TECHNICAL PROGRAMME 2026

SAFETY COOPERATION IN IBERO-AMERICA

FORO


FORO

Reference OFC.07.10

Editing and distribution:
Publishing Service
Consejo de Seguridad Nuclear
Pedro Justo Dorado Dellmans, 11
28040 Madrid, Spain
Tel. (+34) 913 460 100
www.csn.es
Design and layout: Ángel Merlo
Legal deposit: M-18957-2026
Printed on 100% recycled paper, with
responsible forest management certificate

FSC

CSN CONSEJO DE SEGURIDAD NUCLEAR

FORO 2026: 30 years of cooperation for safety in Ibero-America

Since its establishment, the Ibero-American Forum of Radiological and Nuclear Regulatory Organizations (FORO) has become the primary mechanism for technical cooperation among regulatory authorities in the region. Based on mutual trust, the exchange of experiences and technical rigour, FORO has contributed to strengthening national regulatory capacities and improving nuclear, radiological and physical security in Ibero-America for almost three decades.

The quality of FORO's work and the usefulness of its results have established it as an international benchmark in the regulatory field. The International Atomic Energy Agency (IAEA) has consistently supported its activities and recognised the value of the methodologies developed within FORO. This collaboration has enabled the joint production of technical publications and the dissemination of best practices that are also utilised beyond the region.

This edition of the Technical Programme is an update of the publication produced to mark FORO's 25th anniversary, incorporating the progress made in recent years. During this period, projects relating to the medical applications of radiation, nuclear power and research reactors, the transport of radioactive material, nuclear physical security, and the control of naturally occurring radioactive material have been carried out.

These results stem from a collaborative approach involving specialists from different countries, an ongoing exchange of knowledge and a search for common solutions to regulatory challenges. At the same time, the FORO has promoted institutional initiatives aimed at strengthening regulatory organisations and fostering technical excellence.

In short, this Technical Programme reflects the history and achievements of a nearly thirty-year-long cooperative effort. Drawing on the experience accumulated by its members, the FORO is committed to continuously improving regulation to make Ibero-America safer and better prepared for the future.

Index

Introduction/Foreword

The Ibero-American Forum of Radiological and Nuclear Regulatory Bodies (FORO) is an association of regulatory authorities, founded in Veracruz in July 1997, with the aim of achieving and maintaining high levels of radiological and nuclear safety in all practices involving the peaceful uses of ionising radiation.

Currently, FORO's members are the regulatory authorities of Argentina (Autoridad Regulatoria Nuclear, ARN), Brazil (Autoridade Nacional de Segurança Nuclear, ANSN[1]), Chile (Comisión Chilena de Energía Nuclear, CCHEN), Colombia (Ministerio de Minas y Energía, MINENERGÍA), Cuba (Dirección de Seguridad Nuclear, DSN[2]), Spain (Consejo de Seguridad Nuclear, CSN), Mexico (Comisión Nacional de Seguridad Nuclear y Salvaguardias, CNSNS), Paraguay (Autoridad Reguladora Radiológica y Nuclear, ARRN), Peru (Instituto Peruano de Energía Nuclear, IPEN), Portugal (Agência Portuguesa do Ambiente) and Uruguay (Autoridad Reguladora Nacional en Radioprotección, ARNR).

With shared languages and many other cultural ties, FORO has established a high level of understanding and trust among its members to collaborate and thus promote high standards of safety amongst its members and, by extension, throughout the Ibero-American region. Hence, the importance of its vision to be a fruitful platform for strengthening the region's regulatory institutions through the exchange of information, knowledge and experience.

FORO was established with the aim of promoting safety in all peaceful practices involving radioactive or nuclear facilities and materials in Ibero-America, and of fostering the exchange of information, knowledge and experience in the fields of radiation protection, nuclear safety and security in the region from a regulatory perspective.

In 2003, interest arose in generating greater knowledge and harmonising practices among its members through the development of projects and activities of common interest within a Technical Programme, defined in FORO's Statutes, and in close collaboration with the International Atomic Energy Agency (IAEA), the association's scientific and technical reference body. Two new objectives were thus established: to identify, gather, analyse and share knowledge and experience to improve radiological and nuclear safety in Ibero-America;

1 Until 2025, the Comissão Nacional de Energia Nuclear, CNEN.
2 Until 2018, the Centro Nacional de Seguridad Nuclear, CNSN.

1st FORO Meeting (1997, Veracruz, Mexico).

and to establish relationships with national, regional and international organisations whose policies and objectives are relevant to the achievement of FORO's objectives. The working language in FORO is Spanish, but Portuguese is also a priority and, as far as possible, the results are being translated into Portuguese and English to ensure wider dissemination.

Since the launch of the Technical Programme, 24 projects or activities have been initiated, 19 have been completed and 5 are currently underway, with the participation of more than 300 experts from the region and a budget of over one and a half million euros. All outputs generated by FORO are public and available to anyone interested on its website, «La RED» (www.foroiberam.org). Furthermore, many of

XXXII FORO Meeting (2026, Lisbon, Portugal).

the results are being published by the IAEA in the form of joint FORO-IAEA technical documents (TecDoc), and have been presented at the most important international conferences in the regulatory sector. Another way of contributing to global safety has been the use of the results of FORO's Technical Programme in the development of IAEA safety and guidelines, or to incorporate them into the syllabus for training courses, schools and workshops aimed at strengthening the skills of regulators or those subject to regulation. The international community has recognised the excellent quality and usefulness of the work carried out by FORO, which has been incorporated into the regulations and practices of regulators and regulated entities in numerous countries across the region and around the world.

FORO develops its Technical Programme of regulatory interest based on the principles of innovation, equity, effectiveness, efficiency, rigour, consistency and sustainability, and in line with FORO's strategic guidelines and action plan, approved by its Plenary, its governing body.

FORO's contribution to radiation protection and nuclear safety, as well as the value of its model and its Technical Programme, have been recognised by the IAEA, the Ibero-American General Secretariat (SEGIB), the International Commission on Radiological Protection (ICRP), the International Radiation Protection Association (IRPA), the Pan American Health Organization (PAHO) and the World Health Organization (WHO), among others.

FORO's cooperation with these and other relevant institutions is a strategic objective that guides the association's work. Through this cooperation, FORO ensures that its projects are innovative, gathers information to enhance the efficiency of its Technical Programme, and disseminates its results to other countries in the region and elsewhere in the world. Through all this, FORO aims to promote a beneficial exchange of experiences and knowledge in key areas of radiation protection and technological and physical nuclear safety.

This publication, which updates the one presented in 2022, is one of the methods identified by FORO for sharing its regulatory experience and knowledge and, in particular, the results of its Technical Programme, one of FORO's fundamental pillars for achieving its objectives.

THE NETWORK: LA RED

All the results of FORO's Technical Programme, along with the association's most relevant information, such as news, milestones, basic documentation and links of interest are shared on its website, (www.foroiberam.org).

On *La RED*, you can find information on each of the thematic areas in which FORO aims to increase its knowledge and strengthen its practices: occupational radiation protection; radiation protection in medical applications; radiation protection of the public and

FORO's homepage.

the environment; emergency preparedness and response; investigation and follow-up of accidents and incidents; source control; decommissioning and closure of facilities; waste management; nuclear safety; transport of radioactive material; legal affairs; human and organisational factors; nuclear physical security. In addition to this information, *La RED* provides tools for collaboration between experts from the Ibero-American region in different thematic areas and between members of the working groups on their associated projects, offering access to virtual working groups and optimising communications and interactions through the use of social media technologies. Around three hundred regulatory specialists from various technical fields are working virtually, sharing their expertise, best practices and lessons learnt, addressing issues through technical projects and other activities, and making the results available to all interested parties.

Probabilistic Safety Analysis of Radiotherapy Treatments with Linear Accelerator (PSA Project)

OBJECTIVE

The overall objective of this project was to introduce proactive methods of safety assessment in radiotherapy as a complement to traditional reactive methods, through the application of a Probabilistic Safety Analysis (PSA) of the radiotherapy treatment process with a medical linear accelerator (LINAC) to investigate the main causes and sequences of events that may lead to accidental exposure to ionising radiation, and to explore the applicability of this type of analysis. The specific objectives were to carry out a pilot study to identify potential accident-initiating events, accident sequences, possible accidental exposure scenarios and the main contributors to risk based on the significance of human errors and equipment failures considered in the study, thereby enabling improved safety and regulatory control of radiotherapy with LINAC.

SCOPE

The PSA study was applied to the radiotherapy treatment process in a hypothetical radiotherapy department, based on existing practices in the FORO member countries[3] that participated in this project, as well as on experiences reported in the literature, which were referred to as the reference model. This process begins with the clinical prescription of the treatment and concludes upon completion of the prescribed treatment sessions.

3 The member countries of FORO are defined as those whose regulatory authorities are members: Argentina, Brazil, Chile, Colombia, Cuba, Mexico, Paraguay, Peru, Portugal, Spain and Uruguay.

With regard to the equipment under study, only the linear accelerator was analysed in detail, whilst other equipment such as the treatment planning system, the simulation CT scanner and *in-vivo* dosimetry were included as macrocomponents, without delving into the details of their constituent parts and essentially considering human errors related to their operation, but not equipment failures. With regard to the software, only failure modes related to data input and output (failure during software operation) were considered, without analysing its programming (source code) in detail.

HUMAN ERRORS VS EQUIPMENT FAILURE

Patient Exposure

Individual Episodic (Z3A)		Collective Episodic (Z3D)		Programmatic (Z3B)		Systematic (Z3C)	
Due to Human Error	Due to Equipment Failure	Due to Human Error	Due to Equipment Failure	Due to Human Error	Due to Equipment Failure	Due to Human Error	Due to Equipment Failure
87.46 %	-	0.02 %	0.04	15.46 %	-	0.28%	0.03%
87.46 %		0.06 %		15.46 %		0.31%	

100% of accidental programmatic exposures are due to human errors

10% of accidental systematic exposures are due to equipment failure (LINAC; TPS; CT)

Accidental systematic exposures due to equipment failure are **500 times less likely** than programmatic exposures caused by human errors

Some of the results of the probabilistic safety analysis.

All human actions carried out by the various professionals involved in the treatment process were considered, excluding from the analysis those that constitute a medical decision. It was therefore assumed that the doctor's actions were in line with clinical intent, such as, for example, prescribing the treatment dose. However, errors in recording their intent in writing and in communicating the decision were taken into account.

Only radiological risks were the subject of the study; risks of falls, collisions, electric shocks, fire and explosion were excluded. With regard to exposed individuals, the study applied to patients, occupationally exposed persons and the public, although the focus of the study was on patients.

Likewise, the study excluded tasks external to treatment, such as installation, acceptance testing, commissioning, maintenance and repairs. It also excluded the assessment of shielding and tasks related to the decommissioning and closure of the facility.

RESULTS

The project was the first international application of the PSA methodology outside the field of nuclear power plants, adapting and using it to assess the safety of radiotherapy treatments with a linear accelerator (LINAC).

Its results made significant contributions to understanding the risks and safety aspects of radiotherapy with LINAC, defining a set of 118 accident-initiating events for an analysis of 434 possible accident sequences and the consideration of 120 safety barriers, with the determination of impacts and risk significance for the different groups analysed: patients, occupationally exposed staff and the public.

The project formulated 48 key recommendations on strategies to be followed, possible technical or organisational solutions, and initiatives that can help prevent or reduce the likelihood of accidental exposure in LINAC radiotherapy, relating to exposed staff, processes, treatment facilities and stages, equipment and work materials, and organisations involved in the practice, amongst many other factors.

IMPACTS OF THE PROJECT

The project provided a decisive information and data base for the subsequent development of the Risk Matrix project for safety assessment in medical practice.

The main benefit of this project lies in its contribution to improving the understanding of the risks associated with this type of practice and in highlighting the importance of proactive safety assessment. In addition, it demonstrated the applicability of the PSA methodology to LINAC radiotherapy and provided a basis for the subsequent development of the project on risk matrices.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2008		*Seguridad y Control Regulador de las Instalaciones Radiactivas de Radioterapia mediante la aplicación de Técnicas de Análisis e Identificación de Riesgos*, R&D event from the Spanish Nuclear Safety Council (Consejo de Seguridad Nuclear, CSN, Madrid, Spain).
2009	*Análisis Probabilista de Seguridad para Tratamientos de Radioterapia con Acelerador Lineal,* available on the FORO webpage.	
2011	*Los métodos de análisis de riesgo en radioterapia: Análisis probabilístico de seguridad*, ALFA journal no. 15 of the Spanish Nuclear Safety Council (Consejo de Seguridad Nuclear).	
2012	*Análisis Probabilista de Seguridad de Tratamientos de Radioterapia con Acelerador Lineal*, joint FORO-IAEA publication, TecDoc 1670/S.	
2015		*Probabilistic Safety Analysis (PSA) of the radiotherapy treatment process using a medical linear accelerator*, proceedings of the 12th Congress of the International Radiation Protection Association (IRPA 12).

PARTICIPANTS

Juan José Vilaragut Llanes, project leader CNSN, Cuba); Susana B. Papadopulos (ARN, Argentina); Pedro Paulo Pereira Jr. (Instituto Nacional do Cancro, Brazil); Rubén Ferro Fernández (CNSN, Cuba); Manuel Rodríguez Martí (CSN, Spain); María Luisa Ramírez (CSN, Spain); Arturo Pérez Mulas (CSN, Spain); Marta Barrientos Montero (CSN, Spain); Fernando Somoano (ELEKTA, Spain); José Miguel Delgado Rodríguez (Instituto Madrileño de Oncología, Spain); Ramón López Morones (CNSNS, Mexico); Pedro Ortiz López (IAEA).

FORO also wishes to thank the following for their collaboration: Eduardo Larrinaga Cortina, Lourdes Pérez Guevara, Jorge Alemañy Álvarez, José de Jesús Rivero Oliva, Fernando García Yip, Ileana Silvestre Patallo, Andrés de la Fuente Puch, Cruz Duménigo González, Carmen Álvarez, Ana Blanes Tabernero, Anel Hernández Garcés, Verónica Godínez Sánchez, Adrián López García, Daniel García, Ramón del Castillo Bahi, Rodolfo Alfonso Laguardia, and Ivón Morales.

Application of the Risk Matrix Method to Radiotherapy (RISK MATRIX Project)

OBJECTIVE

The aim of the project was to apply the risk matrix methodology to the self-assessment of radiotherapy services. To this end, the aim was to adapt this methodology to the external beam radiotherapy treatment process of a hypothetical radiotherapy department (reference facility), based on existing best practices in FORO member countries, as well as on experiences reported in the literature, and thereby obtain a series of recommendations to strengthen quality and safety programmes in radiotherapy departments.

SCOPE

The study considered situations in the linear accelerator radiotherapy process that could lead to accidental exposure, for the patient, staff or the public, from the installation of the equipment until the end of treatment. Although the medical procedure itself was not included within the scope of this project, all aspects leading to an unintended deviation from the prescription given by the doctor were considered. The analysis of accidents involving exposure to orphan sources or during the transport of radioactive sources was excluded.

Operational experience (lessons learnt from accidental exposures) and the results of probabilistic safety analysis studies (PSA Project) were taken into account for its adaptation and application.

One of the advantages of the risk matrix method is that it allows the various parameter values (frequency of occurrence of an initiating event, probability of barrier failure, accident consequences and risk level of the initiating event) to be grouped into discrete levels, which are more manageable than numerical values for decision-making.

RESULTS

The application of the risk matrix method to a general radiotherapy department revealed that events with catastrophic consequences in external beam therapy carry a medium or low risk. An exception was identified for ^{60}Co radiotherapy involving manual treatment planning, which carries a much higher associated risk.

In the application of the risk matrix for accelerators, 142 possible initiating events that could lead to accidental exposures were identified. Of these events, 93.7 % would have consequences for the patient, 3.5 % for occupational staff and 2.8 % for members of the public. Furthermore, 100 direct barriers were analysed, along with 37 elements that help reduce the frequency of accident-initiating events (frequency reducers) and 26 that could mitigate the severity of potential consequences (consequence reducers). It was found that there were no very high-risk consequences.

With regard to the application of the methodology to external beam radiotherapy with ^{60}Co, 132 initiating events were generated. Of these events, 92 % would have consequences for the patient, 5 % for occupational staff and 3 % for members of the public. A total of 91 direct safety barriers, 41 frequency reducers and 50 consequence reducers were also analysed.

Consequence of the Initiating Event	Very Low Frequency	Low Frequency	Medium Frequency	High Frequency
Very High Consequence	HR	HR	VHR	VHR
	HR	HR	HR	VHR
	MR	MR	HR	HR
	MR	MR	MR	HR
High Consequence	HR	HR	HR	VHR
	MR	HR	HR	HR
	MR	MR	HR	HR
	LR	LR	MR	MR
Medium Consequence	MR	MR	HR	HR
	MR	MR	MR	HR
	MR	MR	MR	MR
	LR	LR	MR	MR
Low Consequence	MR	MR	MR	MR
	LR	LR	MR	MR
	LR	LR	LR	LR
	LR	LR	LR	LR
	Frequency of the initialing event			

Level of consequences versus frequency based on the Risk Matrix.

With regard to the application of the method to high-dose-rate radiotherapy treatments, the results were as follows: 113 initiating events were generated. Of these, 81 % would have

Finally, regarding the application of the methodology to low-dose-rate (LDR) brachytherapy treatments and permanent implants, 80 events were generated. Of these, 76 % would have consequences for the patient, 13 % for occupational staff and 11 % for members of the public. Here, 70 direct safety barriers, 41 frequency reducers and 21 consequence reducers were analysed.

The identified initiating events may occur at any stage of the treatment process, as well as during the installation and commissioning phases.

PROJECT IMPACTS

The risk matrix method is a systematic and simplified methodology derived from Probabilistic Safety Analysis (PSA) techniques. The project results have enabled the creation of a useful tool for obtaining an overview of the entire process and proposing improvements to aspects that contribute to reducing the risk level. Although this method does not quantify the level of risk with the accuracy of a PSA, it provides a structured approach to prioritising risk reduction.

PARTICIPANTS

Ramón López Morones, project leader (CNSNS, Mexico); Susana Papadopulos (ARN, Argentina); José McDonnell (Universidad Nacional de Rosario, Argentina); Marcelo Gonçalves (CNEN, Brazil); Pedro Paulo Pereira Jr. (Instituto Nacional de Câncer, Brazil); Cruz Duménigo (CNSN, Cuba); Alba Guillén (CNSN, Cuba); Juan José Vilaragut (CNSN, Cuba); Rubén Ferro (CNSN, Cuba); Jorge Morales (Instituto Nacional de Oncología y Radiobiología, Cuba); Carmen Álvarez (CSN, Spain); María Luisa Ramírez (CSN, Spain); Manuel Rodríguez (CSN, Spain); Arturo Pérez Mulas (CSN, Spain); José Miguel Delgado (Instituto Madrileño de Oncología, Spain); Carlos Sánchez Cayuela (Instituto Madrileño de Oncología, Spain); Verónica Godínez Sánchez (CNSNS, Mexico); Adrián López García (CNSNS, Mexico); Ángel Bernardo Paz García (CNSNS, Mexico); Ricardo Rodríguez (Instituto Nacional de Cancerología, Mexico); Pedro Ortiz López (IAEA).

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2009	*Aplicación del Método de la Matriz del Riesgo a la Radioterapia. Volumes 1 and 2,* available on the FORO website.	
2012	*Aplicación del Método de la Matriz del Riesgo a la Radioterapia*, joint FORO-IAEA publication, TecDoc 1685/S.	
2012		*Application of the risk matrix approach in radiotherapy: an Ibero-American experience*, IAEA International Conference on Radiation Protection in Medicine (Bonn, Germany).
2013	*Prevention of Accidental Exposure in Radiotherapy: The Risk Matrix Approach*, article in the journal Health Physics, Volume 104; Issue 2; Pages 139–150.	
2015		*Radiation safety assessment of cobalt-60 external beam radiotherapy using the risk-matrix method*, IRPA 12, 12th Congress of the International Radiation Protection Association (Buenos Aires, Argentina).
2015		*Risk analysis methods: their importance for the safety assessment of practices using radiation*, IRPA 12, 12th Congress of the International Radiation Protection Association (Buenos Aires, Argentina).
2016	*Application of the Risk Matrix Method to Radiotherapy*, a joint publication by FORO and the IAEA, TecDoc 1685.	

Development of a Tool for the Application of the Risk Matrix Method to Radiotherapy (SEVRRA Project)

OBJECTIVE

Given the complexity of using the Matrix Project, the National Commission for Nuclear Safety and Safeguards of Mexico developed the System for Risk Assessment in Radiotherapy (*Sistema para la Evaluación de Riesgos en Radioterapia*, SEVRRA) to apply the risk matrix methodology in a systematic and user-friendly manner. SEVRRA was transferred to FORO for further development and use in risk analyses by member organisations and in hospitals operating this type of facility.

SCOPE

SEVRRA includes risk models for 3DC linear accelerator practice, high- and low-dose-rate brachytherapy, as well as cobalt therapy.

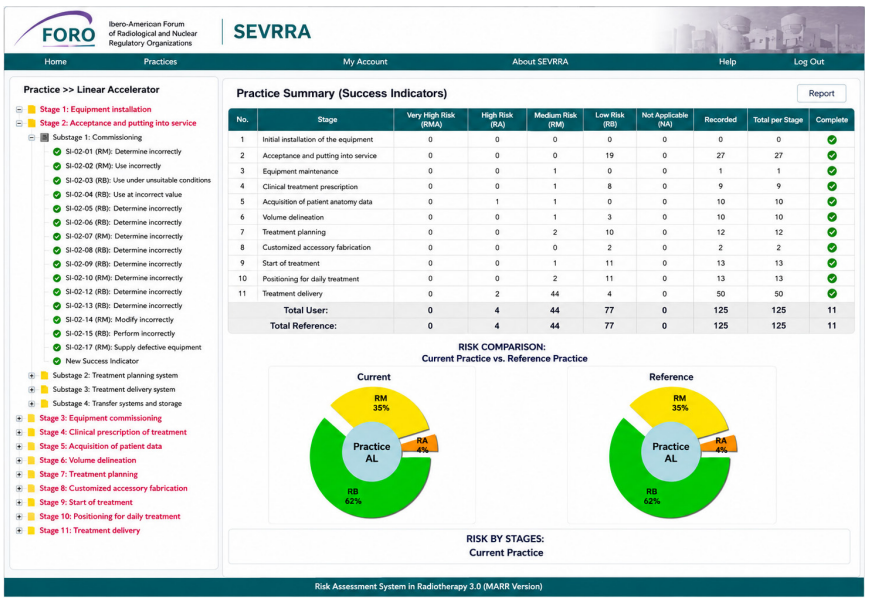
To this end, these models were used in more than a dozen services across the region, confirming their applicability in the field, identifying both strengths and weaknesses, and generating risk profiles, as well as the key safety elements—such as barriers and attenuators—with the greatest impact on improving the safety of radiotherapy services.

Risk calculation has a dual function in SEVRRA: 1) to inform the user of the current level of risk at their facility, and 2) to show the user the barriers they can implement in their practice to reduce the risk level of each initiating event. SEVRRA thus provides a detailed overview of the strengths and weaknesses of their practice with a view to improving them.

The system is designed to accommodate all practices analysed using the risk matrix method. The risk analysis results presented by SEVRRA enable the identification of initiating events with high or very high risk, as well as the barriers and frequency reducers that need to be implemented at the facility to achieve risk optimisation.

RESULTS

The project results highlighted the benefits of conducting this type of prospective analysis for radiation protection and human health, and have been recognised by international organisations and associations, such as the Pan American Health Organization (PAHO) and the International Atomic Energy Agency (IAEA); it is anticipated that, in the future, its use will become increasingly widespread and commonplace in the practice of radiotherapy.



Example of using SEVRRA online: Initiating events and associated risk.

SEVRRA presents users with the accident-initiating events that have been identified in radiotherapy practice, as well as the barriers, frequency reducers and consequence mitigators that exist in practice, and recommends the best practices that should be followed. Consequently, it facilitates the assessment of the risk level of radiotherapy services and enables the standardisation of regulatory activities for assessing the radiological safety of this medical practice, promoting good practices through risk information.

Furthermore, SEVRRA and its underlying methodology enable the identification of both strengths and weaknesses in radiotherapy services, making it possible to focus efforts on the implementation of safety measures, barriers and mitigators to prevent and reduce the occurrence of accidents, as well as to limit their consequences.

Originally, the system operated offline, and its online operation was subsequently expanded, with it being incorporated into FORO's website, La RED. Thus, the tool can be used according to the specific needs of each country, either by downloading it or using it online, meaning that other regions, in addition to Ibero-America, can also benefit.

PROJECT IMPACTS

The wider application of SEVRRA allows for the recording of a group of potential initiating events not considered in the reference services. This is of great importance as it could enrich the collective experience and thereby strengthen the proactive approach to accident prevention in radiotherapy.

The risk matrix methodology and SEVRRA are currently being used for risk analysis by medical physicists and radiation protection experts in over 30 radiotherapy departments across 12 Ibero-American countries, demonstrating that this is a development capable of a large-scale implementation in our region.

A national course on SEVRRA is planned to be held in Mexico, in collaboration with the *Instituto Nacional de Investigaciones Nucleares* (Mexican National Institute for Nuclear Research), ININ, within the framework of the IAEA's national Technical Cooperation project, at which users, health professionals and medical physics societies will be invited to promote the use of this tool in their country.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2012	*SEVRRA 3.0 tool in Spanish, English and Portuguese, in both online and offline versions*, available on the FORO webpage.	
2012	*Aplicación de los Resultados de los Análisis de Riesgo en Radioterapia para Avanzar hacia una Regulación Informada en Riesgo*, available on the FORO webpage.	
2012	*Guía para la realización de Análisis de Riesgos en los Servicios de Radioterapia*, available on the FORO webpage.	
2012		*Main results of the risk assessments for some Ibero-American radiotherapy facilities using SEVRRA Software*, IAEA International Conference on Radiation Protection in Medicine (Bonn, Germany).
2013		*Accident Prevention in Radiotherapy*, 9th IRPA Latin American Regional Congress on Radiation Protection and Safety (Rio de Janeiro, Brazil).
2015		*Accident prevention in radiotherapy. Using the "SEVRRA" software to implement the risk matrix method*, 10th IRPA Latin American Regional Congress on Radiation Protection and Safety (Buenos Aires, Argentina).
2017		*Ibero-America in the prevention of accidents in radiotherapy. Use of the risk matrix methodology and the SEVRRA tool*, IAEA International Conference on Radiation Protection in Medicine (IAEA, Vienna, Austria).
2025		*Application of the risk matrix methodology for the assessment of radiological risk, SEVRRA*, 10th Latin American Congress of Medical Physics, ALFIM 2025, (La Antigua, Guatemala).

PARTICIPANTS

Ramón López Morones, project lead (CNSNS, Mexico); Susana Papadopulos (ARN, Argentina); José McDonnell (Universidad Nacional de Rosario, Argentina); Marcelo Gonçalves (CNEN, Brazil); Georgia Johana (CNEN, Brazil); Pedro Paulo Pereira Jr. (Instituto Nacional de Câncer, Brazil); Cruz Duménigo (CNSN, Cuba); Alba Guillén (CNSN, Cuba); Juan José Vilaragut (CNSN, Cuba); Rubén Ferro (CNSN, Cuba); Jorge Morales (Instituto Nacional de Oncología y Radiobiología, Cuba); Carmen Álvarez (CSN, Spain); María Luisa Ramírez (CSN, Spain); Manuel Rodríguez (CSN, Spain); Arturo Pérez Mulas (CSN, Spain); José Miguel Delgado (Instituto Madrileño de Oncología, Spain); Carlos Sánchez Cayuela (Instituto Madrileño de Oncología, Spain); José Luis Muciño Cruz (CNSNS, Mexico); Mario Ángel Espinosa Santillán (CNSNS, Mexico); Verónica Godínez Sánchez (CNSNS, Mexico); Adrián López García (CNSNS, Mexico); Ángel Bernardo Paz García (CNSNS, Mexico); Ricardo Rodríguez (Instituto Nacional de Cancerología, Mexico); Pedro Ortiz López (IAEA).

Self-assessment of the Regulatory Programme for Radiation Protection in Medical Exposures (PROTECTION OF PATIENT Project)

OBJECTIVE

The objective of the project was to develop a guide for the self-assessment of the regulatory programme for medical exposures, with the aim of providing regulatory bodies with a method to evaluate their programmes and, consequently, to facilitate the development of more efficient regulatory frameworks that promote compliance with the requirements for the radiation protection of patients, as established in the Basic Safety Standards.

SCOPE

The document was intended primarily for regulatory bodies and health authorities, and was also considered of interest to medical facility operators and professional societies involved in medical practices with ionising radiation.

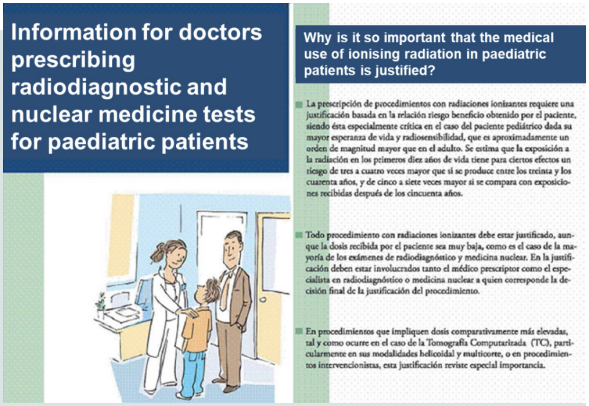
The project covered the regulatory programme for medical exposure, the difficulties that could hinder or prevent compliance with the requirements of the standards, as well as examples of strategies to resolve them. Occupational and public exposure were excluded from the guide, although they were occasionally mentioned due to their relationship with medical exposure.

As part of the results of the project, an informative document for paediatric medical procedure referrers was drafted. It complemented the publications and tools of the International Atomic Energy Agency available at that time, and presented a set of good practices useful for overcoming the obstacles that hinder compliance with the requirements of the Basic Safety Standards on radiation protection for patients.

RESULTS

The outcome of this project presented an analysis of the most common difficulties arising when developing a programme for the regulatory control of medical exposures, and suggested strategies to address and resolve these difficulties. In particular, the final document deals in detail with common situations that hinder such control, such as:

- Division of control responsibilities between radiological and nuclear regulatory bodies and health authorities.
- Lack of regulation.
- Lack of infrastructure and specialised human resources.



Example of an instructional leaflet.

The final self-assessment guide enables the country using it to analyse the state of regulatory control of medical exposure.

PROJECT IMPACTS

The results of this project have contributed to the development of more effective regulatory programmes to facilitate the implementation of requirements for patient radiation protection set in the Basic Safety Standards, and have facilitated the self-assessment of regulatory bodies' performance in the control of medical exposures, thereby contributing to their continuous improvement.

The use of the results obtained has been promoted by the IAEA through various workshops as a tool for assessing the degree of implementation of the requirements of the Basic Safety Standards in the countries of the region, with the participation of the Pan American Health Organization and the World Health Organization, as well as regulators and health authorities from Latin America and the Caribbean.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2008	*Self-assessment of the regulatory programme concerning radiation protection in medical exposures*, WHO Global Initiative on Radiation Safety in Healthcare Settings (WHO, Geneva, Switzerland).	
2010		*Protección Radiológica en Medicina*, 8th Regional Congress on Radiation and Nuclear Safety, 1st IRPA Latin American Congress (Medellín, Colombia).
2011	*Autoevaluación del Programa Regulador de la Protección Radiológica en las Exposiciones Médicas,* available on the FORO website.	
2013	*Programa Nacional de Protección Radiológica en las Exposiciones Médicas*, joint FORO-IAEA-PAHO publication, TecDoc 1710.	
2015		*Autoevaluación del programa regulador de la protección radiológica en las exposiciones médicas*, IAEA Regional Workshop (Santiago de Chile, Chile).
2015		*Autoevaluación del programa regulador de la protección radiológica en las exposiciones médicas*, IRPA 12, 12th Congress of the International Radiation Protection Association (Buenos Aires, Argentina).
2020		*Mejora continua del marco regulador para el control de las exposiciones médicas en Iberoamérica,* LAPRAM Webinar.

PARTICIPANTS

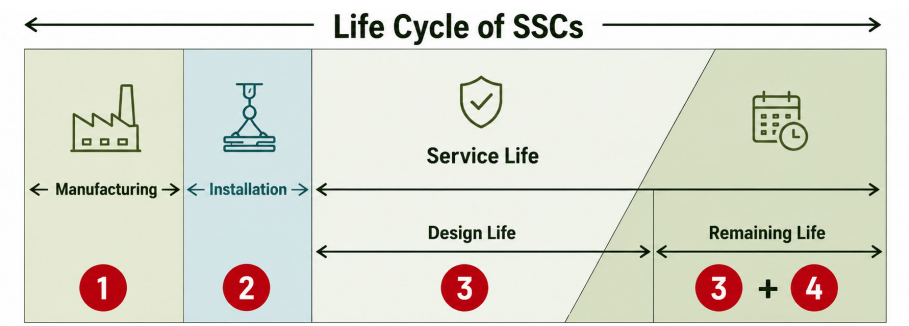
Ana María Larcher, project lead (ARN, Argentina); Maria Helena Maréchal (CNEN, Brazil); Rubén Ferro Fernández (CNSN, Cuba); Ramón Hernández Álvarez (CNSN, Cuba); María Luisa Ramírez Vera (CSN, Spain); Natividad Ferrer (Ministry of Health, Spain); Antonia Castañeda Muciño (CNSNS, Mexico); Mario Reyes Sánchez (CNSNS, Mexico); Blanca Faller (ARNR, Uruguay); Alejandro Nader (IAEA); Pablo Jiménez (PAHO).

Regulatory Practices in the Ageing and Life Extension of Nuclear Power Plants (PREEV Project)

OBJECTIVE

The PREEV project enabled the establishment of criteria to be applied by regulatory bodies to require the implementation of an Ageing Management (AM) system for the structures, systems and components (SSC) of a nuclear power plant, including in the case of long-term operation (LTO) or life extension, which meets the expected objectives from a safety perspective. Furthermore, it establishes general guidelines for the development and implementation of regulatory practices for the licensing, supervision and control of associated programmes and activities.

This development improves regulatory action relating to AM/LTO programmes at nuclear power plants. Thus, for the implementation of the project, the elements used in each country were standardised and compared with existing international standards.



Life Cycle of Structures, Systems and Components.

SCOPE

The project covered both the regulatory and licensing framework and the practices followed in regulatory processes (primarily assessment and inspection).

In addition to physical ageing (degradation phenomena), the project also addressed technological ageing (obsolescence) for nuclear power plants with PWR, BWR, CANDU and PHWR reactors, and is applicable to all operating conditions of nuclear power plants.

RESULTS

As a result, the following four guides were developed for full or partial use, both for the development of specific regulations and for the exercise of regulatory practices. These are criteria of general application, but they also refer to different approaches or methodologies characteristic of certain reactor technologies:

- *DT1 Regulatory Criteria Guide:* Establishes the regulatory criteria for the ageing management of nuclear power plant components, including management in the case of long-term operation.
- *DT2 Assessment Guide:* Provides guidelines for assessing the safety aspects relating to the management of ageing in nuclear power plants, so that it can be verified that they operate safely until the end of their service life. This guide, like DT3, addresses in general terms issues related to the assessment of ageing management, life extension projects and long-term ageing management. Occasionally, country-specific features were highlighted; the same applies to DT3.
- *DT3 Inspection Guide:* Provides guidelines for inspecting safety aspects relating to the ageing management of nuclear power plants, so that it can be verified that plant operators operate them safely until the end of their service life.
- *DT4 Guide for the Periodic Safety Review:* Sets out guidelines for the assessment of documentation relating to the Periodic Safety Review of nuclear power plants, applicable to the ageing of the structures, systems and equipment of such facilities, as well as to the licensing of long-term operation and to long-term operation itself.

In addition, a technical report on the project was drawn up, summarising the technical activities carried out and highlighting the results, conclusions and recommendations obtained.

The guidelines developed are based on the standards of the International Atomic Energy Agency and the regulations of the countries most advanced in nuclear technology; and are aligned with the reference levels established by the Western European Nuclear Regulators' Association (WENRA). Furthermore, they are consistent with the regulatory framework of each country represented in the project, and aim to reflect the experience gained from regulatory practice in each of the countries comprising the project team.

The PREEV documentation package (guidelines and technical report) constitutes a comprehensive guide covering all regulatory activities within the framework of ageing management. Within the IAEA, there was a wealth of guidance material in this field applicable to facility operators, but not to the activities of the regulator, which are covered by the PREEV project.

PROJECT IMPACTS

At regional level, all countries with nuclear power plants (Argentina, Brazil, Mexico and Spain) have used the PREEV products. Furthermore, Chile has adapted the PREEV criteria to research reactors, and Cuba has applied the DT4 guide to a Class I radioactive facility.

As regards the international impact of PREEV, two milestones are worth highlighting:

1. Following the presentation of this project at the *Third International Conference on Nuclear Power Plant Life Management (PLiM)* organised by the IAEA, the regulatory authorities in the US, Switzerland, the Netherlands and China requested that the project documentation be sent to them for their use.

2. Due to the interest shown by the international community, a joint FORO-IAEA scientific publication was produced, which is essentially an English translation of the four PREEV guides.

PARTICIPANTS

Diego Encinas Cerezo, project lead (CSN, Spain); Reinaldo Valle Cepero (ARN, Argentina); Alexandre Gromann Araujo de Góes (CNEN, Brazil); Jaime Riesle Wetherby (CCHEN, Chile); Conrado Alfonso Pallarés (CNSN, Cuba); José María Figueras Clavijo (CSN, Spain); Ricardo Pérez Pérez (CNSNS, Mexico); Javier Yllera Sánchez (IAEA).

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2009	*Proyecto PREEV del FORO*, article in NUCLENOR's INFO magazine (Spain).	
2009		*Participation in the round table on Developments in the European and Ibero-American Regulatory Framework*, 20th Annual Congress of the Mexican Nuclear Society, SNM (Puerto Vallarta, Mexico).
2009		*Participation in the round table on Relations between the CEIDEN Technology Platform and Ibero-America*, Meeting of the Management Board of the Spanish CEIDEN Nuclear Fission Energy Technology Platform (Madrid, Spain).
2010	*Envejecimiento de CCNN*, article in the journal Alfa published by the Spanish Nuclear Safety Council (Consejo de Seguridad Nuclear, CSN).	
2010		IAEA regional workshop on the development of regulatory frameworks (Santiago de Chile, Chile).
2011	*Proyecto PREEV. Prácticas Reguladoras en Envejecimiento y Extensión de Vida de las Centrales Nucleares de Potencia. Guías 1, 2, 3 y,* available on the FORO website.	
2011		*Actividades en el Área de Seguridad Nuclear del FORO*, 37th Annual Meeting of the Spanish Nuclear Society, SNE (Burgos, Spain).
2011		*Cooperación entre Organismos Reguladores. El Proyecto PREEV: Prácticas Reguladoras sobre Envejecimiento y Extensión de Vida*, Iberinco Ibero-American Seminar on Life Management (Madrid, Spain).
2012		*PREEV Project: Regulatory Practices on Ageing and Life Extension*, IAEA Third International Conference on NPP Life Management for Long-Term Operations (Salt Lake City, USA).
2014	*Regulatory Practices on Ageing Management and Long-Term Operation of NPPs in the Ibero-American Region,* joint FORO-IAEA scientific publication.	
2021		*FORO Activities in Nuclear Safety and AM&LTO*, Annual Congress of the Mexican Nuclear Society, LAS-ANS Symposium 2021 (Cancun, Mexico).

Strategy for the Prevention, Detection and Response to the Unintended Presence of Radioactive Material in Metal Recycling and Other Associated Processes (SOURCES Project)

OBJECTIVE

The aim of this project was to assist national governments and regulatory bodies in establishing harmonised strategies to prevent and mitigate the risks arising from the inadvertent presence of radioactive material, as well as to contribute to improving the control of radioactive sources by reintegrating into the regulatory system those detected at any stage of the metal recycling process.

The final document included a series of recommendations on the implementation of technical, training, information and financial measures to establish a national system for the radiological monitoring of scrap metal and the products and by-products resulting from its recycling, as well as to address the occurrence of radioactive sources or material in this industry.

SCOPE

The document covered the development, implementation and maintenance of the strategy, in which the direct participation of all entities involved in the metal recycling process (government and regulatory bodies, customs control authorities, radioactive waste managers, and the companies and business and labour organisations) was considered to be essential.

RESULTS

As a result of the project, a document was drawn up setting out a harmonised strategy for the prevention, detection and response to the inadvertent presence of radioactive material in metal recycling and other associated processes. The strategy was based on: i) agreements, protocols and experience; ii) training programmes for personnel involved in these processes, including regulators and facility staff; and, iii) a method for calibrating radiation gate monitors.

In addition, procedures were drawn up to record the operation of detection systems, to define actions in the event of radioactive material being detected at facility entrances, to ensure cleaning and decontamination in the event of radioactive sources or contaminated materials entering the process, and to investigate the origin of detected sources.

Finally, information leaflets, brochures and posters were produced for the general public and staff working in the metal recovery sector.

PROJECT IMPACTS

As a result of the project, some countries established action protocols for two main activities: the first relates to the management of concentrated radioactive materials during production processes in the oil industry, particularly in the extraction of fossil fuels, whether due to the use of radiation sources in this process or the detection of naturally occurring radioactive material concentrated in extraction pipelines, following the guidelines developed in FORO's project.

The second activity concerns the prevention of the inadvertent presence of radioactive material in the foundry industry. According to the relevant information, thanks to FORO's project, medium-sized and international companies implemented—within their budgetary constraints—detection systems at key stages of the production chain, ranging from the reception of raw materials until the final stage. Some companies even established a radiation safety group responsible for the specific process.

The aforementioned procedures have been applied by the countries that participated in the project, each in accordance with their own capabilities and specific interests.

Leaflet on the presence of radioactive sources in scrap metal.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2011	*Estrategia para la Prevención, Detección y Respuesta frente a la Presencia Inadvertida de Material Radiactivo en el Reciclado de Metales y otros Procesos Asociados,* available on the FORO website.	
2013		*Control de fuentes Radiactivas en el Proceso de Reciclado de Metales*, 9th IRPA Latin American Regional Congress on Radiation Protection and Safety (Rio de Janeiro, Brazil).
2014		*Round table*, International Joint Conference RADIO 2014 (Gramado, Rio Grande do Sul, Brazil).
2017		*Round table*, International Joint Conference RADIO 2017 (Goiânia, Brazil).
2025	*Estrategia para la Prevención, Detección y Respuesta frente a la Presencia Inadvertida de Material Radiactivo en el Reciclado de Metales y Otros Procesos Asociados,* joint FORO-IAEA publication TecDoc 2100.	
2025		*Control de Fuentes Radiactivas*, National workshop on scrap metal control and recycling of metallic materials (Mexico City, Mexico).

PARTICIPANTS

Walter Adrián Truppa, project lead (ARN, Argentina); Josilto Oliveira de Aquino (CNEN, Brazil); Igor Iván Sarabia Molina (CNSN, Cuba); Santiago Mansilla Pérez (Ministry of Health, Chile); Jorge Díaz Rivera (Ministry of Health, Chile); José Ignacio Serrano Renedo (CSN, Spain); Ignacio Jiménez Castro (CNSNS, Mexico); Mardonio Jiménez Rojas (CNSNS, Mexico); Walter Cabral (ARNR, Uruguay); Enrique Fernando Morales (ARNR, Uruguay); Diego Tellería (IAEA).

Establishment of a Common Methodological Guide for the Analysis of Radiological Emergencies and Identification of Lessons Learnt (EMERGENCY Project)

OBJECTIVE

The project aimed to develop methodological guidelines and standardised tools to support preparedness and response actions for nuclear or radiological emergencies in FORO member countries. One of its key milestones was to develop a methodological guide that would establish a standardised framework for the analysis of a nuclear or radiological emergency, with a view to strengthening preparedness and response actions for such events. The guide proposed stages and steps to be followed, ranging from the collection of information once the emergency has been declared to the drafting of the final report.

This project was launched in response to the need to strengthen systematic work in the field of emergencies, as promoted by the International Atomic Energy Agency. The basis for the development of the guide was founded on the recommendations set out in the Safety Standard "Preparedness and Response for Nuclear or Radiological Emergencies – General Requirements", GSR Part 7, of the IAEA and, in particular, on the provisions of its requirement No. 19, *"Analysis of the nuclear or radiological emergency and the emergency response"*. It also draws on the experience of members of the emergency response team, both locally and internationally.

SCOPE

The methodological guidelines and support tools developed within the framework of the project were aimed at the organisations responsible for managing preparedness and response to nuclear or radiological emergencies, such as facility owners and operators, regulatory authorities and response organisations.

The project comprised three activities: the development of two guides (a methodological guide for the preparation of radiological hazard and risk maps, and a common methodological guide for the analysis of radiological emergencies and the identification of lessons learnt) and the preparation of content for FORO's information platform on nuclear and radiological emergencies.

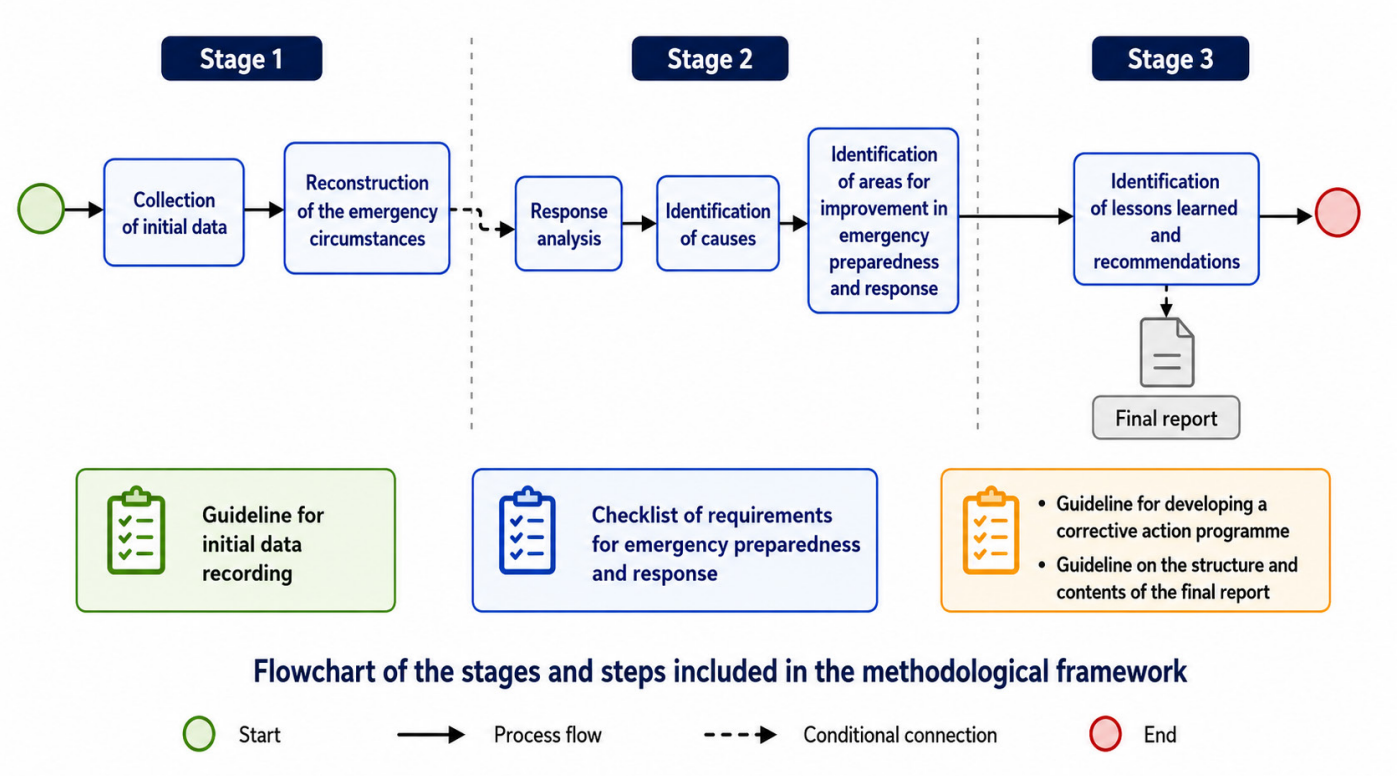
RESULTS

The first guide provided a series of guidelines for the preparation of radiological hazard and risk maps. The second was a common methodological guide for the analysis of nuclear and radiological emergencies, establishing a standardised approach aimed at strengthening preparedness and response for these types of events. Finally, the third activity laid the foundations for the information architecture of an emergency platform, to be made available on FORO's website.

The common methodological guide for the analysis of radiological emergencies and the identification of lessons learned was structured around the following stages:

1. Delineating the event, identifying the conditions prior to its occurrence and the circumstances it presents.
2. Investigate the causes that triggered the event, determining the elements of failure.
3. Draw conclusions and lessons learnt from the event, leading to the strengthening of preparedness and response in the event of emergencies.

For the aforementioned stages, the guide proposed a series of methodologies and tools to be used, such as working guidelines or checklists, as well as recommendations to support the development of each one. The attached figure presents a flowchart of the respective stages and steps proposed for the evaluation of responses to radiological or nuclear emergencies.



Flowchart of the stages and steps included in the methodological framework

PROJECT IMPACTS

The methodological guidelines and tools developed served as a common basis for all organisations involved in the management of nuclear or radiological emergencies for the drafting of regulations and procedures related to preparedness, response and post-event analysis activities, in accordance with their respective areas of competence.

The use of this guide enabled a wider dissemination of guidelines, knowledge and experience, thereby helping to strengthen the field of nuclear or radiological emergency preparedness and response, both locally and internationally.

PUBLICATIONS	CONFERENCE PRESENTATIONS
-- A joint FORO-IAEA publication is currently in progress in the form of a TecDoc entitled: *'Establecimiento de una Guía Metodológica Común para el Análisis de Emergencias Radiológicas e Identificación de Lecciones.*	-- The presentation and dissemination of the *Common Methodological Guide for the Analysis of Radiological Emergencies and Identification of Lessons* is planned in Ibero-American countries, in cooperation with the IAEA's Department of Technical Cooperation.

PARTICIPANTS

Osvaldo Daniel Jordán, *in memoriam*, (ARN, Argentina); Raúl Dos Santos (CNEN, Brazil); Héctor Basáez Pizarro (CCHEN, Chile); Pedro Ibrahim Díaz Guerra (CNSN, Cuba); María Josefa Granada Ferrero (CSN, Spain); Alejandro Cortés Carmona (CNSNS, Mexico); Santiago Regalado Campaña (IPEN, Peru); Marco Munive Sánchez (IPEN, Peru); Olga Edith González Granara (ARNR, Uruguay); Rodrigo Salinas Mariaca (IAEA).

Establishment of Licensing Criteria and Inspection Requirements for Facilities with Cyclotrons for the Production of Radioisotopes Used in Medical Applications and Research (CYCLOTRONS Project)

OBJECTIVE

There is a growing worldwide interest in positron emission tomography (PET), particularly with regard to the research and use of new radiopharmaceuticals. Consequently, the production of radiopharmaceuticals in cyclotrons is an area of increasing importance that requires greater regulatory effort during the licensing process due to its complexity. Facilities operating cyclotrons for the production of radiopharmaceuticals present significant aspects relating to radiation protection that must be properly assessed to ensure that operations are carried out without risk to staff, the environment and the public. In this regard, the objective of the project was to establish procedures for the licensing and inspection of facilities with cyclotrons for the production of radioisotopes.

SCOPE

The project was carried out in two stages, beginning with a document to serve as a guide for the licensing of facilities with cyclotrons for the production of radioisotopes, followed by the development of an inspection manual containing practical procedures to serve as a reference for regulators in the region and other countries with such facilities, to achieve this objective. This facilitated increasing the effectiveness of national inspection programmes, drawing on the

Inspector taking measurements during an inspection of a cyclotron facility.

experience accumulated in each country. The project addressed crucial aspects, such as personnel (basic education and training) and minimum required safety systems, as well as operational, maintenance and emergency aspects, etc.

RESULTS

The project produced a licensing guide and an inspection guide for cyclotron facilities for radioisotope production, proposing a framework and aspects to be verified at each stage of the licensing process, namely: notification and siting, construction, commissioning, operation and decommissioning. Throughout the project, tools were developed for use during the licensing and inspection process of the facilities, as well as a table to assist with shielding calculations and other supporting material for verifying the adequacy of ventilation systems.

PROJECT IMPACTS

The licensing and inspection guidelines have been used both by operators, to assess the radiological safety status of their facilities, and by regulatory authorities, for verification purposes.

The results of this project have been used by several FORO member regulators and others in the Latin American and Caribbean region. In Brazil, for example, they served as the main reference for the development of regulations governing cyclotron facilities. In addition, the International Atomic Energy Agency delivered regional courses on the regulatory control of facilities with cyclotrons, using the project's results as reference material.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2013	*Criterios para el Licenciamiento y Requisitos de Inspección de Instalaciones con Ciclotrones para Producción de Radioisótopos utilizados en Aplicaciones e Investigaciones Médicas,* available on the FORO webpage.	
2015		*Criterios para el licenciamiento y requisitos de inspección de instalaciones con ciclotrones para producción de radioisótopos utilizados en aplicaciones e investigaciones médicas*, 10th IRPA Latin American Regional Congress on Radiation Protection and Safety (Buenos Aires, Argentina).
2017		*Licensing process of cyclotron facilities*, RADIO 2017 International Conference (Goiânia, Brazil).
2019		*Planejamento e segurança para produção de radiofármacos em cíclotrons: como avaliar o impacto regulatório no cenário brasileiro*, RADIO 2019 International Conference (Foz do Iguaçu, Brazil).
2020		*Establecimiento de criterios para el licenciamiento y requisitos de inspección de instalaciones con ciclotrones para producción de radioisótopos utilizados en aplicaciones e investigaciones médicas,* LAPRAM Webinar.
2024	*Procesos reguladores de autorización e inspección de instalaciones de producción de radiofármacos con ciclotrón*, joint FORO-IAEA publication, TecDoc 2069.	

PARTICIPANTS

Alessandro Facure Neves de Salles Soares, project lead (CNEN, Brazil); Flavio Andrada Contardi (ARN, Argentina); Renato Di Prinzio (CNEN, Brazil); Ciro Cárdenas Eyzaguirre (CCHEN, Chile); Ramón Hernández (CNSN, Cuba); Arturo Pérez Mulas (CSN, Spain); Juan Gabriel Salinas Hernández (CNSNS, Mexico); Yuri Ravello (IPEN, Peru); Beatriz Souto (ARNR, Uruguay); Ronald Pacheco (IAEA).

Safety Culture in Organisations, Facilities and Activities Involving Sources of Ionising Radiation (SAFETY CULTURE Project)

OBJECTIVE

The overall objective of this project was to provide a framework for the introduction and practical application of the concept of safety culture in organisations carrying out activities involving radiation sources, taking into account the specific characteristics of radiation and physical protection and safety of such sources. As this was a subject that had not yet been fully developed in this sector, the project's outcome helped to establish a series of definitions, approaches and recommendations that formed the initial reference framework for organisations carrying out activities involving radiation sources to assimilate and work on the subject, gradually and in accordance with their specific circumstances. It also helped regulatory bodies to carry out their work in promoting and monitoring a safety culture within their licensees, whilst encouraging its adoption within the regulatory body itself.

SCOPE

The aspects of safety culture developed in this project had the following scope:

a. They apply only to organisations carrying out activities involving radiation sources for medical, industrial, research and teaching purposes, the transport of radioactive material and the management of radioactive waste arising from such activities, and irradiation facilities. The application to nuclear installations falls outside the scope of this document.

b. They apply to regulatory bodies both in relation to their role in promoting a safety culture and, in the relevant sections of the project, to their own safety culture.

c. They cover both the safety aspects of radiation sources and the radiation protection of individuals and the environment.

d. They include aspects of the physical security of radiation sources, as this is considered inextricably linked to radiation protection and safety.

e. They consider occupational radiation protection, radiation protection in medical exposures, radiation protection for members of the public and the environment.

f. They apply only to processes where radiation sources are present, from the commissioning of a facility to its decommissioning and final closure. The processes of site selection for facilities, the design of the facilities and their systems and equipment, as well as construction, fall outside the scope of this document, even though behaviours and attitudes regarding the safety of facilities and activities involving radiation sources (safety first) must be present in all such processes or phases.

RESULTS

This was a pioneering project, adapting and developing for the first time the concept of safety culture for organisations handling sources of ionising radiation in medicine, industry, and research and teaching. The resulting guide enabled a better understanding and dissemination of this concept, given that the lack of safety culture has been identified as one of the main contributing factors to the occurrence of radiological accidents and incidents in recent decades.

Ten basic elements of safety culture in organisations, facilities and activities set out in FORO's guide.

IMPACTS OF THE PROJECT

The guide has served as the primary resource for national and regional courses in Latin America, the Caribbean and other regions, facilitating the training of over a hundred professionals between 2016 and 2019. Furthermore, since 2019 it has also been used for the training needed for the initial or renewal of gamma radiography operators' qualification in Argentina.

Many countries in the region also organised events to promote safety culture based on FORO's guide; for example, in Cuba, a regulatory authority's guidance document was established for conducting safety culture self-assessments.

For its part, the International Atomic Energy Agency delivered national courses on safety culture using FORO's guide as the core material, and this guide was also used for three regional meetings on the training of professionals in Latin America, in collaboration with the regulatory bodies of Brazil and Chile.

Similarly, both the International Radiation Protection Association (IRPA) and the World Health Organisation (WHO) have expressed an interest in collaborating with FORO on this matter and have invited experts from the working group to give presentations at international events sponsored by these institutions.

FORO's guide on safety culture has been applied in a pilot study for industrial radiography practice (Gammagraphy Project).

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2013		*Proyecto de Cultura de la Seguridad del FORO*, 9th IRPA Latin American Regional Congress on Protection and Safety (Rio de Janeiro, Brazil).
2014		*FORO Project on Safety Culture in organisations, facilities and activities involving sources of ionising radiation*, IAEA International Conference on Occupational Radiation Protection (IAEA, Vienna, Austria).
2015	*Cultura de Seguridad en las Organizaciones, Instalaciones y Actividades con Fuentes de Radiación Ionizante,* available on the FORO website.	
2015		*Proyecto del FORO sobre Cultura de Seguridad en el área radiológica*, 10th IRPA Latin American Regional Congress on Radiation Protection and Safety (Buenos Aires, Argentina).
2015		*Proyecto del FORO sobre Cultura de la Seguridad*, 4th Joint Congress of the Spanish Society of Medical Physics and the Spanish Society of Radiation Protection (Valencia, Spain).
2015		*FORO Project on Safety Culture in organisations, facilities and activities involving sources of ionising radiation*, Regional European Workshop on Radiation Protection Culture in Medicine (WHO, Geneva, Switzerland).
2016	*Cultura de Seguridad en las organizaciones, instalaciones y actividades con fuentes de radiación ionizante*, ALFA magazine No. 30 of the Spanish Nuclear Safety Council (Consejo de Seguridad Nuclear, CSN), ISSN-1888-8925.	
2016		*FORO Project on Safety Culture in Organisations, Facilities and Activities with Sources of Ionising Radiation*, IAEA International Conference on Human and Organisational Aspects of Assuring Nuclear Safety (IAEA, Vienna, Austria.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2016		*Proyecto del FORO sobre Cultura de la Seguridad*, Ibero-American Conference on Radiation Protection in Medicine, CIPRaM (Madrid, Spain).
2018		*Proyecto del FORO sobre Cultura de Seguridad en el área radiológica*, 11th IRPA Latin American Regional Congress on Radiation Protection and Safety (Havana, Cuba).
2020		*FORO Project on Safety Culture in Organisations,* IAEA International Conference on Radiation Safety: Improving Radiation Protection in Practice (IAEA, Vienna, Austria).
2022	*Cultura de la seguridad en las organizaciones, instalaciones y actividades vinculadas al uso de fuentes de radiación ionizante*, joint FORO-IAEA publication, TecDoc 1995.	
2024		*FORO's vision on the development of the Safety Culture of Radiation Protection in Ibero-America*, IRPA 16th International Congress (Orlando, USA).

PARTICIPANTS

Rubén Ferro Fernández, project lead (CNSN, Cuba); Ana María Bomben (ARN, Argentina); Claudia Da Silva Silveira (CNEN, Brazil); Ricardo Videla Valdebenito (CCHEN, Chile); Ana Blanes Tabernero (CSN, Spain); Jorge Arciniega Torres (CNSNS, Mexico); Emilio Ordóñez Gutiérrez (CNSNS, Mexico); Renán Ramírez Quijada (IPEN, Peru); Jorge F. Perera Meas (ARNR, Uruguay); Rodolfo Cruz Suárez (IAEA).

Guide to the Development of a Programme for the Creation and Development of Competencies for Nuclear Reactor Regulators (CReAN Project)

OBJECTIVE

The overall objective of the CReAN project was to improve the systems, programmes and practices for the training and competency development of nuclear reactor regulatory staff. This project enabled the establishment of the principles to strengthen regulatory competencies, based on the operational experience of FORO countries with nuclear programmes, and designed to maximise the use of the Ibero-American region's own resources.

The resulting guide provides practical elements for developing specific aspects of a competency management system, based on the analyses and exercises carried out during the project and on a set of good practices identified in different countries. Furthermore, it can be useful both for regulatory bodies in countries embarking on a nuclear programme and for those operating within well-established nuclear regulatory frameworks that wish to evaluate, develop or improve their competency management systems.

SCOPE

The guide complements and builds on the IAEA methodology for competency management in nuclear regulatory bodies. It focuses primarily on competency analysis and on the processes used to address competency gaps. The other two main processes—competence management, and knowledge management and participation in knowledge networks—are covered in less detail.

The structure of the guide allows for the establishment of general guidelines whilst also introducing specific elements, examples and good practices gathered throughout the project, which can be used as a reference for addressing specific aspects of the strategic plan's implementation that are considered of particular interest or importance.

RESULTS

The main innovative contributions of the guide are as follows:

1. Infrastructures and mechanisms for skill development.

   An assessment of the infrastructures and mechanisms for skill development in each regulatory body is presented, along with a comparative analysis of these, as well as a summary table of the academic provision on nuclear technology and safety available in the region.

2. SWOT analysis ([4]) of the situation in the region.

   Based on this analysis, it is possible to draw up action plans with the necessary strategies for implementing the skills development programme.

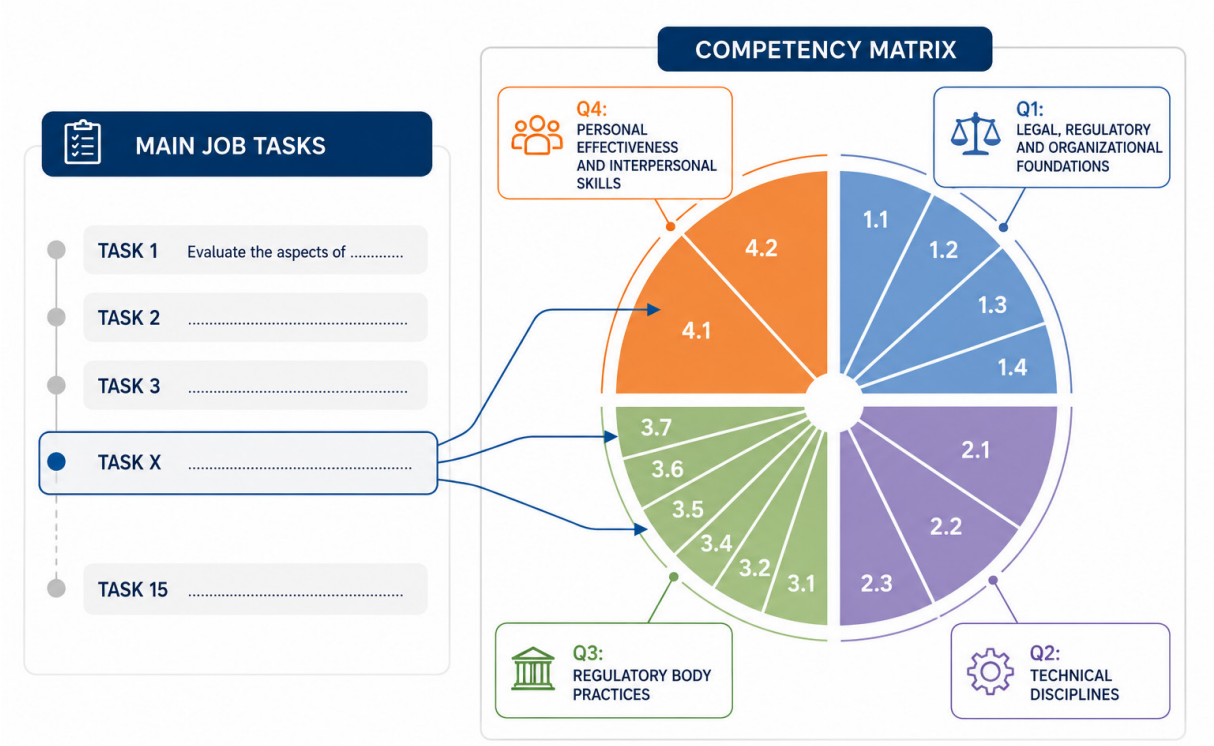
3. Identification and description of best practices.

   Best practices are identified in relation to the regulator's proactive approach to fostering careers, policies on staff recruitment and immersion within the regulatory body, the implementation of performance indicators, and the certification of regulatory competencies.

4 A strategic tool that assesses internal factors (Strengths and Weaknesses) and external factors (Opportunities and Threats)

4. Definition of a core regulatory workforce.

   A workforce of 28 regulatory positions was defined, characterising each position by its objective and a set of main tasks, and defining staffing requirements at each stage of the facility's lifecycle, from the site application to decommissioning and site clearance.



Example of a generic competency profile.

5. Review and adaptation of the regulatory competency model.

   Building on the IAEA's Systematic Assessment of Regulatory Competence Needs (SARCoN) model, a new model tailored to the region's regulatory structures has been developed, incorporating significant innovations to define a methodology for constructing a competence profile for each position within the workforce, as summarised graphically in the figure. The 'pie chart' competency diagram illustrates the average level of performance required across each competency group in each of the quadrants.

6. Foundations for establishing a regional on-the-job training network.

   Based on the information gathered, a series of elements were developed to be used as a starting point for launching a training network in the region.

7. Staged professional career development model.

   A career development framework was drawn up for an expert in the regulatory workforce, summarising the guidelines for designing a programme for the creation and development of the competencies set out in the guide.

PROJECT IMPACTS

The project's results regarding the development and management of regulatory competencies in nuclear safety are being incorporated by various regulators in the region, such as in the development of *the Systematic Approach to Training* (SAT) by the Spanish Nuclear Safety Council.

Furthermore, the project has been considered of great interest at an international level and used as an example in IAEA activities related to the subject, such as workshops on the organisation and staffing of an effectively independent regulatory body, due to the applicability of the tool.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2014	*Final Results of Project CReAN of the Ibero-American FORO*, 6th Meeting of the Steering Committee on Competence of Human Resources for the Regulatory Bodies (IAEA, Vienna, Austria).	
2015	*Guía para la Elaboración de un Programa de Creación y Desarrollo de Competencias de Reguladores de Reactores Nucleares,* available on the FORO website.	
2015	*Resultados del Proyecto CReAN del FORO Iberoamericano*, 10th IRPA Latin American Regional Congress on Radiation Protection and Safety (Buenos Aires, Argentina).	
2015	*El Proyecto CReAN del Foro Iberoamericano: Resultados, Aplicaciones y Perspectivas de Futuro*, International Symposium on Education, Training and Knowledge Management in Nuclear Energy and its Applications (Cusco, Peru).	
2015		*Competence of Regulators in the Nuclear Area, Final Results of the FORO Project "CReAN"*, Technical Meeting on Capacity Building and Human Resource Development for New and Expanding Nuclear Power Programmes (Lyon, France).
2016	*Guía para la Elaboración de un Programa de Creación y Desarrollo de Competencias de Reguladores de Reactores Nucleares,* joint FORO-IAEA publication TecDoc 1794.	
2019		*Outcomes of FORO's technical projects on building regulatory competencies and training. Their contribution to knowledge management in nuclear reactors and medical and industrial radiological applications*, FORO side event during the 63rd session of the IAEA General Conference (IAEA, Vienna, Austria.
2021		*FORO Technical Projects on Regulatory Competences*, IAEA Regional Training Course on Regulatory Body Integrated Management System and Human Resources Planning (IAEA, Vienna, Austria).

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2023		*Devising a Programme for Competence Acquisition and Development among Radiological and Nuclear Regulators*, IAEA International Conference on Effective Nuclear and Radiation Regulatory Systems: Preparing for the Future in a Rapidly Changing Environment (Abu Dhabi, United Arab Emirates).
2023		*FORO's contributions to capacity building of regulators*, IAEA Steering Committee on Regulatory Capacity Building (IAEA, Vienna, Austria).
2023		*FORO technical projects in the acquisition and development of regulatory competencies*, IAEA Steering Committee on Education and Training in Radiation Safety, Transport and Waste (IAEA, Vienna, Austria).

PARTICIPANTS

José María Kay, project lead (ARN, Argentina); Ana María Larcher (ARN, Argentina); Alexandre Gromann (CNEN, Brazil); Jaime Riesle (CCHEN, Chile); Conrado Alfonso (CNSN, Cuba); Diego Encinas (CSN, Spain); José Luis Esquivel (CNSNS, Mexico); Enrique Morales (ARNR, Uruguay); María Josefa Moracho Ramírez (IAEA).

Application of the Risk Matrix Method in Industrial Radiography (SEVRRA INDUSTRY Project)

OBJECTIVE

The objective of this project was to implement risk analysis techniques in industrial radiography practice, with a view to identifying measures that could prevent accidental exposures with adverse radiological consequences for workers and members of the public. To do so, the project employed the "Risk Matrices" method developed by FORO, for both techniques within industrial radiography, using radioactive sources and those using X-rays.

Specifically, the work aimed to:

1. Establish the risk profile of hypothetical reference entities in industrial radiography, by adapting and implementing the "Risk Matrices" method.
2. Adapt the SEVRRA software tool, used in radiotherapy risk analysis, to organisations carrying out these industrial practices.
3. Determine which accident sequences pose the greatest risk, as well as the barriers and mitigators that have the greatest impact on reducing risk in these practices.

This project thus contributes to the self-assessment of companies engaged in industrial radiography by identifying those measures that have the greatest impact on risk reduction. It is also highly useful for strengthening the assessment and inspection procedures for this practice carried out by the regulatory body.

SCOPE

The project was carried out in stages, beginning with industrial radiography using radioactive sources, the most complex due to the risks involved, given the large number of radiological incidents and accidents that have occurred in recent times.

The second part of the project was extended to X-ray generators in *on-site* industrial radiography, thereby covering most commonly used industrial radiography techniques. This part also included radiography in shielded rooms, using X-ray generators and industrial gamma-ray equipment.

In order to identify realistic events, barriers and consequences, industrial radiography operators from Spain and Mexico were invited to participate in two of the working meetings.

RESULTS

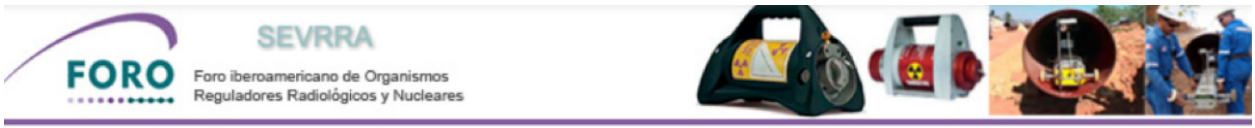
As a result of this project, a technical document was produced. It develops both conceptual aspects and practical suggestions for risk analysis in industrial radiography, along with a computer tool, SEVRRA Industry, which is the practical application of the risk matrix methodology.

Both the technical document and the SEVRRA tool, in their *online* and *offline* versions, are available on FORO's website, and work is currently underway with the International Atomic Energy Agency (IAEA) to produce a joint FORO-IAEA publication in the form of a TecDoc.

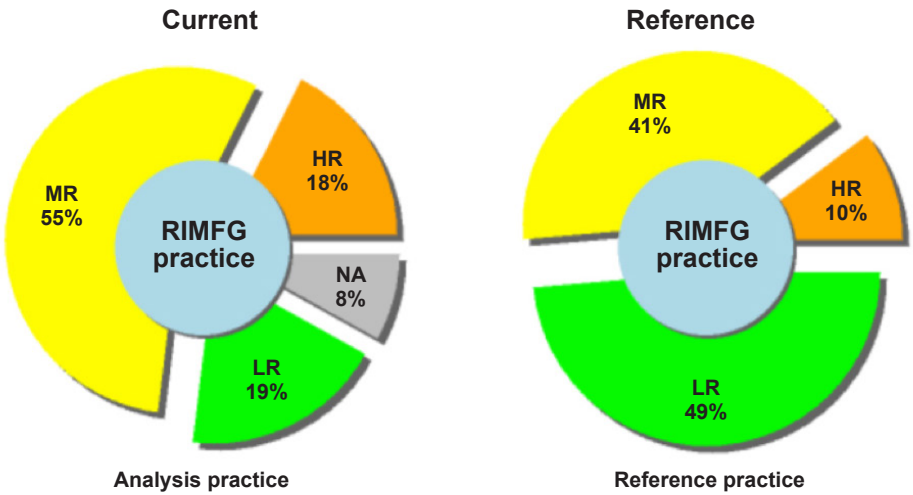
PROJECT IMPACTS

The technical document, as well as the SEVRRA tool, can be used as a reference guide for the application of the risk matrix method in industrial radiography.

The results have been utilised by both organisations working in industrial radiography and regulatory authorities. For users carrying out industrial radiography, whether using radioactive sources or X-ray generators, the tool has helped to improve the protection and safety of staff and the public, and to prevent unintended events. For regulatory bodies, it has been used to carry out



3.2 Graphics: Practice in analysis vs. Reference practice



Report on the SEVRRA tool. Comparison of the risk profile of a real entity against a hypothetical reference entity in the practice of industrial radiography.

the assessment and inspection process in this field, not only to improve their procedures but also as an independent verification tool.

At regional level, many FORO countries have organised local and national workshops and meetings to disseminate the project's findings and carry out practical exercises using the methodology. The aim of these activities was to facilitate the practical implementation of the tool and to gather evidence on its impact on safety and on the potential for improving both the process and the SEVRRA Industry tool. In several countries across the region, the tool is already being used as part of facility safety assessments.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2016	*Aplicación del Método de la Matriz de Riesgo en Radiografía Industrial*, available on the FORO website.	
2016		*Preliminary results of the FORO project "Application of the risk matrix method in industrial radiography"*, 16th European ALARA Network Workshop: ALARA in industrial radiography – How can it be improved? (Bern, Switzerland).
2017		*Aplicación del Método de la Matriz de Riesgo en Radiografía Industrial (SEVRRA Industria)*, RADIO 2017 International Conference (Goiânia, Brazil).
2018		*Aplicación del Método de Matrices de Riesgo para Evaluaciones de Riesgos en Radiografía Industrial*, 11th IRPA Regional Congress on Radiological and Nuclear Safety (Havana, Cuba).
2019		*Round table*, Update Seminar on Radiological and Physical Safety in Industrial Gamma Radiography and the Risk Matrix in Industrial Radiography Workshop (Buenos Aires, Argentina).

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2019		*Actividades del Foro Iberoamericano de Reguladores*, RADIO 2019 International Conference (Foz do Iguaçu, Brazil).
2020		*The Application of Risk Matrix Methodology to Avoid Radiological Accidents in Industrial Radiography*, IAEA International Conference on Radiation Safety: Improving Radiation Protection in Practice (IAEA, Vienna, Austria).
--	A joint FORO-IAEA publication in the form of a TecDoc is currently being finalised.	

PARTICIPANTS

Walter Adrián Truppa, project lead (ARN, Argentina); Josilto Oliveira de Aquino (CNEN, Brazil); Miguel Aravena González (CCHEN, Chile); Rubén Darío Quintero Londoño (INGEOMINAS, Colombia); Yolanda Pérez Reyes (CNSN, Cuba); Cruz Duménigo González (CNSN, Cuba); Belén Tamayo (CSN, Spain); Blanca Alfonso Nicolás (CSN, Spain); Laura Urteaga García (CSN, Spain); Mardonio Jiménez Rojas (CNSNS, Mexico); Adrián López García (CNSNS, Mexico); Gerardo Lázaro Moreyra (IPEN, Peru); Blanca Faller (ARNR, Uruguay); Rodolfo Cruz Suárez (IAEA).

Practical Guide for the Implementation of Clearance in Radioactive Facilities (CLEARANCE Project)

OBJECTIVE

The objective of the guide was to support operators of radioactive facilities that generate small quantities of waste by providing a methodology for carrying out the clearance process in accordance with IAEA standards and the regulations of most FORO countries. Furthermore, through its implementation, it also aims to facilitate to the regulatory bodies the monitoring of clearance by the licence holders.

SCOPE

The guide is applicable to radioactive facilities that generate small quantities of solid and liquid radioactive waste containing radionuclides with very short half-lives (less than 100 days), such as: nuclear medicine centres, research facilities, agricultural and industrial applications, etc.

The guide also includes a methodology that can be applied to the management of disused sealed sources with low-activity and very short half-lives.

The guidance does not apply to facilities associated with the nuclear fuel cycle or to waste generated from activities and practices where radionuclides of natural origin are present, whether in natural or increased concentrations.

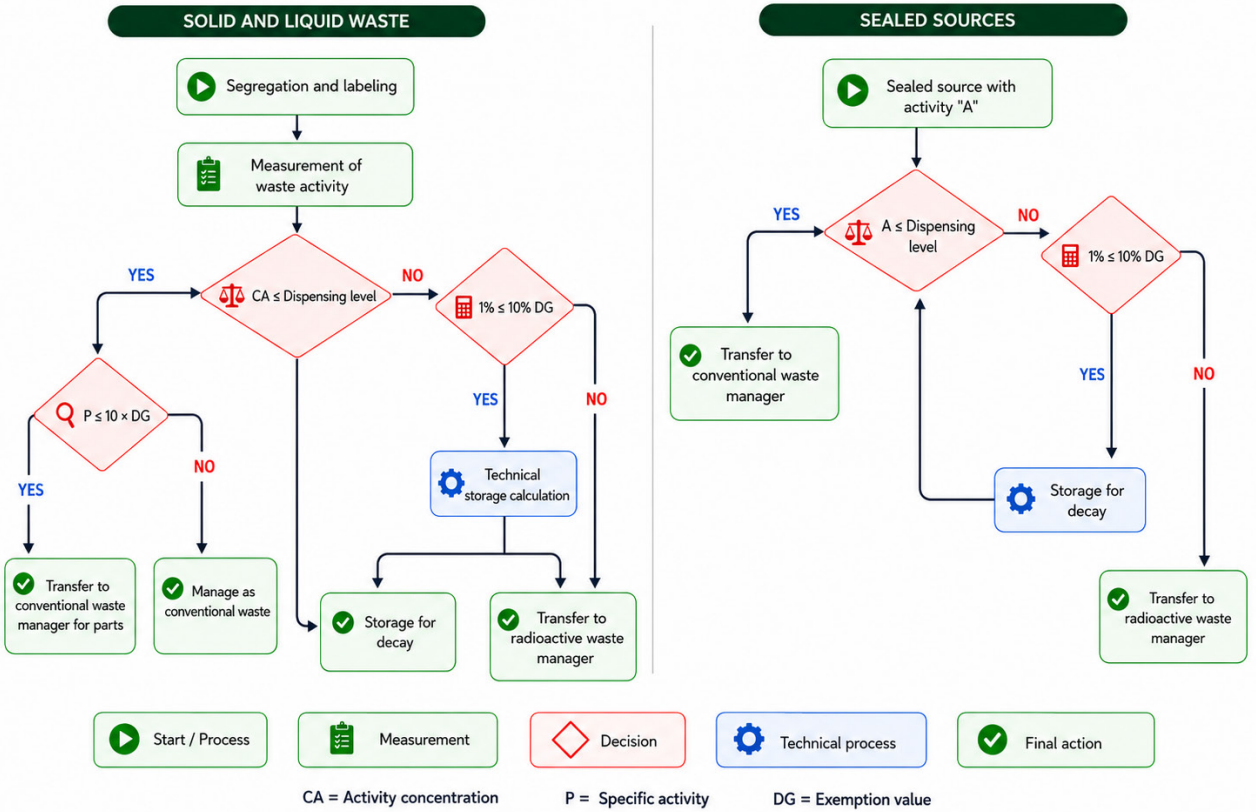
RESULTS

As a result of the project, the document *"Practical Guide for the Implementation of Clearance in Radioactive* Facilities" was produced, which includes:

- the radiological criteria for clearance and the release levels that may be applied,
- the methodology for implementing clearance for both solids and liquids, the flowcharts for its implementation and recording its monitoring,
- recommendations for the release of disused sealed sources,
- the regulatory body's control of the release.

In addition to the guide, three software tools and a user manual were developed, enabling the recording and calculation of clearance levels to be carried out in a simple and practical manner for solids, liquids and sealed sources. The methodology set out in the guide was incorporated into these tools, allowing operators to easily determine the date on which the waste will reach the clearance levels and can therefore be released into the environment. The results can be submitted electronically and periodically to the regulatory bodies in the established formats for monitoring purposes.

As a practical and user-friendly document, it can have a significant impact on countries in the region, given that this issue has not yet been adequately addressed in most countries and constitutes an important contribution for both operators and regulatory bodies, who should promote its dissemination and implementation.



Dispensing diagram for solid and liquid waste (left) and for sealed sources (right)

PROJECT IMPACTS

Regulatory bodies in Colombia and Uruguay have incorporated parts of the guide into their national regulations. Mexico, Cuba and Peru are considering it with a view to updating their regulatory framework. Guatemala, despite its regulator not being a FORO member, has used parts of the project's results for its "Guide to the Safe Management of Radioactive Waste from Nuclear Medicine Facilities".

Work has been carried out in conjunction with the International Atomic Energy Agency (IAEA) to ensure that a practical example of the application of the methodology proposed in the project was incorporated as an annex to the new Safety Guide "Application of the concept of clearance" (IAEA GSG-18). One of the advantages of this guide is that it will help users in any country to carry out clearance more quickly and efficiently, as the proposed methodology will facilitate the disposal of radioactive waste once it reaches the relevant clearance levels (thanks to the automatic calculations performed by the tools), and will prevent the accumulation of waste that unnecessarily occupies space in radioactive facilities.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2016	*Guía Práctica para la Implementación de la Dispensa en Instalaciones Radiactivas*, Regional Expert Meeting on "Enfoque Regulador para la clausura de pequeñas instalaciones (Regulatory Approach to the Decommissioning of Small Facilities)" (Montevideo, Uruguay).	
2017	*Clearance for Small Facilities and Activities*, IAEA Workshop on the Derivation of Specific Clearance Levels for Materials Suitable for Disposal in Landfills (IAEA, Vienna, Austria).	

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2018	*Guía para la implementación de la Dispensa en Instalaciones Radiactivas; Manual de Uso de las Herramientas; Herramienta para el cálculo de dispensa de líquidos; Herramienta para el cálculo de dispensa de sólidos; Herramienta para el cálculo de dispensa de fuente en desusos*, available on FORO's website.	
2018	*Implementación de la dispensa en instalaciones radiactivas*, Proceedings of the IRPA XI Regional Congress on Radiological and Nuclear Safety, ISBN 978-959-7231-06-6.	
2018		*Implementación de la Dispensa en Instalaciones Radiactivas*, IRPA XI Regional Congress on Radiological and Nuclear Safety (Havana, Cuba).
2020		*Guía Práctica para la Implementación de la Dispensa*, LAPRAM Webinar.
2023	*Application of the Concept of Clearance*, Annex VI, pages 96 to 103, IAEA Safety Guide GSG-18.	

PARTICIPANTS

Alma Arnau, project lead (CNSN, Cuba); Cecilia Bossio (ARN, Argentina); Walter Méndez (CNEN, Brazil); Mónica Pastor (CCHEN, Chile); Juan Pablo Parra (MINMINAS, Colombia); Pilar Lorenz (CSN, Spain); Alberto Mut Chable (CNSNS, Mexico); Carlos Ampuero (IPEN, Peru); Alejandro Nader (ARNR, Uruguay); Diego Tellería (IAEA).

Resilience of Nuclear Power Plants in FORO Member Countries (NPP STRESS TEST Project)

OBJECTIVE

The primary objective of this activity was to compile the conclusions reached as a result of the stress test assessment carried out with the participation of regulators from FORO member countries with operational nuclear power plants, taking into account the lessons learnt following the accident at the Fukushima Daiichi nuclear power plant.

The second objective was to share the results with other regulators in the region to provide them with first-hand information on the safety status of these nuclear power plants.

SCOPE

The assessment carried out by FORO aimed to determine the safety margins of nuclear power plants by analysing their behaviour and considering their response to extreme events that could lead to consequences beyond the design basis, such as the total loss of power supply and the final heat sink, as well as to evaluate the capabilities to manage such accidents.

The aim to include this activity in FORO's framework was also the following:

- To agree and harmonise the technical criteria for the assessment of stress tests across all FORO member countries operating nuclear power plants.

- To enhance the level of safety in nuclear power plants, so they improve their capacity to cope with extreme events beyond design basis.
- Review, amongst all FORO members, the results of the National Assessment Report from each regulatory authority regarding the assessments carried out.

RESULTS

Once each nuclear power plant had completed its assessment and submitted the required report to its regulatory authority, that authority submitted a National Assessment Report to FORO. The report presented the results obtained and the regulatory position on the implementation of the identified improvements. Each report was reviewed jointly by all members participating in the project.

To facilitate subsequent analysis, a structure was agreed upon for both the National Assessment Reports submitted by the countries and the summary national presentations. This structure included general information on the concept of the National Action Plan and the strategy for the measures, followed by specific information on the actions associated with the main areas of the assessments, which were:

1. Actions to protect sites and units against external events of a greater magnitude than considered on the licensing basis.
2. Actions to strengthen plant safety against the loss of function of external systems or supplies.
3. Actions to strengthen the capacity to cope with severe accidents.
4. Actions to manage emergencies.

Storage building for portable equipment, portable water injection pumps, flexible hoses, quick-connect couplings for extensive damage mitigation strategies and the Alternative Emergency Control Centre at Ascó nuclear power plant in Tarragona, Spain.

These National Assessment Reports, and the Action Plans for the implementation of the identified improvements, were reviewed jointly, in line with the methodology proposed in the International Atomic Energy Agency (IAEA) Action Plan.

Experiences relating to the implementation of the aforementioned Action Plans were shared openly and transparently, including both the difficulties encountered in implementing the measures and possible solutions. Furthermore, best practices and recommendations were identified for each country to consider when improving its own National Action Plan.

PROJECT IMPACTS

Countries whose regulators are FORO members and have nuclear power stations have independently implemented their Action Plans, which incorporate the conclusions of the National Assessment Reports and have led to the adoption of various measures. These include not only improvements to the design and operational practices of the power plants,

The National Assessment Reports show that regulatory bodies have taken steps to incorporate the lessons learned from the Fukushima Daiichi accident into their regulatory frameworks, concluding that, compared to the situation in 2012, the safety of nuclear power plants in FORO member countries has been significantly strengthened.

The stress tests carried out by FORO have represented a major effort by operators and regulatory authorities, and have enabled the countries of Ibero-America to join the group of nations that have taken the initiative to advance this type of verification, reflecting FORO's vision and objectives of promoting the highest standards of radiological, nuclear and physical security throughout the region.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2012		*Assessment of the Stress Tests Performed on NPPs Belonging to FORO Member Countries*, Side Event at the Second Extraordinary Meeting of the Convention on Nuclear Safety (IAEA, Vienna, Austria).
2014		*Actions taken as a result of stress tests at nuclear power plants belonging to FORO member countries*, Side Event at the 6th Review Meeting of the Convention on Nuclear Safety (IAEA, Vienna, Austria).
2018	*Informe de la Actividad de Evaluación de Resistencia de las Centrales Nucleares de los Países Miembros del FORO*, available on the FORO website.	

PARTICIPANTS

Rubén Navarro, project lead (ARN, Argentina); José Ramón Alonso Escós, project lead (CSN, Spain); Edgardo José Luis Marino (ARN, Argentina); Jorge Calvo (ARN, Argentina); Ricardo Waldman (ARN, Argentina); Alexandre Gromann (CNEN, Brazil); Marcos Eduardo Costa Nunes (CNEN, Brazil); Cristián Sepúlveda (CCHEN, Chile); Conrado Alfonso Pallarés (CNSN, Cuba); Sara González Veci (CSN, Spain); Víctor Manuel González Mercado (CNSNS, Mexico); Ricardo Pérez Pérez (CNSNS, Mexico); Gerardo Lázaro Moreyra (IPEN, Peru); Enrique Morales (ARNR, Uruguay); Francisco Javier Yllera Sánchez (IAEA).

Competencies of Regulatory Body Staff in Medical and Industrial Radiological Applications (CReAR Project)

OBJECTIVE

The acquisition, development and sustainability of regulatory body staff competencies are fundamental to fulfil organisational objectives. The overall objective of this project was to provide a tool enabling the development of a programme for the creation and development of regulators' competencies in medical and industrial practices.

Certain sections of the final document are intended to provide assistance in developing specific aspects of the programme. These sections are based on the exercises and analyses carried out within the framework of the project, as well as on a set of good practices identified in various countries, and may be used in part or in full as a practical guide or as illustrative examples.

SCOPE

The scope of the project was to establish a methodology for determining and developing the competencies required by regulatory body staff in accordance with their roles in medical and industrial radiological applications. The final document focuses on staff performing functions relating to assessment and authorisation, inspection and enforcement, and the drafting of regulations and regulatory guidelines.

Competencies are determined based on the tasks associated with each role, as well as the definition of the knowledge, skills and attitudes required.

Once the competencies have been established and developed, the regulatory body will be in a position to identify existing gaps and define a training plan tailored to its needs.

RESULTS

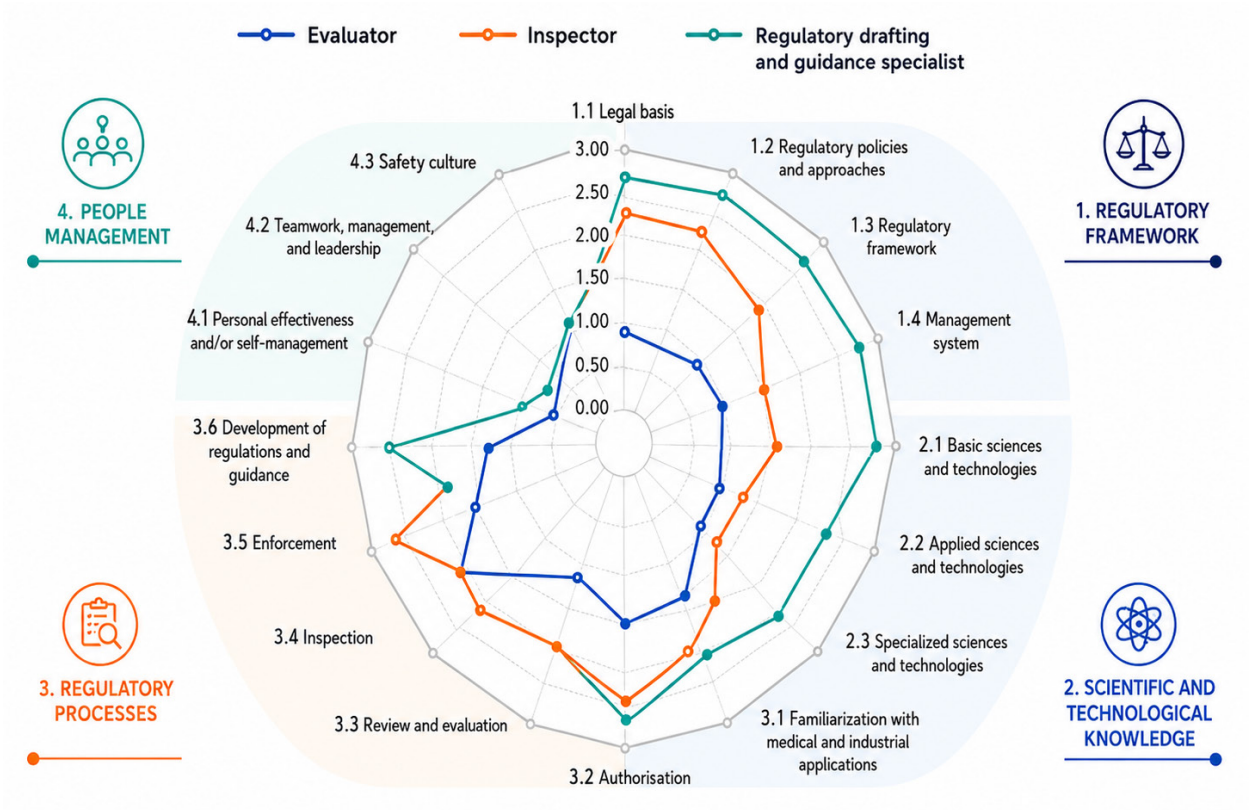
As part of the new approach presented in the document, the general list of competencies proposed in the IAEA's SARCoN Guide was adapted for application to medical and industrial regulators, which led to the modification and regrouping of specific competencies from the IAEA model, as well as the redefinition of the three levels of development for each competency.

The competency profile for each position was constructed based on two elements: the main tasks associated with that position, and the set of competencies required according to their level of development. The selection of the set of competencies linked to each task under consideration was made on the basis of the general list of competencies for regulators in medical and industrial applications.

The competency matrix provides a simplified visual representation of the role's competency profile, which facilitates staff recruitment and training. These competencies are represented in a diagram where the radius is proportional to the level of development required for each competency, as summarised in the figure below.

This project analysed various elements relating to the development of regulatory competencies and the application of strategies with a graded approach, which takes into account the different levels of technological development in each country. This allows the tool to be adapted and implemented for the creation of a competency development programme tailored to the specific needs of each regulator, enabling them to perform their duties and responsibilities more effectively.

Establishing the key elements of a sustainable strategic plan for competence building, as set out in the document produced, can assist in the development of effective and efficient regulatory bodies.



Competency profiles for medical and industrial application regulators.

PROJECT IMPACTS

In 2020, the Cuban regulator used FORO's CReAR project methodology as a reference to develop a system for staff selection, identification of required competencies, and monitoring of training and assessment in accordance with current national legislation.

The project's results were incorporated by other regulators in the region, such as the Spanish Nuclear Safety Council (Consejo de Seguridad Nuclear, CSN) in the development of *the Systematic Approach to Training* (SAT).

Furthermore, the project has been considered of great international interest and used as an example in IAEA related activities, such as workshops on the organisation and staffing of an effectively independent regulatory body, due to the tool's applicability. It is also serving as a basis for IAEA's training programmes.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2019		*FORO's technical project outcomes in regulatory competency building and training. Their contribution to knowledge management in nuclear reactors and medical and industrial radiological applications*, FORO side event during the 63rd session of the IAEA General Conference (IAEA, Vienna, Austria).
2019		*Competencies of the Staff of Regulatory Bodies in Medical and Industrial Radiological Applications*, IAEA International Conference on Effective Nuclear and Radiation Regulatory Systems (The Hague, Netherlands).
2020	*Competencias del Personal de Organismos Reguladores en Aplicaciones Radiológicas Médicas e Industriales*, available on the FORO website.	
2021		*Methodology for the Development of Competencies of Regulators of Medical and Industrial Radiological Applications*, 15th International Congress of the International Radiation Protection Association, IRPA (Seoul, South Korea).

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2021	*FORO Technical Projects on Regulatory Competences*, IAEA Regional Training Course on Regulatory Body Integrated Management System and Human Resources Planning (IAEA, Vienna, Austria).	
2022	*Programa para la Creación y el Desarrollo de Competencias de Reguladores de Aplicaciones Médicas e Industriales*, joint FORO-IAEA TecDoc 2005 publication.	
2023		*Devising a Programme for Competence Acquisition and Development among Radiological and Nuclear Regulators*, IAEA International Conference on Effective Nuclear and Radiation Regulatory Systems: Preparing for the Future in a Rapidly Changing Environment (Abu Dhabi, United Arab Emirates).
2023	*FORO's contributions to capacity building for regulators*, IAEA Steering Committee on Regulatory Capacity Building (IAEA, Vienna, Austria).	
2023	*FORO technical projects on the acquisition and development of regulatory competencies*, IAEA Steering Committee on Education and Training in Radiation Safety, Transport and Waste Management (IAEA, Vienna, Austria).	

PARTICIPANTS

Marcela Gisela Ermacora, project lead (ARN, Argentina); Anderson de Oliveira (CNEN, Brazil); Isabel Casas Morales (CCHEN, Chile); Mauricio Hernando Mañosca Ruiz (MINMINAS, Colombia); Conrado Alfonso Pallares (CNSN, Cuba); María Pinos (CSN, Spain); Diana Preza Hernández (CNSNS, Mexico); Fredy Aurelio Doncel Invernizi (ARRN, Paraguay); Richard Rosalino Florentín Cano (ARRN, Paraguay); Miguel Ángel Ticllacuri Carbajal (IPEN, Peru); Alejandro Nader (ARNR, Uruguay); Ronald Pacheco Jiménez (IAEA).

Pilot Application of FORO's Safety Culture Assessment Methodology Guide to an Industrial Gamma-ray Imaging Company (GAMMAGRAPHY Project)

OBJECTIVE

The main objective of this project was to conduct a pilot study to assess the radiation safety culture at an industrial gamma-ray imaging company by applying the methodology designed in FORO's guide "Safety Culture in Organisations, Facilities and Activities Involving Sources of Ionising Radiation". The study enabled the validation and adaptation of this methodology to the specific features and characteristics of this type of practice, with a view to its subsequent widespread application to all gamma-ray imaging facilities in the region.

To this end, the following specific objectives were established:

1. To develop standard tools for assessing radiation safety culture in an industrial gamma-ray imaging company, based on the methodology set out in FORO's guide.
2. To apply the tools in a pilot industrial gamma-ray imaging facility in each participating country.
3. To analyse the results of the pilot study.
4. To draw up methodological recommendations for the assessment of safety culture in industrial gamma-ray imaging companies.
5. To draw up recommendations for improving safety culture in industrial gamma-ray imaging companies.

SCOPE

The project was carried out through a series of tasks, including familiarisation with FORO's guide methodology, the design of assessment tools adapted to the context of an industrial gamma-ray imaging company, their pilot application at an organisation in each FORO member country, and the processing of results to improve the tools used and document them for wider use.

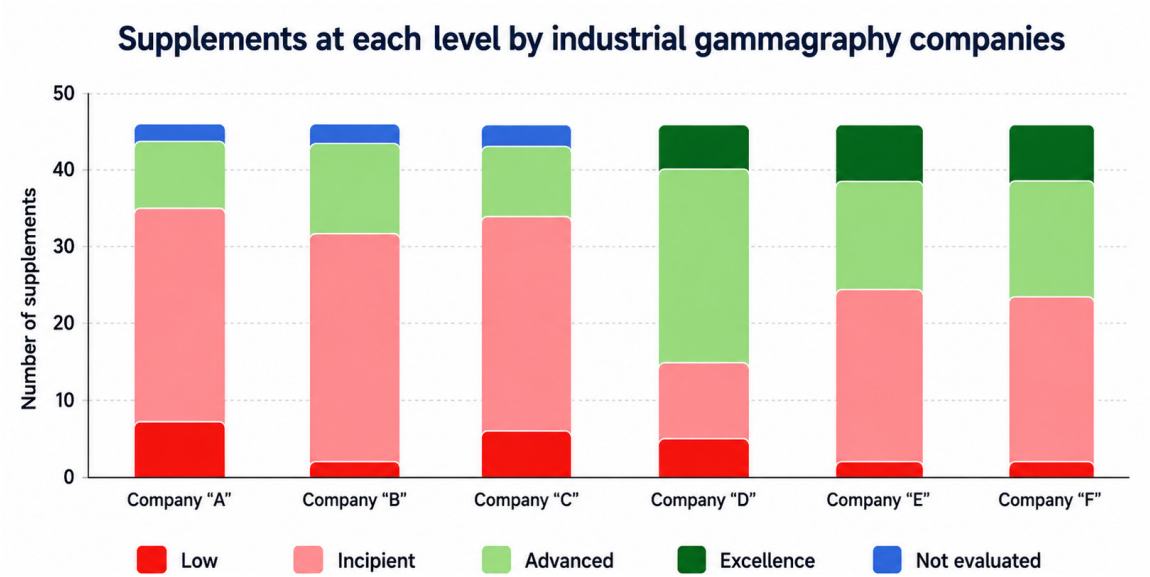
RESULTS

Assessment activities were completed for five (BE1, BE2, BE5, BE7 and BE8) of the ten basic elements (BE) identified in the safety culture methodology.

All sub-elements were reviewed and reconciled based on the findings of the applied methodology, with all modifications for each sub-element reflected in accordance with the specific characteristics of industrial gamma-ray imaging practice.

To this end, the work carried out included:

- Review and reconciliation of the wording of the definitions of the basic elements and the objective of the assessment.
- Review of each sub-element to analyse and reconcile the safety culture level criteria for each of them, their evaluation results by country, and the findings (identifying whether they were visible manifestations, stated values or basic assumptions) for each sub-element.
- Reconciliation of the findings, conclusions and best practices derived from the assessment of the core elements.
- Reconciliation of the safety culture recommendations for industrial gammagraphy relating to each basic element.
- Analysis of experiences and suggestions regarding the assessment methodology for each core element.



Preliminary partial assessment of all sub-elements of five basic elements.

The differences between pilot organisations and the findings that emerged from the evaluation highlight cultural differences between privately owned family businesses and state institutions. On this basis, certain evaluation criteria for the sub-elements included in FORO's Guide were amended. Similarly, cultural patterns were identified in practice across the participating countries in the region.

IMPACTS

This project confirms the validity and applicability of FORO's guide on safety culture, adapting it to the practice of industrial gamma radiography for assessments and improvements in this field.

Furthermore, specific guidelines are now available for assessing the basic elements of safety culture in industrial gamma radiography and for the application of the five recognised techniques for this type of evaluation. This facilitates the work of specialists, organisations and regulatory bodies in promoting and developing safety culture in industrial gamma radiography activities within their respective organisations or countries.

Finally, the findings and conclusions regarding safety culture in the pilot organisations of this study constitute an important source of lessons for learning and improving safety culture in any organisation that carries out industrial gamma radiography, and also have an impact on the refinement of regulatory approaches and processes relating to this practice.

The results obtained are being applied by some of the FORO regulatory bodies during the inspection process.

PUBLICATIONS

CONFERENCE PRESENTATIONS

-- The results of this project will soon be available on FORO's website.

PARTICIPANTS

María Teresa Alonso, project lead (ARN, Argentina); Cristiane Oliveira (CNEN, Brazil); Miguel Aravena (CCHEN, Chile); John F. Lozano (MINMINAS, Colombia); Yamil López Forteza (DSN, Cuba); Rubén Ferro Fernández (DSN, Cuba); Renán Ramírez Quijada (IPEN, Peru); Melina Andrea Mondelli (ARNR, Uruguay); Rodolfo Cruz Suárez (IAEA).

Extension of the Application of the SEVRRA Risk Matrix Methodology to New Radiotherapy Techniques (SEVRRA II Project)

OBJECTIVE

The aim of this project was to develop and implement a model for risk analysis in Intensity-Modulated Radiotherapy (IMRT) and Diagnostic Nuclear Medicine (DNM) practices, using the risk matrix methodology, to prevent the occurrence of accidents with adverse radiological consequences for patients, staff or members of the public, and to identify the barriers or defences that have the greatest impact on risk reduction. This also contributed to strengthening the regulatory authority's assessment and inspection procedures for these practices.

To this end, the accident sequences posing the greatest risk were identified, as well as the barriers and risk reducers that have the greatest impact on risk reduction in these practices, thereby enabling proposals for improvements to the regulatory authority's inspection and authorisation procedures.

SCOPE

For IMRT practice, the project focused on facilities employing walk-and-shoot, sliding window and arc therapy techniques, considering a fractionation regime, termed conventional, which involves administering treatment over 25 to 39 sessions, with an average daily dose of 2 Gy per session.

For DNM, the project focused on facilities employing the following techniques and modalities: whole-body, dynamic and static tomography, acquired using flat-panel gamma cameras, SPECT and hybrid SPECT/CT and PET/CT systems.

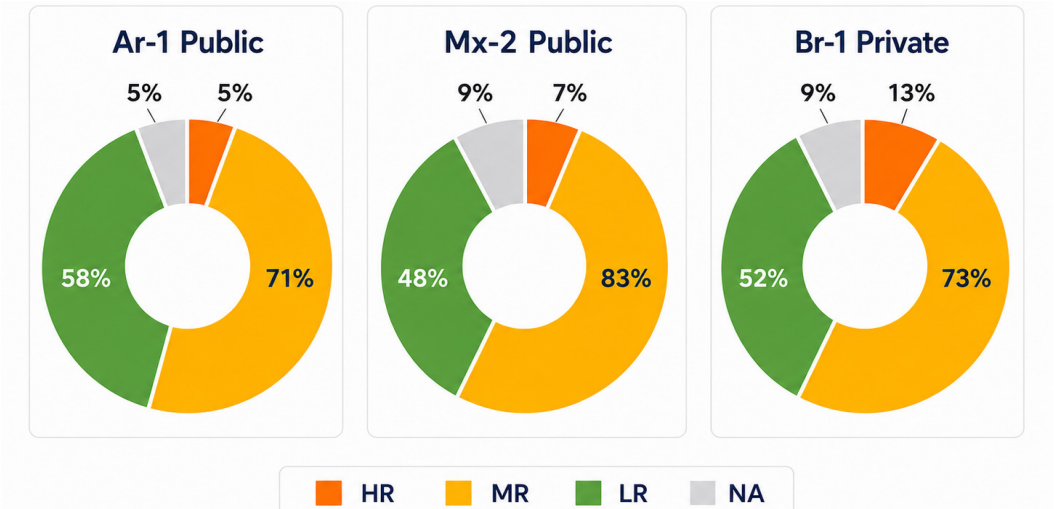
RESULTS

For IMRT, 151 equipment failures/human errors capable of triggering accident situations were identified, along with 216 safety elements (safety barriers and frequency and consequence reducers) with the capacity to prevent, detect and/or halt accident conditions or mitigate their consequences. The accident sequences were grouped into 13 main processes, categorised by consequences for patients, staff and the public.

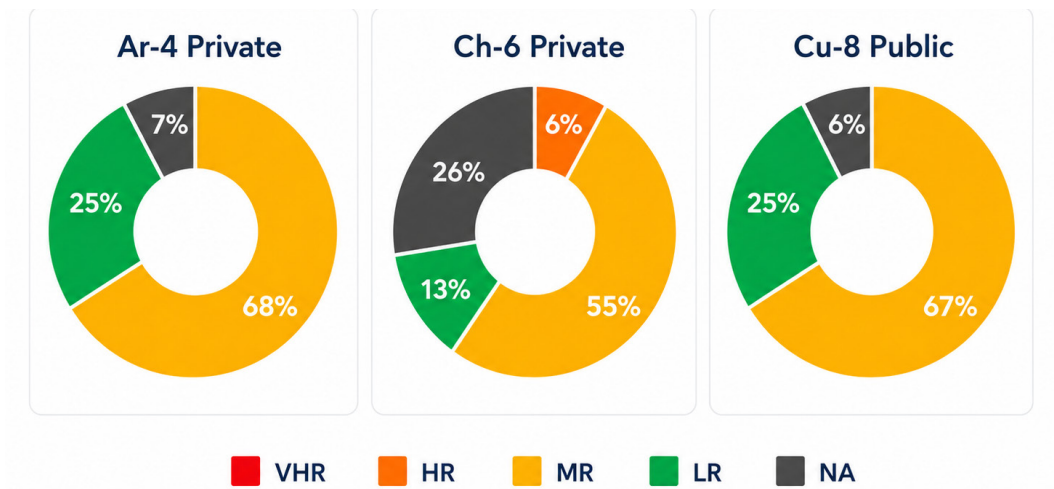
Meanwhile, the DNM model identified 96 potential accident-initiating events with 80 barriers, 42 frequency reducers and 13 consequence reducers which, together, covered the 12 main stages of the process ranging from service design and construction to radioactive waste management.

For each technique, an ideal facility was modelled to meet the highest safety standards in the Ibero-American region. For testing purposes and to obtain feedback from end-users on the risk models developed, a pilot application of the risk model was carried out for IMRT in five hospitals and for DNM in 14 hospitals (all in the Ibero-American region), taking care at all times to protect the sensitive information of all centres.

For the IMRT technique, the steps in the "Acceptance and Commissioning" and "Treatment Planning" processes show the highest number of sequences with high risk, mainly due to the lack of safety barriers such as "in vivo dosimetry during the initial treatment session", "redundant checks" and "peer review". Meanwhile, in DNM, no accidental sequences with "Very High" risks were identified; the majority of accidental sequences showed medium (tolerable) risk, followed by those presenting a low risk (widely accepted). The "Radiopharmaceutical preparation" and "Image acquisition" stages in DNM account for almost 50% of medium-risk sequences; therefore, particular attention must be paid to compliance with the established working procedures in these two stages. The risk models developed also enabled the identification of safety elements (barriers and mitigants) with the greatest impact on risk reduction and risk increase for each facility analysed.



Examples of risk profiles (percentage of High, Medium, Low and Not Applicable) obtained for IMRT.



Examples of risk profiles (percentage of Very High, High, Medium, Low and Not Applicable) obtained for MND.

PROJECT IMPACTS

The application of these risk models enables regulators and end-users to identify the risk profile of the facility, as well as the specific safety elements (barrier and mitigating) within their facility that have the greatest impact on reducing or increasing risk, thereby facilitating risk management and focusing supervision and inspection efforts. By fostering better communication between licence holders and regulators on relevant safety aspects, improvements in the radiological safety of these facilities are promoted.

The final models for both practices, as well as the corresponding SEVRRA tool, are incorporated into FORO's website, all of which are freely available for regulators, users and the general public.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2020		*Overview of Risk Models and Results obtained by the FORO Project (SEVRRA 2) for IMRT and DNM Techniques*, IAEA International Conference on Radiation Safety: Improving Radiation Protection in Practice (IAEA, Vienna, Austria).
2022	*Extensión de la Aplicación de la Metodología de Matrices de Riesgo y SEVRRA a Nuevas Técnicas de Radioterapia para Consolidar las Evaluaciones de Seguridad en las Prácticas Reguladas por los Países Miembros del FORO. Volumen 1 Modelo para Radioterapia de Intensidad Modulada (IMRT)*, available on the FORO webpage.	
2022	*Extensión de la Aplicación de la Metodología de Matrices de Riesgo y SEVRRA a Nuevas Técnicas de Radioterapia para Consolidar las Evaluaciones de Seguridad en las Prácticas Reguladas por los Países Miembros del FORO. Volumen 2 Modelo para Medicina Nuclear Diagnóstica (MND)*, available on the FORO webpage.	
2022		*The use of the SEVRRA computer tool in radiotherapy and nuclear medicine*, Duménigo et al., e-poster, 6th International Symposium on the System of Radiological Protection, ICRP 2021+1 (Vancouver, Canada).

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2022		*Extensión de SEVRRA a IMRT y MND*, 12th Regional Congress on Radiological and Nuclear Safety and 10th IRPA Regional Congress (Santiago de Chile, Chile).
2024		*SEVRRA IMRT y MND*, 1st REPROLAM International Symposium (Recife, Brazil).
2025		*Aplicación de metodología de matrices de riesgo, mediante el uso del sistema para la evaluación del riesgo radiológico, SEVRRA*, 10th Latin American Congress of Medical Physics, ALFIM 2025 (La Antigua, Guatemala).
2025		*SEVRRA*, Congress of the Mexican Society for Radiation Protection (Mérida, Mexico).

PARTICIPANTS

Ramón López Morones, project lead (CNSNS, Mexico); Susana Papadopulos (ARN, Argentina); José McDonnell (Medical Physicist, Argentina); Georgia Joana (CNEN, Brazil); Guilherme Bittencourt (Medical Physicist, Brazil); Lorena Mariángel (CCHEN, Chile); Cruz Duménigo (DSN, Cuba); Jorge Morales (Medical Physicist, Cuba); María Luisa Ramírez (CSN, Spain); Arturo Pérez Mulas (CSN, Spain); José Miguel Delgado (Medical Physicist, Spain); Carlos Prieto (Medical Physicist, Spain); Jose Luis Muciño Cruz (CNSNS, Mexico); Mario Ángel Espinosa Santillán (CNSNS, Mexico); Jorge Omar Hernández (Medical Physicist, Mexico); Gustavo Píriz (Medical Physicist, Uruguay); Rodolfo Cruz (IAEA).

Standardisation of the Inspection Process and Ageing and Obsolescence Management in Nuclear Research Reactors (RESEARCH REACTOR Project)

OBJECTIVE

The objective of this project was to harmonise the manuals, guidelines, plans, processes and criteria governing the scope, depth and frequency of inspections for research reactors, in order to verify compliance with the applicable legislation, license conditions and other relevant requirements, and to promote an adequate and consistent level of safety across these facilities. The project also included the development of harmonised guidelines for the regulatory control of ageing in research reactors.

This contributes to improving the effectiveness of national inspection programmes by providing a consistent basis for establishing the frequency, scope and depth of inspections. It also helps to define the applicable safety criteria and regulatory requirements applicable to the inspection according to the type of facility, thereby supporting a more structured and harmonised regulatory approach.

Simulation of an inspector's visit using a checklist during a regulatory inspection of the operation and safety of a research reactor.

SCOPE

The scope of the manual is limited to the radiological and nuclear safety of research reactors, including critical and subcritical assemblies, and excluding those requiring a pressurised cooling system. The activity focuses on improving the safety control process for research reactors in the Ibero-American region, through the harmonisation of criteria, manuals, guidelines and inspection procedures, and the exchange of experiences among experts during the project.

RESULTS

One of the main results of the project was the development of a manual for the planning and management of regulatory inspections of nuclear research reactors. This manual provides recommendations on aspects relating to the management, planning, conduct and evaluation of regulatory inspections, as well as on the training and qualification of inspection staff. In addition, it includes a set of 13 generic inspection procedures that can be used by regulatory bodies to develop their own procedures for the various areas of regulatory inspection.

No.	INSPECTION PROCEDURES
1	RADIATION PROTECTION
2	MAINTENANCE
3	OPERATION AND NUCLEAR SAFETY
4	REACTOR USE
5	EMERGENCIES
6	ENVIRONMENTAL MONITORING
7	ORGANIZATION AND PERSONNEL
8	MODIFICATIONS AND NEW EXPERIENCE
9	SAFETY MANAGEMENT
10	MANAGEMENT SYSTEM
11	FIRE PROTECTION SYSTEM
12	PRELIMINARY PLAN FOR SERVICE SHUTDOWN
13	AGEING MANAGEMENT

List of inspection procedures included in the Manual for the planning and management of regulatory inspections of research reactors.

The project also produced a manual for the regulatory control of ageing in research reactors. This manual includes a guide to regulatory criteria, an assessment guide and an inspection procedure.

PROJECT IMPACTS

Some of the generic inspection procedures included in the manual were tested during the inspection of the Peruvian RP-10 reactor and were considered to define the inspection programme for Chilean research reactors. Other regulators who participated in the project referred their intention to use them as a reference for their inspection programmes.

PUBLICATIONS

2019

Standardization of the Inspection Process for Research Reactors, IAEA International Conference on Research Reactors: Addressing Challenges and Opportunities to Ensure Effectiveness and Sustainability (Buenos Aires, Argentina).

CONFERENCE PRESENTATIONS

PARTICIPANTS

Gerardo Lázaro, project lead (IPEN, Peru); Carlos Perrín (ARN, Argentina); Marcelo Herrero (INVAP, Argentina); Eneida Dourado (CNEN, Brazil); Víctor Calzavara (CNEN, Brazil); Patricio Fonseca (CCHEN, Chile); Diego Encinas (CSN, Spain); Manuel Fernández (Tecnatom, Spain); Olgger Anaya (IPEN, Peru); Manuel Recio (IAEA); Martín Marchena (IAEA).

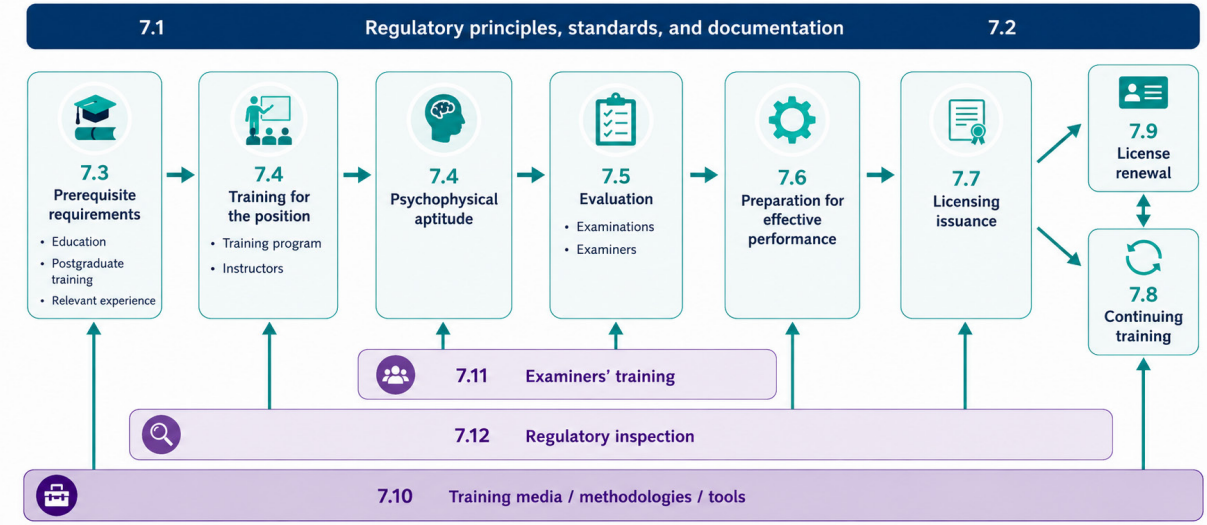
Reactor Operators Training and Licensing (CLOR Project)

OBJECTIVE

The overall objective of this project was to improve regulatory practices in the training and licensing process for operating personnel, through technical exchange, benchmarking and the development of documentation, methodologies and support tools.

The project's specific objectives were to:

- Exchange regulatory practices across all aspects and stages of the process related to the training and licensing of reactor operators.
- Share the methodologies, resources, tools and infrastructure available to regulators in the process.
- Develop support material (good practice guides, technical documents applicable to specific activities within the process).
- Apply the best practices and lessons learnt from the project to both power and research reactors, through mutual learning between the practices applied to both types of reactors.
- Disseminate and promote the application of the project's outputs at national, regional and international levels, in close collaboration with the IAEA.



Training, assessment and licensing process for operators of nuclear or research reactors.

SCOPE

The project covered all regulatory aspects relating to the process of granting and renewing licences for operating personnel of nuclear power and research reactors, as well as, in general, all regulatory activities related to the training of such operating personnel.

To this end, the project established a regional map showing the current status of the regulatory process associated with the training and licensing of nuclear reactor operators, based on a comparative exercise of processes and practices and a regional catalogue of methods, means, tools and infrastructure used in the training and licensing of nuclear reactor operators.

RESULTS

The main outcome of this project was the development of a guide with good regulatory practices in the training and licensing of nuclear reactor operators, including the use of tools, with technical documents applicable to specific aspects of the process (for example, examination techniques and methods), which were identified as key topics whose development is considered to be of greatest interest.

The aim was to outline actions to promote greater regional harmonisation of regulatory practices and to optimise the potential of the resources available across the region through exchange and sharing.

Technical visit by CLOR project experts to the control room of the Laguna Verde Nuclear Power Station, Mexico.

In addition, a regional map was drawn up showing the current status of the regulatory process for the training and licensing of nuclear reactor operators. This map was based on a benchmarking exercise of national processes and practices, as well as on a regional catalogue of methods, tools and infrastructure used in the training and licensing of nuclear reactor operators.

A guide with good regulatory practices in the training and licensing of nuclear reactor operators was also produced, including the use of tools and infrastructure (e.g. replica simulators), based on a discussion of the best practices established in each country and taking into account, where applicable, the documentation developed by the IAEA.

PROJECT IMPACTS

Based on the results, a proposal for action is being drawn up to promote greater regional harmonisation of regulatory practices and to make optimal use of the means and resources available in Ibero-America through exchange; this will strengthen the standardisation of training not only for personnel working in nuclear power reactors across the region, but will also be extended to research reactors.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2022		*FORO project on Reactor Operator Training and Licensing*, IAEA Technical Meeting on Nuclear Power Plant Personnel Training (IAEA, Vienna, Austria).
2024	*Prácticas reguladoras en Capacitación y Licenciamiento de Operadores de Reactores-Guía de buenas prácticas*, available on the FORO webpage.	

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2024	*Prácticas reguladoras en Capacitación y Licenciamiento de Operadores de Reactores-Guía de Criterios Reguladores*, available on the FORO webpage.	
2026		*FORO project on reactor operator training and licensing,* European Research Reactor Conference – RRFM 2026 – (Leiden, Netherlands).
--	A joint FORO-IAEA publication in the form of a TecDoc is currently in progress, entitled: *Prácticas reguladoras en Capacitación y Licenciamiento de Operadores de Reactores-Guía de buenas prácticas y Guía de Criterios Reguladores.*	

PARTICIPANTS

Diego Encinas, project lead (CSN, Spain); Reinaldo Valle (ARN, Argentina); Marco Antonio Bayout (CNEN, Brazil); Cristian Sepúlveda (CCHEN, Chile); Enrique Meléndez (CSN, Spain); Noel Moreno Cuahquentzi (CNSNS, Mexico); Julio César Romaní (IPEN, Peru); María Josefa Moracho (IAEA); Héctor Jorge Cols (IAEA).

Requirements for Authorisation and Procedures for the Inspection of Radiopharmacies (RADIOPHARMACIES Project)

OBJECTIVE

The field of radiopharmacy is growing considerably worldwide and requires increasing efforts from regulatory authorities during the authorisation and inspection of these facilities due to their high complexity. Currently, there are no international recommendations for their regulation. The criteria depend, amongst other things, on the radionuclides and activities to be commercialised, the facility design, the personnel involved, transport requirements, etc. Such facilities present important aspects for radiation protection that must be individually assessed to ensure that operations are carried out without risk to staff, the environment and the public.

In this context, the aim of this project has been to draw up technical requirements for the licensing and inspection procedures of radiopharmacies so that these processes can be carried out more efficiently and consistently.

Examples of radiopharmacy services.

SCOPE

The project focused on producing a guide to serve as a guideline for regulatory bodies when establishing and implementing technical requirements for the authorisation and inspection of centralised and industrial radiopharmacies, excluding hospital-based ones. It also helped to increase the effectiveness of national inspection programmes, drawing on the experience accumulated in each country.

The technical requirements for physical and radiological safety during the transport of radioactive materials were not addressed in this document, as it is considered that shipments must comply with the requirements set out in each country's legal framework.

RESULTS

Technical requirements were developed for the authorisation and inspection process throughout the lifetime of a radiopharmacy facility, including the stages of notification and siting, construction, commissioning, operation and decommissioning.

The guidance also contains the technical criteria for assessing the design of the facilities and their safety systems, the radiation protection programme, the monitoring plan, the emergency plan and waste management. Furthermore, it details the stages, tests and verifications to be carried out during the conduct of inspections at each stage of the authorisation process. In addition, a model checklist for inspections was developed to verify radiological safety aspects, covering all stages of the licensing process.

PROJECT IMPACTS

The application of the guide is strengthening radiological safety through the establishment of technical procedures for the authorisation and regulatory inspections of radiopharmacy facilities.

The guidance is being used by some FORO member regulatory bodies to strengthen regulatory control in this area and has formed the basis for the development of specific Brazilian regulations, detailing the minimum parameters that must be met when granting authorisations and carrying out inspections of radiopharmacy facilities.

It is worth noting that this project involved the participation of a representative from the US regulatory body (Nuclear Regulatory Commission, NRC), making it the first project in which a non-FORO member body has participated.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2022		*Panorama actual de las radiofarmacias en países miembros del FORO: licenciamiento y requisitos de seguridad*, 12th Regional Congress on Radiological and Nuclear Safety and 10th IRPA Regional Congress (Santiago de Chile, Chile).
2024	*Requisitos Técnicos para la Autorización y Procedimientos para la Inspección de Radiofarmacias*, available on FORO's website.	
2024		*Licensing criteria and inspection requirements for radiopharmacies*, IRPA 16 International Congress (Orlando, USA).
2025		*Requisitos para la autorización y procedimientos para la inspección de radiofarmacias,* Latin American Congress of Medical Physics, ALFIM 2025 (La Antigua, Guatemala).
2025		*Critérios técnicos para autorização e inspeção de radiofarmácias industriais e centralizadas no âmbito do FORO*, 11th Congress on Radiation Protection of the Community of Portuguese-Speaking Countries (Coimbra, Portugal).

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2026	*Development of Checklist Models for Inspections in Radiopharmacies: an Initiative of the Ibero-American Forum of Regulatory Bodies to Strengthen the Regulatory Ecosystem*, IAEA International Conference on Effective Nuclear and Radiation Regulatory Systems (Vienna, Austria).	
--	A joint FORO-IAEA publication in the form of a TecDoc is currently in progress, entitled: *Requisitos Técnicos para la Autorización y Procedimientos para la Inspección de Radiofarmacias.*	

PARTICIPANTS

Samira M. Carvalho, project lead (CNEN, Brazil); Germán Rabi (ARN, Argentina); Aylinne Román (CCHEN, Chile); Ramón Hernández (DSN, Cuba); Ana Blanes (CSN, Spain); Alfonso Uruburu (CSN, Spain); María Luz Rodríguez (CSN, Spain); Mauricio Salvador Neme Peralta (CNSNS, Mexico); Yuri Roger Ravello Ratzenberg (IPEN, Peru); Luis Neves (NRC, United States of America); Ronald Pacheco (IAEA).

Maintenance and Periodic Inspections of Reusable Packages for the Transport of Radioactive Material that are Not Subject to Design Approval (TRANSPORT Project)

OBJECTIVE

The objective of this project was to develop a guide setting out criteria to assist in the development and implementation of programmes for the maintenance and periodic inspections of reusable packages for radioactive material that are not subject to design approval, as well as for their monitoring and control by regulatory authorities.

Reusable packages for the transport of radioactive material.

To this end, firstly, documents and best practices on the maintenance and periodic verification of packages that did not require approval were identified, following the IAEA SSR-6 Regulations for the Safe Transport of Radioactive Material. Secondly, experience was compiled from Ibero-American countries regarding the monitoring by regulatory authorities of the maintenance and periodic inspections of these packages, identifying the difficulties encountered.

SCOPE

The project focused on aspects related to the periodic inspections and maintenance of packages for the transport of radioactive material, exclusively those that do not require design approval (excluding industrial and Type A packages) and which are used repeatedly (reusable packages). The sectors where this packaging is most widely used are medical and industrial applications of radioactive material, but it is also widely used in radioactive waste management, in both the nuclear and non-nuclear sectors.

The guide developed was intended to be useful not only to those who use the packaging but also to all stakeholders who, in one way or another, are involved in maintenance work. For this reason, a section was included detailing the roles of the various participants in the maintenance process, describing the roles of the designer, manufacturer, owner, user/consignor, as well as the competent authority, and outlining how the relationship between the different participants should be structured.

Furthermore, the guide covered routine checks as well as preventive and corrective maintenance of the packaging, and recommended the procedure to deal with any design modifications resulting from corrective maintenance.

RESULTS

The guide identifies the basic elements of a maintenance programme, focusing on the most common types of reusable packaging. This identification was based on a classification of packages according to their use, considering the typical characteristics of the packaging according to its applications (medical, industrial or waste), which ultimately determine the type of periodic inspections and maintenance to be carried out.

For each group of packaging, in accordance with this *ad hoc* classification, its characteristic safety features were identified, as well as the common problems encountered in operational experience. Illustrations, photos and diagrams were provided to facilitate a detailed description. The inspection and maintenance requirements for detecting and resolving these problems were

also outlined, and best practices in the corresponding inspection and maintenance programmes were reported.

Finally, the guide recommends the types of records to be kept for periodic inspection and maintenance operations, which facilitate the monitoring of a packaging's lifecycle by users and regulatory authorities.

PROJECT IMPACTS

The guide facilitates the development of maintenance programmes for packages used in transport. Furthermore, the results can be used by regulatory bodies to develop and implement procedures for the assessment and inspection of aspects related to the periodic verification and maintenance of these packages.

The guide establishes a common framework for the maintenance and periodic inspections of reusable packages for the transport of radioactive material that are not subject to design approval, and harmonises regulatory requirements in countries whose regulatory bodies are members of FORO.

Reviewing this entire process enables an improvement in the safety of the transport of packages that are not subject to design approval, which accounts for approximately 90 % of radioactive material shipments.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2023	*Mantenimiento y Verificaciones Periódicas de Bultos Reutilizables para el Transporte de Material Radiactivo No Sujetos a Aprobación de Diseño*, available on FORO's website.	
2023		*Maintenance and periodic checks of reusable packages for the transport of radioactive material not subject to design approval*, a FORO side event during the 67th session of the IAEA General Conference (IAEA, Vienna, Austria).
2024		*Atividades do Foro Iberoamericano de Organismos Reguladores Radiológicos e Nucleares,* 7th International Joint Conference RADIO 2024 (Rio de Janeiro, Brazil).
--	The results of this project have been used in the drafting of the IAEA safety guide DS546: *Ageing Management and Maintenance of Packages for the Transport of Radioactive Material*, which is currently in the process of being published.	

PARTICIPANTS

Engracia Rubio de Juan, project lead (CSN, Spain); Alejandro Gabriel Fernández (ARN, Argentina); Natanael Bruno (CNEN, Brazil); Maidelys Rosa Rodríguez Rodríguez (DSN, Cuba); Isabel Casas (CCHEN, Chile); Fernando Zamora Martín (CSN, Spain); Manuel García Leyva (CSN, Spain); Diego Martín Bautista Arteaga (CNSNS, Mexico); Miguel Ticllacuri Carbajal (IPEN, Peru); Blanca Esther Faller Velázquez (ARNR, Uruguay); Nancy Capadona (IAEA).

Assessment of Resilience for the Safe Operation of Nuclear Power Plants, Nuclear Research Reactors and Radioactive Facilities in Times of Pandemic (RESILIENCE Project)

OBJECTIVE

The overall objective of the project was to harmonise, amongst FORO member countries, a regulatory position aimed at ensuring and maintaining nuclear and radiological safety in the event of a pandemic or the simultaneous unavailability of personnel necessary for the safe and reliable operation of nuclear power plants, nuclear research reactors and more complex radioactive facilities, in accordance with a graded approach.

The specific objectives included:

1. In response to COVID-19, to identify and define a set of regulatory requirements that would enable regulatory bodies to ensure the nuclear and radiological safety of the aforementioned facilities, covering all functioning modes (including the safe shutdown in the case of nuclear power plants and research reactors).

2. Proactively, to clarify Requirement 4 of IAEA Guide SSR 2/2 Rev.1: *Safety of Nuclear Power Plants: Commissioning and Operation*, regarding the definition of the term "sufficient", with the aim of incorporating it into the applicable national regulations, including operating licences. Additionally, to conduct a similar analysis of the "sufficiency" of supplies in pandemic scenarios.

3. Extend the methodology and analysis to research nuclear reactors and more complex radioactive facilities, in accordance with a graded approach.

Nuclear and radioactive facilities in various operational contexts, within the framework of resilience assessment for safe operation.

SCOPE

The scope of the project covers nuclear power plants, nuclear research reactors and more complex radioactive facilities (facilities that use or produce radioactive material, or equipment emitting ionising radiation, such as cyclotrons, radioisotope and radiopharmaceuticals production facilities) in operation.

In the case of research nuclear reactors and radioactive facilities, the definition of regulatory requirements based on a graded approach is considered.

RESULTS

An executive summary and a working report were produced, compiling the main regulatory activities undertaken by each participating country in response to the pandemic, together with the elements and processes most affected and considered of greatest interest to each country. In this context, FORO played a proactive role in promoting the exchange and systematisation of the work carried out throughout the pandemic years.

IMPACT OF THE PROJECT

The project has been useful for the objectives of the participating organisations, as it enabled a very rapid exchange of information and experiences regarding the practices being developed during the pandemic and the processes that might be affected.

The work carried out by experts and international organisations in this field is very important and useful for improving knowledge and experience on how to deal with these expected, and even unexpected, events.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2024	*Reflexiones sobre la Evaluación de la Resiliencia de la Operación Segura de las Centrales Nucleares de los Reactores Nucleares de Investigación y de las Instalaciones Radiactivas de los Países del FORO en tiempos de Pandemia,* available on FORO's website.	
2024		*Assessment of the resilience of the safe operation of nuclear and radioactive facilities of FORO countries in times of pandemic,* The Nuclear Sector Response to Covid-19 from an Organisational and Human Perspective – How to Manage the Unexpected? OECD/NEA Technical Meeting of the Working Group on Human and Organisational Factors, WGHOF (Paris, France).

PARTICIPANTS

Roxana Barsi, project lead (ARN, Argentina); Adriana Politi (ARN, Argentina); Jefferson Borges de Araújo (CNEN, Brazil); Patricio Fonseca (CCHEN, Chile); Mauricio Hernando Mañosca Ruiz (MINMINAS, Colombia); Alma Arnau Fernández (DSN, Cuba); Benito Gil (CSN, Spain); Víctor Manuel González Mercado (CNSNS, Mexico); Enrique Ariel Páez Lovera (ARRN, Paraguay); Olgger Anaya Garro (IPEN, Peru); Marco Munive Sánchez (IPEN, Peru); Olga González (ARNR, Uruguay); Ronald Pacheco (IAEA).

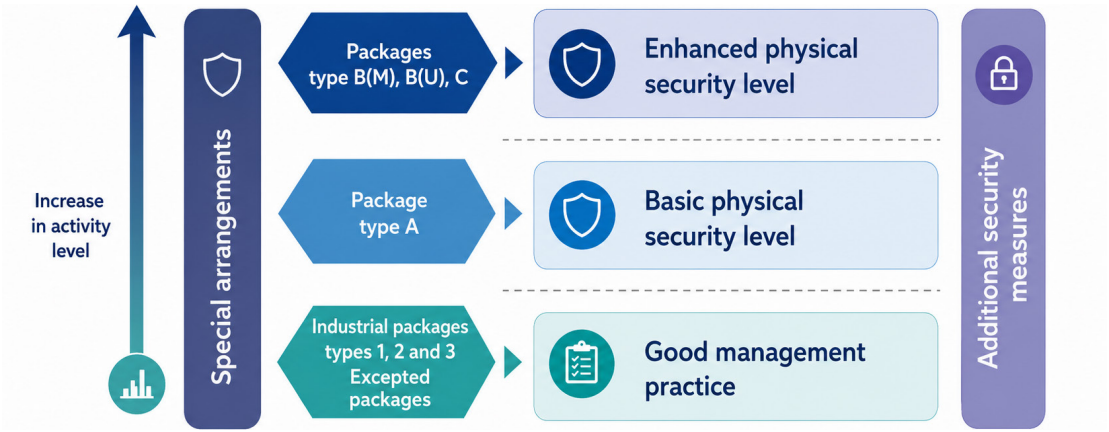
Physical Security during the Domestic Transport of Radioactive Materials (SECURITY Project)

OBJECTIVE

This project develops a technical guide setting out recommendations to be considered in the development and establishment of physical security requirements for the domestic transport (land, air and sea or river) of radioactive materials in countries whose regulators are FORO members. To this end, the impact of these recommendations on technological safety requirements has been considered, as well as those technological safety requirements that contribute to physical security.

To this end, the following steps have been taken:

- Developing a self-assessment guide to establish the current status of the physical security regime relating to the domestic transport of radioactive materials. This covers sealed sources in use, disused sealed sources, unsealed sources, and radioactive waste.
- Developing a technical guide to standardise physical security measures during the domestic transport of these materials and strengthen the national physical security regime, taking into account the synergy between physical security and technological security during domestic transport operations.
- To promote a platform for the exchange of national experiences, based on the technical guide to be produced by this project.



Assignment of physical security levels for radioactive materials during transport.

SCOPE

A self-assessment guide is proposed to characterise national circumstances and assess how closely they align with current international recommendations.

In addition, a harmonised technical guide would be provided, containing regulatory requirements based on a risk-based, graded approach to the domestic transport of radioactive materials, in accordance with international recommendations and national regulations.

EXPECTED RESULTS

The aim is to obtain an overview of national situations, experiences and lessons learnt from domestic transport operations of radioactive materials, and to develop a technical guide to assess the conditions of domestic transport of radioactive materials and enhance physical security during these operations.

This guide could be used for the preparation and training of new regulators.

POTENTIAL IMPACTS OF THE PROJECT

It is expected that the guide will help establish a common framework of nuclear physical security measures for the domestic transport of radioactive materials and harmonise regulatory requirements in countries whose regulatory bodies are FORO members.

Paraguay's Radiological and Nuclear Regulatory Authority (Autoridad Reguladora Radiológica y Nuclear, ARRN) has already used the guidance as a reference in drafting the *Regulations on Nuclear Security for the Domestic Transport of Radioactive Material* (*Reglamento de Seguridad Física Nuclear para el Transporte Interno de Material Radiactivo*).

In addition, some members of the project's working group have been invited as experts to participate in activities organised by the IAEA in the field of Nuclear Physical Security.

	PUBLICATIONS	CONFERENCE PRESENTATIONS
2025		*Nuclear Security during Domestic Transport of Radioactive Materials in the Regulatory Agencies of FORO Member Countries*, 29th Nuclear Security Information Exchange Meeting (IAEA, Vienna, Austria).
--	The final project report will soon be available on FORO's website.	

PARTICIPANTS

Pedro Ibrahim Díaz Guerra, project leader (CNSN, Cuba); Carlos Eduardo Rodríguez (ARN, Argentina); Sergio Adrián Menossi (ARN, Argentina); Fernando Antonio Vega Riquelme (CCHEN, Chile); Ángela Liliana Abadía Zapata (MINMINAS, Colombia); Edgar Mauricio López Rodríguez (SGC, Colombia); Dolores Aguado Molina, *in memoriam*, (CSN, Spain); Belén Tamayo (CSN, Spain); César López García (CNSNS, Mexico); Fredy Aurelio Doncel Invernizzi (ARRN, Paraguay); Pablo César Aliendre Cabañas (ARRN, Paraguay); Marco Munive Sánchez (IPEN, Peru); Joana Carina da Silva Pereira (APA, Portugal); Luisa Aniuska Betancourt Hernández (IAEA).

Safety Guide for Establishing Licensing Criteria and Inspection Requirements for Proton Therapy Facilities (PROTON THERAPY Project)

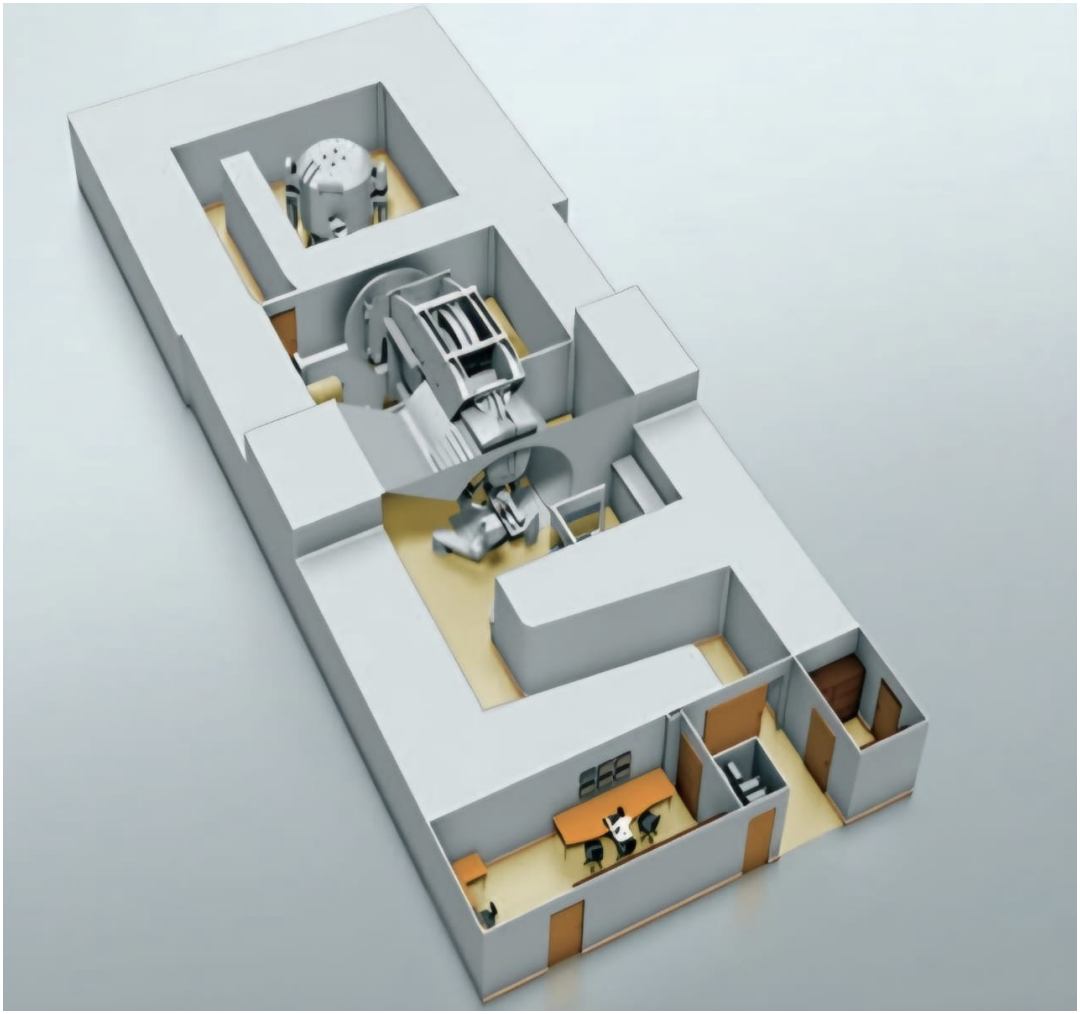
OBJECTIVE

Proton therapy has been introduced in many countries and is now considered a well-established technique for the treatment of certain types of cancer, particularly tumours located near vital organs. It is a technique whose primary aim is to maximise the radiation dose to the treatment area whilst minimising it in adjacent organs, thereby avoiding potential adverse side effects on healthy tissue.

In 2026 there are 79 proton therapy centres in operation across more than 20 countries, and it is expected that some will also be established in Latin American countries in the not-too-distant future.

The expansion of proton therapy requires regulatory authorities to devote increasing attention and resources to the licensing process, since the initial assembly and calibration processes associated (pre-operational period) are more complex than for conventional linear accelerators. In fact, there are a number of additional conditions relating to radiation protection that must be properly assessed to ensure that operations are carried out without risk to staff, the environment and the public.

Due to the advanced technology employed in this type of treatment, the equipment used for quality control, the calculation of room shielding and the specific characteristics of the accelerator make a proton therapy facility a major challenge for regulatory authorities.

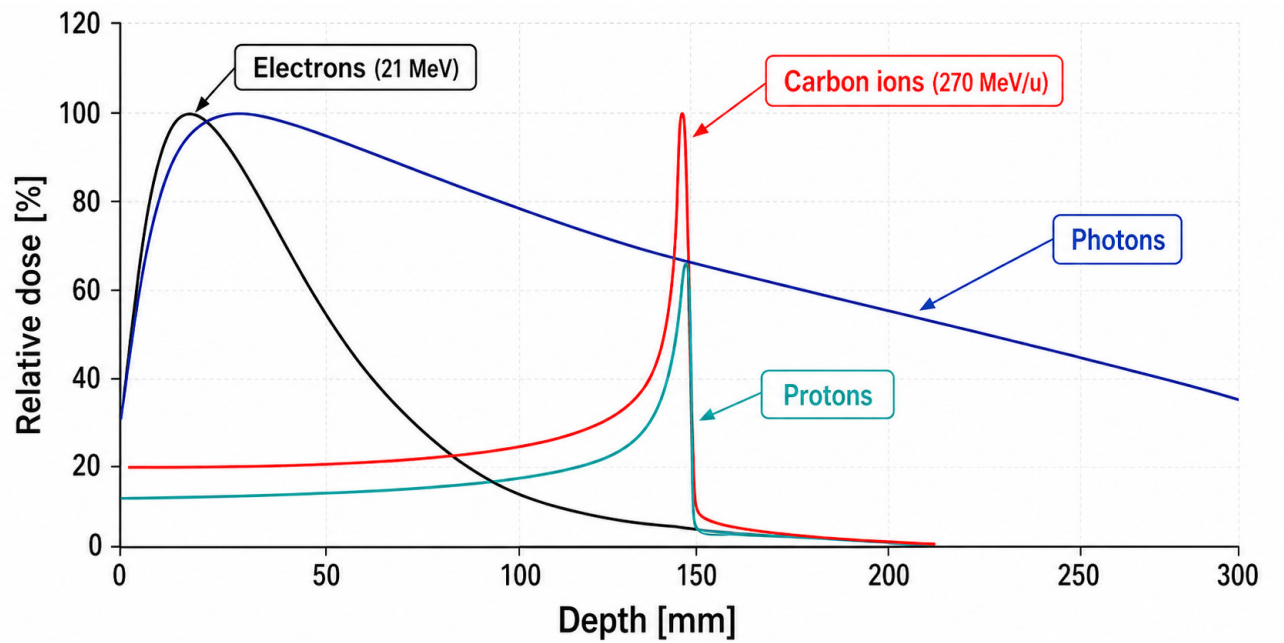


Compact proton therapy system with synchrocyclotron
(Source: Ion Beam Applications and Quirónsalud Proton Therapy Centre).

Currently, there are no specific international recommendations for its regulation. The criteria depend, amongst other things, on the design of the facility, the personnel involved, and the operating conditions, among other considerations.

This project aims to develop licensing criteria and inspection requirements for proton therapy facilities, and specifically:

- To develop guidelines for the licensing of proton therapy facilities.
- Develop guidelines for regulatory inspections of proton therapy facilities.



Proton dose distribution versus photon dose distribution.

- Establish a network of experts in this field to advise FORO members and other regulators in the region who may request support or assistance with the licensing of proton therapy facilities.
- To enhance the effectiveness of national inspection programmes, drawing on the experience accumulated in each country.

SCOPE OF THE PROJECT

Some FORO countries are in the process of acquiring proton therapy facilities. The necessary licensing requirements will depend, among other things, on the types of equipment, the facility design, the personnel involved, etc. Although there is an IAEA document (TecDoc 1891) that covers proton therapy facilities, its content is very broad as it also covers other types of facilities. Consequently, there is a need to create a specific guide containing practical information for the licensing of proton therapy facilities, in response to the growing demand from countries participating in FORO.

The project focuses on developing guidelines to serve as a reference for regulatory bodies when establishing and implementing technical requirements for the authorisation and inspection of proton therapy facilities.

EXPECTED RESULTS AND POTENTIAL IMPACTS OF THE PROJECT

The guidelines developed may be incorporated into the licensing processes of regulatory authorities in Ibero-America; and if published and translated by the IAEA, they could be used in other regions, alongside training courses run by the Department of Technical Cooperation.

The guidelines could be widely disseminated through conferences and congresses in the regulatory field, in scientific journals, and also published on the regulatory bodies' websites.

This project also aims to:

- Enhance radiation safety through the establishment of technical procedures for the licensing and regulatory inspection of proton therapy facilities;
- Develop a document to serve as a guide, setting out the minimum parameters to be observed when licensing these facilities, verifying compliance and establishing guidelines for inspections;
- Design training programmes for the relevant regulators.

PARTICIPANTS

Arturo Pérez Mulas (CSN, Spain) and Camila Salata (ANSN, Brazil), project leaders; Germán Rabi (ARN, Argentina); Ciro Cárdenas Eyzaguirre (CCHEN, Chile); Ramón Hernández Álvarez (DSN, Cuba); Roberto Ortega Jiménez (CNSNS, Mexico); Yazmin Paraguay Villa (IPEN, Peru); Susana Vaz (ERS, Entidade Reguladora da Saúde, Portugal); Ola Holmberg (IAEA); Ronald Pacheco Jiménez (IAEA).

Guide to the Characterisation of Industries and Activities Related to NORM: A Focus on the Gas, Oil and Mining Industries (NORM Project)

OBJECTIVE

This project is developing a highly practical guide to assist countries in properly characterising industries and activities linked to Naturally Occurring Radioactive Materials (NORM), thereby enabling the determination of the inventory of such materials and the optimal level of regulatory control in each case.

Furthermore, the specific objectives are:

- To establish criteria for determining the activity concentration of natural radionuclides in different materials, as well as measurements of dose rate, surface contamination, or activity concentration in air in different work areas, together with simple dose estimates based on the results obtained from the characterisation.
- To present case studies illustrating experience and best practices in how to carry out the characterisation of different materials and work areas.
- To establish the training content on radiation protection and the authorisation procedure for personnel responsible for carrying out characterisation tasks.

Phosphogypsum pond in Huelva (Spain).

SCOPE

The proposed guide will focus on the hydrocarbon (oil and gas) and mining industries, which were identified as priority sectors by FORO member countries in a 2021 survey, in line with the provisions of ICRP-142.

This guide for the characterisation of industries and activities related to NORM will include the determination of activity concentration in the products, by-products and waste, through practical case studies as examples, and will also recommend best practices for carrying out screening characterisations in cases where only gamma spectrometry techniques and *in situ* measurements are available.

EXPECTED RESULTS AND POTENTIAL IMPACTS OF THE PROJECT

As the project was conceived based on the results of a questionnaire identifying the main needs in countries whose regulatory bodies are members of FORO, the guide for the characterisation of industries and activities using NORM is expected to represent a useful tool for establishing the baseline that a regulatory body would require for decision-making on the topic.

The project's results may be useful for establishing appropriate policies and regulatory frameworks to ensure that workers, the public and the environment are adequately protected from the harmful effects of ionising radiation associated with NORM.

PARTICIPANTS

Analía Canoba, project lead (ARN, Argentina); Flávia Borges (ANSN, Brazil); Flávia Schenato (CNEN, Brazil); Karen Ibarra (MINENERGÍA, Colombia); Juan Ramón Fuentes (DSN, Cuba); Manuel Martínez (CSN, Spain); Alberto Mut Chable (CNSNS, Mexico); Fernando Pío Barrios (ARRN, Paraguay); Walter Cruz (IPEN, Peru); Guilherme Cardoso (APA, Portugal); Horst Monken Fernandes (IAEA); Okyar Burcin (IAEA).

In addition, the following are permanent contributors: Fabio López (ARN, Argentina); Nivaldo da Silva (ANSN, Brazil); Juan Camilo Jaramillo (MINENERGÍA, Colombia); Karel Núñez (MINENERGÍA, Colombia); Marta García Talavera (CSN, Spain) and Rafael García Tenorio (University of Seville, Spain).

Acknowledgements

The Ibero-American Forum of Radiological and Nuclear Regulatory Bodies (FORO) would like to thank all the experts from the member organisations who have participated in the projects and activities for their dedication and professionalism, and for their contribution to creating a collaborative environment in our region.

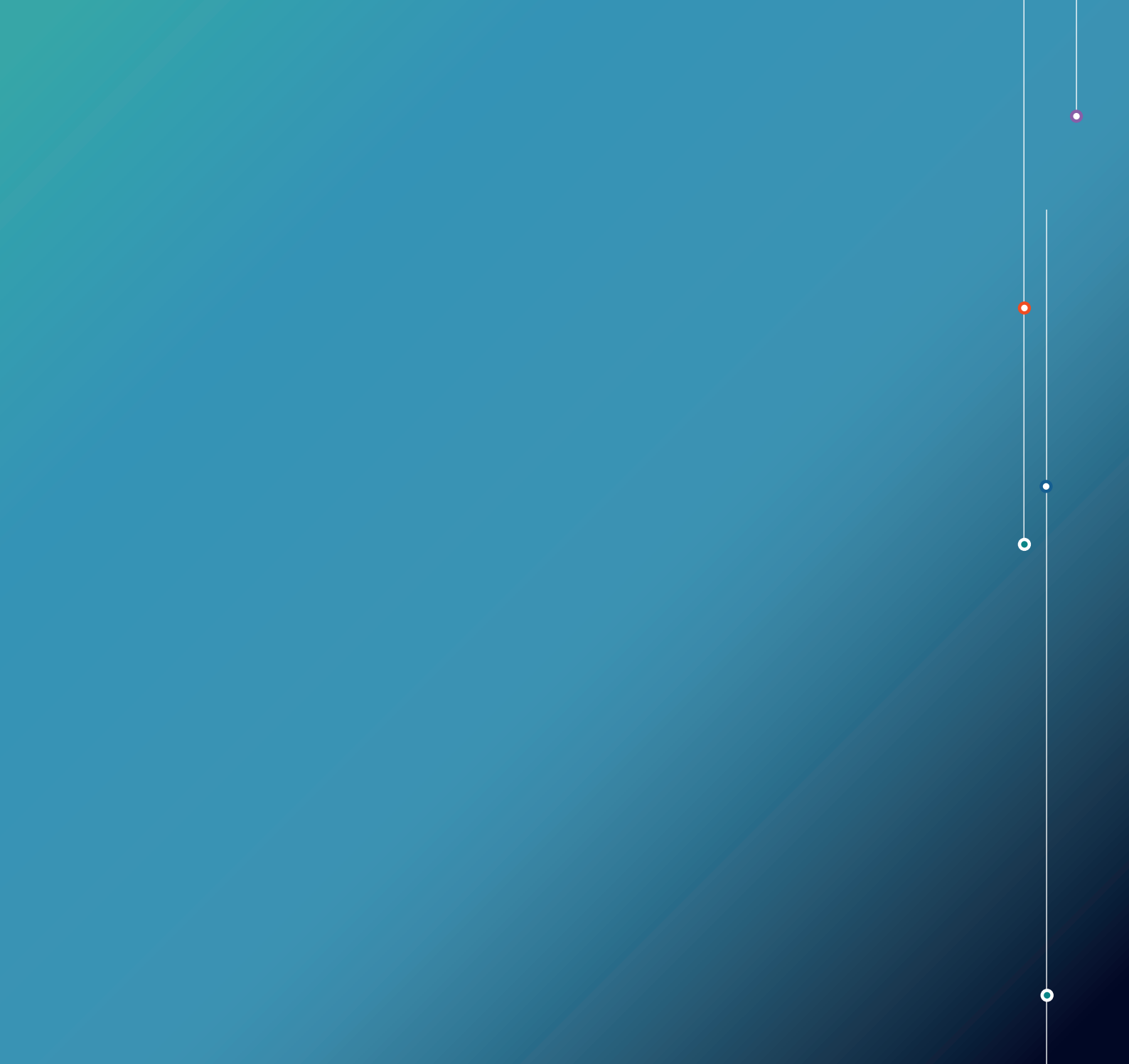
We would also like to extend our thanks to the technical officers of the IAEA who, by sharing their knowledge and promoting the dissemination of FORO's results, have helped to make our Association an international benchmark for the improvement of radiation protection, nuclear safety and nuclear security.

Finally, it should be noted that the results achieved and the drafting of this document would not have been possible without the efforts and cooperation of FORO's Executive Technical Committee, its Secretariat and the IAEA Scientific Secretariat.

FORO steering committee meeting (2026, Lisbon, Portugal).

Steering committee members, scientific secretariat and secretariat of FORO from 2006 to 2026:

- Norberto Ciallella and Marcela Ermacora (ARN, Argentina).
- Maria Helena Maréchal, Carlos Eduardo González Ribeiro Alves, Alessandro Facure Neves de Salles Soares, Ricardo Fraga Gutterres and Samira Marques de Carvalho (CNEN/ANSN, Brazil).
- Mauricio Lichtemberg and Lorena Mariángel (CCHEN, Chile).
- Jorge Vallejo and John Lozano (INGEOMINAS/MINMINAS/MINENERGÍA, Colombia).
- Alba Guillén, Andrés de la Fuente, Rosbell Bosch and Maidelys Rosa Rodríguez (DSN, Cuba).
- Carlos Torres and Alfredo de los Reyes (CSN, Spain).
- Hermenegildo Maldonado, Jaime Aguirre and Carlos González (CNSNS, Mexico).
- Inocencia Peralta, Fredy Doncel, Ildefonso Riquelme and Pablo César Aliendre (ARRN, Paraguay).
- Tony Benavente, Julio César Romaní, Jorge Condori and Marco Munive (IPEN, Peru).
- João Oliveira Martins (APA, Portugal).
- Alejandro Náder, Beatriz Souto, Leticia Pica and Ana Laura García Fedullo (ARNR, Uruguay).
- Diana Clein, Sonia Fernández Moreno and Marina Yannibelli (FORO Secretariat).
- Pedro Ortiz, Luis Ledermann, Khammar Mrabit, Paul Woodhouse, Rejane Spiegelberg and Gustavo Caruso (IAEA Scientific Secretariat).




ARGENTINA
BRAZIL
CHILE
COLOMBIA
CUBA
MEXICO
PARAGUAY
PERU
PORTUGAL
SPAIN
URUGUAY
FORO
Ibero-American Forum
of Radiological and Nuclear
Regulatory Agencies