**HUNGARY**


**INTERNATIONAL ATOMIC ENERGY AGENCY**

# Country

# Programme Framework

# 2024-2029

**On behalf of the Government**

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**Budapest, , 2024**

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# HUNGARY
# Country Programme Framework (2024-2029)
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## LIST OF ABREVIATIONS

ARTEMIS - Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation
CNFF – Central Nuclear Financial Fund
CPF – Country Programme Framework
CTBT - Comprehensive Nuclear-Test-Ban Treaty
DRL - diagnostic reference levels
EPR - Emergency Preparedness and Response
EPREV - Emergency Preparedness Review
E&T – education and training
GSR – General Safety Requirements
HAEA – Hungarian Atomic Energy Authority
HEU - highly enriched fuel elements
HLW - high level radioactive waste
HUN-REN – Hungarian Research Network
HUN-REN CER – HUN-REN Centre for Energy Research
IAEA – International Atomic Energy Agency
IDMCC - Inter-ministry Disaster Management Coordination Committee
ILW - intermediate-level waste
INSSP – Integrated Nuclear Security Support Plan
IRRS - Integrated Regulatory Review Service
LLW - Low level waste
LTE - lifetime extension
MRs - Microreactors
NCPHP - National Centre for Public Health and Pharmacy
NEA – Nuclear Energy Agency
NERP – National Nuclear Emergency Response Plan
NFSSD - National Framework Strategy on Sustainable Development
NLO - National Liaison Officer
NPP – Nuclear Power Plant
NPT - Treaty on the Non-Proliferation of Nuclear Weapons
NRWR – National Radioactive Waste Repository
OECD – Organisation for Economic Co-operation and Development
PACT – Programme of Action for Cancer Therapy
PMO – Programme Management Officer
PSR - periodic safety review
PURAM – Public Limited Company for Radioactive Waste Management
QA – Quality Assurance
QC – Quality Control
RASIMS - Radiation Safety Information Management System
RWTDF – Radioactive Waste Treatment and Disposal Facility
R&D - Research & Development
SDG – Sustainable Development Goals
SFISF – Spent Fuel Interim Storage Facility
SMRs - Small Modular Reactors
SNF - spent nuclear fuel
TC – Technical Cooperation
TCP – Technical Cooperation Programme
VLLW - Very low-level waste

## EXECUTIVE SUMMARY

The proposed technical cooperation programme under the Country Programme Framework (CPF) is aligned with national and sectoral strategies and policies including the National Framework Strategy on Sustainable Development of Hungary 2012-24, the National Energy Strategy of Hungary 2030 with a view to 2040, the Second National Climate Change Strategy, the Second Climate Change Action Plan 2021-23, the National Clean Development Strategy, the Strategy for Research, Development and Innovation 2021-30, the Strategical Research Plan 2021-25, the National Energy and Climate Plan, the Climate and Nature Protection Action Plan, the National Policy on management of spent fuel and radioactive waste, the National Program on management of spent fuel and radioactive waste, the Healthy Hungary Strategy 2021-27 and the National Anti-Cancer Programme 2019-30.

The present CPF constitutes the frame of reference for short and medium-term technical cooperation between Hungary and the International Atomic Energy Agency (IAEA) during the period of 2024-2029.

The CPF builds on the achievements of past technical cooperation between Hungary and the IAEA. The CPF has been developed in close consultation with key stakeholders both in Hungary and at the IAEA with the aim of contributing to key national priorities and needs, where nuclear science and technology make meaningful contribution and present a comparative advantage over other technologies.

The programme is centred on major socioeconomic orientations of the country and focuses on fields in which the IAEA can make significant contributions. This enjoys strong government commitment and outlines a seven-year strategy for targeted IAEA support in the following priority fields, with indication of expected outcomes:

(1) Nuclear and radiation safety and nuclear security
(2) Spent fuel and radioactive waste management;
(3) Emergency preparedness and response;
(4) Sustainability of nuclear institutions and nuclear knowledge management.
(5) Human health

Review of progress will be carried out, as required, throughout the timeframe of this CPF to ensure a better preparation of new project proposals for the following Technical Cooperation Programme (TCP) cycles.

# I. INTRODUCTION

The CPF contained in this document constitutes the frame of reference for short and medium-term technical cooperation between Hungary and the IAEA during the period 2024-2029. The CPF reflects an agreement between Hungary and the IAEA, whereas nuclear science and technology can contribute meaningfully and cost-effectively to national priorities and goals.

This document provides an overview of what Hungary aims to achieve within the framework of the TCP over the 2024-2029 period. The CPF preparation process was led and coordinated by the national regulatory body, the Hungarian Atomic Energy Authority (HAEA), the Ministry of Energy and facilitated by the Programme Management Officer (PMO) in the Division for Europe of the IAEA Department of Technical Cooperation (TC). It was developed through in-depth consultations with and the involvement of a broad range of stakeholders both at the IAEA and in Hungary. Key stakeholders involved in the preparation of the CPF included governmental organisations the Ministry of Energy, the Ministry for Foreign Affairs and Trade, the Ministry for Culture and Innovation, the Ministry of Interior, the Ministry of Agriculture, the National Centre for Public Health and Pharmacy), dedicated counterparts in Hungarian universities, the nuclear research institutes and licensees (see Annex II). All stakeholders who participated in the previous CPF were invited again to participate in the preparation of the present document.

The present CPF 2024-2029 has been developed after a thorough analysis of relevant sectoral, national and international strategies and policies, including the National Framework Strategy on Sustainable Development of Hungary 2012-24, the National Energy Strategy of Hungary 2030 with a view to 2040, the Second National Climate Change Strategy, the Second Climate Change Action Plan 2021-23, the National Clean Development Strategy, the Strategy for Research, Development and Innovation 2021-30, the Strategical Research Plan 2021-25, the National Energy and Climate Plan, the Climate and Nature Protection Action Plan, the National Policy on management of spent fuel and radioactive waste, the National Program on management of spent fuel and radioactive waste, the Healthy Hungary Strategy 2021-27, the National Anti-Cancer Programme 2019-30 and the UN Sustainable Development Goals. The aim was to identify those priority areas where nuclear science and technology can play an important role in achieving national development objectives and has a comparative advantage over other technologies.

Equality of men and women was an integral consideration in the development of the CPF. The stakeholders engaged in the development, implementation and monitoring of the CPF represent a balanced participation of men and women. Moreover, the TCP itself enhances their equal participation as training participants, fellows, scientific visitors, project counterparts, researchers and experts.

The CPF 2024-2029 outlines a six-year strategy for targeted IAEA support, building upon achievements of past technical cooperation activities and will address the following priority areas:

1. Nuclear and radiation safety and nuclear security;
2. Spent fuel and radioactive waste management
3. Emergency preparedness and response;

4. Sustainability of nuclear institutions and nuclear knowledge management.

5. Human health;

In addition, Hungary will participate in relevant regional/interregional projects focusing on the above-mentioned areas to improve national capacity in the applications of nuclear science and technology.

# II. SITUATION ANALYSIS

## 2.1. Cooperation with the IAEA

Since Hungary joined the IAEA and its technical cooperation programme in 1957, the country has strengthened its regulatory infrastructure and capacities in the nuclear area.

During the past decade, technical cooperation with the IAEA has focused on building and strengthening the capacities of the country's capacity in peaceful uses of nuclear technologies in the areas of safety assessment, quality assurance programmes in radiology and radiotherapy, and water resource monitoring. The TCP focused on maintaining and improving the existing knowledge base and ensuring the provision of reliable services and operations. Its goals were achieved through the implementation of national projects with a preliminary focus on human resource activities. More specifically, fellowships and scientific visits allowed professionals and young experts to build and further strengthen competence and knowledge of the staff of relevant institutions and universities. Most of the trainees continued their professions in their original institutions or at least in the field of peaceful uses of nuclear technology where they share and apply their knowledge and expertise gained through the TCP.

In previous years Hungary has benefited from the assistance provided by the TCP focusing on the strengthening of regulatory infrastructure for radiation safety, the improvement of radioactive waste management of decommissioning activities, the quality enhancement of radiotherapy services, and the development of nuclear knowledge. In addition to national TC projects, Hungary also has been actively participating in the regional and interregional projects that are relevant to its national priorities.

Since 2018, Hungary has also benefited from assistance in the area of nuclear security from the IAEA through training courses, workshops, exercises and more, addressing topics such as computer security for nuclear security, physical protection, contingency response, insider threat mitigation, nuclear security detection architecture, nuclear forensics, etc. Hungarian experts also attended numerous nuclear security related regional and international training courses, workshops, conferences, consultations, and technical meetings, as well as contributed to international nuclear security peer review and advisory missions. Hungary's Integrated Nuclear Security Sustainability Plan (INSSP) provides a customized framework for coordinating and implementing nuclear security activities conducted by the country, the IAEA, and potential partners, in a systematic manner. It is a useful tool for reviewing the national nuclear security regime and identifying areas where it needs to be strengthened. The INSSP of Hungary and its Implementation Plan were finalized in July 2018, and formally approved in February 2019. Since then, Hungary has actively cooperated with the IAEA in this field. The first INSSP review mission was held in Hungary between 25th and 28th April 2022, which observed that Hungary has a well-built nuclear security regime, and identified that, during the next 4-year period, the country should further enhance national cooperation and the regime's sustainability.

Meanwhile, Hungary has been a regular contributor to the Working Capital Fund, the Regular Budget and the Technical Cooperation Fund of the IAEA and has been the host country to many IAEA training events, fellowships, and scientific visits, receiving participants from all over the world, in particular from developing countries. These participants were trained in different institutes and organizations of Hungary depending on their expertise and needs. Having reached a high-level of technical expertise in using nuclear power, Hungary provides know-how and expertise transfer through training and making available its national infrastructure for training purposes within the IAEA TCP.

## 2.2. National priorities and goals

The national priorities and needs that will be addressed through the TC programme have been identified based on the situation analysis and a thorough review of relevant sectoral, national and international strategies and policies. These include the following:

- the National Framework Strategy on Sustainable Development (NFSSD) of Hungary 2012-24: The NFSSD outlines the sustainability goals taking into account Hungarian specificities. The basic task for the development of a sustainable society is the preservation and enhancement of national resources. Four main resources are therefore outlined in the NFSSD: human, social, environmental, and economic.

- the National Energy Strategy of Hungary 2030 with a view to 2040: This Strategy focuses on energy efficiency, increased use of renewable energy and of low CO2-emission transport. The main purpose of the strategy is to make the energy sector more competitive, more sustainable, and more secure in the next 20 years.

- the Second National Climate Change Strategy: This Strategy identifies the national duties imposed by international treaties to address climate change and provides guidelines to harmonize climate protection with development policy.

- the National Energy and Climate Plan: The main objective of this Plan is to strengthen energy sovereignty and energy security, to maintain the results of reduced overhead costs, and to achieve the decarbonisation of energy production, which is possible only through the combined use of nuclear energy and renewable energy. For countries with scarce conventional energy sources, such as Hungary, energy sovereignty is a question of welfare, economy, and national security.

- the National Clean Development Strategy 2020-50: This Strategy outlines the pathways toward climate neutrality and confirms that the government of Hungary is taking concrete actions to combat climate change. Hungary opts for a clean future that follows the path of climate protection, energy sovereignty, and green economic development.

- the Strategy for Research, Development, and Innovation 2021-30: The aim of this strategy is to achieve a knowledge-based, balanced, sustainable economy and society capable of creating high added value in all areas of the country.

- the Strategical Research Plan 2021-25: the aim of this Plan is to reinforce nuclear research activities in Hungary.

- the Climate and Nature Protection Action Plan: This Plan's primary task is to protect and preserve the Carpathian Basin's natural environment, rich water resources, agricultural land, forests and diverse flora and fauna.

- the National Policy on management of spent fuel and radioactive waste: The most important objective of the National Policy is to establish a national policy on the management of spent fuel and radioactive wastes and to lay down the requirements (fundamental principles) related to management of radioactive waste and spent fuel, which ensure the protection of human health and the environment against the harmful effects of ionising radiation and guarantee that a burden more severe than justified is not placed on the future generations.

- the National Program on management of spent fuel and radioactive waste: While implementing the principles and boundary conditions of the National Policy, the National Program includes the presentation of plans and technical solutions as well as their financing for the management of all spent fuel and radioactive waste generated on the territory of the country - from the stage of their generation until their final disposal.

- the Healthy Hungary Strategy 2021-27: The achievement of the overall sectoral goal of this Strategy is served by the realization of six sub-goals: 1. A healthy start to life and priority protection and development of children's health; 2. Promoting a healthy lifestyle, reducing health risks through health awareness health literacy and health promotion; 3. Reducing the burden of chronic diseases by providing professionally based health promotion and prevention services and more accessible to health care with transparent, uniform patient pathways; 4. Protection of the population's health from epidemics and environmental damage; 5. Improving the health of the disadvantaged population, reducing regional inequalities in health; 6. Strengthening the public health system; 7. Providing the healthcare workers with a secure and predictable future, and continuous improvement of working and living conditions; 8. Implementation of e-Health and telemedicine developments, introduction of forms of care based on modern digital technologies.

- the National Anti-Cancer Strategy 2019-30: its goal is to implement a complex approach to oncology by transforming current practice into an effective care system that ensures modern patient care.

In terms of risks, the overall programme implementation could be affected by lack of and/or insufficient coordination between various institutions, insufficient capacity and competences of staff, and budget limitation and cancellation of fellowships/scientific visits due to unpredictable events.

The proposed technical cooperation programme under this CPF will contribute to the achievement of SDG 3 "Ensure healthy lives and promote well-being for all at all stages", SDG7 "Ensure access to affordable, reliable, sustainable and modern energy for all" and SDG9 "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation" by reaching the following outcomes.

## 2.3. Legal and regulatory framework

Hungary is a party to most international legal instruments adopted under IAEA auspices in the areas of nuclear safety, security, and civil liability for nuclear damage. It is also party to technical cooperation and safeguards agreements, and relevant international treaties such as the Comprehensive Nuclear-Test-Ban Treaty (CTBT) and the Treaty on the Non-Proliferation of Nuclear Weapons (NPT).

The Act No. CXVI of 1996 on Atomic Energy (Act on Atomic Energy) and its implementing regulations (decrees of the President of HAEA, as well as Government and ministerial decrees) provide the legal framework for nuclear safety and security and radiation protection. These and other related laws, and decrees concerning the responsibilities of the HAEA and the prohibition of chemical and biological weapons are available on the continuously updated website[1].

Hungary is an EU member state since 2004 and IAEA Member State since 1957. Hungary, therefore, has to comply with the 'acquis communautaire', which includes all EU treaties, legislation, declarations, resolutions, international agreements that are directly applicable in the country or fully transposed into national legislation. IAEA safety standards are also applied.

The national regulatory body in the field of nuclear safety, security and radiation protection in Hungary is the HAEA that is an organization with a special legal status. It reports directly to the Parliament and has its own budget independent from any ministry.

The Act on Atomic Energy requires to ensure financial reserves (Central Nuclear Financial Fund, CNFF) for radioactive waste and spent fuel management and also for the preparation and actual decommissioning of nuclear installations. The Minister of Energy disposes over the CNFF. The CNFF is a separate state fund pursuant to the Act on Public Finance. It is earmarked for financing the construction and operation of spent fuel and radioactive waste (SF&RW) management facilities, for the disposal of radioactive waste, the storage of spent fuel, the closure of nuclear fuel cycle, and the decommissioning of nuclear facilities.

The Act on Atomic Energy further requires that the organization designated by the Government shall prepare a proposal for the National Policy and the National Programme on radioactive waste and spent fuel management as well as for their revision. Furthermore, the Government shall carry out tasks related to the final disposal of radioactive waste, interim storage of spent fuel, back-end of nuclear fuel cycle and to the decommissioning of a nuclear facility. Based on this, the Public Limited Company for Radioactive Waste Management (PURAM) was established to perform the public tasks listed in the Act on Atomic Energy.

**Radiation protection** is regulated by HAEA decree 2/2022 (IV.29.) on the protection against ionizing radiation and the corresponding licensing, reporting (notification) and inspection system. The requirements of the decree have been developed in accordance with the EU's legal framework and the IAEA General Safety Requirements (GSR), taking also into account the outcome of Integrated Regulatory Review Service (IRRS) missions completed in 2015 and 2018. Individual doses and inspection's results related to radiation exposure are recorded in the National Personal Dosimetry Register and in the personal monitoring results kept by the employer. By operating the National Personal Dosimetry Register, the regular individual monitoring of workers classified to Category "A" and "B" on the basis of measurements, interpretation and evaluation of monitoring results are carried out. The National Centre for Public Health and Pharmacy (NCPHP) is responsible the packaging, distributing and evaluating of the personal dosimeters, and the results of evaluation are sent to the National Personal Dosimetry Register maintained by HAEA. Developing the technical requirements of personal dosimetry is one of the future plans of the HAEA and the NCPHP.

On the basis of the principle of graded approach, in justified cases, neutron dosimetry monitoring is the responsibility of the employer where the worker's external exposure to

[1] http://www.oah.hu/web/v3/HAEAportal.nsf/web?openagent&menu=03&submenu=3_0

neutron radiation or the exposure of the lens or limbs to neutron radiation may exceed 1/10 of the applicable dose limit. However, measurements must be carried out using validated methods and submitted to the National Personal Dosimetry Register. Thus, the dosimetry control for workers exposed to neutron radiation is ensured.

## 2.4. Overview of identified areas for technical cooperation

### 2.4.1. Nuclear and Radiation Safety and Nuclear Security

The nuclear infrastructure in Hungary including the competent authorities and institutions, the legal framework, nuclear research, and fuel cycle facilities can be found in the Country Nuclear Power Profile and the National Reports to the Convention on Nuclear Safety and the Joint Convention.

Nuclear power will remain one of the main sources of electric energy in Hungary. The new National Energy Strategy of Hungary 2030 with a view to 2040 confirms the need for nuclear safety and nuclear energy. Nuclear energy remains a key component of a cost-effective, climate-friendly, stable energy mix that helps Hungary meet its environmental goals, including the very ambitious target of having 90% of the electricity generation becoming carbon-neutral by 2030.

The Paks Nuclear Power Plant (NPP) four units' lifetime was extended; the operational license of existing 4 units will expire between 2032 and 2037, but due to the rapid increase in electricity demand and the good technical performance of main parts of the power plants, the preparation for a further lifetime extension (LTE) is in progress. The Hungarian Parliament adopted the Resolution No. 56/2022 on the further LTE of the Paks NPP. The relevant Hungarian authorities and other respective stakeholders continue to focus on operational reliability and safety issues of these operating units in full compliance with international safety standards and practices. With that in mind, Hungary will count on the methodological knowledge transfer of IAEA relating to long-term operation and ageing management.

Commitment is also confirmed for constructing the two new units at the Paks site in order to maintain the nuclear capacity of Hungary. High level of power plant performance and nuclear safety, sound management practices, adequate level of resource maintenance and Research & Development (R&D) require continued focus and exchange of experience in order to continuously and sustainably comply with international best practices and standards.

Nuclear fuel safety is a basic component of safety requirements associated with nuclear energy production. On 25 October 2024, the French company Framatome signed a contract for the long-term supply of fuel for the four VVER-440 reactors in operation at Paks NPP, starting from 2027. In order to increase the security of supply of nuclear fuel, Hungary is highly interested in new nuclear fuel concepts in order to realize the diversification of nuclear fuel supply.

Taking into account the climate goals, Hungary is very interested in improving knowledge on capacity building of and safety review capability in all the fundamental aspects of Small Modular Reactors (SMRs) and Microreactors (MRs) deployment and their electric and non-electric applications, as well as in mitigating climate change and integrating the basic principles of circular economy. Special emphasis is on siting, design, construction, operation, maintenance, technology and safety assessment, fuel cycle, waste management, economics and financing, safety and regulation.

Two reactors operate in Hungary for research (and training) purposes. The Budapest Research Reactor operated by the HUN-REN Centre for Energy Research of Hungarian Research Network (HUN-REN CER), has an operating license valid until 15 December 2033. The HAEA issued the new operating license in December 2023 based on the present periodic safety review (PSR). The other research reactor operated by the Institute of Nuclear Techniques at the Budapest University of Technology and Economics was built in 1971 for training and research purposes. The current operating license of the Training Reactor of the Budapest University of Technology and Economics that was granted by the HAEA in 2017 based on the results of the PSR, is valid until 30 June 2027. Although there is no decision yet on their future operation, preserving experience on these reactors is essential.

Hungary is constantly working on the improvement of its infrastructures for radiation safety to best align with the IAEA safety standards. In the coming period 2024-2029 focus will continue on the improvement of personal neutron dosimetry service at a national level to ensure the radiation protection of workers exposed to neutron radiation and to reduce the risks to human health due to occupational exposure.

The effort has been supported by the IAEA via the TC project HUN 9023, implemented by the HUN-REN CER. The project supports the update of guidelines and protocols on the measurement of personal neutron dosimeters, improve the infrastructure of the personal neutron dosimetry laboratory, and train specialists in personal neutron dosimetry. The objectives of the project are included in the 2022–2026 research strategy of the HUN-REN Hungarian Research Network, of which the HUN-REN CER is a member.

An **IRRS** mission took place in 2015 in Hungary and the respective IRRS follow-up mission in 2018. The 2018 IRRS team concluded that Hungary has gone through a significant transition during which the country was successful in addressing many of the recommendations and suggestions identified during the initial mission. In 2023 Hungary invited IAEA to review the regulatory framework, including radiation safety; the next IRRS mission is scheduled for 2025 Q3.

Of special interest in the area of Nuclear and Radiation Safety and Nuclear Security are the following:

(1) Using the results of the self-assessment, recommendation and suggestions of the IAEA technical assistance missions, where applicable, as input for necessary adjustments in policy documents, in the legislative and regulatory framework, in coordination between the responsible state institutions.

(2) Evaluation of safety issues which are of importance for the permanent strengthening of nuclear safety of VVER reactors including implementation of plant safety improvements in connection with the second LTE;

(3) Continuous strengthening of nuclear safety and radiation protection through development of inspection techniques and operational feedback;

(4) NPP ageing management programme, safety assessment and licensing of new NPPs including new nuclear fuel concepts;

(5) Sustainable development in the field of waste management and decommissioning preparation programmes as well as its final disposal;

(6) Reliable operation of Budapest Research Reactor and the Training Reactor of the Budapest University of Technology and Economics, improvement of their safety and safety assessment in line with updated technologies as well as their utilization for the production of radioisotopes, material testing, reactor physics and training;

(7) Improving knowledge, capacity building and safety review capability in all the fundamental aspects of SMRs and MRs deployment,

(8) Improvement of the national regulatory framework based on international experience in order to improve the efficiency of regulatory oversight.

IAEA support will be sought to improve the legal and regulatory framework for the safe use of nuclear technology in accordance with IAEA standards and to strengthen the capacity and expertise of the regulatory body in all areas of its responsibility and other involved institutions for safety and security. In support of efforts to strengthen the national radiation safety infrastructure, Hungary has provided information in the IAEA's Radiation Safety Information Management System (RASIMS). Periodically updating this information in RASIMS can help record achievements and assess the effectiveness of actions and progress made. The support will be provided through the national TCP and participation in regional and interregional technical cooperation projects.

In addition to its national TCP, Hungary intends to continue its active involvement in NPP related regional and interregional technical cooperation activities, especially those related to nuclear safety, because these activities are highly beneficial and of key importance for the country.

### 2.4.2. Spent fuel and radioactive waste management

In Hungary, radioactive waste and spent fuel are managed by PURAM. Spent fuel from the Paks NPP is stored in reactor pools and after that in the Spent Fuel Interim Storage Facility (SFISF) at the vicinity of the NPP site at Paks. Two disposal facilities are in operation, one near-surface (Radioactive Waste Treatment and Disposal Facility, RWTDF) and one geological (National Radioactive Waste Repository, NRWR) repository. A disposal facility is envisaged for very low level waste in preparation for the future shut down and decommissioning of the four reactors at Paks NPP.

A medium and a long-term plan (covering up to the decommissioning of the various nuclear facilities and the closure of the radioactive waste repositories) and an annual work schedule on the use of the CNFF shall be prepared by PURAM and shall be approved by the minister supervising the CNFF. The medium- and long-term plans are to be reviewed annually and revised as required. The due payments into the CNFF are defined in accordance with these plans. The contribution of the Paks NPP to the CNFF is determined by the act on the annual budget.

According to the National Policy on management of spent fuel and radioactive waste, the final decision concerning the back-end of the fuel cycle of power reactors is not yet necessary to be made, but it is necessary to state that Hungary must address the management of high level radioactive waste regardless of the chosen back-end option. The most suitable and most widely accepted solution to this is final disposal in a deep geological disposal facility. According to the National Policy on management of spent fuel and radioactive waste, the final disposal of high-level radioactive waste must be carried out in Hungary in a repository to be established in a stable, geological formation. The primary consideration in the selection of the site as well as

in the construction of the repository is the following: the site, the bedrock and the technical solutions adopted, matching the properties of the deposited waste, shall jointly provide isolation and containment of the waste from the living environment until the required period of time.

The policy concerning the back-end of the fuel cycle follows the "do and see" principle, meaning that an open cycle i.e. direct, domestic disposal of spent fuel originating from nuclear power plants has been determined as the reference scenario, which provides the basis of the relevant cost estimates concerning the currently operating four units. Domestic and international developments concerning the back-end of the fuel cycle must be followed ("see") and if necessary must be incorporated into the policy, while at the same time progress must be made on the site selection of the domestic deep geological disposal facility ("do"). In view of this, Hungary is progressing with the development of a deep geological disposal facility for high level radioactive waste, but also interested in plans for implementing regional disposal facilities for cost-effectiveness.

The policy of the back-end of the fuel cycle for spent fuel from domestic non-power generating reactors, i.e. Budapest Research Reactor and the Training Reactor of the Budapest University of Technology and Economics is the repatriation of the spent fuel in such a way that secondary wastes, generated during the reprocessing remained in the Russian Federation. Alternative option is the domestic management (storage and after that disposal together with NPP origin spent fuel in a domestic deep geological disposal facility) of research reactor fuel. As a result of the modification (conversion) of the Budapest Research Reactor (change of the highly enriched fuel elements (HEU) to low enriched), from the beginning of 2013 the reactor core is only composed of low enriched fuel elements. The HEU fuel assemblies and other nuclear materials were transported back to the Russian Federation. The last repatriation was completed in 2013. The decision on future actions regarding the spent fuel element from the Budapest Research Reactor and the Training Reactor of the Budapest University of Technology and Economics will be made by the Government in the frame of the review process of the National Programme on management of spent fuel and radioactive waste.

An Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation (ARTEMIS) mission was conducted in 2022. The ARTEMIS team concluded that the Hungarian system provides a well-developed infrastructure for ensuring the safe and effective management of spent fuel and radioactive waste now and in the future, but at the same time noted potential for enhancing the decision-making process for the backend of the fuel cycle and elaborating the regulatory framework for disposal of very low-level radioactive waste.

Of special interest in the area of radioactive waste management and environmental monitoring are:

(1) Continue increasing SFISF storage capacity according to planned steps; Further extension of the SFISF using different storage technologies (dry casks);

(2) Commission disposal chambers in NRWR according to schedule based on the needs;

(3) New NPP units' integration into the Hungarian SF and RW management;

(4) Development of a roadmap for the implementation of the Domestic Geologic Repository for SNF/HLW; Conduct survey for alternative potential geological formation for the future DGR;

(5) Reviewing the strategy and basic assumptions for future decommissioning of nuclear installations;

(6) Implementation of the existing plans for safety upgrading of the near surface repository (RWTDF) by retrieval of those critical waste streams which pose unacceptable hazard during the post closure period of the repository;

(7) Considering the potential benefits of integrating and optimizing the management, including disposal options, of institutional and NPP-origin low-level waste (LLW) and intermediate-level waste (ILW) streams;

(8) Development of safety regulations for management of Very low-level waste (VLLW) including disposal; Site survey and site selection criteria of the VLLW repository;

(9) Review of the National Programme for RWM and SFM to further identify improvements.

(10) Assessing and developing the resources and competences of the Regulatory Body to fulfil all responsibilities related to the safety of radioactive waste and spent fuel management, in particular with regard to the development of deep geological and very low activity level radioactive waste disposal facilities.

IAEA TC support will thus be sought to strengthen capacities and competencies of national institutions involved in the oversight of spent fuel and radioactive waste management through staff training, exchange of experience (including available technologies), and procurement and replacement of necessary measurement equipment. Support will also be sought for the selection of the final sites of the VLLW and the deep geological repository.

The support will be provided through the national TC programme as well as through participation in regional and interregional technical cooperation projects.

### 2.4.3. Emergency preparedness and response

In 2006, a High Level Working Group was established for the revision and maintenance of the National Nuclear Emergency Response Plan (**NERP**). The High Level Working Group, with the authorization of the Inter-ministry Disaster Management Coordination Committee (IDMCC), develops technical-scientific documents (guidelines) to harmonize the nation-wide planning and to provide guidance in expert questions that are not regulated in sufficient detail by the NERP.

The modification of the NERP occurred in two steps. First, the Council Directive 2013/59/Euratom was transposed into the domestic legal framework. Accordingly, the new version of the NERP specifies the radiation protection reference levels, the generic criteria and the operational intervention levels, as well as the strategy of protection. With these changes, the plan partially adhered to the IAEA GSR Part 7 standard. The second step aimed at the total compliance with the IAEA GSR Part 7 standard to be carried out by the High Level Working Group. The NERP version 3.2 was approved by the IDMCC in December 2023.

In July 2022, the IAEA Emergency Preparedness Review (EPREV) Mission follow-up team reviewed the emergency preparedness and response framework for nuclear and radiological emergencies in Hungary and stated that Hungary had addressed the recommendations from the initial EPREV mission and had taken significant steps to improve its preparedness for nuclear and radiological emergencies.

Of special interest in the area of emergency preparedness and response is to:

(1) Develop the necessary procedures and analytical tools to identify dangerous and contaminated material and respond accordingly, and clearly identify the responsible organisation;

(2) set up arrangements to establish a national system for recording doses received by emergency workers;

(3) set up arrangements for medical personnel, both general practitioners and emergency staff, to recognize the symptoms of radiation exposures;

(4) revision of the NERP and other relevant documents to align them with the revised IAEA safety standard on EPR, GSR Part 7;

(5) enable first responders to identify radiological conditions they may face during their duty as required by GSR Part 7 paragraph 5.17.

IAEA support will be sought to strengthen the necessary capacities of institutions involved in emergency response including first responders through staff training, exchange of experience and modernizing radiation monitoring equipment. Most of these activities will be financed through national resources or arranged in the framework of regional or interregional TC projects.

### 2.4.4. Sustainability of nuclear institutions and nuclear knowledge management

Hungary, a country with developed nuclear energy sector, dedicates systematic care to education, R&D, and training human resources and specialists to ensure the provision of reliable services and the operation of various nuclear devices.

Training of experts is provided permanently through university and post-graduate programmes, courses and different types of education, including on-the-job trainings with the aim to: (1) strengthen the capacity of the regulatory body in all areas of its responsibility and relevant research institutions and universities; (2) foster exchange of information and knowledge in radiation physics and lessons learned on specific aspects of QA/QC and the integrated management for laboratories; (3) build and strengthen capacity of institutions responsible for radioactive waste and spent nuclear fuel management and for environmental monitoring, including remediation work.

Nuclear institutions in Hungary are generally sustainable in the education of new personnel through the establishment of strategic planning and knowledge management as an integral part of the management practices. However, the country faces increasing difficulties due to the ageing of personnel and the decreased interest in nuclear science and technologies. Moreover, Hungary faces new challenges with regard to the building of new nuclear infrastructures (nuclear reactors, the deep geological repository for spent nuclear fuel) and a further LTE of Paks NPP. The lack of qualified human resources could affect the sustainability and self-reliance of national nuclear institutions and facilities. Therefore, in addition to the technical cooperation (fellowships, scientific visits, training etc.) under national and regional programmes, it is essential to strengthen activities focused on maintaining and improving the existing nuclear knowledge.

A new initiative has been introduced by the Paks-2 Project Company which is cooperating with 6 universities countrywide in financing 100 scholarships annually to train nuclear engineers

and attract engineers of other fields to nuclear grade. This program is very popular, especially in the region of the operating NPP units. The University of Dunaújváros receives financial support from the Government to establish a material test scientific laboratory that would serve the needs of the new build Paks-2 project during its licensing, construction and operation.

The TC collaboration aims to enhance the competence and expertise of the regulatory body (HAEA), relevant research institutions, and universities as well as medical facilities. These activities are focused on maintaining and improving the existing knowledge base through universities and postgraduate programmes, courses and different types of education including on-the-job trainings. It helps to ensure provision of reliable services, operations and manufacturing of various nuclear devices, and to support necessary R&D activities.

Hungary intends to preserve its extensive nuclear expertise and also stands ready to offer it to the international community.

Of special interest relating to sustainability of nuclear institutions and nuclear knowledge management are:

(1) development and implementation of (inter-disciplinary) knowledge management systems to share and draw upon national expertise in the nuclear field;

(2) capacity building, human resources development and knowledge management in order to contribute to preserving and transferring nuclear knowledge in the nuclear power and radiation technology organizations;

(3) reassessment and organization of education and training, as necessary, for professionals in the nuclear field.

Most of these activities will be financed through national resources or under the framework of regional or interregional TC projects. However, IAEA support will be sought to build the necessary capacities of institutions involved, through staff training and exchange of experience.

The following is the expected outcome to be achieved in the thematic area nuclear and radiation safety and security:

### 2.4.5. Strengthened nuclear and radiation safety and security for the protection of people and the environment from the adverse effects of ionizing radiation. Human Health

The national strategy titled "Healthy Hungary Strategy 2021-2027" was adopted by the Government of Hungary in January 2021. The strategy offers a comprehensive framework to help choose and implement priorities and mobilize resources to promote health and health system while at the same time takes account of EU directives and international guidelines.

Based on the statistics of the OECD, tumour-related illnesses still account for a significant proportion of mortality for both men and women in Hungary. Therefore, the necessity of providing continuous research and innovation and education and training (E&T) in healthcare and developing radiation medicine in the country is fundamental.

The Government of Hungary considers health promotion and improvement as productive investments which are essential elements of the country's socio-economic development and require inter-sectoral and multidisciplinary cooperation in implementation.

The updated "National Anti-Cancer Program 2019-2030" aims to strengthen the cancer control system in Hungary through the application of European cancer care principles, standards and guidelines. The Program comprises of legislative actions, educational and training initiatives, research and innovation priorities, improvements of the function of multidisciplinary tumour boards and addresses cancer survivorship and rehabilitation. Based on successful European models, the Program is coordinated by the National Institute of Oncology.

Cancer care in Hungary is organized as a network where the tasks are shared by general practitioners, the oncology departments of the municipal/county/Budapest regional hospitals, the clinical oncology departments of universities and, at the top of the nationwide network, the National Institute of Oncology. In this network, county and Budapest metropolitan clinical oncology departments assume the role of county level cancer care centres, which integrate the cancer care services in their regions, and the hospital and clinic units that handle all cancer care activities. Since the past 10 years the equipment of radiation therapy centres has been replaced by the most modern devices, the newest radiation treatment procedures have become available. The transition from 3D conformal radiation therapy to intensity modulated and image guided radiation therapy requires the continuous professional development of the radiation therapy staff, therefore the necessary E&T has to be provided. Due to career changers and retiring workers, the young generation has to be attracted to the radiation therapy field in order to avoid labour shortage.

In the past few years, after harmonising the regulatory framework with the Council Directive 2013/59/Euratom laying down basic safety standards for protection against the dangers arising from exposure to ionising radiation, repealing Directives 89/618/Euratom, 90/641/Euratom, 96/29/Euratom, 97/43/Euratom and 2003/122/Euratom and adopting requirements from the IAEA Safety Standards, the Decree of the Minister of Human Capacities No. 21/2018 *On the health protection of people undergoing exposure to ionising radiation not related to their course of work during the provision of healthcare services* introduced several new requirements for both the regulatory body and the licensees operating diagnostic imaging devices using ionising radiation.

The NCPHP published the list of accepted radiological procedures on its webpage which shall provide a basis for the development of the national diagnostic reference levels (DRL), clinical audits and the estimation of the population dose from medical exposures. A national DRL survey was initiated in 2021, which required significant professional and financial efforts from the regulatory body and the licensees.

The comprehensive evaluation of the population dose from medical exposures will be recommended, especially for high dose procedures e.g. computer tomography, interventional X-ray equipment, positron emission tomography, which have become more easily accessible due to significant financial support in recent years.

The registration of accidental, unintended and near miss events is also a recommended action by the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources and Council Directive 2013/59/Euratom. A few institutions operate dose monitoring systems and a reporting system for the aforementioned events, but these efforts should be extended to as many institutions of radiation medicine as possible beside the Centre of Competence. This could be organised on a national level with the support of the regulatory body or on a professional level by professional societies.

Establishing a system of internal and external (peer review) clinical audits is essential and enhances the safe practice and optimal patient care. The assessment methodology should be

based on the standards applied for performing the audits. Under the guidance of the IAEA the local/national clinical audit protocols should be harmonised with international recommendations, which ultimately will provide a standardized tool to facilitate the audit process. Internal clinical audits need to be initiated at the local level aiming at determining the current performance level of the radiation medicine services. Each field of study (radiation therapy, nuclear medicine, diagnostic radiology) requires an own separate national external audit programme. By assessing the management, operating and safety and dosimetry procedures, facilities, equipment and human resources and their impacts on clinical practice, a comprehensive evaluation can be performed. The process must be patient-oriented, systematic and evidence-based. To ensure the adequate quality of practice, following the internal audits, independent external audits on a national level (peer reviews) should also be carried out. The independent external audits are advisable to be developed under the support of the IAEA, involving international experts.

Since radiation therapy technologists, nuclear medicine technologists and radiographers are important participants of clinical audits, their number should be increased through training and promotion of the field, while at the same time, their continuous E&T has to be provided.

According to the root-cause assessment of the present situation and by the support of the IAEA's guidance document "Medical Physics Staffing Needs in Diagnostic Imaging and Radionuclide Therapy: An Activity Based Approach", it is estimated that ideally 40 medical physicists would be required in diagnostic radiology and about 10 more would be necessary to support diagnostic nuclear medicine. This evaluation considers that in diagnostic and interventional radiology, comprehensive quality control tests are currently performed by the NPHC. The effort to strengthen the clinical presence of medical physicists in diagnostic radiology has been supported by the IAEA via the TC HUN6004 project. The project enabled several institutions to integrate their own quality control (QC) related tasks in their quality management system. Considering the implementation of provisions of Council Directive 2013/59/Euratom and in particular the complex responsibility, including patient dosimetry and optimisation, implementation of a comprehensive quality control programme and furthermore counselling as regards the procurement of new equipment and the support of local educational efforts of radiation protection, it is of utmost importance to increase the number of medical physicists. Participation in different coordinated research projects is also crucial for the development of diagnostic radiology departments.

The growing importance of nuclear medicine in healthcare is driven by its ability to provide functional and molecular information, guide personalized treatment, facilitate early disease detection, and contribute to medical research and drug development. The field continues to evolve, with ongoing technological advancements and expanding applications, making nuclear medicine an indispensable tool in modern healthcare. Theranostics, which combines diagnostic imaging with therapeutic interventions, enables the selection of the most appropriate treatment based on an individual patient's specific characteristics. The development and implementation of theranostics require collaboration among researchers, clinicians, and regulatory bodies to ensure safety, efficacy, and cost-effectiveness. While the field of theranostics is still evolving, it holds great potential as regards advancing personalized medicine and improving patient outcomes. There is an evolving need for wider dissemination of novel theranostic applications in Hungary. In order to achieve this objective specialised training, an appropriate infrastructure, and the appropriate regulatory framework should be set up, and the widespread high-level use of hybrid medical imaging (e.g. SPECT/CT and PET/CT) applications should be ensured.

The increased use of ionizing radiation and radioisotopes for diagnostic and therapeutic

purposes, the rapid advances in computed tomography, positron emission tomography as well as the high radiation doses delivered by interventional procedures have raised serious safety and health concerns for both patients and medical staff. Safety culture, which includes the knowledge of risks, rules and practices related to radiation safety, has become highly important concerning all stakeholders. A clear commitment of the senior management to safety culture - encouraging a questioning and learning attitude by the staff, discouraging complacency with regard to protection and safety, applying risk analysis and ensuring the understanding of procedures by all relevant staff at the organization - provides more effective diagnosis and treatment, improves patient and staff safety and reduces radiation exposure.

Of special interest in the area of human health is:

(1) strengthening the quality of cancer control program in Hungary through the application of international recommendations, standards and guidelines;

(2) improvement in radiation therapy treatment techniques, enhancing the quality of radiation therapy and patient dosimetry, increasing the quality of patient life by decreasing the side effects;

(3) enhancing a quality assurance programme, leading to accurate dosimetry, dose delivery and patient protection for all fields of radiation medicine (radiotherapy, diagnostic radiology, interventional radiology and nuclear medicine);

(4) providing continuous professional development in education and training that comply with European standards for professionals and healthcare-staff to meet demands of radiation medicine;

(5) improvement of quality and safety of the diagnostic and therapy patient care through the clinical audit for the radiation medicine;

(6) Establishing and implementing of appropriate national DRL;

(7) Hungary's active participation in the Rays of Hope initiative of the IAEA.

IAEA support will be sought to build the necessary capacities of institutions including staff training and exchange of experience. Most of these activities will be financed through national resources or arranged in the framework of regional or interregional TC projects and Coordinated Research Projects.

The following is the expected outcome to be achieved in the thematic area of Human Health and Nutrition:

- **Improved health outcomes and increase survival rates of cancer patients.**

## III. Results Matrix

### Nuclear and Radiation Safety and Nuclear Security

| Nuclear and Radiation Safety and Security Outcome[s] | Baseline | Indicators | Means of Verification | Assumptions/risks |
|---|---|---|---|---|
| Outcome: Strengthened nuclear and radiation safety and nuclear security for the protection of people and the environment from the adverse effects of ionizing radiation. | RASIMS status TSA1 -2<br><br>Only the special HAZMAT units of the Disaster Management were equipped with personal dosimeters prior to 2023.<br>The purchase and delivery of further 160 dosimeters for fire engine unites has been done in 2023.<br>Supply of further 324 fire engine unites of the Disaster Management, 487 first responders of the Police and the 85 Emergency Medical Teams with dosimeters is missing.<br>Altogether 896 personal electronic dosimeters and 22 surface contamination | TSA 1-2 status improved against 2024 baseline by 2029.<br><br>Number of staff trained.<br>Equipment and training available for first responders<br><br>Sufficient storage and disposal capacity corresponding to current needs.<br><br>Implementation of dedicated safety requirements for VLLW management<br><br>Updated RAW and SF national programme, with a view to the commissioning of new NPP units, a roadmap for the DGR and the future decommissioning of nuclear installations<br><br>The continuous safe operation of research reactors.<br><br>Capabilities available for maintaining expertise in RAW and SF management<br>Continuous professional development in education and training<br><br>Number of experts trained in the nuclear field<br><br>National guidelines for knowledge management | RASIMS databases.<br>Project reports.<br><br>Proof of delivery. Lists of participants of training courses, workshops, scientific visits and fellowships, training certificates.<br><br>New requirements in place<br><br>Adopted national programme<br>Studies<br><br>National guidelines, training certificates | Assumptions-<br>HAEA continues to be independent regulatory authority reporting directly to the Parliament.<br><br>Trained staff remain on board after training.<br>Training of staff is periodically renewed due to infrequent use of the equipment and the change in personnel.<br><br>Risks:<br>HAEA status is changed.<br>Insufficient commitment by the institutions to support the programme activities.<br>Lack of human resources<br>Delay in progress during implementation of activities<br><br>Means of managing or mitigating risks -<br>Continuous dialogue to raise awareness and commitment of all stakeholders. |

| | | | | | |
|---|---|---|---|---|---|
| | monitors need to be purchased.<br><br>Necessity of increasing RAW disposal and SF storage capacity , including the assessment of alternative storage technologies (casks)<br><br>RAW and SF national framework needs to be developed further (e.g. no dedicated safety regulations for VLLW management)<br>The review of the national programme is currently ongoing.<br><br>Lack of national knowledge management system | | | | |

**Nuclear and Radiation Safety and Nuclear Security**

| Indicative Outputs | Indicative Timeframe (Future TC cycle) | Relevant national counterpart(s)/ institution(s) | Approximate Cost in € (A) | Resources*currently available in € (B) | Resources to be identified/mobilised in € (A-B) |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Output<br>Strengthened the national regulatory framework and infrastructure to ensure the safe and secure use of nuclear power and the effective regulation and supervision of nuclear installations, radiation facilities, and ionizing radiation sources. | 2024-2027, 2028-2029 | HAEA, Ministry of Energy, PURAM (national WMO), licensees (MVM Paks NPP, Paks 2 Ltd.), | €600,000 | €360,000 | €240,000 |
| Output: Improved emergency preparedness and response of first responders. | | HAEA, Ministry of Interior, Ministry of Interior-NDGDM licensees (MVM Paks NPP, Paks 2 Ltd.), national WMO | | | |
| Output : Safe and secure management of spent fuel and radioactive waste. | 2024-2027 | HAEA, Ministry of Energy, PURAM (national WMO) , licensees (MVM Paks NPP, Paks 2 Ltd.), national WMO | | | |
| Output : Improved sustainability of nuclear institutions and nuclear knowledge management. | 2026-2029 | Licensees (MVM Paks NPP, Paks 2 Ltd.), TSOs, universities and research institutes | | | |

| Nuclear and Radiation Safety and Nuclear Security Subtotals | | |
|---|---|---|
| **Approximate Cost in € (A)** | **Resources* currently available in € (B)** | **Resources to be identified/mobilised in € (A-B)** |
| €600,000 | €360,000 | €240,000 |

(*)-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.*

## Health

| Thematic Area Outcome[s] | Baseline | Indicator | Means of Verification | Assumptions/risks |
|---|---|---|---|---|
| Outcome: Improved health outcomes and increase survival rates of cancer patients. | Hungary does not have an established national clinic audit programme (internal and external) that ensures the quality and safety of radiotherapy practices in the radiation therapy centres. | Quality and safety of radiotherapy practices ensured through officially required clinical audits. | Clinical audits reports with results and recommendations. | Assumptions:<br>Strong government commitment and financial support to implement the anticancer programme 2019-2030 and improve the cancer control system. |
| | National diagnostic reference levels (DRL) survey initiated in 2021 and list of justified radiological procedures available. These documents will provide the basis for the development of a DRL comprehensive countrywide study and the estimation of the population dose from medical exposures. | National diagnostic reference levels (DRL) established and patient dose assessments available from medical exposures, especially for high dose procedures, e.g., computer tomography, interventional X-ray equipment, and positron emission tomography. | National diagnostic reference levels (DRL) established and maintained.<br><br>Patient dose (assessment) report available at the NCPHP website.. | Risks – shortage of radiation medicine specialists due to lack of new graduates in this field and staff turnover (retirement, career changes).<br><br>-Means of managing or mitigating risks -promote the radiation medicine field in universities to attract the young generation; adopt better retention policies and professional development opportunities for staff. |
| | Medical staff of the radiation therapy, medical imaging, interventional radiology and nuclear medicine need continuous education and training in the use of advanced diagnostic and radiation therapy treatment procedures. | Number of the staff trained in advanced diagnostic and radiation therapy procedures.. | Education and training certificates and expert reports. | |

## Health and nutrition

| Indicative Outputs | Indicative Timeframe (Future TC cycle) | Relevant national counterpart(s)/ institution(s) | Approximate Cost in € (A) | Resources* currently available in € (B) | Resources to be identified/mobilised in € (A-B=C) |
|---|---|---|---|---|---|
| Output. National clinical audit programme established and implemented for radiation therapy | 2024-2026 | Ministry of Human Resources<br>National Institute of Oncology<br>National Centre for Public Health and Pharmacy<br>Nationwide network of cancer care centres<br>ROs, MPs and RTTs<br>IAEA/WHO | 150,000 | 130,000 | 20,000 |
| Output. National diagnostic reference levels (DRL) developed for the estimation of the population dose from medical exposures | 2026-2029 | Ministry of Interior<br>National Institute of Oncology<br>National Centre for Public Health and Pharmacy<br>Nationwide network of cancer care centres<br>ROs, MPs and RTTs<br>IAEA/WHO | 115,000 | 0 | 115,000 |
| Output . Improved quality and safety of diagnostic, radiation therapy and treatment for cancer patients through education, training, and certification of radiation medicine staff. | 2026-2029 | Ministry of Interior<br>National Institute of Oncology<br>National Centre for Public Health and Pharmacy<br>Nationwide network of cancer care centres<br>ROs, MPs and RTTs<br>IAEA/WHO | 100,000 | 0 | 100,000 |

| Thematic Area Subtotals | | |
|---|---|---|
| **Approximate Cost in € (A)** | **Resources* currently available in € (B)** | **Resources to be identified/mobilised in € (A-B)** |
| 365,000 | 130,000 | 235,000 |

(*)-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.

### 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 and Security | €600,000 | €360,000 | €240,000 | (+) |
| Health and Nutrition | €365,000 | €130,000 | €235,000 | |
| | **Total estimated overall cost for CPF** | **Total estimated resources* available for CPF** | **Total resources to be identified/mobilised** | |
| | €965,000 | €490,000 | €475,000 | (=) |
| | **Estimated government cost sharing (included in the above total of resources* available – B)** | | 20,000 | |
| | **Other estimated extrabudgetary contributions from donors/partners who have expressed interest ((included in the above total of resources* available – B)** | | 0 | |
| | **Estimated in kin-kind contributions from the Government and other partners/donors that have expressed interest (included in the above total of resources** available – B)** | | 10,500 | |

stated figures
Signing of the
commit to
CPF
by the Member
IAEA, nor does
expectation of
of Agency
main purpose is
planning and
the Country
Framework.
(**)-This
should reflect
estimated value
of in-kind
contributions
by the Member
carry out the
programme (in-
examples: time
infrastructure,

equipment, repairs, construction work, sampling costs, shipment costs, etc.)

(*)-The above
are indicative.
CPF does not
funding of the
implementation
State or the
it suggest the
continued levels
funding. The
to assist
prioritization of
Programme

estimate
the total
(in Euros)

provided
State to
planned
kind
of staff,
materials,

# IV. PROGRAMME IMPLEMENTATION AND SUPPORT

## 4.1. CPF Coordination

The preparation of this CPF was coordinated and monitored by HAEA in Hungary, as the host of the NLO office, and the PMO of the Division for Europe of the IAEA Department of Technical Cooperation.

The PMO provided guidance and input on the strategic and programmatic level of the development, furthermore coordinated the relevant inputs from the IAEA Technical Departments, as well as the IAEA's Programme of Action for Cancer Therapy and the Division for Programme Support and Planning at the IAEA's Department of Technical Cooperation.

The National CPF Coordinator in HAEA cooperated with responsible persons in the Ministry of Interior, the former Ministry of Technology and Industry (at present the Ministry of Energy), the Ministry for Culture and Innovation, the Ministry for Agriculture, Ministry of Foreign Affairs and Trade and the respective institutions and universities listed in the Results Matrix.

All stakeholders who were previously involved were invited again to participate in the process of preparation of the CPF. Involved parties submitted their proposals by e-mail to the National CPF Coordinator. Relevant stakeholders involved in the development of the CPF and the relevant senior managers within the ministries as well as the relevant institutions were kept informed and invited to participate to ensure ownership.

The National CPF Coordinator compiled and consolidated all inputs from the national stakeholders based on the guidance for CPF development.

## 4.2. Future Review of CPF

Progress reviews under this CPF will be conducted shortly before the end of each TC programme cycle. The knowledge gained from the programme reviews will serve to better define new project proposals for the following TC programme cycle. The reviews will consider evolving development priorities at national level, including any changes (positive or negative) that have affected the programme.

The reviews will be led by the relevant PMO within the Division for Europe at the IAEA's Department of Technical Cooperation and the NLO at HAEA. The final review and update towards the following CPF will be made at the latest in 2028, one year prior to the expiry of this CPF.

## 4.3. Partner Coordination

Hungary is active in the field of international cooperation and has good relations with a number of foreign nuclear-oriented organizations, both on bilateral and multilateral basis.

Being a member of the United Nations, Hungary adopted its National Sustainable Development Framework Strategy in 2013 in line with the UN SDGs. The proposed TCP under this CPF will contribute to the attainment SDG 8 - Decent Work and Economic Growth and SDG 12 - Responsible Production and Consumption.

As a member of the EU since 2004 Hungary fulfils its obligations deriving from the European Development Policy and the relevant EU legal framework. HAEA is responsible for the cooperation with the European Commission and its advisory committees as well as for the participation in the Council of the European Union's working groups concerning the nuclear

field. Hungary is a committed participant in international organizations, such as OECD/NEA, CRPPH/NEA, Western European Nuclear Regulators Association, VVER Forum, CTBTO etc.

Long-term priorities of Hungary:

- Enhancing bilateral cooperation with neighbouring countries;
- Enhancing bilateral cooperation with other countries, with special focus on the exchange of technical information and cooperation on nuclear safety matters: i.e. Belarus, Bulgaria, Finland, Poland, Russia, Türkiye, United Kingdom, United States,
- Maintaining the quadrilateral cooperation with the Czech Republic, Slovakia and Slovenia established as an informal "quadrilateral" group in 2003. The objective of the cooperation is to create a framework to facilitate the cooperation on subjects related to the assessment of safety and operation of nuclear facilities in the region. The members in this group aim to increase the effectiveness of cooperation over subjects of common interest.

The main national partner for the implementation of the proposed programme under this CPF is HAEA. The planned programme will be implemented through cooperation with universities and research institutions and institutions responsible for radiation protection, waste management and environmental monitoring including remediation works.

Organisations/Institutions referred to in Annex 2 have been identified as main participating institutions for the implementation of the proposed programme under the CPF.

## Annex 1: Partnership Matrix

| Thematic Area | Outcome in National Plan or Sector Strategy | CPF Outcomes | Links with SDGs | Links with UNSDCF | Relevant Partners |
|---|---|---|---|---|---|
| **Nuclear and Radiation Safety and Nuclear Security** | National Development plan:<br><br>National Programme on management of spent fuel and radioactive waste<br><br>Nuclear Emergency Response Plan<br><br>Act No. CXVI of 1996 on Atomic Energy<br><br>Resolution No. 56/2022. on the further LTE of the Paks NPP.<br><br>Goal 1 – Maintaining a high level of nuclear safety<br>Goal 2 – Development of new management routes of VLLW<br>Goal 3– Improvement of protection of first responders involved in the national emergency response system<br><br>Goal 4 - National knowledge management system | Strengthened nuclear and radiation safety and nuclear security for the protection of people and the environment from the adverse effects of ionizing radiation. | SDG 3: Ensure healthy lives and promote well-being for all at all stages<br><br>SDG7:Ensure access to affordable, reliable, sustainable and modern energy for all<br><br>SDG9: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation | | National:<br>HAEA<br>Ministry of Energy<br>Ministry of Interior<br>PURAM (national WMO), licensees (MVM Paks NPP, Paks 2 Ltd.) national technical support organizations (TSOs), research institutes, universities<br><br>International:<br>IAEA<br>EU |
| **Health and Nutrition** | National Development plan:<br><br>Healthy Hungary Strategy 2021-2027 | Outcome: Improved health outcomes and increase survival rates of cancer patients. | SDG 3: Ensure healthy lives and promote well-being for all at all stages | | Ministry of Interior<br>National Institute of Oncology |

| Thematic Area | Outcome in National Plan or Sector Strategy | CPF Outcomes | Links with SDGs | Links with UNSDCF | Relevant Partners |
|---|---|---|---|---|---|
| | National Anti Cancer Programme 2019-2030<br><br>Goal 1 – Improve national cancer control system with the aim of reduced exposure to radiation for patients<br><br>Goal 2 – Continuous development of education and training of health care professionals in radiation medicine | | | | National Centre for Public Health and Pharmacy,<br>Nationwide network of cancer care centres<br>ROs, MPs and RTTs<br>IAEA/WHO |
| | | | | | |

## Annex 2: List of Participating Institutions

**Governmental organizations with responsibility in nuclear field:**

**Hungarian Atomic Energy Authority** (HAEA) regulates the nuclear sector in Hungary, and exercises the regulatory (supervising) duties concerning the safety of the peaceful application of nuclear energy, particularly the safety of nuclear facilities under normal and accidental conditions and nuclear emergencies. By the amendment of the Act on Atomic Energy at the end of 2021, the organisational independence of the HAEA was strengthened. The HAEA is now directly accountable only to the Parliament and has a budget as a separate heading under the budget of the Parliament, ensuring its financial and management independence from the Government. The HAEA determines its own organizational structure and select its staff. As a result, the HAEA can adapt more flexibly and quickly to the changing tasks and circumstances and perform its duties more efficiently.

The **Ministry of Energy** is in charge of the energy supply of the country and is supervising the realization of the Energy Policy for the period 2020-2030, with a view to 2040, a resolution passed by the Parliament. As the NPP is state owned, the Ministry is the main authority to whom the Paks NPP is reporting. However, the Ministry of Interior undertakes the tasks of the authority regarding issues related to radiation protection of persons posed to radiation risk.

The **Ministry of Energy and Ministry of Interior** are responsible for establishing air and water quality standards, limits in radioactive releases from nuclear facilities, as well as for controlling the releases at the facilities to the environment.

**Ministry of Interior - National Directorate General for Disaster Management (NDGDM)** comprises of Inspectorates of Industrial Safety, Firefighters and Civil Protection as well as Authority Fields. NDGDM is responsible for protecting the lives and the property of the population living in Hungary, ensuring the safe operation of the national economy and protecting the elements of critical infrastructure, and the health sector including environmental health and official control.

**Licensees:**

**MVM Paks Nuclear Power Plant Ltd.** operates four VVERs-440/213 type power reactors.

**Paks II. Ltd.** performs the tasks involved in the preparation of the establishment of new nuclear power plant units.

**HUN-REN Centre for Energy Research** (CER) operates the Budapest Research Reactor.

**Institute of Nuclear Techniques of the Budapest University of Technology and Economics** operates the Training Reactor of the Budapest University of Technology and Economics.

**Public Limited Company for Radioactive Waste Management** (PURAM) operates the Spent Fuel Interim Storage Facility at Paks as well as the Radioactive Waste Treatment and Disposal Facility in Püspökszilágy, and the National Radioactive Waste Repository in Bátaapáti.

**Institutes and Centers:**

The HUN-REN Centre for Energy Research (HUN-REN CER) operates the 10 MW(th) Budapest Research Reactor. It is active in several fields of nuclear technology such as reactor physics, thermal-hydraulics, health physics, simulator techniques, reactor chemistry. The HUN-REN CER performs also a wide variety of research, related to the use of radioactive materials and nuclear techniques, among them a research and development programme for nuclear safeguards. HUN-REN CER provides the expert support and the laboratory background for the HAEA.

**The HUN-REN Institute for Nuclear Research (ATOMKI, Debrecen)** is a multidisciplinary research center for accelerator based sciences. HUN-REN ATOMKI has the highest number of particle accelerators in Hungary. It operates a 20 MeV cyclotron, a 2 MV tandetron accelerator, a

stand alone ECR ion source, as well as an accelerator mass spectrometer, and is active in several fields of nuclear physics and nuclear technology.

The HUN-REN **Wigner Research Center for Physics (Wigner RCP)** was created on 1st January 2012, through the merger of the MTA KFKI Research Institute for Particle and Nuclear Physics and the MTA Institute for Solid State Physics and Optics. It is currently the biggest research institute for physics in Hungary. Since 2013, the world-class Wigner Datacenter has also been part of the research center.

The **National Centre for Public Health and Pharmacy** (NCPHP, Budapest), Department of Radiobiology and Radiohygiene performs a wide spectrum of research including the biological effects of radiation and radioisotopes, radiohygiene (operational and environmental), sterilization, detoxification etc.

The **National Institute of Oncology** is the epidemiological, organizational, methodological, treatment, research, education and training centre of Hungarian oncology.

The **Nuclear Research Safety Institute** (NUBIKI, Budapest) carries out safety analysis and risk assessment of nuclear power plants including level 1 and 2 PSA and severe accident analysis.

The **Institute of Nuclear Techniques of the Budapest University of Technology and Economics** (BME NTI) operates a research reactor for training purposes, teaches nuclear technology for engineers, physicists, chemists and environmentalists, and performs research in some specialized fields, additionally organizer of the Medical Physics MSc from 2024.

The **Semmelweis University, Budapest** is Hungary's oldest medical school – its nearly 250 years of tradition, experience and expertise serve as the basis for innovation and the application of modern technologies.

The **Faculty of General Medicine at the University of Pécs** is the only internationally recognised centre for medical, dental and pharmacological education in the Trans-Danubian region of Hungary.

The **University of Szeged, Albert Szent-Györgyi Medical School** is one of the four excellent medical training schools in Hungary. The University has a significant role in the scientific life of Southern Great Plain and outstanding in the training of the region's healthcare professionals.

The **Institute of Radiochemistry and Radioecology of the University of Pannonia** (PE RRI), teaches nuclear technology and radiochemistry for engineers, chemists and environmentalists, and performs research in some specialized fields.

**University of Debrecen, Faculty of Medicine, Department of Medical Imaging, Division of Nuclear Medicine** covers the wide spectrum of development, research and service in the field of radiochemistry, pre-clinical and clinical areas. The department takes part in various IAEA training programs.

The **Institute of Isotopes Co., Ltd. (Izotop)** is dealing with the research, development and production of a wide variety of radioactive isotopes and other products for a broad range of application areas, especially healthcare, research and industry.

**Faculty of Medicine and Occupational Health, University of Debrecen** works in the field of Nutrition, obesity and non-communicable diseases.

**National Institute of Pharmacy and Nutrition** works in the field of nutrition, obesity and non-communicable diseases.

**Other organizations:**

The **Power Engineering and Contractor Co.** (AFRY-ERŐTERV Co., Budapest) works in the field of design, construction, commissioning and operating management of nuclear facilities. Its activities also include waste management (treatment, storage and disposal).

**SOM System Engineering Office** is an engineering company with acknowledged experience in nuclear field.

The Central Agricultural Office (CAO) and the former Hungarian Food Safety Office were integrated into a new office establishing the **National Food Chain Safety Office** (NFCSO) on 15th March, 2012.

The **Mecsekérc Ltd.** has an expansive professional record regarding the field of geological research.

## Annex 3: Legal Framework and IAEA-Relevant Treaties

**International Treaties and Conventions**

| Ref. | Title | In Force | Status |
|---|---|---|---|
| **International Treaties** | | | |
| CTBT | Comprehensive Nuclear-Test-Ban Treaty | Not in force | Signature: 1996-09-25<br>Ratification: 1999-07-13 |
| NPT | Treaty on the Non-Proliferation of Nuclear Weapons | 1970-03-05 | Party |
| **International Treaties under IAEA auspices** | | | |
| **Multilateral Agreements** | | | |
| P&I | Agreement on the Privileges and Immunities of the IAEA | 1967-07-14 | Acceptance: 1967-07-14 |
| VC | Vienna Convention on Civil Liability for Nuclear Damage | 1989-10-28 | Accession: 1989-07-28<br>Entry into force: 1989-10-28 |
| VC/OP | Optional Protocol Concerning the Compulsory Settlement of Disputes | | Non-Party |
| CPPNM | Convention on the Physical Protection of Nuclear Material | 1987-02-08 | Signature: 1980-06-17<br>Ratification: 1984-05-04 |
| CPPNM/A | Amendment to the Convention on the Physical Protection of Nuclear Material | 2016-05-08 | Ratification: 2008-12-04 |
| NOT | Convention on Early Notification of a Nuclear Accident | 1987-04-10 | Signature: 1986-09-26<br>Ratification: 1987-03-10 |
| ASSIST | Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency | 1987-04-10 | Signature: 1986-09-26<br>Ratification: 1987-03-10 |
| JP | Joint Protocol Relating to the Application of the Vienna Convention and the Paris Convention | 1992-04-27 | Signature: 1989-09-20<br>Approval: 1990-03-26 |
| NS | Convention on Nuclear Safety | 1996-10-24 | Signature: 1994-09-20<br>Ratification: 1996-03-18 |
| RADW | Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management | 2001-06-18 | Signature: 1997-09-29<br>Ratification: 1998-06-02 |
| PVC | Protocol to Amend the Vienna Convention on Civil Liability for Nuclear Damage | | Signature: 1997-09-29 |
| SUPP | Convention on Supplementary Compensation for Nuclear Damage | | Non-Party |

| Ref. | Title | In Force | Status |
|---|---|---|---|
| **Technical Cooperation Agreements** | | | |
| RSA | Revised Supplementary Agreements Concerning the Provision of Technical Assistance by the IAEA | 1989-06-12 | Party |
| **Safeguards Agreements** | | | |
| 894 | Application of safeguards in connection with the Treaty on Non-Proliferation of Nuclear Weapons | 1972-03-30 | Signature: 1972-03-06 |
| 1240 | Application of safeguards in implementation of Article III (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons (with Protocol) | 2007-07-01 | Accession: 2006-12-12 |
| 1717 | Protocol Additional to the Agreement between the Republic of Hungary and the International Atomic Energy Agency for the Application of Safeguards in Connection with the Treaty on the Non-Proliferation of Nuclear Weapons | 2000-04-04 | Signature: 1998-11-26 |
| 1769 | Prot. Add. to Agreement between the Rep. Austria, the Kingdom of Belgium, the Kingdom of Denmark, the Rep. of Finland, the Federal Rep. of Germany, the Hellenic Rep., Ireland, the Italian Rep., the Grand Duchy of Luxembourg, the Kingdom of the Netherlands, the Portuguese Rep., the Kingdom of Spain, the Kingdom of Sweden, the European Atomic Energy Community and the IAEA in Implementation of Article III, (1) and (4) of the Treaty on the Non-Proliferation of Nuclear Weapons | 2007-07-01 | Accession: 2006-12-12 |

Hungary's national legal framework for nuclear safety, nuclear security and radiation protection is based particularly on the Act on Atomic Energy, as of 1st of May, 2022, on decrees of the President of HAEA and some Government and ministerial decrees. The list of legislative acts in force can be found on the website of HAEA that is continuously updated: https://www.haea.gov.hu/web/v3/HAEAportal.nsf/web?openagent&menu=03&submenu=3_0

The most relevant EU legislative acts can be found on HAEA's website: https://www.haea.gov.hu/web/v3/HAEAportal.nsf/web?openagent&menu=03&submenu=3_8

## Annex 4: Details of Past TC Programme Achievements

Since becoming a member of the IAEA in 1957, Hungary has been actively participating in and has benefited greatly from the IAEA's TC programme. Over the years, this programme helped the country in the creation of a comprehensive and competent infrastructure for peaceful uses of nuclear energy and specifically nuclear power. Also, key deliverables were the transfer of knowledge and continuous improvement of safety culture in the country as well as technical advice on specific issues. In particular, human resource development, training of specialists involved in plant operation, safety evaluation and licensing, increasing awareness of the industry of quality assurance/quality control (QA/QC), and improving knowledge management in nuclear institutions have been some of the most important and positive outcomes of the TC programme as recognized by Hungary. The IAEA also assisted the country in establishing an independent and effective regulatory infrastructure for radiation safety and aided the development and improvement of technical support for the NPP programme.

Within the IAEA TCP specifically, Hungary has been participating actively in the TC Europe national and regional programmes, as well as in interregional projects. Nuclear power-related activities (especially those focused on nuclear safety) have dominated Hungary's involvement in the Agency's TCP. Special attention was given to a number of specific technical issues of VVER-type reactors, such as integrity of primary circuit, in-service inspection, plant operation, maintenance and ageing management. A systematic approach to training, comprehensive safety assessment methodology and analysis and implementation of operational feedback.

During the last decade, support through the national technical cooperation programme focused on building and strengthening the skills and capabilities of the staff of the country's nuclear institutions (relevant technical universities, hospitals, research institutes, TSOs, bodies of the state administration) including the staff of the nuclear regulatory authority in the peaceful applications of nuclear science and technology. The proposed technical cooperation activities build on past technical cooperation projects, thus ensuring sustainability of the achieved results and enhancing their impact.

Lately, national projects have put emphasis on the radiation protection of workers and the public and dosimetry and medical physics, since with the increasing complexity of radiation diagnostic procedures, the role of medical physicists (MPs) is becoming more important. The safe use of these diagnostic modalities requires adequately trained human resources. Emphasis is placed on the enhancement of the personal neutron dosimetry system to ensure radiation protection of workers exposed to neutron radiation and reduce the risks to human health due to occupational exposure.

Over the years, the country has placed great emphasis on regional and national TC projects related to safety assessment. The list of national projects includes:

| Project Number | Project Title | 1st Year of Approval | Status |
|---|---|---|---|
| HUN0002 | Establishing University Courses in Nuclear Engineering | 1991 | Completed on 1996-09-25 |
| HUN0003 | Manpower Development | 1993 | Completed on 1996-06-27 |
| HUN0004 | Human Resource Development and Nuclear Technology Support | 1997 | Completed on 2001-08-27 |
| HUN0005 | Human Resource Development and Nuclear Technology Support | 2001 | Completed on 2008-12-30 |
| HUN0006 | Sustainability of Nuclear Institutions and Knowledge Management | 2003 | Completed on 2008-12-02 |
| HUN0007 | Knowledge Management in Nuclear Institutions | 2007 | Completed on 2010-12-17 |
| HUN0008 | Supporting the AeroSort Laboratory for the Characterization of Aerosol Pollution Sources | 2014 | Active |
| HUN1004 | Nuclear Non-Destructive Nitrogen Determination | 1978 | Completed on 1981-12-31 |
| HUN1005 | Neutron Generator | 1978 | Completed on 1979-08-22 |
| HUN1006 | Establishment of an Automated Radiation Laboratory | 1982 | Completed on 1987-12-31 |
| HUN1008 | Strengthening of an Advanced Automated Radiation Laboratory | 1987 | Completed on 1992-06-19 |
| HUN2002 | Chemical and Biochemical Research | 1987 | Completed on 1989-08-09 |
| HUN2003 | Nationwide Distribution of Fluorine-18 Labelled Radiopharmaceuticals for PET Imaging | 2001 | Completed on 2004-10-29 |
| HUN4004 | Cyclotron Laboratory | 1979 | Completed on 1988-06-27 |
| HUN4005 | Thermohydraulic Loop Experiments | 1985 | Completed on 1987-06-29 |
| HUN4006 | Reactor Modernization | 1985 | Completed on 1990-12-22 |
| HUN4007 | Production of Cobalt-60 Sources | 1987 | Completed on 1991-06-01 |
| HUN4008 | Procurement Assistance for Hungary | 1988 | Completed on 1991-06-01 |
| HUN4009 | in-Service Inspection | 1989 | Completed on 1994-02-20 |
| HUN4010 | Spent Fuel Storage Technology | 1992 | Completed on 1994-02-09 |
| HUN4011 | Quality Assurance in Nuclear Power Plant Operation | 1993 | Completed on 1995-05-15 |
| HUN4012 | Cold Neutron Source for the Budapest Research Reactor | 1995 | Completed on 1999-08-30 |
| HUN4013 | Improvement of Cyclotron Parameters | 1995 | Completed on 1997-12-23 |
| HUN4014 | License Renewal of Paks Nuclear Power Plant Operation | 2003 | Completed on 2008-12-02 |

| Project Number | Project Title | 1st Year of Approval | Status |
|---|---|---|---|
| HUN4015 | Technical Assistance in Safety Enhancement of the Near-surface Repository in Püspökszilágy | 2003 | Completed on 2008-12-02 |
| HUN4016 | Renewal of the Licence for the Paks Nuclear Power Plant | 2007 | Completed on 2011-11-16 |
| HUN4017 | Renewing the Licence for the Paks Nuclear Power Plant | 2009 | Completed on 2014-05-07 |
| HUN5009 | Radioisotopes in Agriculture | 1975 | Completed on 1977-10-12 |
| HUN5010 | Food Irradiation | 1976 | Completed on 1978-03-29 |
| HUN5011 | Agricultural Residue Studies | 1981 | Completed on 1986-03-06 |
| HUN5012 | Radioactive Contamination and Food Control | 1989 | Completed on 1992-12-30 |
| HUN6003 | Radioisotopes in Medicine | 1976 | Completed on 1977-12-23 |
| HUN8005 | Nuclear Techniques in Glass Technology | 1984 | Completed on 1986-03-06 |
| HUN8006 | Food Irradiation Technology | 1985 | Completed on 1990-12-22 |
| HUN8007 | Radiation Chemistry in Biomedical Materials for Industry | 1997 | Completed on 2000-12-18 |
| HUN8008 | Implementation of a Pilot Plant and Upgrading the Laboratory for Treatment of Water and Wastewater Using Radiation Processing Technology | 2009 | Completed on 2012-01-20 |
| HUN9004 | Radiation Protection | 1977 | Completed on 1978-09-28 |
| HUN9005 | Environmental Monitoring | 1977 | Completed on 1978-09-28 |
| HUN9006 | Waste Management | 1977 | Completed on 1982-09-02 |
| HUN9007 | Computational Safety Analysis | 1983 | Completed on 1984-10-18 |
| HUN9009 | Environmental Radioactivity | 1986 | Completed on 1987-09-25 |
| HUN9010 | Modernization of Personnel Dosimetry System | 1991 | Completed on 1994-02-09 |
| HUN9011 | Environmental Radiation Telemetry | 1991 | Completed on 1994-02-20 |
| HUN9012 | OSART Follow-up Visit to Paks Nuclear Power Plant | 1991 | Completed on 1992-12-30 |
| HUN9013 | Training in Management and Analysis of Severe Accidents | 1991 | Completed on 1994-02-20 |
| HUN9014 | Enhancement of Safety in NPP Operation | 1993 | Completed on 1997-02-04 |
| HUN9015 | Control of Low and Intermediate Level Radioactive Waste | 1993 | Completed on 1995-06-30 |

| Project Number | Project Title | 1st Year of Approval | Status |
|---|---|---|---|
| HUN9016 | Countrywide Environmental Radiation Monitoring Database | 1993 | Completed on 1997-04-30 |
| HUN9017 | Analysis of Atmospheric Pollutants by XRF and Pixe | 1993 | Completed on 1995-12-22 |
| HUN9018 | Nuclear Safety Review Missions | 1993 | Completed on 1995-08-02 |
| HUN9019 | Strengthening Training for Operational Safety at Paks NPP | 1994 | Completed on 1999-04-12 |
| HUN9020 | Emergency Response Preparedness | 1997 | Completed on 2002-12-06 |
| HUN9021 | Safe Operation of X-Ray and Radiation Therapy Systems | 1999 | Completed on 2001-06-14 |
| HUN9022 | Support for Nuclear Safety Review Missions | 2003 | Completed on 2010-02-17 |
| HUN6004 | Implementing a Formal Quality Assurance Programme in Diagnostic Radiology at End User Level | 2020 | Completed |
| HUN9023 | Improving Personal Neutron Dosimetry Services | 2022 | Ongoing |
| HUN6005 | Development of infrastructure for clinical audits of radiotherapy in Hungary | 2024 | Ongoing |

The ongoing national projects (2022-2026) are the following:

| Thematic area | Results of past technical cooperation | Key counterpart institutes and partners |
|---|---|---|
| Human Health - Dosimetry and Medical Physics for Imaging and Therapy | The project will provide opportunities for Continuing Professional Development (CPD) as well as training materials, syllabi and relevant publications, all of which will contribute to the overall sustainability of better QA programmes in Hungary. The project will focus on training medical physicists in the practical application of QA, on establishing QA/QC guidelines for the major pieces of diagnostic radiology equipment, on improving QA infrastructure and on disseminating knowledge and good practice related to QA in diagnostic radiology. Moreover, the established guidelines will be applied in practice, relationships will be built with medical institutions that would like to participate in the programme in order to improve their QA/QC programme. In addition, workshops will be organized with the Hungarian Society for Medical Physics to disseminate information among experts in the radiology community. | The National Institute of Oncology<br>National Centre for Public Health and Pharmacy Budapest<br>University of Technology and Economics |
| Radiation and Transport Safety – Radiation safety and monitoring | Improving personal neutron dosimetry services HUN9023<br>The personal neutron dosimetry service able to conduct dosimetry in compliance with international guidelines and protocols for at least 300 workers on a regular basis even for unusual circumstances (e.g. complex radiation quality) will be implemented. The service will also be able to conduct short-term dosimetry to monitor individual workflows by evaluating 20 dosimeters per day. To reach the goal of the installation of a compound system for routine and occasional monitoring, passive and active dosimetry systems available on the market will be reviewed. During the technical visits to international laboratories, the available instruments, protocols, and practices will be examined, and the experiences of the users will be collected. Both technical and financial aspects will be taken into consideration prior to the procurements. Concerning the new database, consultations with the users (including the dosimetry service staff, radiation protection officers, management and the workers themselves) and the developers (IT experts) will take place. During the project, the basis of the knowledge transfer will be developed: training materials will be assembled, laboratory practices or training courses will be organized, laboratory visits will be organized to the dosimetry laboratory established, and demonstration of the routine operation will be performed in order to provide opportunity to adapt the procedure. These trainings will be open for both internal workers (e.g. technicians) and external professionals from other laboratories and facilities involved in personal neutron dosimetry. The developed training framework will be reviewed and updated regularly, if necessary. Emphasis will be placed on maintaining and keeping the knowledge of the trained staff updated, so in addition to the initial training, opportunities for further training will be provided. The training activities include technical/scientific visits and fellowships to the state-of-the-art international personal dosimetry services as well as domestic and international instrument developers, in order to observe and master good practices. Also, the involvement of experts is crucial to ensure high quality of the services for which quarterly-based consultations are planned. The implementation of best practices in the established personal neutron dosimetry service will also be supported through the procurement of relevant devices and instruments. This also requires expert support for ensuring a high-level implementation and managing of cross-cutting issues of personal neutron dosimetry. | Centre for Energy Research |