and onions.	2022-2023
Livestock and human health	Application of nuclear and related techniques for the control of transboundary animal diseases	National University, Veterinarian Medicine School	Build national capacity for early rapid diagnosis of transboundary animal and zoonotic diseases.	2022-2023
Strengthening of radiation safety and emergency response	Strengthening the infrastructure of laboratories providing external personal dosimetry and calibration services at the national level to meet ionizing radiation metrology needs and comply with regulatory requirements	Ministry of Health (MS)	Build capacity in laboratories providing external dosimetry and calibration services in order to meet regulatory requirements and contribute to apposite decision making. Procure the equipment required to broaden, improve the services on offer and train the laboratories' staff members and support participation in inter-comparison with laboratories in other countries in order to meet regulatory requirements.	2020-2021

Strengthening of radiation safety and emergency response	Strengthening the Nuclear Regulatory Authority's advisory role in radiological emergency response, along with infrastructure improvements for support institutions	Ministry of Health (MS)	Build the capacity of staff at the central, local and regional directorates of the Ministry of Health and of the National Regulatory Authority to perform their advisory role in a radiation emergency. Provide emergency-response training to participating institutions such as the fire brigade, the National Emergency Response Commission and the Costa Rican Social Security Fund.	2021-2023
Improvement of cancer treatment	Developing hybrid modalities in nuclear medicine through optimization of planning for external and internal radiotherapy	Technical Cancer Coordination Unit. Medical Management Section. Costa Rican Social Security Fund	Formulate training and implementation strategies to optimize external and internal radiotherapy planning, to establish a quality control management projects for holistic cancer treatment through planning based on hybrid modalities and dosimetric calculations. Draw up national protocols on the use of new radiotherapy planning tools based on studies in nuclear medicine in order to improve users' quality of life, to gradually build the knowledge of professionals involved in multidisciplinary care for the oncological population and finalize the national strategic cancer care plan and the approach to the promotion of radiation protection.	2022-2023
Developing irradiation capacity	Developing gamma irradiation capacities for sterilising products	Costa Rica Technology Institute. LACOMET.	Develop industrial sector processes for sterilising products, application of best practices and QA and increase competitiveness and availability of technology for industry.	2020-2023
Developing irradiation capacity	Developing irradiation processes using ionizing radiation sources for the in vitro co-cultivation of human cells	Costa Rica Technology Institute.	Develop capacity to do in vitro co-cultivation of human cells (e.g. skin) for treatment and medical services.	2022-2025

Annex 4. List of treaties under the auspices of the IAEA signed by Costa Rica

Multilateral Agreements

	Title	In Force	Status
P&I	Agreement on the Privileges and Immunities of the IAEA		Non-Party
VC	Vienna Convention on Civil Liability for Nuclear Damage		Non-Party
VC/OP	Optional Protocol Concerning the Compulsory Settlement of Disputes		Non-Party
CPPNM	Convention on the Physical Protection of Nuclear Material	2003-06-01	accession: 2003-05-02
CPPNME	Amendment to the Convention on the Physical Protection of Nuclear Material		Non-Party
NOT	Convention on Early Notification of a Nuclear Accident	1991-10-17	Signature: 1986-09-26 ratification: 1991-09-16
ASSIST	Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency	1991-10-17	Signature: 1986-09-26 ratification: 1991-09-16
JP	Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention		Non-Party
NS	Convention on Nuclear Safety		Non-Party
RADW	Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management		Non-Party
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
RSA	Revised Supplementary Agreement Concerning the Provision of Technical Assistance by the IAEA (RSA)	1982-08-25	Signature: 1982-08-25
ARCAL	Co-operation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean (ARCAL)	2005-09-05	Signature: 1998-09-25 ratification: 2001-10-15

Safeguards Agreements

Reg. No	Title	In Force	Status
1368	Agreement between the Republic of Costa Rica 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 (with Protocol)	1979-11-22	Signature: 1973-07-12
1886	Protocol Additional to the Agreement between the Republic of Costa Rica and the IAEA 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	2011-06-17	Signature: 2001-12-12

Annex 5. Active regional and interregional projects in which Costa Rica participates⁶

Project Number	Project Title	1st Year of Approval
INT0083	Support for Human Capacity Building in Developing Member States	2009
INT5154	Improving Food Safety through the Creation of an Interregional Network that Produces Reliable Scientific Data Using Nuclear and Isotopic Techniques	2016
INT5155	Sharing Knowledge on the Sterile Insect and Related Techniques for the Integrated Area-Wide Management of Insect Pests and Human Disease Vectors	2016
INT6057	Establishing a Joint IAEA/ICTP International Post-Graduate Medical Physics Education Programme	2014
INT7019	Supporting a Global Ocean Acidification Observing Network towards Increased Involvement of Developing States	2016
RLA0048	Networking for Nuclear Education, Training, Outreach and Knowledge Sharing	2012
RLA0052	Strengthening the Planning, Design and Review of the Programme to Support the Implementation of Strategic Activities for Nuclear Technology and its Applications	2014
RLA0053	Strengthening Regional Cooperation in the Latin America and the Caribbean Region (ARCAL CXXXVIII)	2014
RLA0054	Strengthening the Planning, Design and Review of the Programme to Support the Implementation of Strategic Activities for Nuclear Technology and its Applications	2016
RLA0055	Establishing National Legal Frameworks in Member States	2016
RLA0056	Strengthening Regional Cooperation (ARCAL CXLVII)	2016
RLA0057	Enhancing Nuclear Education, Training, Outreach and Knowledge Management	2016
RLA0058	Using Nuclear Techniques to Support Conservation and Preservation of Cultural Heritage Objects	2016
RLA1013	Creating Expertise in the Use of Radiation Technology for Improving Industrial Performance, Developing New Materials and Products, and Reducing the Environmental Impact of the Industry (ARCAL CXLVI)	2016
RLA5064	Strengthening Soil and Water Conservation Strategies at the Landscape Level by Using Innovative Radio and Stable Isotope and Related Techniques (ARCAL CXL)	2014
RLA5065	Improving Agricultural Production Systems Through Resource Use Efficiency (ARCAL CXXXVI)	2014
RLA5066	Increasing the Commercial Application of Electron Beam and X Ray Irradiation Processing of Food	2014
RLA5068	Improving Yield and Commercial Potential of Crops of Economic Importance (ARCAL CL)	2016
RLA5069	Improving Pollution Management of Persistent Organic Pollutants to Reduce the Impact on People and the Environment (ARCAL CXLII)	2016
RLA5070	Strengthening Fruit Fly Surveillance and Control Measures Using the	2016

⁶ As of September 2016.

Project Number	Project Title	1st Year of Approval
	Sterile Insect Technique in an Area Wide and Integrated Pest Management Approach for the Protection and Expansion of Horticultural Production (ARCAL CXLI)	
RLA5071	Decreasing the Parasite Infestation Rate of Sheep (ARCAL CXLIV)	2016
RLA5074	Strengthening Regional Capacity in Latin America and the Caribbean for Integrated Vector Management Approaches with a Sterile Insect Technique Component, to Control Aedes Mosquitoes as Vectors of Human Pathogens, particularly Zika Virus	2016
RLA6072	Supporting Capacity Building of Human Resources for a Comprehensive Approach to Radiation Therapy (ARCAL CXXXIV)	2014
RLA6073	Improving the Quality of Life of Older People Through the Early Diagnosis of Sarcopenia	2014
RLA6074	Supporting the Development of Regionally Produced Radiopharmaceuticals for Targeted Cancer Therapy through the Sharing of Capabilities and Knowledge, and Improvement of Facilities, Networking and Training (ARCAL CXXXVII)	2014
RLA6075	Supporting Diagnosis and Treatment of Tumours in Paediatric Patients (ARCAL CXXXIII)	2014
RLA6077	Taking Strategic Actions to Strengthen Capacities in the Diagnostics and Treatment of Cancer with a Comprehensive Approach (ARCAL CXLVIII)	2016
RLA6078	Improving Coronary Artery Disease Patient Care with Nuclear Cardiology	2016
RLA7016	Using Isotopes for Hydrogeological Assessment of Intensively Exploited Aquifers in Latin America (ARCAL CXXVII)	2012
RLA7018	Improving Knowledge of Groundwater Resources to Contribute to their Protection, Integrated Management and Governance (ARCAL CXXXV)	2014
RLA7019	Developing Indicators to Determine the Effect of Pesticides, Heavy Metals and Emerging Contaminants on Continental Aquatic Ecosystems Important to Agriculture and Agroindustry (ARCAL CXXXIX)	2014
RLA7020	Establishing the Caribbean Observing Network for Ocean Acidification and its Impact on Harmful Algal Blooms, using Nuclear and Isotopic Techniques	2014
RLA7021	Using Environmental Isotopes and Hydrogeochemical Conventional Tools to Evaluate the Impact of Contamination from Agricultural and Domestic Activities on Groundwater Quality (ARCAL CXLIX)	2016
RLA7022	Strengthening Regional Monitoring and Response for Sustainable Marine and Coastal Environments (ARCAL CXLV)	2016
RLA9073	Supporting Human Resource Development in Nuclear Security	2012
RLA9075	Strengthening National Infrastructure for End-Users to Comply with Regulations and Radiological Protection Requirements	2014
RLA9076	Strengthening of National Capabilities for Response to Radiation Emergencies	2014
RLA9078	Enhancing the National Regulatory Framework and Technological Capabilities for Radioactive Waste Management	2014
RLA9079	Enhancing Governmental and Regulatory Safety Infrastructure to Meet the Requirements of the New IAEA Basic Safety Standards	2014

Annex 6. National projects that were approved for Costa Rica within the last three Technical Cooperation cycles

Sector of interest	Project Number	Project Title	1st year of approval	IAEA field of activity
Agriculture and the environment	COS5029	Strengthening of Good Agricultural Practices (GAP) for Food Safety and Security and Environmental Protection	2012	Agricultural water and soil management
	COS5030	Supporting Biological Control of Stable Flies (<i>Stomoxys calcitrans</i>) through the Use of Parasitoids Reproduced on Fruit Flies	2012	Insect pest control
	COS7004	Establishing a Conceptual Hydrogeological Model to Estimate Groundwater Availability and Aquifer Vulnerability in the Western Zone of the Rio Grande	2012	Water resources management
	COS5032	Enhancing the Capacity to Control Contaminants and Residues of Veterinary Medicines and Pesticides in Foodstuffs of Animal Origin Using Nuclear and Conventional Analytical Techniques	2014	Food safety
	COS5031	Consolidating a National Reference Laboratory for the Measurement of Greenhouse Gases	2014	Agricultural water and soil management
	COS5033	Assessing and Implementing Biochar Use in Climate Smart and Environmentally Friendly Pineapple Production Using Isotopic Techniques	2016	Agricultural water and soil management
	COS5034	Strengthening national capacities for the early and rapid detection of Zika virus infections in Costa Rica	2016	Insect pest control
	COS7005	Ensuring Sustainability and Water Security in the Central Valley	2016	Water resources management

Radiation protection and safety	COS9007	Strengthening of Quality Management and Radiation Protection in Nuclear Medicine, Radiology and Radiotherapy at the Caja Costarricense de Seguro Social	2012	Radiation protection of workers and the public
	COS9008	Strengthening the Radiation Safety and Protection Service of the Ministry of Health	2012	Governmental and regulatory infrastructure for radiation safety
	COS9009	Establishing a Biological Dosimetry Service	2016	Emergency preparedness and response
Health services	COS6023	Introducing Hybrid Modality Positron Emission Tomography/Computed Tomography (PET/CT) in Clinical Practice in the Caja Costarricense del Seguro Social	2012	Radioisotopes and radiopharmaceuticals production for medical applications
	COS6024	Improving Cancer Management through Training in New Techniques in Radiotherapy, Nuclear Medicine, Medical Physics and Radiopharmacy	2016	Radiation oncology in cancer management
Industry	COS1007	Establishing Gamma Irradiation Capabilities at the Costa Rican Institute of Technology (ITCR) for the Use of Radiation Processing Technology	2012	Reference products for science and trade