Nuclear Safety Council Report to the Parliament

Summary of 2017

CSN

CSN CONSEJO DE SEGURIDAD NUCLEAR

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Table of Contents

Introduction

This 2017 annual report, submitted to the Spanish Parliament in accordance with the Law setting up the Spanish Nuclear Regulatory Body (*Consejo de Seguridad Nuclear* or *CSN*) in 1980 and requiring the report submitted to the Parliament, includes the most relevant activities carried out throughout 2017 by the CSN, which is the only organism competent in the matters of nuclear safety and radiation protection in Spain.

As in previous years, this report presents the main activities carried out by the CSN to comply with its duties, which fall under the concept of public service and affect many groups, including companies with interest in the field (activity and facility licensees, manufacturers and suppliers), exposed workers in regulated facilities and activities, stakeholders (people living in the vicinity of facilities, trade unions, non-governmental organizations, media, professional associations, scientific and professional societies, research centers, universities, international agencies and political parties), public institutions of the Central, Regional and Local governments, the population and society in general.

This report includes aspects and data which confirm that nuclear and radioactive facilities in Spain operated safely, and also that the measures applied to this end were effective in ensuring the radiological protection of workers, the public and the environment.

In this area, the task of the Spanish Regulatory Body (*CSN*) is carried out in two main scenarios. On the one hand, ongoing control and supervision of applicable regulations in Spain for all licensees of nuclear and radiological facilities, their users, people in charge and the guarantors ensuring correct implementation of Regulatory Body requirements. On the other hand, the CSN ensures regulations remain at the forefront of research and legislation, commensurate with countries in our vicinity, in accordance with International Treaties and Agencies, in which Spain in general and its Nuclear Regulatory Body in particular, play an active role.

This international participation and prominence result in constant work and collaboration with various international agencies and associations in the area of nuclear safety and radiation protection. *In this line, substantial progress has been made in the task of completing the transposition of two European Directives: 2013/59/Euratom, establishing basic safety standards against ionizing radiation exposure hazards, and Directive 2014/87/Euratom on nuclear safety.*

The Strategic Plan for the 2017-2022 period was approved in 2017, taking into consideration innovations in the national and international arenas and within the CSN itself. The main short- and mid-term Regulatory Body challenges were also considered,

prioritizing safety as the envelope of nuclear, radioactive and physical safety. This was achieved by ensuring credibility as a basic, fundamental sub-goal as well as pursuing four instrumental objectives: efficiency and efficacy, transparency, neutrality and independence.

Activities related to the transparency principle were also carried out in 2017. In this sense, the CSN developed and approved its Communication Plan, aimed at guiding CSN communications and improve the Regulatory Body's management of information and communication with other public institutions, society and stakeholders. The ultimate purpose is to increase and reinforce the credibility of and confidence in the actions carried out by the CSN.

Furthermore, a safety culture reinforcement and improvement process is being developed at the CSN, resulting in the publication of the CSN's policy on Safety Culture and the implementation of a Code of Ethics by the Regulatory Body.

Parliament resolutions have touched on these aspects because one of the objectives of our commitments with society is to give all citizens the possibility of learning how the CSN protects people and the environment from the harmful effects of ionizing radiations.

In this regard, the CSN implements recommendations on voluntary transparency, in addition to developing and consolidating human resources policies focused on sufficiency, personnel qualification and knowledge management.

Lastly, it is worth mentioning that throughout 2017 the CSN maintained the highest technical, solvency, efficiency and efficacy standards to be expected from a Regulatory Body in terms of independence, transparency and neutrality.

The objectives included within three areas developed in the CSN's Communication Plan, namely communications during nuclear and radiological emergencies, both internal and external, as well as commissioning of e-government, have been implemented.

To conclude, it is necessary to highlight that one of our main focuses this year, as will be reflected in the upcoming annual report, is the hosting of the IRRS-ARTEMIS mission by the International Atomic Energy Agency (IAEA). This mission entails a review of our regulatory framework and is an excellent opportunity to prove and verify that this Regulatory Body and the entire regulatory framework in Spain, are aligned to the main international scales and standards.

Fernando Marti Scharfhausen

Chapter I. The Nuclear Safety Council

1. The CSN

The *Consejo de Seguridad Nuclear*, name of the Spanish Regulatory Body, is a Public Law Body, independent from the National Government Administration, with full legal personality and assets, independent from those of the State, and created by Law 15/1980, dated April 22, on Creation of the *Consejo de Seguridad Nuclear*, as the only competent organism in the matters of nuclear safety and radiation protection.

The legal status regulating CSN actions is based on the prevalence of its constitutive Law and Statute, with the supplementary provisions of organizational requirements and a legal status common to the National Government Administration. The CSN has organic and functional autonomy, fully independent from the National Government Administration and stakeholders, without prejudice to being subject to parliamentary and judicial control.

The CSN Statute was approved by the Government by Royal Decree Law 1440/2010, dated November 5, in accordance with the provisions of Law 15/1980.

The CSN has the mission of protecting workers, the public and the environment from the harmful effects of ionizing radiations. It also has to ensure that nuclear and radioactive facilities are safely operated by their licensees, establishing prevention and correction measures against radiological emergencies, regardless of their origin.

It is the responsibility of the CSN to exercise all functions established in article 2 of Law 15/1980, dated April 22, and in Title 1 of the Statute. The CSN should also exercise any other function which, within the framework of nuclear safety, radiation protection and security, is attributed by norms equivalent to Laws, regulations or in accordance with International Treaties.

Additionally, article 11 of Law 15/1980 establishes that on a yearly basis, the Spanish Regulatory body shall submit to both Chambers of the Spanish Parliament, as well as to the local parliaments of any region where there is a nuclear facility, a report describing the activities carried out. This report complies with such requirement.

The higher management bodies of the CSN are the Board and the Presidency. On December 31, 2017, the members of these two bodies were as follows:

- President: Fernando Marti Scharfhausen (Royal Decree 1732/2012, dated December 28).
- Vice-president: Rosario Velasco García (Royal Decree 138/2013, dated February 22).
- Commissioner: Fernando Castelló Boronat (Royal Decree 139/2013, dated February 22).
- Commissioner: Javier Dies Llovera (Royal Decree 934/2015, dated October 16).
- Commissioner: Jorge Fabra Utray (Royal Decree 1028/2017, dated December 7).

The Board is supported by a General-Secretariat, which on December 31, 2017, was chaired by Manuel Rodríguez Martí, appointed by Royal Decree 280/2017, dated March 17.

The governing bodies of the CSN are, under the direction of the Presidency and the Board, the General Secretariat of the Regulatory Body (*CSN*), the Technical Directorate for Nuclear Safety, the Technical Directorate for Radiation Protection, the Directorate for the President's Cabinet, as well as the Deputy Directions.

The Presidency and Board members develop activities exercised within the powers delegated by articles 26 and 36 of the Statute.

Furthermore, the CSN has an Advisory Committee for public information and participation. The role of this Committee is to propose and issue recommendations aimed at enhancing transparency, access to information and public participation in fields of competence of the Regulatory Body.

1.1. The CSN Board

The Board is the CSN's highest management body, responsible for the implementation of arrangements to exercise all duties foreseen in article 2 of Law 15/1980. The Board also has to exercise any other function attributed to the CSN as the only competent organism in the matters of nuclear safety and radiation protection.

In the year 2017, the Board held 36 plenary sessions or meetings, adopting a total of 343 agreements, most of them unanimously.

The minutes of CSN Board sessions or meetings and the decisions supporting the agreements reached by the Board, are available to the public at the website of the CSN (www.csn.es), in accordance with article 14.2 of Law 15/1980, dated April 22, on creation of the *Consejo de Seguridad Nuclear* (Nuclear Safety Council or CSN)

1.2. CSN Commissions

CSN commissions have promoted activities assigned to the Regulatory Body both in the areas of nuclear safety and radiation protection, as well as in terms of regulations.

Nuclear Safety and Radiation Protection Commission

The Nuclear Safety and Radiation Protection Commission, chaired by the President of the CSN, serves as the forum for exchange of technical information amongst Board members and technical directorates of the Regulatory Body.

The aim of this commission is to inform Board members of the evolution of subjects to be assigned in the short term, as well as to favor open dialog on specific thematic areas and items of significant interest and technical complexity.

In 2017, this Commission held two sessions, making four case study presentations on a wide variety of topics.

Standards Commission

The Standards Commission, chaired by Commissioner Javier Dies Llovera, includes the participation of representatives from CSN units responsible for regulation-making, as well as representatives from Spain's Ministry for Energy, Tourism and Digital Agenda.

The mission of this Commission is to promote, monitor and control the CSN's regulation program.

In 2017, the Standards Commission met twice. Some subjects addressed in this Commission over this period, included the progress made by work groups in the transposition of Directives establishing a communitarian framework for nuclear safety at the facilities (Directive 2014/87/Euratom) and Directive 2013/59/Euratom, establishing the basic norms for protection against ionizing radiation risks.

Review Committee for Sanction Proceedings (CRES)

This Committee has the key role of assessing proposals for sanction proceedings, warnings, precautionary measures, intervention, prohibition and cautions referred to in article 2.e) of Law 15/1980 and chapter XIV of Law 25/1964.

This Committee, chaired by the Secretary General, Manuel Rodríguez Martí, includes the participation of CSN representatives who propose sanction proceedings.

In 2017, this Commission met four times. The results of sanction proceedings assessed by this Committee are reported in corresponding activities within this document.

1.3. CSN Relationships

1.3.1. Institutional Relations

One of the roles of the Spanish Regulatory Body is to maintain formal relationships with State institutions at a local, regional and national level, as well as with professional associations and non-governmental agencies in the field of nuclear safety and radiation protection.

Parliament

On June 26, 2017, the CSN progress report for 2016 was submitted to the Spanish Congress and Senate.

Throughout 2017, the CSN received a request for report submittal from the Senate. Furthermore, the Spanish Ministry for Energy, Tourism and Digital Agenda (acronym: *MINETAD*) asked the CSN for information to answer to seventeen questions from Congress Deputies and senators on aspects relating to nuclear safety and radiation protection, within the provisions of article 7 of National Congress Regulations.

On June 6, 2017, the CSN President, Fernando Marti Scharfhausen, and the Commissioners, Fernando Castelló, Cristina Narbona and Javier Dies, gave presentations in response to a request received at the CSN from the Commission for Energy, Tourism and Digital Agenda. The presentations focused on activities carried out by the CSN during 2014 and 2015. The CSN Vice-president, Rosario Velasco, had previously (February) made a presentation on the same topic to the same Commission

The CSN President appeared upon his own request before the Commission for Energy, Tourism and Digital Agenda in the Parliament on December 13, 2017, with the aim to present the Report on activities carried out by the Regulatory Body throughout 2016.

In 2017, the CSN continued to submit to the Spanish Parliament information on periodic resolutions 1, 42 and 15, resulting from CSN progress reports corresponding to the years 2002, 2006 and 2007, respectively. Resolutions 1 and 42, with a quarterly periodicity, and resolution 15, with a half-yearly periodicity, are aimed at informing on technical specification compliance exemptions granted by the CSN to nuclear power plant licensees, on the most representative performance reports associated to those nuclear facilities, as well as on the results of the Reactor Oversight Process (Spanish acronym: *SISC*), respectively.

National Government Administration

In developing its functions, the CSN maintains relationships with Spain's Department of Energy, Tourism and Digital Agenda, Department of Healthcare, Social Services and Equality, Department of Civil Works, Department of Agriculture, Fisheries and Foodstuffs and Environment, Department of Homeland Security, Department of Defense and Department of Foreign Affairs and International Cooperation.

Regional Administrations

The Spanish Regulatory Body (*CSN*), according to the third additional provision of its Setting-Up Law, can delegate some of its legally assigned competences onto Spanish Autonomous Communities.

There are currently nine Autonomous Communities to which the Regulatory Body has delegated specific roles, namely inspection functions, and in some cases the evaluation of radioactive facilities: Asturias, Balearic Islands, Canaries, Catalonia, Galicia, Murcia, Navarre, Basque Country and Valencia. In each of these Regions, there is a Joint Monitoring Commission

chaired by the Secretary-General of the Regulatory Body and comprised of CSN and regional government representatives. The Commission meets at least once per year.

Decision agreements are subject to the audit plan established within the CSN Management System. Throughout 2017, the CSN audited the decision agreements reached in the Regions of Asturias and the Balearic Islands.

Local Administrations

With regards to institutional relationships between the Spanish Regulatory Body and local administrations, it is worth highlighting the participation of the Local Information Committees, in line with article 13 of Spain's Regulation on Nuclear and Radioactive Facilities (acronym: *RINR*), as well as the collaboration with the Association of Municipalities hosting Nuclear Power Plants (acronym: *AMAC*).

Universities

In 2017, the CSN signed annual agreements with the Polytechnic University of Madrid for the CSN Chair *Juan Manuel Kindelán* and the CSN Chair *Federico Goded*; the Polytechnic University of Catalonia for the CSN Chair *Argos*; and the Polytechnic University of Valencia for the CSN Chair *Vicente Serradell*. Each agreement signed involves each chair will be receive € 70,000 of funds from the CSN in an annual basis.

The purpose of these CSN Chairs is to promote and foster the training of highly qualified technicians in the areas of nuclear safety and radiation protection, through their own curricula, specialization courses and active participation in related research projects.

Transparency and Good Governance Council

The *CSN*, similar to most other organizations bound by the Act for Transparency, Access to Public Information and Good Governance, has gradually expanded the information published on its website with the aim to comply with the requirements of the abovementioned Act. In this regard, work continued in 2017 to optimize the institutional website of the CSN, making it more transparent to the public by voluntarily including more information than required by the Act.

It is worth mentioning that in the Evaluation Report on Transparency Act compliance, carried out by the Transparency and Good Governance Council, the CSN website was ranked at 9.13 over 10 in terms of compliance with active publicity obligations required by the Transparency Act.

1.3.2. International Relations

As for international relationships, the CSN shall collaborate with the Government in international nuclear safety and radiation protection agreements, relationships with international organizations specializing in those areas, as well as in relationships with peer foreign Regulatory Bodies. This includes a large range of activities, which are summarized as follows:

Multilateral Relations

European Union

One of the main treaties that underpin the European Union is the Treaty establishing the European Atomic Energy Community (Euratom) which addresses, among other things, the basic Regulatory framework in the area of nuclear safety and radiation protection. The CSN has representatives in expert working groups that discuss various articles in the actual Euratom Treaty (articles 31; 35; 36 & 37) and participates in other technical initiatives, committees and work groups resulting from such Treaty.

Atomic Questions Group (AQG)

This is the European Union Council work group specializing in the analysis of Euratom Treaty aspects.

The AQG is chaired in rotation every six months. In 2017 Malta chaired the AQG during the first half and Estonia in the second half. During the first half of 2017, the main subjects discussed were as follows: negotiations for Euratom's position at the seventh Convention of the Nuclear Safety Review Meeting, as well as Council Regulation revision for article 41 in Euratom's Treaty. During the second half of 2017, the main topics focused on revising the Joint Convention report on spent fuel management safety and radwaste management safety, drafting the European Commission (EC) report on support to Member States in nuclear power plant decommissioning projects, as well as on further developing the report on implementation of Directive 2011/70/Euratom, which had commenced in the first half of the year.

European Nuclear Safety Regulators Group (ENSREG)

Together with Spain's Department of Energy, Tourism and Digital Agenda, the CSN participates in ENSREG, set up in 2007 to advice the EU Council, Parliament and Commission on aspects relating to nuclear safety and safe radwaste management. Within the scope of this association, the CSN chairs since 2014 a work group specializing in International Nuclear Safety Cooperation (WG1). Within this group, the CSN has contributed to updating the ENSREG work program, monitoring both the implementation of post-Fukushima National Action Plans and obligations resulting from the Nuclear Safety Directive. It is important to mention the preparation of reference terms that will guide the first thematic safety revision under the Nuclear Safety Directive, expected to conclude in 2018 and applicable to nuclear power plant aging management.

In December 2017, the CSN Board approved the national topical peer review report on aging management, in line with the commitments undertaken in ENSREG and in compliance with Directive 2014/87/Euratom on nuclear safety. The report is to be sent to the European Commission.

In June 2017, the fourth edition of ENSREG's Nuclear Safety Conference was held in Brussels. The CSN participated in the organization Committee, responsible for conference preparation and coordination.

In December 2017, the CSN Board approved revision 2 of the post-Fukushima National Action Plan, in accordance with ENSREG's reference terms, prior to its submittal to the European Commission as committed.

Regulatory Support Activities

The International Cooperation Work Group in ENSREG's group WG1, is monitoring projects for support to third countries that are funded by means of the European Commission's Instrument for Nuclear Safety Cooperation (INSC). Throughout 2017, the CSN led activities within that group with the aim to follow up on partnerships for planning, assessing and enhancing the cooperation instrument (INSC). The CSN advises and collaborates with Spain's Department of Energy, Tourism and Digital Agenda in the preparation and negotiation of INSC project approvals. Lastly, the CSN participates in the development of various INSC projects aimed at improving regulatory infrastructures in beneficiary countries. More specifically, in 2017 the CSN participated in the second phase of the INSC cooperation project with China; similarly, the CSN participated in processes to select a number of INSC cooperation projects in Iran, Morocco and Turkey, some of which were led by the CSN within the creation and candidacy of the Spanish consortium.

International Atomic Energy Agency (IAEA)

The International Atomic Energy Agency (IAEA) is a body under the United Nations system with the mission to promote the

contribution of atomic energy to peace, health and prosperity throughout the world. One of its main goals is to develop and promote high technological safety and security standards in the peaceful applications of nuclear energy in Member States. This goal is ensured through the development of regulations of an advisory nature.

The CSN actively participates in IAEA activities, both in agency management bodies as well as in technical committees and work groups within the areas of technological safety and security, scientific and technical events, and international IAEA missions.

The CSN makes financial contributions to support Agency programs and activities. In 2017, the CSN contributed € 452,920 for radiological and nuclear safety projects in Ibero-America, translation of safety regulations and technical cooperation projects of interest for the CSN.

Similarly, the CSN planned expenditure for the IRRS (*Integrated Regulatory Review System*) Mission in Spain, which will take place in 2018, in compliance with Directive 2014/87/Euratom, which lays down the community framework for safety in nuclear facilities.

General Conference

The General Conference of the IAEA is held annually in Vienna. In 2017, it was held between September 17 and 22. The Spanish Nuclear Regulatory Body delegation was led by the CSN President. The CSN supported Spain's Department of Foreign Affairs and International Cooperation (*MAEC*) to draft the national statement. In parallel, meetings were held with the IAEA Director General and the IAEA deputy director general for Nuclear Safety and Security. Furthermore, meetings were carried out within the framework of the Ibero-American Forum on Nuclear and Radiological Regulatory Agencies (*Foro*) and the International Nuclear Regulators' Association (INRA).

Work Groups and Committees

With the aim to favor the drafting of national safety regulations that ensure high nuclear, radiological and security standards in nuclear facilities and activities, the IAEA develops and continuously reviews a standard regulatory framework of advisory character, agreed internationally and used as a reference by Member States to develop their own national frameworks. The CSN participates actively in work groups and committees drafting and reviewing IAEA regulations and reference guidelines within the areas of nuclear safety and radiation protection.

The IAEA has a Commission on Safety Standards (Spanish acronym: *CSS*) in which the CSN Commissioner Javier Dies participates in representation of Spain.

CSN experts participated in the meetings held in 2017 to address a wide variety of topics including radioactive source control, nuclear and radioactive emergency response, severe accident management, security, seismic safety of the facilities and knowledge management.

International IAEA Missions

The IAEA coordinates international missions to review compliance with standards, within the framework of nuclear safety, radiation protection and security of the Member States. The CSN supports the development of peer review missions with other countries through the participation of CSN representatives in revision teams, when requested by the IAEA. In 2017, the CSN sent experts to regulatory infrastructure review missions (IRRS missions) in Cyprus and Guatemala.

On the other hand, throughout 2017 the CSN allocated a significant amount of resources to the preparation and organization of the combined peer review mission IRRS & ARTEMIS. Spain requested the IAEA to carry out this mission in 2018.

NEA/0ECD

In 2017, the CSN participated actively in the NEA steering committee and main technical committees, comprised of work groups and responsible for the supervision of international research projects and databases within their field of expertise. The CSN is currently participating in six committees, 26 work groups and subgroups and specific activities associated to these, as well as in 12 international research projects and databases coordinated by NEA. The CSN also makes financial contributions to some of these projects and is engaged in NEA activities and workshops organized to cover specific topics and present the results of works carried out.

Other Regulatory Groups

Within the multilateral framework, the CSN is a member of various regulatory associations, set up on the common will to cooperate as a way to address global regulator policy issues and challenges, as well as to identify and explore opportunities for enhancing nuclear safety, radiation protection and security regulations.

*International Nuclear Regulators Association (INRA)*In 2017, the CSN participated in two regular annual meetings; one organized in Chicago by the US Nuclear Regulatory Commission (NRC) and other in Vienna, during the General Conference of the IAEA.

Western European Nuclear Regulators Association (WENRA)

The main goal of this association is to harmonize the main technical standards in nuclear safety amongst member countries, thus contributing to ongoing safety improvement. They meet twice a year in the Plenary, the association's main decision-making body. In 2017, the CSN participated in both meetings. Furthermore, WENRA has two permanent work groups specializing in the harmonization of nuclear safety requirements for reactors (RHWG) and safe management of radwaste and decommissioning (WGWD). In the case of Spain, nearly all RHWG reference levels have been integrated into the country's regulatory framework. The CSN participates in plenary group meetings of WENRA and its technical work groups.

Ibero-American Forum on Nuclear and Radiological Regulatory Agencies (Foro)

The *Foro* is an association comprised of nuclear and radiological safety regulators from Argentina, Brazil, Chile, Colombia, Cuba, Spain, Mexico, Paraguay, Peru and Uruguay. In 2017, the *Foro* Plenary Board met in Argentina. In addition, within the framework of the IAEA's General Conference in Vienna, *Foro* representatives were hosted by the IAEA's Director General to strengthen and ratify cooperation between both organizations, as well as to share news on ongoing projects.

Heads of European Radiological Protection Competent Authorities (HERCA)

The aim of this association is to promote harmonized work practices by assessing practical application of European directives and regulations in the area of radiation protection. The CSN participates in plenary group meetings of HERCA and its work groups.

The HERCA Steering Committee met twice in 2017. Both times, a CSN´s delegation led by the CSN Vice-president, Rosario Velasco, attended the meetings. Some of the subjects covered were the approval of an inspection work group for justification and optimization of nuclear medicine activities, the creation of a work group on construction materials and radon, as well as the approval of a work group for emergency preparation and response throughout the 2018-2022 period.

European Nuclear Security Regulators Association (ENSRA)

The CSN participates in the European Nuclear Security Regulators Association (ENSRA),

independent from the European Commission and created as a result of the interest of association members, who wanted to have a forum for safe exchange of information and experiences on the application of security practices in nuclear power plants and other nuclear facilities. In 2017, the CSN participated in the annual meeting of ENSRA, held in Liverpool.

International Conventions of the International Atomic Energy Agency (IAEA)

Convention on Nuclear Safety

The Convention on Nuclear Safety, which came into effect on October 24, 1996, has currently 80 Member States.

With a periodicity of three years, the Contracting Parties of the Convention on Nuclear Safety have to draft a report on the measures implemented to comply with their obligations. The seventh review meeting of the Convention was held in 2017. In this meeting, Spain presented and defended its national report, which included aspects such as measures and actions to improve safety in nuclear power plants after the Fukushima accident. Spain also presented information on the country's application of principles deriving from the Vienna Declaration resulting from the Diplomatic Conference held in 2015. The report drafted by the Contracting Parties identified four areas of good performance for Spain, relating to the development of a safety culture policy in the CSN, implementation of cross-functional areas in *SISC* (equivalent to ROP), establishment of CSN Chairs on promotion of nuclear safety and radiological protection training, and CSN exclusion of the zero replacement rate to maintain the number of technical personnel at the CSN.

Joint Convention on safety in spent fuel management and safety in radioactive waste management

The CSN drafts national reports in cooperation with Spain's Department of Energy, Tourism and Digital Agenda. Enresa, Spain's Radwaste Management Agency, also participates. Spain submitted the sixth national report in October 2017. The report will undergo scrutiny by the remaining Contracting Parties in May 2018.

Convention for the Protection of the Marine Environment of the Northeast Atlantic (OSPAR)

The CSN participates as representative of Spain in the Radioactive Substance Committee (RSC) of the OSPAR Convention. The areas covered include those relating to nuclear and non-nuclear facilities and activities (NORM radioactive facilities and industries) that could discharge radioactive substances in the Atlantic Ocean, either directly or via river basins. In 2017, CSN experts participated in the meeting of this Committee in Switzerland.

Bilateral Meetings

The CSN considers relationships with peer Regulatory Bodies from other countries to be highly important. The Spanish Regulatory Body has signed a number of bilateral cooperation agreements aimed at laying the foundations for collaboration and exchange of technical information and regulatory experience.

Throughout 2017, the CSN cooperated closely with the Regulatory Bodies of the United States of America and France, through many joint activities at an institutional and technical level. In 2017, bilateral relationships with countries of geostrategic interest in the regions of Latin America and the Middle East, were promoted. High-level meetings were also held within the framework of bilateral relationships with Germany, China, Slovenia, Morocco, Portugal and Russia, in addition to technical visits and information exchanges with representatives of their Regulatory Bodies.

United States of America

The framework agreement between the Nuclear Regulatory Body of the United States of America (NRC) and the Spanish Regulatory Body (CSN) governs their ongoing exchange of technical

information and cooperation in nuclear safety. As in previous occasions, the CSN participated in 2017 in the Regulatory Information Conference (RIC), an event organized by the NRC annually with the aim to disseminate its lines of work.

Information exchanges and technical visits between the CSN and the NRC continued throughout 2017, with technical cooperation in areas such as code usage and maintenance in the area of radiation protection (RAMP program), as well as others already in place such as collaborations in thermohydraulic areas (CAMP program) and severe accidents (CSARP program), emergency response capabilities, exams for licensed operators in nuclear power plants and seismic characterization and requirements for nuclear sites.

France

The CSN has continued to collaborate actively with the French Regulatory Body (*Autorité de Sûreté Nucléaire - ASN*) throughout 2017. A bilateral meeting was held in Paris in September between the CSN and the ASN, with the participation of both the CSN's president and vice-president. In this meeting, the CSN discussed various items, including the renewal of operating licenses for Spanish nuclear power plants, new regulations developed in CSN instructions, publication of the CSN's Code of Ethics and implementation of a safety culture program in the Spanish Regulatory Body.

The CSN and the ASN also met in 2017 in the Permanent Group of experts in radiation protection in medical facilities.

1.3.3. Public Information and Communication

In accordance with its Setting-Up Law, the Spanish Regulatory Body has to inform the public within its fields of competence. The CSN has to determine the extent and periodicity of such information, notwithstanding the advertising of its administrative actions under the legally established terms and ensuring utmost CSN transparency and credibility in performing its duties.

This obligation of the CSN as a Body under Public Law is particularly relevant. Thus, the empowerment, systematization and characterization of a comprehensive information and communication system at the CSN, has established itself as a transparency-related strategic line within the existing Strategic Plan.

Information to the Media and other Actions

In 2017, a total of 133 informative briefing notes were issued for the media and institutions with an interest in the CSN's areas of competence. In addition to incidences occurred in nuclear and radioactive facilities, some areas of interest in this field were the CSN Board decisions, the main institutional and international CSN actions, as well as the mandatory emergency drills carried out every year. A total of 47 articles and reviews relating to licensee events were published on the CSN's institutional website, in accordance with existing incident reporting criteria.

On the other hand, response was given to 202 direct information requests from the media, mainly in relation to the permanent shutdown of Santa María de Garoña nuclear power plant and on the status of the centralized temporary storage facility license at Villar de Cañas (Cuenca, Spain).

Additionally, in February 2017 the CSN Board and both technical directors gave a press conference to inform on the limits and conditions of the operating license renewal request from Santa María de Garoña NPP.

In 2017, the CSN approved the institutional Communication Plan, which is available for download on the Regulatory Body's institutional website.

The CSN on the Internet

The main milestone was the creation on the institutional website of the "Transparency" section, which contains includes active publicity section information, such as institutional, organizational, regulatory and economic data. The creation of the abovementioned section is compliant with Law 19/2013, dated December 9, for transparency, access to public information and good governance.

In 2017, the CSN joined the Registry Interconnection System, which enables the exchange of electronic entries between ascribed organizations, hence facilitating bureaucratic proceedings between citizens and public administrations.

Concerning social media, the Twitter account of the Spanish Regulatory Body (@CSN_es) had 3,706 followers in 2017, consolidating itself as an efficient tool to disseminate information on regulatory affairs, standard updates, nuclear safety and radiation protection progress and key institutional and international activities.

Information to Citizens

One of the main challenges faced by the CSN is to bring information closer to society and to maintain a proactive policy by using all available means and tools, with the aim to reach citizens directly. The following channels are used:

Edition of publications

Throughout 2017, a total of 26 new titles in hardcopy (books, *Alfa* magazine, standards, brochures and billboards) with a print-run of 30,660 copies and 6 publications in electronic format, were edited within the Publication Plan. Additionally, 13 pieces with a print-run of 19,200 copies, distributed mostly to Information Centers and in congresses, were re-edited.

Distribution of publications: 43,247 copies, about half of them sent to Information Centers.

Information Center

Ever since its inauguration in 1998 until December 31, 2017, a total of 127,623 visitors have been accounted for. In 2017, a total of 7,430 visitors went to the Center in the 312 visits that took place.

In November 2017, the CSN collaborated with the Region of Madrid during an Open House Day held every year within the framework of the *Science Week* event.

As part of the center's continuous improvement and modernization efforts, a number of interactive modules were upgraded to the latest technologies, and bilingual panels (Spanish-English) replaced the original ones. Work has taken place to implement an augmented reality cellphone application that includes the center's contents.

Other Activities

Some of the activities carried out by the Regulatory Body to inform the public, include attendance to congresses, seminars and exhibitions organized throughout the year. In this sense, in 2017 the CSN had a stand at the:

- 43th Meeting of the Spanish Nuclear Society (acronym: SNE), on October 3-6 in Malaga.
- 5th Joint Congress SEPR - SEFM, from June 13-16 in Girona.

1.4. Advisory Committee for Public Information and Participation

The Advisory Committee for Public Information and Participation on nuclear safety and radiation protection was created, under article 15 of Law 15/1980, for Creation of the Spanish Regulatory Body (CSN). The mission of the new Advisory Committee is to issue for the CSN

recommendations that favor and improve transparency, access to information and public participation in fields of competence of the Regulatory Body.

This Advisory Committee is comprised of representatives from civil society, business community, trade unions and public administrations (local, regional and national).

Throughout 2017, the following meetings were held:

1. On June 8, 2017, the 13th meeting of the Advisory Committee was held. During the meeting, the CSN president informed of his presentation to the Spanish Congress regarding the fire occurred at Unit I of Ascó nuclear power plant. Furthermore, the last six recommendation proposals received since the last meeting of the Advisory Committee in 2016 and the actions carried out, were presented.

2. On November 16, 2017, the 14th meeting of the Advisory Committee was held. During the meeting, the CSN informed on the status of the centralized temporary storage facility license and on the actions foreseen for Santa María de Garoña nuclear power plant. The CSN also made a presentation on the renewal of the network of automatic environmental radiation monitoring stations (*REA*). The CSN president informed attendees on the publication of two new CSN documents: CSN Safety Culture Policy and CSN Code of Ethics.

2. Strategy and Resource Management

2.1. Strategic Plan

The 2011-2016 Strategic Plan, approved by the CSN Board of May 31, 2011, laid down the strategic objectives for the CSN's regulatory role over the 2011-2016 period. It can be generally concluded that the objectives were met, despite the significant challenge of having to respond to an unplanned and unexpected situation: the Fukushima Dai-ichi nuclear power plant accident in Japan, March 2011, which resulted in an additional workload for the CSN as an organization.

The Board, in its meeting of July 26, 2017, approved a new Strategic Plan for the 2017-2022 period. This new plan was developed after revising and updating the previous one, which had an approach and general framework that continue to be valid. To draft the new plan, new national, international and in-house CSN developments were taken into consideration, as well as the main regulatory challenges to be addressed in the short- and mid-term.

In the new 2017-2020 Strategic Plan, safety is considered the overriding priority and the envelope of nuclear and radiological safety and security. To reach this objective, the Plan establishes credibility as a basic, supporting sub-objective, as well as four instrumental objectives: efficacy and efficiency, transparency, neutrality and independence. Furthermore, to support the CSN in carrying out its functions and meeting its objective, the following values are also laid down: independence, rigor, veracity, competence, excellence, accountability and commitment.

The Plan lays down the strategic objectives and identifies the instruments to fulfill CSN targets and policies, which together with compliance indicators, comprise the strategy to be followed by the Regulatory Body over the next few years. Such strategy should be developed in annual work plans (AWP) that include the main activities to be carried out throughout the year, as well as the most important numerical targets (performance indicators). These plans are approved by the CSN Board.

There is also a new chapter relating to CSN policies, listing the main Regulatory Body policies that are developed in the Management system manual.

2.2. Management System

The management system is driven by the Information Security and Management System Committee, in which Commissioner Fernando Castelló is the president and Commissioner Javier Dies the vice-president. This Committee is responsible for proposing, developing and monitoring the CSN management system strategy, assessing the management system, analyzing CSN evaluations of processes and activities, as well as proposing, promoting and supervising improvement plans.

An AWP monitoring tool is the scorecard, which includes the numerical values of 17 indicators measuring the level of compliance with key AWP activities. Such values are compared with previously established targets.

Procedures and In-house Audits

The CSN has a process-based Management System. The *Management System Manual* contains a general system description, as well as an overall description of documentation developing the system.

The CSN management system makes it necessary for the entire organization to be subject to a continuous improvement process. In addition to evaluations of plan and objective compliance, the CSN has an in-house audit plan and

systematically undergoes external evaluations by national and international organizations. The basic in-house audit plan is comprised of two parts, one for CSN activities and the other for activities carried out by Spanish Autonomous Communities where specific functions have been delegated. Eight processes were audited throughout the year.

In 2017, the CSN prepared the documentation needed within the action plan of the IRRS (*International Regulatory Review Service*). In this regard, the CSN intends to revise the *Management System Manual* and adapt it to the new IAEA requirements established in publication GSR Part 2 and Standard ISO 9001-2015.

Seven procedures were edited or reviewed in 2017. One of those procedures was in the area of management and the remaining six were of an administrative nature.

Training Plan

The CSN has always paid close attention to the training of its personnel, which is structured in annual plans. The 2017 Training Plan was structured in seven programs: nuclear safety and radiation protection technician (subdivided in four sub-programs: nuclear safety, radiation protection, cross-functional management areas and induction technical training), Managerial development, Administrative and legal management, Prevention, IT, Languages and Skills.

The total number of hours allocated to staff training was 21,940, with an average of 2.86 activities/person. The Training Plan Budget approved by the CSN Board was € 560,000, of which € 420,091.16 have already been spent (75.02%).

Knowledge Management

Knowledge management is defined as an integrated, systematic approach to identify, manage and share an organization's knowledge, as well as to allow groups of individuals to collectively create new knowledge that facilitates the success of organizational objectives.

The International Atomic Energy Agency (IAEA) has been very active in this field. The aim of the CSN is to develop a knowledge management model customized to its own needs and based on IAEA recommendations. The model would then be integrated into the Management System and use characteristic knowledge management elements already available.

In 2016 a specific action plan for this area was developed, focusing on preserving and recovering the knowledge and experience of CSN technicians who are nearing their retirement age. This model continued to be developed in 2017, laying the foundations for its continuity and drafting the document "Knowledge Management Model of the CSN. Action Proposal, 2017-2020".

Communication Plan

In April 2017, the CSN Board approved the CSN's Communication Plan, which aims to guide in-house, external and emergency communication by the Regulatory Body. This plan is intended to improve information and communication management within the CSN, as well as to determine the most effective communication channels and messages to be delivered to public institutions, society and stakeholders with the ultimate goal of increasing and reinforcing credibility of and trust in CSN actions and decisions.

2.3. Research and Development

A role of the CSN is to establish and monitor research programs in the area of nuclear safety and radiation protection. A key tool in doing so is the CSN's R&D Plan.

In 2016, the CSN approved the R&D Plan for the 2016-2020 period, which specifies the CSN's

course of action in the area of R&D. Throughout 2017, the CSN continued participating in international R&D activities related to the accident occurred at the Fukushima Dai-ichi nuclear power plant in March 2011. The main activity in this area was the Regulatory Body's participation in the project "Benchmark Study of the Accident at the Fukushima Daiichi Nuclear Power Plant". The CSN also reached agreements with various national organizations to carry out R&D analyses and activities that improve the evaluation of accidents and their implications, as well as the quality of lessons learned.

Throughout 2017, a total of 56 R&D projects were managed. This number includes all R&D projects carried out within the framework of collaboration covenants and agreements with other organizations, as well as projects funded by the CSN through R&D subsidies, some of which are yet to be granted. In addition to these 56 projects, the CSN Board authorized proceedings for approval of an additional thirteen R&D projects. The annual R&D event was held at the CSN headquarters in 2017.

The main institutional activities carried out by the CSN in 2017 in the area of R&D, were as follows:

- Participation in R&D Technological Platform activities relating to fission energy (CEIDEN), chaired by Vice-president Rosario Velasco and considered a useful tool to coordinate and look for R&D synergies within the area of nuclear safety.

- Participation in R&D National Platform activities relating to Radiation Protection (PEPRI), chaired by Commissioner Fernando Castelló and considered a useful tool to coordinate and look for R&D synergies within the area of radiation protection.

The CSN continues to carry out actions as requested by Resolution 2 from the Spanish Congress in relation to the 2012 Annual Report of the CSN. In that request, the CSN was asked to promote R&D testing amongst power plants, universities and technology centers, with the aim to better understand the behavior of unforeseen degradation phenomena. In this regard, a Material Degradation Work Group was put together, within the framework of the technology platform CEIDEN.

The CSN budget for R&D activities was € 2,155,000 in 2017.

2.4. Resources and Means

2.4.1. Human Resources

On December 31, 2017, the CSN had a workforce of 448, 70.32% of whom are graduates, 5.80% undergraduates and 23.88% have other types of degree. Women account for 52% of the entire workforce and men for the remaining 48%. The average age is 53.

In October, the career recognition for civil servants underwent its annual review, resulting in wage rises for 23 individuals.

Royal Decree 702/2017, dated July 7, approved government jobs for 2017, with eight vacancies for technical staff on Nuclear Safety and Radiation Protection.

Resolution 4 of the CSN Presidency, dated September 2017, authorized the internship of six civil servants in the CSN's technical staff on nuclear safety and radiation protection, in preparation to fulfill the government job vacancies announced in 2016.

2.4.2. Financial Resources

In terms of economic and financial aspects, the CSN is regulated by the provisions of General

Budget Law 47/2003, dated November 26, as it is a public government agency according to the terms of articles 2.2.b and 3.b.1. That means the CSN is subject to the Public Accounting scheme and the Accounting Regulations and rules applicable to the State's Administration.

Economic aspects are broken down into budgeting items and financial items, with the Regulatory Body's accounting complying with the requirements of the General public accounting plan (Order EHA/1037/2010, dated April 13).

The CSN prepares an annual revenue and expenditure budget that is integrated into the Spanish National Budget for approval by the Parliament. The initial CSN budget for 2017 was € 46,507,000. This initial budget was not modified during the year.

The vast majority of economic resources (98.58%) are obtained via taxation and public fees associated to CSN services provided within the framework of Law 14/1999, dated May 4, on Public Prices and Fees for services rendered by the Nuclear Safety Council. The remaining 1.42% comes from regular transfers and subsidies, financial revenues and other management income.

As for expenditure, staff costs accounted for 62.13% of the total. Staff costs include personnel wages, social security contributions made by the employer and social welfare costs. The second most important cost was external services (30.62%), mainly tasks carried out by contractor companies, costs of consumables and stationery and communications. The remaining costs refer to contributions for depreciation (3.30%), transfers and subsidies for nuclear safety and radiation protection, post-doctoral fellowships and transfers abroad (2.60%). Lastly, other small costs include taxes, financial costs, ordinary management costs and impairment of financial assets. During 2017, there was a surplus of € 5,215,000.

2.4.3. IT Means

As a result of compliance with the National Security Scheme (Spanish acronym: *ENS*), risk analysis and risk management plan data from 2016 remains valid. ENS conclusions highlight that in all three frameworks (organizational, operational and protection), the CSN has a maturity level of around 70%; in the Emergency Room contingency center, it was 70.7%, whereas in the contingency center of the CSN's calculation center, it was 84.3%.

A major aspect to be highlighted is daily cyber-security defense, which is ensured by the application of an in-house administrative procedure approved in 2016.

During the first semester of 2017, cabinet distribution at the calculation center was remodeled and a new disk storage cabinet was fully implemented.

The technological innovation process remains active. This process includes multiple aspects, from renewal of emergency room services and applications (known as B3CN group), to implementation of new authentication and signature methods going beyond digital certificates, and periodic testing to ensure good performance of emergency network communication system, also known as *Red N* (N Network).

In 2017 the process to enhance corporate applications continued. Currently, the CSN is completing the last stages of ICT adaption to Law 39/2015, dated October 1, of Common Administrative Procedure of the Public Administrations, requiring implementation of e-Files, Online Register, Online Office, Spanish Central Administration Mediation Platforms, Notifications, etc.

A number of projects aimed at implementing in the CSN various Interoperability Platforms with

the Social Security, Police Departments, the IRS, the Government's Contracting Platform, etc., are still in progress. Furthermore, in-house process automation based on workflow technologies supported by electronic signature of certified documents and automatic messaging via email and text messages, continues to be developed.

The transfer of documentation reception between the actual office and the online office, keeps increasing gradually.

Management applications for nuclear facilities and radioactive facilities are at the core of the information system. Development of the new application (*INUC*) for optimized CSN activity management, has been completed. These applications include most documents of the documentation system.

With the aim to support the Knowledge Management process, a set of necessary tools and the methodology favoring the implementation of many activities, have been contributed.

Chapter II. Report on Activities

3. Overview of Nuclear Safety and Radiation Protection, 2017

The overall performance of authorized facilities is assessed considering the results of the Spanish Reactor Oversight Process (Spanish acronym: *SISC*), but also of inspection, supervision and control of radioactive facilities; licensee event reports, mainly those classified higher than zero in the International Nuclear and Radiological Event Scale (INES) of the IAEA; radiological impact; dosimetry of workers; relevant modifications proposed; warnings and sanctions; as well as operating events occurred at these facilities.

All nuclear facilities operated safely throughout 2017. Facilities operated normally, with inspection and deficiency correction requirements being implemented. The only exception was Vandellós II nuclear power plant, which during the first quarter was in the "regulatory response" column as one of its indicators was in the white band. All inspection findings throughout 2017 were categorized as *green*.

The environmental quality around the facilities remains acceptable from a radiological point of view, without any risk for people resulting from facility operation or dismantling or decommissioning activities.

Radioactive facilities operated within required safety margins.

3.1. Safety at the Facilities

3.1.1. Nuclear Power Plants

SISC is currently the main instrument for plant performance evaluation from the perspective of safety, CSN supervision and control planning, as well as communication to the public on these two items.

The main *SISC* results relating to the performance of operating nuclear power plants in 2017, are as follows: at the end of 2017, all performance indicators were green, although at Vandellós II NPP the reliability index indicator for emergency diesel generator mitigation systems, was in the white column during the first quarter of the year. Table 3.1.1.1 shows the action matrix status in 2017, where it can be seen that at the end of the year all NPP were in the licensee response (LR) mode. It is also seen that in the first quarter of 2017, Vandellós II nuclear power plant was in the regulatory response (RR) mode.

Table 3.1.1.2, shown below, describes the characteristics of each action matrix mode.

On the CSN institutional website, there is a link to *SISC* (https://www.csn.es/sisc/index.do), with updated quarterly results for all nuclear power plants, as well as system results and operative information relating to those results. There is also descriptive documentation and the corresponding procedures.

The total number of inspections carried out in operating NPP throughout 2017, including Santa María de Garoña nuclear power plant, was 132, 2 more than the 130 scheduled.

All inspection findings throughout 2017 were categorized as *green*.

In application of the provisions of CSN Instruction IS-10, establishing the Criteria for reporting events to the Nuclear Safety Council by the Nuclear Power Plants licensee, the latter reported 44 events in 2017, one of them classified as level 1 in the International Nuclear Event Scale (INES) and the other 43 classified out of scale (level 0).

Table 3.1.1.1. Action Matrix Status. *SISC* 2017

	1st quarter	2nd quarter	3rd quarter	4th quarter
Almaraz I	LR	LR	LR	LR
Almaraz II	LR	LR	LR	LR
Ascó I	LR	LR	LR	LR
Ascó II	LR	LR	LR	LR
Cofrentes	LR	LR	LR	LR
Trillo	LR	LR	LR	LR
Vandellós II	RR	LR	LR	LR

LR: Licensee Response. RR: Regulatory Response.

Table 3.1.1.2. SISC Action Matrix

Modes	Fundamental	Resulting Actions
Licensee Response	A plant is in this column when all assessment results are *green*.	The CSN will carry out only the basic inspection program, and any deficiencies identified will be addressed by the licensee within its corrective action program.
Regulatory Response	A plant is in this column when one or two results, either a performance indicator or inspection finding, are *white* on different safety pillars, with no more than two *whites* in one single strategic area.	The licensee shall perform an analysis to determine the root cause and contributing factors, including in its corrective action program the activities needed to solve the deficiencies identified. The licensee's assessment shall be subject to a supplementary inspection by the CSN. Following this inspection, the CSN will meet with the licensee to analyze the deficiency detected and the corrective actions implemented.
Degraded Pillar	A pillar is considered to be degraded when it contains two or more *white* results or one *yellow*. A plant is in this column when it has a degraded pillar or three *white* results in a single strategic area.	The licensee shall perform an analysis to determine the root cause and contributing factors, including in its corrective action program the activities needed to solve the deficiencies identified. This applies to both problems identified in each subject area and to potentially related collective deficiencies. The licensee's assessment shall be subject to a supplementary inspection by the CSN. Following this inspection, the CSN will meet with the licensee to analyze the deficiencies detected and the corrective actions implemented.

Table 3.1.1.2. SISC Sction Matrix *(Cont'd)*

Modes	Fundamental	Resulting Actions
Multiple Degradations	A plant is in this column when it has several degraded pillars, several *yellow* results or one *red* result, or when a pillar has been degraded for five or more consecutive quarters.	The licensee shall perform an analysis to determine the root cause and contributing factors, including in its corrective action program the activities needed to solve the deficiencies identified. This applies to both problems identified in each subject area and to potentially related collective deficiencies. This assessment may be performed by a third party, independent from the licensee. The CSN shall perform a supplementary inspection to determine the scope and depth of deficiencies. Following this inspection, the CSN will decide whether further regulatory actions are required (additional inspections, request for additional information, issuance of instructions and/or plant shutdown).
Unacceptable Performance	The CSN includes a plant in this category when there is insufficient guarantee that the licensee can operate the station without causing an unacceptable risk.	The CSN will meet with licensee management to discuss the performance degradation observed and the actions to be implemented before the plant can return to operation. The CSN will draw up a specific supervision plan.

The CSN issued four warnings in 2017: one to Ascó nuclear power plant due to non-compliance with the existing Operating License, after a radwaste management and control issue; one to Trillo nuclear power plant due to non-compliance with CSN Safety Instructions *IS-21* and *IS-23*, related to requirements applicable to modifications and in-service inspection at nuclear power plants, respectively; one to Vandellós II nuclear power plant due to non-compliance with CSN Safety Instruction *IS-30* on the requirements of the fire protection program (FP) at nuclear power plants; and one to Santa María de Garoña nuclear power plant due to non-compliance with FP regulations on storage of radioactive sources. Additionally, a proposal for the initiation of sanction proceedings has been issued against Vandellós II nuclear power plant due to non-compliance with CSN Safety Instruction IS-30 and Technical Specifications applicable to FP elements.

3.1.2. *Juzbado* Fuel Assembly Factory

The overall operation of the *Juzbado* factory was adequate in terms of safety, with reported licensee events being managed correctly, the necessary analyses being carried out and corrective actions resulting from those analyses being implemented. In 2017, the *Juzbado* facility reported five events, none of them resulting in risks for the workers, the public or the environment. The CSN issued a warning to this facility.

3.1.3. *El Cabril* Radwaste Disposal Facility

As a result of monitoring and controlling operations, evaluating periodic reports submitted by this facility, and carrying out CSN inspections, it was concluded that activities developed at El Cabril were in accordance with existing regulations and operating license limits and

conditions. No licensee event report was recorded in this facility throughout 2017.

3.1.4. Public Research Agency for Energy, Technology and Environment (Ciemat)

Ciemat has an operating license as a unique nuclear facility comprised of nuclear and radioactive facilities differentiated in two groups: one including facilities that are shutdown, undergoing dismantling for decommissioning or already decommissioned, and the other comprising 21 second- and third-category radioactive facilities still in operation.

During 2017, Ciemat continued developing activities within the framework of projects associated to the Integrated Plan for Improvement of Ciemat Facilities (*PIMIC*), *PIMIC*-Dismantling and *PIMIC*-Reconditioning. No event was reported. All activities were carried out in line with applicable safety limits, without undue impact on the workers, the public or the environment.

The CSN carried out 10 inspections of Ciemat, not proposing the issuance of any sanction proceedings or warnings against this facility.

In 2017, the CSN sent a Technical Instruction to Ciemat and submitted three mandatory reports to Spain's Department of Energy, Tourism and Digital Agenda.

3.1.5. Facilities under Decommissioning and Permanent Closure

The following nuclear or radioactive fuel cycle facilities have ceased to operate or are in the dismantling and decommissioning phase: Vandellós 1 nuclear power plant (in the latency phase following the first dismantling phase), José Cabrera nuclear power plant (undergoing active dismantling), *Elefante* uranium concentrate facility (dismantled and currently in the compliance period), *Quercus* Plant (in permanent shutdown and with the dismantling and decommissioning request submitted in September 2015) and *Andújar* uranium concentrate factory (dismantled and in the compliance period).

In all these facilities, the programs for environmental radiation monitoring, radiological protection of workers, security and, when applicable, control of effluent releases and waste management, remain operational. No deviations occurred during implementation of any of these programs.

The activities carried out in 2017 in each of these facilities, were performed in accordance with their status, within applicable safety limits and without undue impact on people or the environment.

3.1.6. Radioactive Facilities

Throughout 2017, the operation of radioactive facilities for scientific, medical, agricultural, commercial and industrial purposes was accomplished within existing safety standards, adhering to required measures for radiological protection of people and the environment. No situations of undue risk occurred.

In compliance with CSN Safety Instruction IS-18, dated April 2, 2008, on the criteria applied by the CSN to demand from the licensees of radioactive facilities the reporting of radiological events and incidents, radioactive facilities reported 20 events to the CSN in 2017.

As a result of control inspection and evaluation actions at the facilities, the CSN proposed in 2017 the issuance of two sanction proceedings due to serious infringement. Similarly, the CSN issued 70 warnings to radioactive facilities and related activities.

3.2. Application of the Radiation Protection System

3.2.1. Summary of Dosimetry Data

The number of dosimetrically controlled workers amounted to 112,868[1], who received a collective dose of 17,645 mSv·person and an average individual dose of 0.74 mSv/year, equivalent to 1.48% of the maximum annual individual dose allowed by law. (The effective dose limit for professionally exposed workers is 100 mSv over a period of five official consecutive years, with a maximum effective dose of 50 mSv in any given official year).

It is worth noting that:

- Medical radioactive facilities have the highest collective dose (11,443 mSv·person), this being quite logical since these facilities employ the largest number of professionally exposed workers (90,076).
- Radioactive material transport activities are those with the highest average individual dose (1.95 mSv/year).
- Operating nuclear power plants had 9,159 workers who were dosimetrically controlled, with a collective dose of 3,967 mSv·person and an average individual dose of 1.35 mSv/year.

Table 3.2.1 shows this data, which includes the doses received by workers in each of the sectors considered in this annual report.

During 2017, there were four cases in which the legal annual dose limit was potentially exceeded, all of them occurring at radioactive medical facilities. In all these cases, an investigation process was initiated, with conclusions yet to be determined.

Table 3.2.1. Dose received by workers in each sector considered in the annual report

Facilities	Number of Workers	Collective dose (mSv·person)	Average individual dose (mSv/year)
Nuclear Power Plants	9,159	3,967	1.35
Fuel cycle facilities, radwaste storage facilities and research centers (*Ciemat*)	1,141	60	0.45
Radioactive Facilities			
Medical	90,076	11,443	0.63
Industrial	7,152	1,384	0.83
Research	5,562	372	0.38
Facilities under Decommissioning and Permanent Closure	301	237	1.68
Transport	177	183	1.95

1. As dosimetry data was provided by the National Dosimetry Bank, the total number of exposed workers in the country does not coincide with the sum of workers in each of the sectors reported on. This can be explained by the fact that there may be workers who provide their services in more than one sector throughout the year.

3.2.2. Discharge Control and Environmental Radiation Monitoring

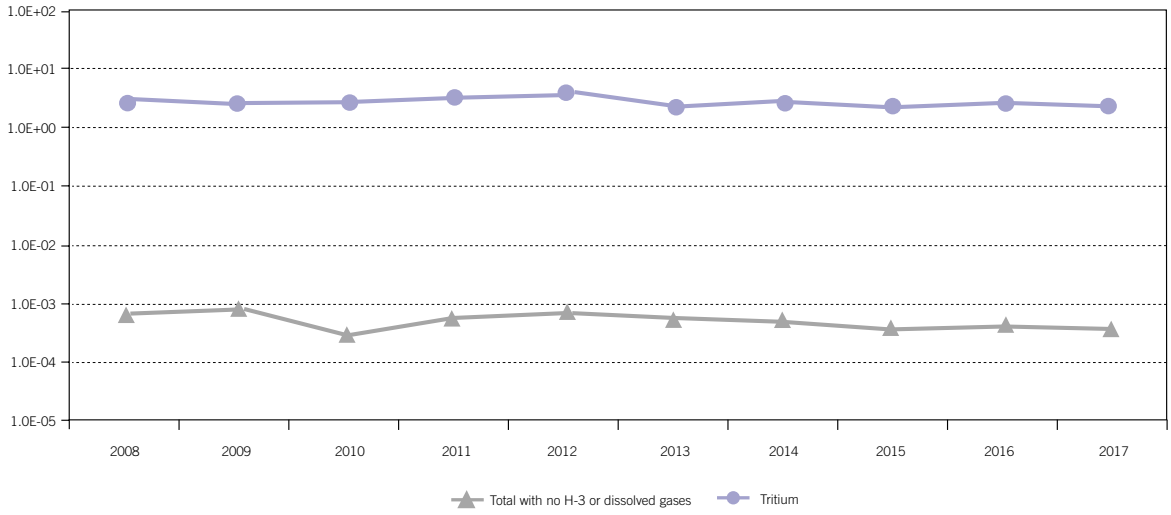
The CSN controls and oversees the radiological protection of the public and the environment, offsite releases of radioactive materials from nuclear and radioactive facilities, as well as their impact on areas near these facilities, all with the aim of estimating their radiological impact. Furthermore, the CSN carries out an environmental radiation monitoring program throughout Spain to monitor and maintain the radiological quality of the environment throughout the country.

Discharge Control and Environmental Radiation Monitoring near the facilities

As required by the CSN, nuclear and radioactive fuel cycle facilities have established a program to control radioactive effluents and keep their resulting doses to the public as low as reasonably achievable, always below the values of Spain's Regulation on Sanitary Protection against Ionizing Radiations.

In the case of nuclear power plants, radioactive effluents had an overall stable trend over the last few years, as shown in the following figures:

Figure 3.2.2.1. Radioactive liquid effluents from PWR NPP. Normalized activity (GBq/GWh)



Effective doses caused by the release of radioactive liquid and gaseous effluents, based on conservative criteria estimates for the most exposed individual in the critical group, have never exceeded 3.2% of the authorized limit (0.1 mSv in 12 consecutive months).

This report presents the results of Spain's environmental radiation monitoring programs (Spanish acronym: PVRA) for the year 2016, because the procedure followed for processing and analyzing samples does not provide the 2016 campaign results on time for inclusion in this report.

Figure 3.2.2.2. Radioactive gaseous effluents from PWR NPP. Normalized activity (GBq/GWh)

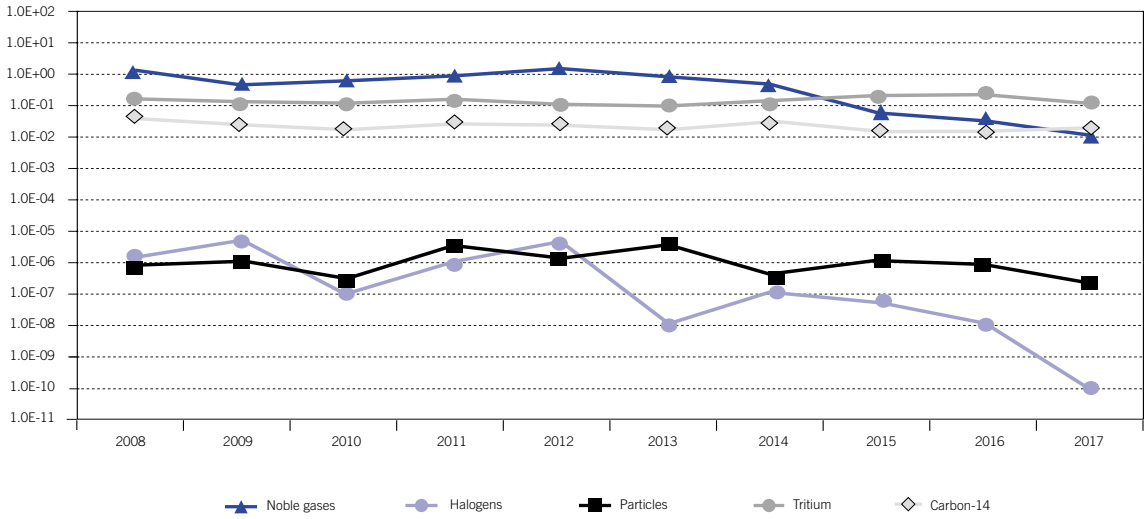


Figure 3.2.2.3. Radioactive liquid effluents from BWR NPP. Normalized activity (GBq/GWh)

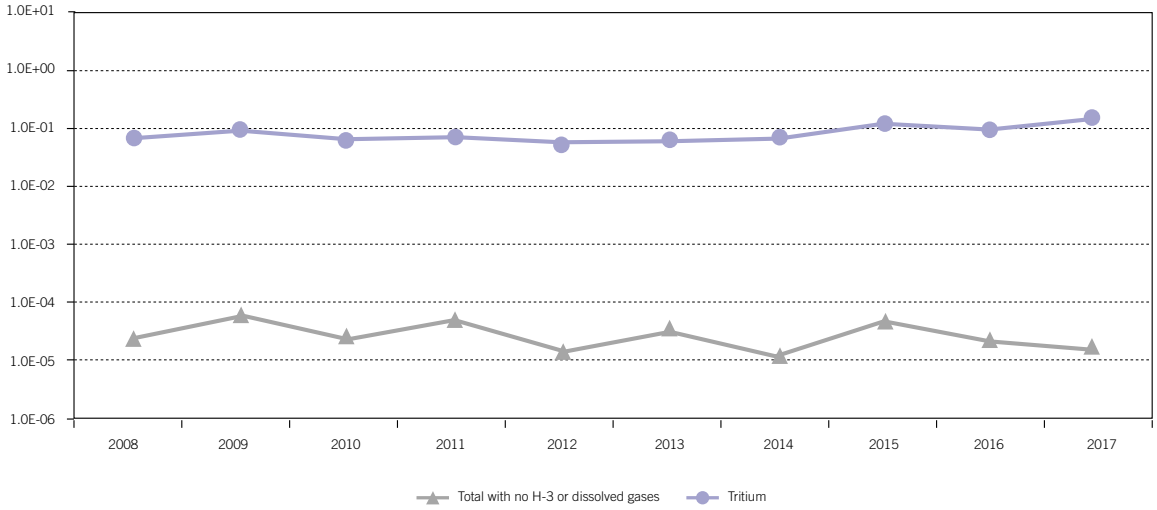
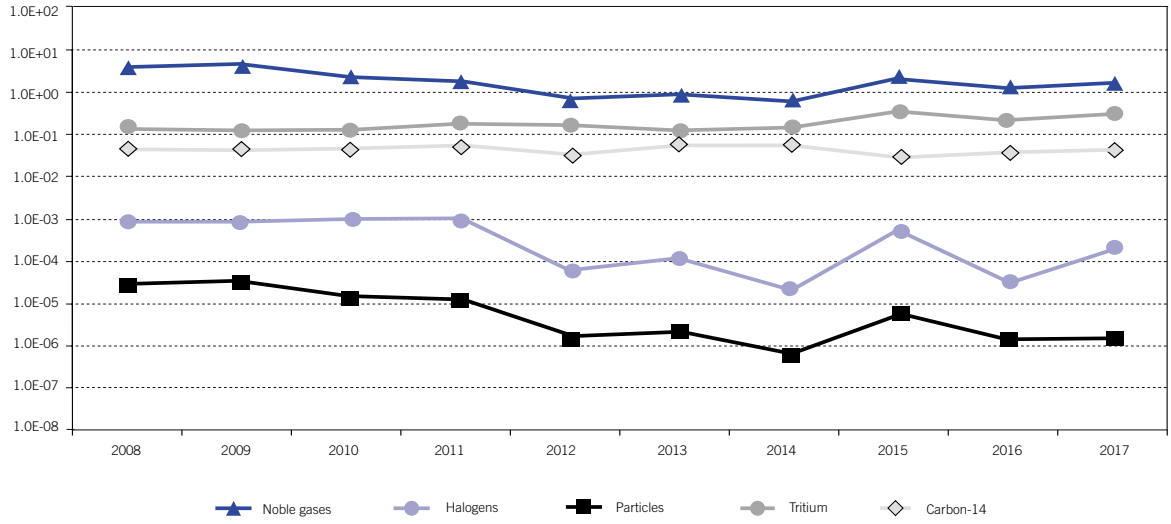


Figure 3.2.2.4. Radioactive gaseous effluents from BWR NPP. Normalized activity (GBq/GWh)



Facility licensees are responsible for implementing these monitoring programs. During 2016, 6,292 samples were collected in the vicinity of nuclear power plants, 1,368 from fuel cycle facilities (Juzbado fuel assembly factory and El Cabril), and 2,517 from facilities in the dismantling and decommissioning phase, namely Ciemat, the José Cabrera and Vandellós 1 nuclear power plants, the Elefante and Quercus plants, the Enusa mining sites, the Andújar uranium factory and the now decommissioned Lobo-G plant.

A new feature in 2017 is that the CSN, in compliance with the public information functions mandated to the Regulatory Body and with the provisions of Law 27/2006, regulating the right to access environmental information, developed a new IT application to facilitate public access to environmental radiation monitoring data in Spain. This data, of which the CSN is depository, can be accessed on the CSN's institutional website.

This application allows users to display on a map the sampling stations of Spain's environmental radiation monitoring network, both those at the facilities, which are the responsibility of licensees, as well as those used for national surveillance and managed by the CSN. For each sampling station, it is possible to check available data for the period covering 2006 to 2016.

The new application is accessible to the public on the CSN's website, in the tab "Operating states and environmental data", in a new link called "Environmental values- *REM* and *PVRA*":

https://www.csn.es/kprGisWeb/consultaMapa-Puntos2.htm

The results of the 2016 *PVRA* campaign are similar to those obtained in previous years and lead to the conclusion that the environmental quality around the facilities remains acceptable from a radiological point of view, without any risk for people as a result of facility operation or dismantling or decommissioning activities.

In order to verify the adequacy of monitoring programs undertaken by the facilities, the CSN implements independent environmental radiation monitoring programs (Spanish acronym: *PVRAIN*). The number of samples and

determinations of these independent programs represents around 5% of those implemented by licensees. The results of 2016 campaign programs did not show any significant deviation compared to those obtained from licensee programs.

Environmental monitoring outside the vicinity of facilities

The CSN monitors the environment at a national level by means of a surveillance network known as *Revira*, in collaboration with other institutions. This network is made up of automatic stations that measure atmospheric radioactivity continuously (Spanish acronym: *REA*) and stations that collect samples for subsequent analysis (Spanish acronym: *REM*).

Network of automatic stations (REA)

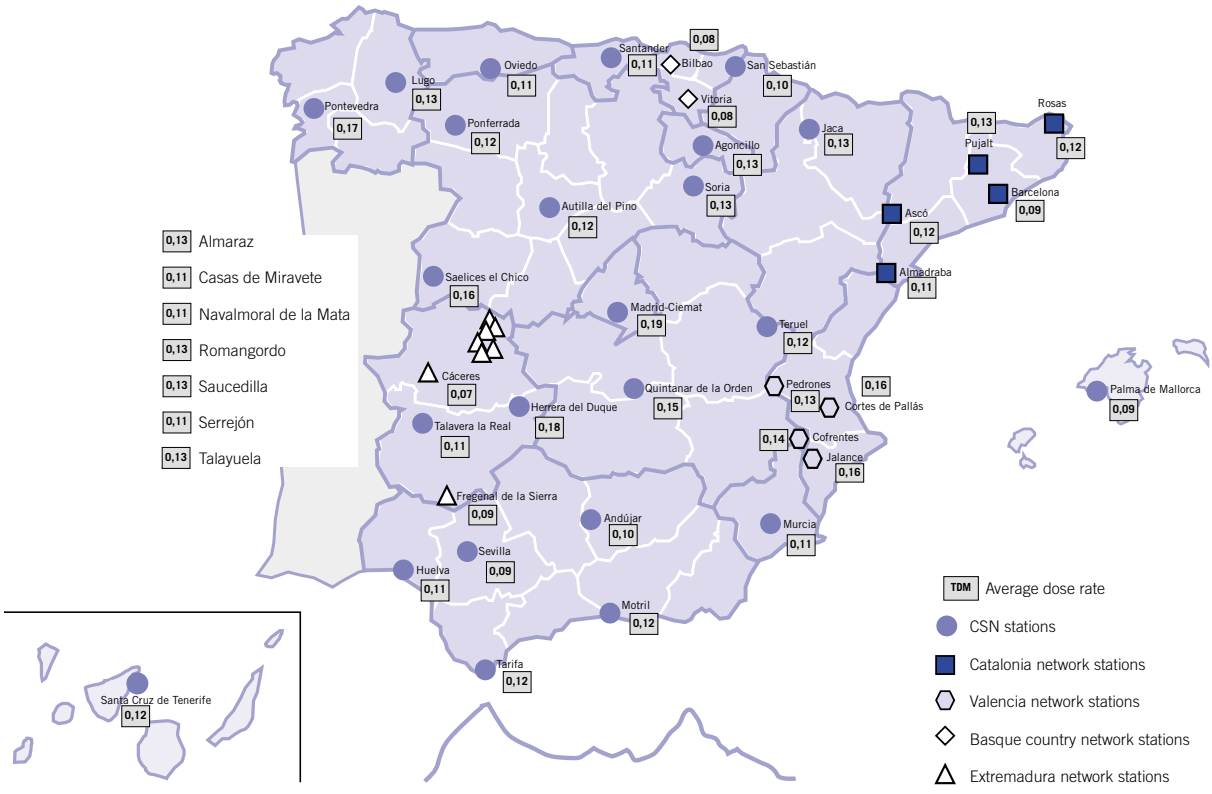
Figure 3.2.2.5 shows the average annual gamma dose rate values measured at each CSN network station, the Valencia Community network, the Basque Country Community network, as well as in the Catalonia Community and Extremadura Community network stations that measure dose rates.

The results of measurements taken in 2017 were characteristic of the environmental radiation background, indicating the absence of radiological risk for people and the environment.

The daily average gamma dose rate data taken by automatic stations is available on the CSN website:

https://www.csn.es/mapa-de-valores-ambientales

Figura 3.2.2.5. Average gamma dose rate values. Year 2017 (microSievert/hour)



Network of sampling stations (REM)

This network collects samples of air, soil, drinking water, milk, typical diet and inland and coastal waters. Within this network, consideration is given to the following:

- A Dense Network, with multiple sampling points to ensure the entire territory is adequately monitored.

- A high-sensitivity or Spaced Network, comprised of only a few sampling points where highly sensitive measurements are required.

The overall assessment of 2016 results is that values are coherent with background radioactivity levels and, in general, remain relatively stable over different periods. The slight variations between the points are attributable to typical radiological characteristics of the different areas.

In October, some European labs detected in the atmosphere Ruthenium-106, a radioactive isotope of artificial origin. As a result, the CSN implemented special monitoring measures to determine the potential impact of this event in Spain. Results confirmed that in none of the atmosphere samples taken in Spain this radionuclide was present, concluding that the radioactive cloud did not reach our country, hence making it unnecessary to implement measures to protect people or the environment.

4. Monitoring and Control of Facilities and Activities

4.1. Regulations and standards

In 2017, the regulatory capacity of the CSN resulted in the following CSN Instructions:

- IS-27, revision 1, dated July 14, 2017, on general nuclear power plant design criteria (Spain's Official Gazette dated July 3, 2017).

  It was rendered necessary to review some specific aspects of this Instruction with the aim to clearly establish its scope, which now focuses solely on "safety-related" Structures, Systems and Components (SSC), not on "non safety-related" SSC.

- IS-22, revision 1, dated November 15, 2017, on safety requirements for the management of ageing and long-term operation of nuclear power plants (Spain's Official Gazette dated November 30, 2017).

  This Instruction is reviewed to update and clarify CSN requirements for development of an aging management process for structures, systems and components (SSC) in nuclear power plants, including long-term operation scenarios.

  "Reference Level" regulatory requirements agreed at WENRA were taken into consideration with the aim to harmonize regulations within association member countries.

With regards to safety guides, the following were approved during 2017:

- GS-01.15 (rev. 1) "Probabilistic Safety Assessment updating and maintenance". Approved by the CSN Board on January 25, 2017.

- GS-01.10 (rev. 2) "Periodic Safety Reviews at Nuclear Power Plants". Approved by the CSN Board on May 30, 2017.

- GS-06.06 "Development of Safety Analyses for transport packages of radioactive material not subject to approval". Approved by the CSN Board on June 14, 2017.

Throughout 2017 at a nationwide level, the following provisions on CSN regulation and operation, were approved and published:

- Law 9/2017, dated November 8, on Public Procurement Legislation, transposing into Spain's legal order the Directives of the European Parliament and Council 2014/23/EU and 2014/24/EU, dated February 26, 2014.

- Ministerial Decree ETU/1185/2017, dated November 21, regulating the declassification of waste materials generated in nuclear facilities.

Within the European Union legal field, the following Regulation of direct application published in 2016 will come into effect in 2018:

- Regulation (EU) 2016/679 of the European Parliament and Council, dated April 27, 2016, on protection of people concerning personal data processing and free movement of data. This Regulation repeals Directive 95/46/EC (General data protection regulation).

Throughout 2017, the CSN participated in national work groups in charge of transposing the following Euratom Directives:

- Directive 2014/87/Euratom of the Council, dated July 8, 2014 and amending Directive 2009/71/Euratom, which set up a Community framework for nuclear safety in nuclear facilities.

- Directive 2013/59/Euratom of the Council, dated December 5, 2013, establishing basic safety standards for protection against ionizing radiation exposure hazards, repealing Directives 89/618, 90/641, 96/29, 97/43 and 2003/122/Euratom.

Work was carried out simultaneously in an in-house group within the CSN, reviewing some aspects of Spain's Regulation on Nuclear and Radioactive Facilities (*RINR*) which could be affected by this last Directive.

Furthermore, throughout 2017 the CSN collaborated with Spain's Department of Energy, Tourism and Digital Agenda to draft a Royal Decree on control and recovery of orphan radioactive sources, with the aim to transpose Directive 2013/59/Euratom. Public hearing requirements were completed in late 2017.

4.2. Nuclear Power Plants

4.2.1. General and Licensing Aspects

During 2017, the CSN Board issued 55 authorization reports for nuclear power plants, mostly in relation to requests for revision of official site operating documents, as well as 30 favorable reports relating to compliance with CSN Instructions and Technical Instructions and to implementation timelines for the requirements included in those Instructions.

The Board, in its meeting dated February 8, 2017, agreed to issue a favorable report with conditions, granting an operating license to Santa María de Garoña nuclear power plant. On

August 1, 2017, Spain's Department of Energy, Tourism and Digital Agenda, issued an order refusing the operating license renewal for Santa María de Garoña nuclear power plant.

Table 4.2.1.1 shows the main features of Spanish nuclear power plants and table 4.2.1.2 includes the main data for those NPP throughout 2017.

Table 4.2.1.2 contains specific data on nuclear power plants for 2017, specifying whether they had a refueling outage that year.

4.2.2. Inspection, Supervision and Control of Nuclear Power Plants: SISO

The CSN's Reactor Oversight Program (Spanish acronym: *SISC*) is a basic tool to monitor the operation of Spanish nuclear power plants and establish the necessary corrective actions based on their results. *SISC* has been in service for over ten years now.

As part of *SISC*'s revision and improvement process, new elements have been added for more detailed monitoring of station performance, especially with regards to cross-functional items. The objective of this new approach is to have some type of cross-functional item indicators or warnings, allowing the CSN to identify potential degradation of organizational and cultural aspects that could affect nuclear safety.

In 2014 the CSN Board approved a new supervision and monitoring system (Spanish acronym: *SSG*) for Santa María de Garoña nuclear power plant, adapted to the station's shutdown condition. As a result, this plant no longer appears within SISC and its corresponding half-yearly assessment reports are now included within *SSG*.

Table 4.2.1.1. Basic Features of Nuclear Power Plants

	Almaraz	Ascó	Vandellós II	Trillo	Garoña	Cofrentes
Type	PWR	PWR	PWR	PWR	BWR	BWR
Thermal Power (MW)	U-I: 2,956.60 U-II: 2,955.80	U-I: 2,940.6 U-II: 2,940.6	2,940.6	3,010	1,381	3,237
Electrical Output (MW)	U-I: 1,049.18 U-II: 1,051.84	U-I: 1,032.5 U-II: 1,027.2	1,087.1	1,066	465.6	1,092.02
Cooling	Open Arrocampo Dam	Mixed, Ebro River Cooling Towers	Open Mediterranean Sea	Closed Make-up Towers TagusRiver	Open Ebro River	Closed Make-up Towers Júcar River
Number of Units	2	2	1	1	1	1
Previous License Unit I/II	29-10-71 23-05-72	21-04-72 21-04-72	27-02-76	04-09-75	08-08-63	13-11-72
Construction License Unit I/II	02-07-73 02-07-73	16-05-74 07-03-75	29-12-80	17-08-79	02-05-66	09-09-75
Commissioning License Unit I/II	13-10-80 15-06-83	22-07-82 22-04-85	17-08-87	04-12-87	30-10-70	23-07-84

Tabla 4.2.1.2. Summary of nuclear power plant data for 2017, specifying whether they had a refueling outage that year

	Almaraz I/II	Ascó I/II	Vandellós II	Trillo	Garoña	Cofrentes
Existing License	07-06-10 07-06-10	02-10-11 02-10-11	21-07-10	03-11-14	Until 06-07-13 Operating License Since 06-07-13 End of Operations	20-03-11
Validity period (years)	10 10	10 10	10	10	N/A	10
Number of inspections in 2017	25	28	17	21	16	25
Production (GWh)	8.048,056 7.997,598	7.844,390 8.041,730	7.964,778	8.530,705	–	7.049,703
Load factor (%)	87,55 97,69	86,73 89,37	83,41	98,74	–	76,73
Operating factor (%)	90,01 98,82	87,78 90,37	86,15	99,61	–	80,26
Hours coupled to the grid	8.760 8.760	7.689,41 7.916,25	7.567,63	8.058	–	7.031,133
Refuelling Outages	26-06/29-07 NO	13-05/25-06 28-10/02-12	NO	05-05/03-06	N/A	23-09/27-10

SISC has increased the number of supervision indicators compared to former "classical" indicators, which had been in place since 1992 and were used to compare Spanish NPP to USA power plants by means of an analysis carried out by the US Regulatory Body (NRC). The NRC decided to stop using those indicators in 2016, meaning the CSN no longer has that comparative info. Considering obsolescence aspects, the full implementation of *SISC* indicators and the fact that the classical NRC indicator program is no longer in place, the CSN Board decided to end the use of classical indicators.

Throughout 2017, the NPP were in the "licensee response" column within the *SISC* action matrix, which corresponds to a situation of normality, with application of standard inspection and deficiency correction programs. The only exception, as abovementioned, was Vandellós II, which was in the "regulatory response" column due to the reliability index of emergency diesel generator mitigation systems being in the white band during the first quarter of the year. All performance indicators remained in the green band over the last 12 months, with the abovementioned exception of the mitigation systems at Vandellós II nuclear power plant during the first quarter of the year. All inspection findings throughout the last 12 months were categorized as green.

A total number of 132 inspections were performed at the operating plants in 2017, including Santa María de Garoña. In addition to basic inspection program visits (112), other inspections, both planned and unplanned, were performed, such as reactive inspections after operating incidents, special inspections relating to generic issues following new standards and in-house and external operating experience, as well as generic or scheduled inspections focusing on the action plans of the nuclear power plants.

Sanction proceedings and warnings

In 2017, the CSN proposed to Spain's Department of Energy, Tourism and Digital Agenda to open sanction proceedings against Vandellós II nuclear power plant due to non-compliances with CSN Instruction IS-30 and Tech Specs.

In 2017, the CSN issued the following warnings to nuclear power plants:

- Santa María de Garoña nuclear power plant: warning due to non-compliance with item (a.iv) of Complementary Technical Instruction CSN/ITC/SG/SMG/13/04 on the use of radioactive sources needed for nuclear power plant operation. Such item establishes that "the licensee has to ensure radioactive material facilities are equipped with firefighting means, which should be easy to access and available at all times. Furthermore, all personnel should know how to use such firefighting means".

- Ascó nuclear power plant: warning due to non-compliance with existing Operating License requirements on radwaste management and control.

- Vandellós II nuclear power plant: warning due to non-compliance with CSN Instruction IS-30 and Adapted Post-Fukushima Complementary Technical Instruction CSN/ITC/SG/VA2/13/04, relating to requirements for protection against large fires.

- Trillo nuclear power plant: warning due to non-compliance with the safety analysis (KTA 3601, licensing base) of CSN Instructions for nuclear power plants, IS-21 on design modifications and IS-23 on in-service inspection.

4.2.3. Follow-up of actions deriving from the Fukushima nuclear power plant accident

Regulatory post-Fukushima requirements for Spanish nuclear power plants were implemented by means of four Complementary Technical Instructions (ITC-1/2/3/4), issued by the CSN during 2011 and 2012. More recently, in April 2014, the CSN issued a new Complementary Technical Instruction to consistently adapt the requirements of existing post-Fukushima Complementary Technical Instructions with completion date prior to January 1, 2014. In the specific case of Santa María de Garoña nuclear power plant, post-Fukushima requirements included in Complementary Technical Instruction ITC-1/2/3/4 were adapted to the NPP's condition of permanent shutdown. All requirements have been implemented.

The CSN carried out four inspections in every station throughout 2017 to ensure compliance with post-Fukushima Complementary Technical Instruction.

Nuclear power plants complied with improvement implementation programs required by Regulatory post-Fukushima Complementary Technical Instructions. During 2017, pending large-scale design modifications were completed.

At the time of drafting this report, action monitoring by licensees through the post-Fukushima Complementary Technical Instruction Follow-up Committee (Spanish acronym: *CSITCF*), which follows licensee actions and completed evaluation by the CSN, is considered complete, hence being integrated into regular CSN control and supervision processes.

4.2.4. Safety Improvement Programs

4.2.4.1. Periodic Safety Review (PSR) Programs

CSN Safety Guide 1.10 (rev. 2) "Periodic Safety Reviews in Nuclear Power Plants" was published in 2017. This new Safety Guide is based on the guide by the International Atomic Energy Agency (IAEA), SSG-25 "*Periodic Safety Review for Nuclear Power Plants*", dated March 2013, which also includes post-Fukushima WENRA reference levels relating to periodic safety reviews.

In this Guide, the CSN establishes the need for licensees to carry out a PSR at least once every 10 years. It is up to Spain's Department of Energy, Tourism and Digital Agenda (*Minetad*) to exercise its competence and determine the validity period of the administrative license.

This guide determines the timelines for carrying out the PSR, establishing basic cut-off dates. Six months prior to the cut-off date, the licensee has to submit a base document for PSR development and nine months after the cut-off date the actual PSR document needs to be presented. In that regard, the CSN Plenary meeting of February 1, 2017, proposed to *Minetad* the modification of section 2 of the Ministerial Decree, which grants operating licenses to the nuclear power plants of Almaraz I & II, Ascó I & II, Cofrentes, Trillo and Vandellós II, with the aim to include the new periodic safety review systematics included in Safety Guide GS 1.10.

On May 30, 2017, the CSN Board gave a favorable report to *Minetad*'s request to modify the ministerial decrees that grant operating license renewals to the nuclear power plants of Almaraz I & II, Vandellós II, Trillo, Ascó I & II, and Cofrentes, thus allowing these nuclear power plants to adapt to the new periodic safety review systematics. The Ministerial Decree project also

modified the period for submittal to *Minetad* of the operating license renewal request, establishing as reference the date of Comprehensive Energy and Climate Plan approval or, when applicable, the deadline for periodic safety review submittal. On the other hand, the three-year period prior to operating license expiry remains. Such period is aimed at allowing licensees to submit documentation to be evaluated in preparation for possible continuation of plant operation.

Similarly, the submittal period for the periodic safety review and other complementary documentation, remains.

The following table summarizes, for each nuclear power plant, the PSR submittal milestones: expiration date of existing operating license (OL), cut-off date, submittal date for the PSR base document required in new revision of Safety Guide GS-1.10 (which should receive favorable report by the CSN), and submittal date of PSR document in line with new PSR systematics.

The date three years prior to OL expiration is also included, as first milestone in which licensees need to submit specific long-term operation (LTO) documentation, considering it would be the ten-year period prior to the end of nuclear power plant design life.

	Three years < OL Expiration DOC LTO	Present. BASE Doc PSR	Cut-off Date PSR	Present. PSR Doc	Expiration OL
Almaraz	01/06/2017	31/12/2017	30/06/2018	31/03/2019	07/06/2020
Ascó	01/10/2018	31/12/2018	30/06/2019	31/03/2020	02/10/2021
Cofrentes	01/03/2018	31/12/2018	30/06/2019	31/03/2020	20/03/2021
Trillo	01/11/2021	31/12/2021	30/06/2022	31/03/2023	16/11/2024
Vandellós II	01/07/2017	31/12/2017	30/06/2018	31/03/2019	21/07/2020

4.2.4.2. Organizational and Human Factors in Nuclear Facilities

Since 1999, all Spanish nuclear power plants have safety evaluation and improvement programs for organizational and human factors (Spanish acronym: *OyFH*). The Juzbado fuel assembly factory also integrated this program a few years later. These programs are currently mature enough, although they are not the same in each facility.

By promoting these programs and inspecting the level of program progress and implementation, the CSN favors improvement of all aspects impacting safety. Inspections of organizational and human factors programs are part of the basic CSN inspection plan, and are integrated within the Spanish Reactor Oversight Process (*SISC*) for nuclear power plants. They are also part of the Supervision Program for the Juzbado factory. In 2017, Organizational and Human Factors programs were inspected in Cofrentes nuclear power plant and the Juzbado factory.

4.2.5. Generic Issues

A Generic Issue is any safety problem identified in a Spanish or foreign nuclear power plant that may affect other nuclear power plants. The CSN monitors them and promotes the analysis of their applicability to Spanish nuclear plants, as well as the implementation of corrective actions resulting

from such analysis. Generic Issues can also result from the analysis of events occurred in operating Spanish or foreign nuclear facilities, in research programs or in new requirements issued in the country of origin of the nuclear power plant project. In this regard, the CSN has two panels of experts: the Incident Review Panel (Spanish acronym: *PRI*) and the International Incident Review Panel (Spanish acronym: PRIN).

Throughout 2017, two new generic issues were opened:

- Problems in emergency diesel generators (EDG) relating to maintenance by the vendor (Wartzila).
- No scanning of welds required by the ASME XI Code.

New information was provided and additional requirements on generic issues were established:

- Pre-conditioning of pressure breakers prior to testing (IN 2012-16).
- Grid reliability and the impact on plant risk and the operability of offsite power. (GL 200602). A work line proposal has been submitted with the aim to solve this issue following evaluations in different meetings.

The generic issue was closed:

- Aging of active components.

Throughout 2017, three letters were sent to nuclear power plants in relation to the revision of international events included in the "*Incident Reporting System* (IRS)", requesting an applicability analysis within three months to consider new research on the efficiency of filtered containment ventilation lines. IRS 8582.

With regards to other international events, nuclear power plants were asked to include their applicability analyses in their upcoming annual operating experience report.

4.3. Nuclear and Radioactive Facilities in the Fuel Cycle and Research Centers

This section includes the Juzbado fuel assembly factory, the El Cabril radwaste repository, the Public Research Agency for Energy, Technology and Environment (Ciemat) and the Quercus plant.

In 2017, all these facilities operated within established safety margins, without any situation of undue risk.

Other sites included are the Retortillo plant, the uranium mining sites and the centralized temporary storage facility (Spanish acronym: *ATC*), which are currently in the licensing phase.

4.3.1. General and Licensing Aspects

Throughout 2017, the CSN issued the following favorable reports:

- Juzbado Fuel assembly factory: three favorable reports were issued on Tech Specs, Radiation Protection Manual and Emergency Plan.
- El Cabril repository: a favorable report was issued in relation to the periodic safety review.
- With regards to Ciemat, throughout 2017 the CSN drafted reports for the following licenses: modification of radioactive facility, reference IR-08: "Isotope Lab" and another to shelve the file due to withdrawal by the interested party.

4.3.2. Monitoring and Control of the Juzbado Fuel Assembly Factory

The Supervision System for the Juzbado factory is an adaption of the Licensee Performance Review (LPR) by the NRC. This adaption, made by the CSN, takes into consideration differences in existing regulations, in compliance with the agreement signed by the CSN on June 16, 2010. The process is included in procedure PG.IV.13 "Monitoring and Supervision System for the Juzbado Factory (Spanish acronym: *SSJ*)".

The CSN carried out 12 inspections of the Basic Inspection Plan of the Juzbado factory, as well as an inspection of encapsulated sources in use, as part of the management program for this type of sources.

In 2017, the *Juzbado* facility reported five events, none of them resulting in risks for the workers, the public or the environment. The CSN approved the issuance of a warning. During the year, the CSN did not propose the issue of any sanction proceedings.

4.3.3. Centralized Temporary Storage Facility

In January 2014, Enresa submitted construction license requests for the centralized temporary storage facility (Spanish acronym: *ATC*) for spent nuclear fuel and high-level radwaste. The CSN Plenary meeting held on July 15, 2015, focusing on the radiological impact for the Environmental Impact Assessment (EIA), informed that the normal operation of this facility had no significant radiological impact on people and the environment.

The CSN Plenary meeting held on July 27, 2015, after assessing the pre-license or site request, as well as the technical assessment proposal, reported favorably on the request, with limits and conditions. In 2017, the CSN continued with the assessment process associated to the issuance of the mandatory report relating to the construction license request.

Since 2014 and due to assessment activities, six requests for additional information have been issued. Furthermore, Enresa submitted throughout 2017 its responses to the Technical Instruction for application of Directive 2009/71/Euratom, on nuclear safety at nuclear facilities.

Following the CSN Board approval of the Complementary Technical Instruction in December 2016 with the aim to comply with the content of Royal Decree 1308/2011, dated December 26, on security of nuclear facilities and materials and of radioactive sources, Enresa responded in 2017 to the Complementary Technical Instruction. The CSN is currently evaluating the response within the framework of the construction license.

In 2016, pre-operational Environmental Radiation Monitoring Program (Spanish acronym: *PVRA*) activities were launched in the area of the facility. The basic objectives during this phase are to determine the radiological background of the facility and to fine-tune sampling and analysis procedures, as well as the equipment required for operation *PVRA* development. During the 2017 campaign, 56 samples were taken and 169 analyses were performed.

In 2017 three inspections were carried out: The first one focused on the Environmental Radiation Monitoring Program (*PVRA*), the second on the Quality Assurance Program application in Centralized Temporary Storage Facility activities and the third on confirming the results of the complementary action plan for site characterization and actions included within the CSN's favorable report on the pre-license request,

as well as on the proposal for associated Complementary Technical Instructions.

4.3.4. Monitoring and Control of El Cabril Radwaste Disposal

This facility carries out evolutions relating to the reception, temporary storage, treatment, conditioning and permanent storage in cells of radwaste of very low, low and medium activity generated by nuclear and radioactive facilities in Spain.

Since 2014, the CSN implements a specific supervision and control system program in this facility, according to procedure PG.IV.15 "System for supervision and control of El Cabril Radwaste Disposal".

As a result of monitoring and controlling operations, evaluating periodic reports submitted by this facility, and carrying out CSN inspections, it was concluded that activities were developed in accordance with existing regulations and operating license limits and conditions.

As of December 31, 2017, the total number of low- and mid-level disposal units stored on the north and south platforms amounted to 6,816, accounting for 76.07% of the total capacity. The total number of very low-level disposal units on the east platform amounted to 15,977. The total volume occupied in cells 29 and 30 on the east platform was 48.3%.

In cells 26, 27 and 28 on the south platform, 95 ISO casks containing wastes from steelworks incidents, are temporarily stored.

In 2017, low- and mid-level radwaste was stored in cell 19, which remained operational until November, when filling of cell 25 began. Very low-level radwaste was disposed of in section 1 of cell 29 and in cell 30.

In relation to waste characterization and verification activities, the characterization testing of small producer samples and the analysis of packages in Temporary Store Modules, continued in 2017.

Radiochemistry testing of a reduced amount of non-conditioned waste from some nuclear power plants and technical verification of package testing, also continued in 2017. Within optimization and development processes, other ongoing initiatives are the project for proficiency testing of chemical compositions of an inactive sample, and within the European CAST project, active testing for analysis of C-14 release in activated stainless steel. Testing of the toxicity and stabilization of three samples from steelworks incidents, was completed. Lastly, tests performed within the framework of a waste characterization protocol applied to two nuclear power plant packages, were also completed.

On April 6, 2017, the annual emergency drill was performed.

In 2017, Enresa presented a request to Spain's Department of Energy, Tourism and Digital Agenda for approval of the Tech Specs document, revision 14, as well as a request for a favorable report to the CSN in relation to the radiological capacity update of storage systems at El Cabril.

In 2017, no sanction proceedings were opened, no warnings were issued and no licensee events occurred.

4.3.5. Monitoring and Control of the Public Research Agency for Energy, Technology and Environment (Ciemat)

Ciemat has an operating license as a unique nuclear facility. The license was granted by resolution of the former Department of Energy on July 15,

1980. Additionally, a resolution dated February 3, 1993, includes a catalog of Ciemat's nuclear and radioactive facilities differentiated in two groups: one including facilities not operating, shutdown, undergoing dismantling for decommissioning or already decommissioned, and the other comprising 21 second- and third-category radioactive facilities still in operation. For each of the Agency's radioactive facilities, there are operating limits and conditions established by resolution of Spain's Directorate General for Energy Policy and Mining.

In 2002, the CSN issued a favorable report for revision 2 of the Master Plan for implementation of the integrated plan to improve Ciemat facilities (*PIMIC*).

The dismantling project (*PIMIC*-Dismantling) affects the area that housed the main nuclear facilities of the former Junta de Energía Nuclear (Spanish acronym: *JEN*) and is being carried out by Enresa.

In 2017, with regards to *PIMIC*-Dismantling Project activities and in addition to surveillance and control tasks in facilities where radwaste is stored while awaiting offsite dispatchment, one of the activities carried out included managing and shipping to the El Cabril site most of the radwaste stored.

The rest of the site, which is not part of the *PIMIC*-Dismantling Project, is subject to the so-called *PIMIC*-Rehabilitation project and includes those facilities already under dismantling as well as restoration activities in radiologically affected areas of the center. In 2017, four scheduled PIMIC-Rehabilitation project activities aimed at declassifying surfaces and faces, were carried out.

Throughout 2017, ten inspections were carried out at the center, seven of them previously scheduled.

On December 31, 2017, the usage level of temporary radwaste storage facilities included within the PIMIC-Dismantling project, was 34.07%.

In 2017, the CSN did not propose the issuance of any sanction proceedings or warnings against this facility.

Throughout 2017, there were no licensee events.

4.3.6. Uranium Concentrate Manufacturing Plants

4.3.6.1. Quercus Plant

The Quercus facility for manufacturing of uranium concentrates, is in the permanent shutdown stage. After a number of delays caused by the possibility of restarting the plant, Enusa eventually requested to Spain's Department of Industry, Energy and Tourism on September 14, 2015, a license for phase 1 of the dismantling and shutdown process.

During 2017, activities focused on the treatment of liquid effluents collected from existing mining site drains in the area (strip pit waters), as well as on conditioning and discharging supernatant liquids from the tailings dam.

In 2016 and 2017, the CSN asked Enusa for additional information on the documentation supporting the phase 1 license request for Quercus plant dismantling and shutdown. As a result, Enusa had to put together a new revision of the abovementioned support documentation, which was submitted to the CSN in December 2017.

Throughout the year, there were no limiting conditions for operation and no incidents with radiological consequences for workers or the environment. As part of the Quercus plant supervision and control program, the CSN carried out two inspections.

The CSN, throughout 2017, did no propose the opening of sanction proceedings or issued warnings against this facility.

4.3.6.2. Retortillo Plant

Spain's Department of Industry, Energy and Tourism granted the company Berkeley Minera España, SL, (BME) a preliminary license for the Retortillo Plant as a radioactive facility within the first-category nuclear fuel cycle for manufacture of uranium concentrates. The license was published in Ministerial Decree IET/1944/2015 of September 17, and included in Spain's Official Gazette nº 230 of September 25, after being favorably reported by the CSN on July 8, 2015, with limits and conditions.

In October 2016, Spain's Department of Energy, Tourism and Digital Agenda asked the CSN for the mandatory report on the Retortillo Plant construction license request, pursuant to the Regulation on nuclear and radioactive facilities. The necessary support documentation was attached. In late 2017, the documentation is being assessed by the CSN. Together with the construction license request, and in line with pre-license conditions, BME submitted to the CSN an update of the Underground Water Control and Monitoring Program (*PVCAS*) and of the pre-operational Radiation Monitoring Program (*PVRA*). These documents are currently being assessed.

In 2017, the Retortillo-Santidad site was inspected twice. The first inspection focused on the pre-operational Underground Water Control and Monitoring Program (*PVCAS*), whereas the second checked construction project aspects relating to the release of radioactive liquid and gaseous effluents.

4.3.7. Uranium Mining

This heading refers to proceedings for granting operating licenses to uranium mining resources, and permits to research such resources, currently carried out by the company Berkeley Minera España, SL (BME).

In April 2014, the Autonomous Community Government of Castile-Leon granted BME a permit to operate the Retortillo-Santidad site. Prior to beginning operations, BME must comply with a number of radiation protection instructions and considerations established by the CSN. During 2017, BME submitted technical documentation focused on this objective.

4.4. Facilities Under Permanent Shutdown, Dismantling and Decommissioning

The following fuel cycle nuclear or radioactive facilities are permanently shutdown or in the dismantling or decommissioning phase: Vandellós I and José Cabrera nuclear power plants, Elefante uranium concentrate plant and Andújar uranium factory (Spanish acronym: *FUA*)

Vandellós I nuclear power plant is since early 2005 in the latency phase of its dismantling program. Four inspections were carried out in 2017, with no warnings, sanctions or licensee events recorded in this facility.

Enresa continues with dismantling activities at the José Cabrera nuclear power plant. As of December 31, 2017, some 84% of activities in the Dismantling and Decommissioning Plan had been performed. A total of 15 inspections were carried out in 2017, with no warnings, sanctions or licensee events recorded in this facility.

Dismantling of the Elefante Plant was completed in 2004. The site, adjacent to the Quercus plant and the Saelices mining center facilities, has already been reconditioned. An inspection of the old Elefante plant was carried out in 2017 with the aim to monitor scheduled activities during the compliance period.

The Resolution by the Directorate General for Energy on March 17, 1995, authorized the so-called compliance period for the reconditioned site of the former Andújar Uranium Factory. Throughout 2017, two inspections were carried out to verify general, radiological and hydrological conditions specified within the monitoring and maintenance program.

4.5. Radioactive facilities

4.5.1. General Aspects

Radioactive facilities are subject to authorization by the Directorate General for Energy Policy and Mining of Spain's Department of Energy, Tourism and Digital Agenda, or by agencies of regional governments to which executive competences were transferred in this area. Such authorization requires the submittal of a mandatory, binding report from the CSN.

As of December 31, 2017, specific executive competences on 2nd and 3rd category radioactive facilities, were transferred to the following Autonomous Community governments: Aragón, Asturias, the Balearic Islands, the Canary Islands, Cantabria, Catalonia, Castile-Leon, Ceuta, Extremadura, Galicia, La Rioja, Madrid, Murcia, Navarre, the Basque Country and Valencia.

Diagnostic X-ray facilities are managed by regional governments, being governed by a specific regulation that establishes a declaration and registration system.

Throughout 2017, the operation of radioactive facilities for scientific, medical, agricultural, commercial and industrial purposes was accomplished within existing safety standards, adhering to required measures for radiological protection of people and the environment.

Table 4.5.1 shows the evolution in the number of radioactive facilities.

Tabla 4.5.1. Evolution in the Number of Radioactive Facilities

Category	Field of application	2013	2014	2015	2016	2017
1st	Irradiation	1	1	1	1	1
	Research	1	1	1	1	1
	Subtotal	**2**	**2**	**2**	**2**	2
2nd	Commercialization	67	68	67	69	68
	Research & Training	98	101	94	91	90
	Industry	538	517	493	485	468
	Medicine	323	329	322	324	324
	Subtotal	**1,026**	**1,015**	**976**	**969**	**950**
3rd	Commercialization	17	17	18	18	18
	Research & Training	89	83	78	78	76
	Industry	217	220	226	226	229
	Medicine	37	35	29	28	27
	Subtotal	**360**	**355**	**351**	**350**	**350**
	Medical X-ray	34,592	35,302	36,293	37,142	37,931
	Total	**35,980**	**36,674**	**37,622**	**38,463**	**39,233**

Generic Issues

A Generic Issue is any safety problem related to radiological safety that could affect facilities and leads to special supervision by the CSN. Such supervision may involve the submittal of instructions or circular letters to all facilities or specific sectors to require actions, inform of relevant developments, or request the analysis of experiences that may affect them. Generic issues can also result from the analysis of events occurred in Spanish or foreign nuclear facilities, as well as from the analysis of standards issued by international agencies or Regulatory Bodies from other countries.

Generic actions carried out by the CSN in radioactive facilities in 2017, are summarized below:

- Radioactive facilities with viability issues.

  In 2017, the CSN formalized and Action Protocol for scenarios with risk of radioactive source abandonment, requesting the submittal to the Technical Directorate for Radiation Protection of a report describing the inventory and status of each radioactive source every six months. In late 2017, the inventory included 24 facilities under special supervision, as well as 58 facilities removed from the protocol after solving their issues and submitting the radioactive source to an authorized, well-established site, to the vendor or to Enresa.

- Increased control of encapsulated high-activity sources.

  The CSN has developed an IT application for licensees of encapsulated high activity sources to register source data. As of 2017, all licensees use inventory pages on the CSN's IT application designed for that purpose.

- As a result of operating experiences occurred in Spain, the Radiation Protection Directorate sent a circular letter in April to all radioactive industrial gammamaphy facilities to warn them on Sentinel equipment maintenance deficiencies that they would need to fix.

4.5.2. Licensing

Main Activities

Within the framework of radioactive industrial and research facilities, modification of the *Sincrotrón Alba* radioactive facility was authorized in 2017, including a new line of *Lorea* light. Commissioning of laser accelerator *Vega 2* at the radioactive facility of CLPU (center for ultraintense and ultrashort laser pulses) was authorized after completion of the mandatory inspection. Furthermore, authorization, operation and commissioning of the laser facility at the University of Santiago de Compostela, was assessed within the framework of the LaserPet project.

A high percentage of commissioning requests and some modification requests submitted this year, refer to portable jet-type equipment used for material analyses. The increased use of this type of equipment was already detected in previous years and has continued in 2017.

In relation to the licensing process for medical facilities, requests received this year referred mainly to the modification of external radiotherapy facilities. This is caused by replacement of old linear accelerators due to application of new techniques, such as Image Guided Radiation Therapy (IGRT), Intensity-Modulated Radiation Therapy (IMRT) and Stereotactic Body Radiation Therapy (SBRT), as well as by three-dimensional conformal radiotherapy. Still in relation to radiotherapy, the first request for a proton radiotherapy facility in Spain was received in 2017.

The CSN is participating together with the Spanish Medical Physics and Radiation Protection Societies, in the delivery of courses for users of radiotherapy facilities in hospitals. The course focuses on the Risk Matrix methodology, allowing users to perform their own risk assessments onsite, as required by the new Directive 2013/59/Euratom, which is currently being transposed to the Spanish regulatory framework.

Throughout 2017, a total of 334 decisions were made in relation to radioactive facility licenses. CSN personnel assessed 255 of those requests, with the remaining assessments being made by technical personnel in the Spanish Autonomous Communities authorized to do so: Catalonia (48); the Balearic Islands (5) and the Basque Country (26).

With the aim to illustrate the submittal of licensing dossiers and the capacity of the CSN to respond to report requests, table 4.5.2.1 shows the requests received in 2017, the reports drafted that year, as well as the reports pending on December 31.

Tabla 4.5.2.1. Number of Licensing Files Received, Settled and Pending for Different Types of Radioactive Facilities

	Type of request			Total
	Operation	Modification	Shutdown	
Request received in 2017	38	263	32	333
Requests settled in 2017	30	258	46[a]	334
Requests pending report as of 31/12/17	15	68	5	88

[a] Settled permanent shutdowns include those requested by licensees and those shut down ex officio. An ex officio permanent shutdown is proposed by the CSN when it identifies that the licensee has disappeared and/or abandoned the facility and the radioactive sources have been removed.

4.5.3. Inspection, Monitoring and Control of Facilities

Throughout 2017, the 1,374 inspections of radioactive facilities were distributed as follows:

- 462 were performed by CSN staff.
- 41 were performed by CSN-certified personnel, ascribed to the Autonomous Community Government of the Balearic Islands.
- 295 were performed by CSN-certified personnel, ascribed to the Autonomous Community Government of Catalonia.
- 166 were performed by CSN-certified personnel, ascribed to the Autonomous Community Government of the Basque Country.
- 70 were performed by CSN-certified personnel, ascribed to the Autonomous Community Government of Asturias.

- 41 were performed by CSN-certified personnel, ascribed to the Autonomous Community Government of the Canary Islands.

- 86 were performed by CSN-certified personnel, ascribed to the Autonomous Community Government of Galicia.

- 42 were performed by CSN-certified personnel, ascribed to the Autonomous Community Government of Murcia.

- 52 were performed by CSN-certified personnel, ascribed to the Autonomous Community Government of Navarre.

- 119 were performed by CSN-certified personnel, ascribed to the Autonomous Community Government of Valencia.

In addition to inspections, the review of annual reports is a key element for controlling facilities. In 2017, the CSN received some 1,300 annual radioactive facility reports, around 5,000 of them on medical diagnosis X-ray facilities, as well as 348 quarterly commercialization reports.

The analysis of minutes resulting from inspections, of annual facility reports, of radioactive material and equipment information provided by commercialization facilities and of waste management data supplied by Enresa, led to the submittal of 357 control letters relating to various technical licensing and control aspects applicable to the facilities.

In terms of control, it is also worth mentioning that the 37 complaints received in 2017 in relation to radioactive and radiodiagnosis facilities, were duly addressed. When rendered suitable, an inspection visit was made, informing complainants on facility status and submitting a letter to the licensee, when applicable.

4.5.4. Incidences and Coercive Actions

During 2017, 17 incidences were recorded in radioactive facilities. Following the launching of a pilot experience in 2016 to enable a more systematic assessment of all events reported by Spanish radioactive facilities, a new process was formalized in 2017 with the approval of procedure *Panel to Review Regulatory and Operating Experience associated to Radioactive Facility Incidents* (Spanish acronym: *PIRA*). With that aim, a database (*SUCRA*) linked to the radioactive facility database was developed, enabling the upload of operating experiences and events for analysis.

In 2017, the CSN proposed to the Autonomous Community Government of Castile-Leon the opening of sanction proceedings due to serious infringement by a radioactive facility specializing in soil humidity and density measurements. Similarly, it was proposed to revoke the license and confiscate all the radioactive material of that same facility.

The CSN made a similar proposal to the Madrid Autonomous Community Government, requesting license withdrawal and radioactive material confiscation, as well as opening sanction proceedings against a radioactive facility specialized in soil humidity and density measurement, due to serious infringement.

As a result of facility control assessment and inspection activities, 31 warnings were issued by the CSN, 5 by the Autonomous Community Government of Catalonia, 29 by the Autonomous Community Government of Basque Country and 5 by the Autonomous Community Government of the Balearic Islands, requesting licensees to correct the deviations identified within two months. In one case, a coercive fine was imposed due to the non-implementation by a radioactive facility licensee of the corrective actions required in the warning.

4.6. Service Organizations, Licensed Personnel and other Activities

This section refers to companies or organizations subject to existing regulations that can provide services to third parties in the field of radiation protection. It also includes radiation protection services, technical radiation protection units, companies selling and providing technical assistance for medical X-ray equipment, personal dosimetry services and external registered companies.

In relation to radiation protection services, in 2017 the CSN authorized one and modified an additional eight ex officio, meaning that at the end of the year, the number of these CSN-authorized services was 86. A total of 21 control inspections were performed by authorized radiation protection services. Additionally, 4 licensing inspections were carried out to check evaluation aspects relating to radiation protection service license or modification requests.

The CSN did not license any technical radiation protection unit in 2017, but it did license the modification of an existing one. At the end of the year, the number of these CSN-authorized units was 41. Seventeen control inspections of technical radiation protection units were carried out, two by CSN-certified personnel ascribed to the Regional Government of Catalonia.

Dosimetry monitoring of workers exposed to ionizing radiations services is regulated by Spain's Royal Decree 783/2001, which establishes that individual dosimetry must be ensured by personal dosimetry services expressly authorized by the CSN.

In 2017 and within the area of external dosimetry, a new dosimetry service was licensed, being the first one in Spain to use Optically Stimulated Luminescence (OSL). Furthermore, licenses previously granted to other three services were modified. As a result, at the end of the year the number of authorized external dosimetry services was 21.

In the field of internal dosimetry, no new services were licensed, although an existing one was modified. At the end of the year, the number of authorized internal dosimetry services was nine.

Eight control inspections and a licensing inspection, were carried out.

Throughout 2017, the necessary tests were made prior to awarding 7 radiation protection service manager diplomas, five of them for radiation protection services and the other two for technical radiation protection units.

External companies (or contractors) whose workers perform activities in controlled areas have to be registered with the CSN. At the end of 2017, a total of 1,941 external companies were registered with the CSN, most of them providing their services in nuclear power plants.

In 2017, the CSN reported on the license granted to eleven new companies specializing in sales of and technical support for medical radiodiagnosis equipment. Furthermore, it modified 7 existing licenses, meaning that at the end of the year, the number of authorized sales and technical support companies amounted to 344.

Around 50 annual reports on activities performed by sales and technical support companies in 2016 were assessed during 2017.

The existing personnel licenses currently active in Spain for all radioactive and nuclear facilities, are as follows:

Radioactive Facilities

Table 4.6.1 shows the number of radioactive facility licenses that were awarded, renewed and valid as of December 31, 2017. Ciemat and nuclear fuel cycle licenses are not included.

Tabla 4.6.1. Radioactive Facility License Award and Renewal. Year 2017

Facility	New licenses and extensions					Valid 31/12/17		
	Awards			Extensions				
	Supervisor	Operator	Protection Service Manager	Supervisor	Operator	Supervisor	Operator	Protection Service Manager*
1st Category Radioactive Facility (fuel cycle excluded)	3	1	–	–	4	11	30	1
2nd and 3rd Category Radioactive Facility (Ciemat excluded)	300	1,084	7	406	781	3,738	9,720	193
Total	303	1,085	7	406	785	3,749	9,750	194

* Protection Service Manager (including Technical Radiation Protection Unit Service Manager).

Tabla 4.6.2. Nuclear Power Plant License Award and Renewal throughout 2017

Facility	New licenses and renewals					Valid 31/12/17		
	Awards			Renewals				
	Supervisor	Operator	Protection Service Manager	Supervisor	Operator	Supervisor	Operator	Protection Service Manager
Santa María Garoña	–	2	–	–	–	13	7	2
Almaraz I y II	2	3	–	2	4	27	35	4
Ascó I y II	–	4	–	–	1	32	39	4
Trillo	4	–	–	–	–	17	15	2
Cofrentes	1	–	–	–	1	20	21	4
Vandellós II	1	3	–	1	–	21	20	4
Total	8	12	–	3	6	130	137	20

Throughout 2017, the CSN issued 243 licenses to manage and 1,112 to operate medical radiodiagnosis facilities. Furthermore, 1,808 accreditations to direct and 2,654 accreditations to operate were granted to individuals who successfully completed training courses. These individuals can now manage and operate medical diagnosis equipment in X-ray facilities, according to the minutes submitted by organizations certified to deliver such courses.

As of December 31, 2017, the total number of certified individuals was 149,680, of whom 60,935 are accredited to manage and 88,745 to operate radiodiagnosis facilities, respectively.

Nuclear Power Plants

Table 4.6.2 shows the list of licenses that were awarded, renewed and valid in Spanish nuclear power plants on December 31, 2017.

Other Facilities

During 2017, 11 radioactive facility licenses were renewed at Ciemat, two operator licenses were renewed at El Cabril radwaste repository and two operator licenses were renewed at José Cabrera

nuclear power plant; ten radioactive facility supervisor licenses were renewed at Ciemat; a supervisor license was renewed at José Cabrera nuclear power plant, a supervisor license was renewed at Vandellós I nuclear power plant, two supervisor licenses were renewed at El Cabril radwaste repository and two supervisor licenses were renewed at the Quercus Plant, one of which was temporarily suspended.

Four new Quercus Plant operator licenses were awarded, as well as a new operator license for Ciemat's radioactive facilities. Six new radioactive facility supervisor licenses were awarded in Ciemat and a new supervisor license was granted in José Cabrera nuclear power plant.

Table 4.6.3 shows the list of licenses that were awarded, renewed and valid on December 31, 2017.

Specialized training for individuals who obtain the operator and supervisor licenses for radioactive facilities, are delivered via CSN-certified courses. In the case of radioactive facilities, this function is developed in CSN Safety Guide 5.12 *Certification of training courses for supervisors and operators of radioactive facilities*, whereas for facilities specializing in medical radiodiagnosis, it is developed in CSN Instruction IS-17, on *Certification of training courses and accreditations for personnel managing or operating medical diagnosis X-ray equipment*. With regards to training courses for radioactive facility personnel, in 2017 a new site was certified. Furthermore, the certificate of an additional six sites was modified. In the Autonomous Community of the Basque Country, where these competences are transferred, the certificate of another site was also modified.

Tabla 4.6.3. Nuclear and Cycle Facility License Award and Renewal throughout 2017

Facility	New licenses and extensions					Valid 31/12/17		
	Awards			Extensions				
	Supervisor	Operator	Protection Service Manager	Supervisor	Operator	Supervisor	Operator	Protection Service Manager*
Juzbado Factory	2	1	–	–	–	14	42	2
Saelices Center (Quercus & Elefante Plants)	–	4	–	2	–	2	8	1
Ciemat Nuclear Facilities	–	–	–	–	–	1	1	–
Ciemat Radioactive Facilities	6	1	–	10	11	56	52	2(1)
El Cabril Radwaste Repository	–	–	–	2	2	5	9	3
Vandellós I	–	–	–	1	–	3	–	1
José Cabrera	1		–	1	2	4	3	2
Total	9	6	–	16	15	85	115	11

* Protection Service Manager (including Technical Radiation Protection Unit Service Manager). (1) Also for nuclear facilities.

With regards to accreditation courses to manage and operate radiodiagnosis facilities, four new organizations were certified and twelve existing certificates were modified.

The CSN carried out 59 inspections with the aim to assess 85 courses on radioactive facilities. Additionally, in line with competences delegated onto them, the Autonomous Communities of the Basque Country and Catalonia informed in 2017 that they carried out seven and eighteen inspections of radioactive facility courses, respectively. The CSN itself carried out twelve inspections of courses for personnel accreditation in medical radiodiagnosis facilities.

Article 74 of the Regulation on nuclear and radioactive facilities establishes the need to license, once authorized by the CSN, other activities such as: Manufacture of ionizing radiation generators or radioactive equipment, introduction in the Spanish market of consumer products containing radioactive material, marketing of ionizing radiation generators or radioactive materials and devices containing radioactive materials, transfer of radioactive material with no owner to any authorized organization, as well as technical support for radioactive devices and ionizing radiation generators.

With regards to licenses to market and provide technical support for ionizing radiation generators that could be granted to companies not required to have radioactive facilities due to the nature of their activities, the CSN issued 32 reports in 2017: 19 modifications of existing licenses, 9 new licenses, 1 to be archived and 3 for shutdown.

The CSN issued 4 favorable reports for radioactive equipment manufacture in 2017.

In 2017, the CSN issued 30 favorable reports, 23 for modification and 7 authorizing the approval of 51 radioactive device models. For the most part, radioactive device approvals referred to X-ray equipment, which can be controlled more effectively in terms of risk by having good design and maintenance standards that preserve the conditions in which it was approved.

4.7. Transport of Nuclear and Radioactive Materials

In Spain, the transport of radioactive material is governed by a series of regulations on the transport of hazardous goods by road, rail, air and sea, in line with international regulatory arrangements based on the IAEA's Regulation for the Safe Transport of Radioactive Materials.

Transport safety relies mainly on the safety of the packaging, with operational controls during shipment being secondary. In that regard, regulations focus on packaging design requirements and on standards to be met by the shipper, who is the party that prepares the package (packaging plus content) for shipment. There are five types of packages: excluded, industrial, type A, type B or type C.

Most transports in Spain relate to radioactive material of medical or research application, within the excluded type or type-A packages. Radwaste from nuclear and radioactive facilities that is transported to the El Cabril Disposal normally includes excluded packages of the industrial type or type A. These type of packages are for low- or mid-risk contents. Contents with a higher risk are transported in fissionable material packages or packages type B and C.

Licensing activities include the following:

- Approvals of transport package designs and transport licenses required by hazardous transport regulations.

- Security licenses and registration of organizations that transport materials requiring

security measures, in accordance with Spain's Royal Decree 1308/2011, dated September 26, on security of nuclear materials and facilities, and protection of radioactive sources.

- Radwaste transport licenses, in accordance with Spain's Royal Decree 243/2009, dated February 27, regulating the supervision and control of spent nuclear fuel and radwaste transports between Member States or coming inside or going outside a particular region.

In 2017, a Spanish package design was licensed and three approved foreign designs were validated. Similarly, the CSN issued a favorable report for a new spent nuclear fuel transport cask design. Throughout the year, three transport licenses, three security licenses and a radwaste transport, were reported.

Also in 2017, 70 inspections focused on transport were carried out: 20 by the CSN and 50 by organizations of Spanish Autonomous Communities where these services have been delegated. In addition to these transport-focused inspections, radioactive material transport requirements were controlled during inspections carried out at radioactive facilities, as such inspections also look into transport-related aspects.

A total 53 shipments of fissile material were carried out. Enresa carried out a total of 304 shipments to El Cabril facility from nuclear facilities (272) and radioactive facilities (32).

In 2017 there were seven events during the transport of radioactive material, all affecting industrial type or type A packages. Six of these were classified as level 0 (off scale, with no safety significance), in accordance with the IAEA's International Nuclear and Radiological Events Scale (INES), and the other as level 1 (Anomaly).

The event in this case was the robbery of a package containing soil density measurement equipment, which was eventually found.

In 2017, there were 177 exposed workers who provided their services in the area of transport, a slight increase compared to the previous year. Out of those 177, 94 received significant doses (higher than zero). Dosimetry readings resulted in a collective dose of 183.36 mSv·person and an average individual dose of 1.95 mSv/year, 3.9% in relation to the maximum legal annual dose.

Individual dose decreased in comparison to the value obtained the year before (2.22 mSv/year). Collective dose also decreased (189.04 mSv·person). The number of users increased slightly and individual doses decreased in the various dose ranges considered. The abovementioned is considered a positive trend in a sector that historically had significant individual doses, always under the legal limits.

4.8. Activities and Facilities not Covered by Nuclear Regulations

The CSN also manages radioactive material detected in facilities not subject to nuclear regulations, including the removal of unauthorized radioactive material, removal of radioactive material in metallic materials and detection of radioactive materials in ports.

Removal of Unauthorized Radioactive Material

The management of radioactive materials which are not authorized, probably as a result of practices prior to the existence of nuclear regulations in Spain, usually involves the classification of such material as radwaste and its removal by Enresa.

During 2017, the CSN drew up reports for 24 transfer licenses to Enresa for various radioactive

materials and sources. In 15 of these cases, the requesting company or organization did not have a radioactive facility, whereas the remaining requesters were facility licensees. One of the 24 reports was drawn up by the delegated staff in Catalonia, one by the Basque Country delegated staff and one by the Balearic Islands delegated staff

Removal of Radioactive Material detected in Metallic Materials

The Collaboration Protocol for Radiological Monitoring of Metallic Materials is the reference framework for radiological monitoring of metals to be recycled in Spain. As a result of protocol application, 46 cases of radioactivity detection in metallic materials were communicated to the CSN throughout 2017.

Facilities affected by radioactive source melting incidents

During 2017 there have been no incidents involving the melting of radioactive sources.

Radioactive material detected in seaports

The Action Protocol for cases of illegal trafficking or inadvertent movement of radioactive material in ports of general interest (Algeciras, Valencia, Barcelona, Bilbao, Vigo, Tarragona and Santa Cruz de Tenerife), is a reference framework for radiological monitoring of merchandise entering Spain by sea. The protocol was signed in 2010 by the CSN, the IRS (Spanish acronym: *AEAT*), the Department of Home Security, the Department of Civil Works, the former Department of Industry, Tourism and Commerce, as well as the National Radwaste Management Company (*Enresa*).

As a result of protocol application, 7 cases of radioactivity detection in merchandise in the ports of Algeciras and Barcelona were communicated to the CSN throughout 2017. The radioactive materials detected were returned to their shippers or declared exempt. In two of those occasions, the radioactive materials were transferred to Enresa to be managed as radwaste.

5. Radiation Protection of Exposed Workers, the Public and the Environment

5.1. Radiation Protection of Workers

Control of radiation doses received by professionally exposed workers is ensured mainly through individual monitoring using passive physical dosimeters. However, in cases when the radiological risk is sufficiently low, doses are determined from the results of radiological monitoring in the areas where workers perform their professional activity.

The dosimetry of workers exposed to ionizing radiations services is regulated by Spain's Regulation on Sanitary Protection against Ionizing Radiation, which establishes that individual dosimetry must be ensured by personal dosimetry services expressly authorized by the CSN.

In late 2017, the National Dosimetry Bank had 24,483,225 dosimetry records corresponding to 369,774 workers and to 76,237 facilities.

The number of dosimetrically controlled workers who replaced their dosimeters correctly was 112,868, accounting for a collective dose of 17,645 mSv·person.

It is worth mentioning that although the maximum legal effective dose value in any given year is 50 mSv:

- 79% of dosimetrically controlled workers (88,899) received no dose.
- 96% of dosimetrically controlled workers (108,453) received a dose lower than 1 mSv/year.
- 99.75% of dosimetrically controlled workers (112,588) received a dose lower than 6 mSv/year.
- 99.99% of dosimetrically controlled workers (112,859) received a dose lower than 20 mSv/year.

This distribution highlights the good trend shown by Spanish nuclear and radioactive facilities regarding compliance with the dose limit (100 mSv over a five-year period) established in Spain's Regulation on Sanitary Protection against Ionizing Radiation.

During 2017, there were four cases in which the annual legal dose limit was potentially exceeded, all at radioactive facilities. An investigation process has been initiated.

Table 3.2.1 summarizes dosimetry information (number of workers, collective dose and average individual dose) for each occupational area considered in this report. In addition, figures 5.1.1 and 5.1.2 show the values for collective dose and average individual dose in these sectors.

Analysis of the aforementioned data underlines the following:

- Medical radioactive facilities have the highest collective dose (11,443 mSv·person), this being quite logical since these facilities employ the largest number of exposed workers (90,076).
- Transport facilities have the highest average individual dose (1.95 mSv/year), exceeding that of facilities in the dismantling phase.
- With regards to operating NPP, the number of dosimetrically controlled workers was 9,159, for a collective dose of 3,967 mSv·person and an average individual dose of 1.35 mSv/year. For

staff (2,113 workers) the collective dose was 498.3 mSv·person and the average individual dose 1.18 mSv/year, whereas for contractors (7,140 workers), the collective dose was 3,468.64 mSv·person and the average individual dose was 1.37 mSv/year.

- Regarding internal dosimetry, controls were carried out through direct whole body radioactivity measurements for all workers exposed to a significant risk of radionuclide intake. Values were never higher than the established registration level (1 mSv/year).

Figure 5.1.1. Collective dose and number of exposed workers per sector. Year 2017

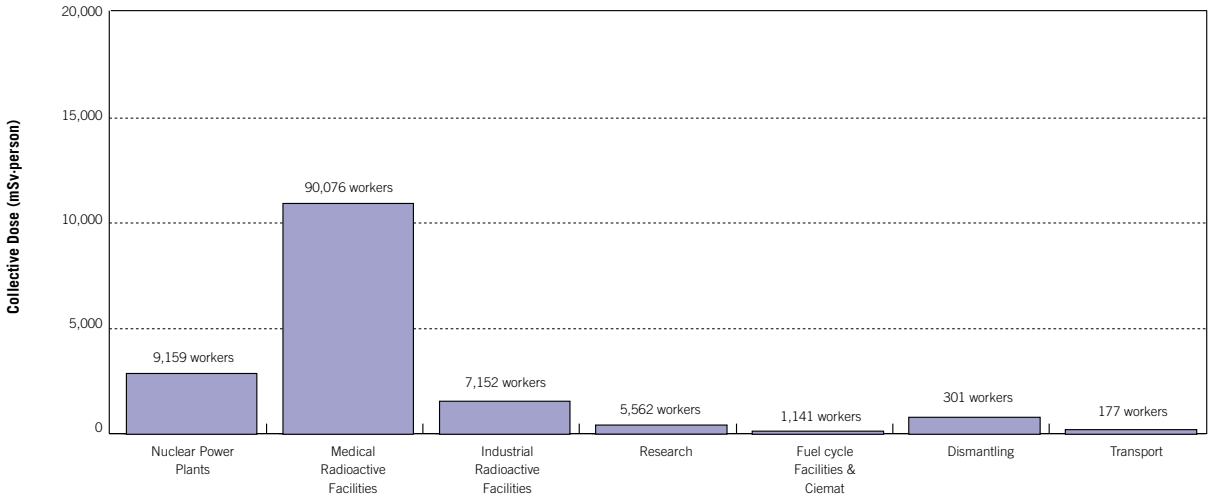


Figure 5.1.2. Average individual dose per sector. Year 2017

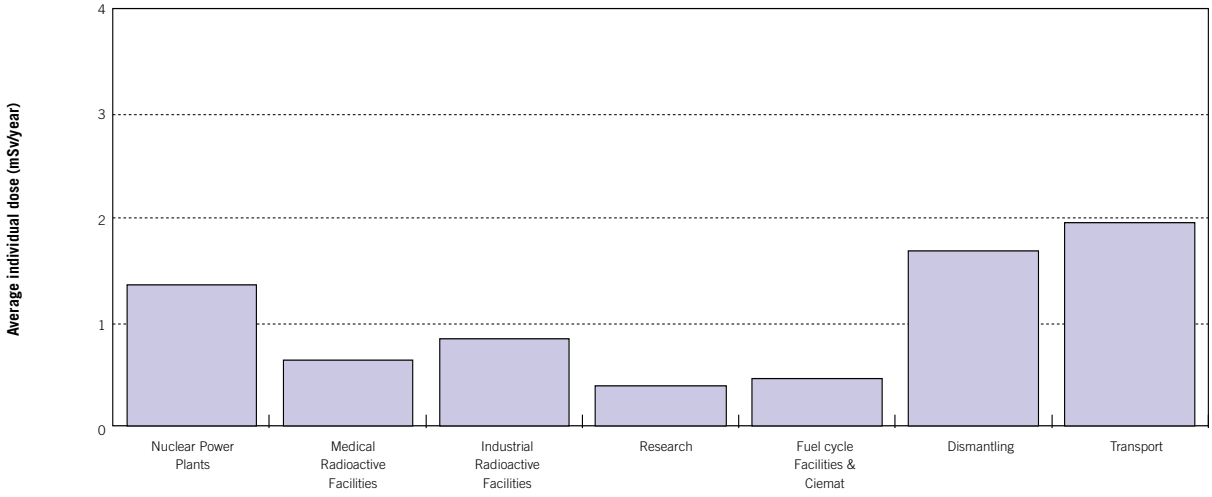


Figure 5.1.3. Three-year period average collective dose for PWR NPP. International comparison

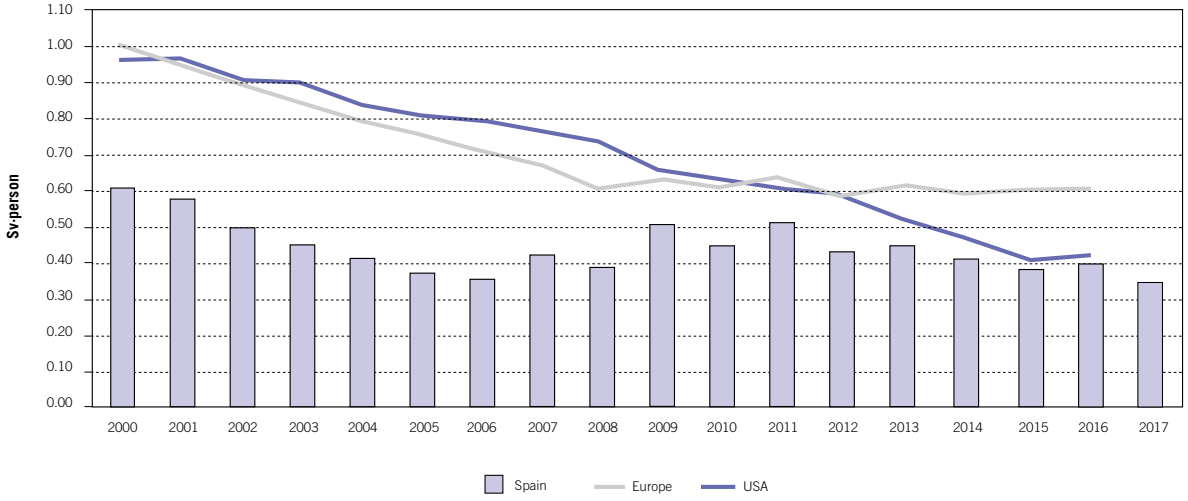
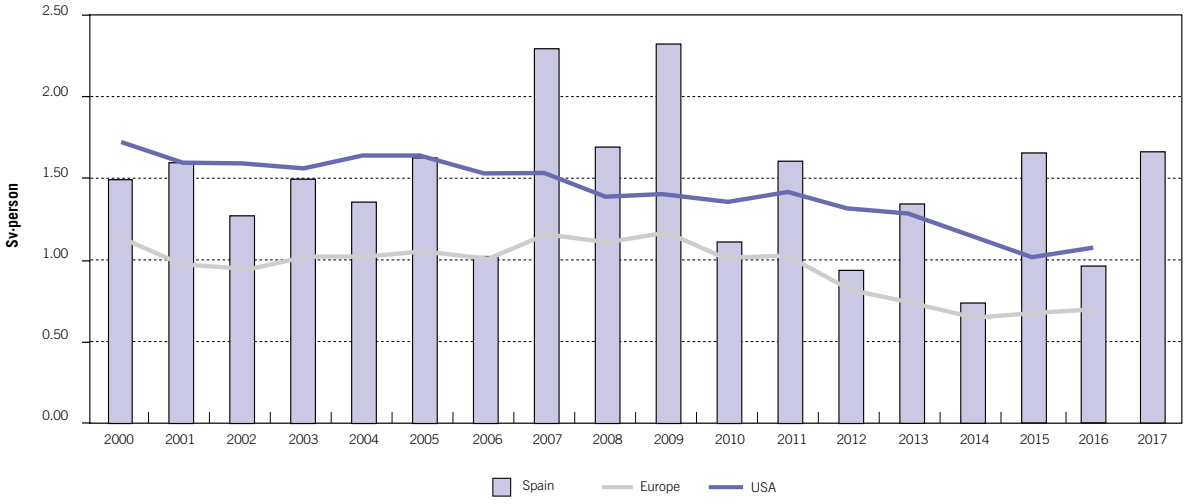


Figure 5.1.4. Three-year period average collective dose for BWR NPP. International comparison



Figures 5.1.3 and 5.1.4 show the evolution over time of the three-year collective dose per reactor type for the Spanish nuclear power plant fleet, compared to the values registered at an international level.

In order to evaluate the results, the following should be taken into account:

a) Pressurized Water Reactors (PWR)

During the three-year period 2015-2017, there has been a decrease in the three-year average collective dose per reactor in Spanish nuclear power plants. In 2017, four nuclear power plant units had a refueling outage: Almaraz I, Ascó I, Ascó II and Trillo.

Occupational doses in Spanish nuclear power plants of this reactor type continue to have lower values than the latest data available for European plants of the same type (three-year period 2014- 2015) and for USA plants (three-year period 2012-2014).

b) Boiling water reactors (BWR)

After 2013, year when Santa María de Garoña nuclear power plant was permanently shutdown, the average three-year collective dose values for BWR reactors only reflect the official dose data for Cofrentes nuclear power plant, thus impacting the results for this parameter.

Cofrentes nuclear power plant had a refueling outage in 2017. The dose value for BWR plants during the three-year period 2015-2017 was higher than in the previous three-year period because it includes two refueling outages in Cofrentes, as opposed to the last three-year period when there was only one. The three-year period collective dose values for BWR reactors in Spain are similar in the last two refueling outage periods.

The average three-year collective dose in Spanish BWR plants during the 2015-2017 period was higher than the latest three-year data available from USA and European plants for the three-year period (2014-2016).

5.2. Discharge Control and Environmental Radiation Monitoring

The CSN controls and oversees the radiological protection of the public and the environment, offsite releases of radioactive materials from nuclear and radioactive facilities, as well as their impact (one-off or aggregated) on areas near these facilities, all with the aim to estimate their radiological impact and monitor and ensure the radiological quality of the environment throughout the country.

Articles 35 and 36 of the Euratom Treaty establish that each Member State shall have the necessary facilities to control environmental radioactivity and regularly provide information on such controls to the European Union Commission.

With regards to environmental radiation monitoring, this report presents the results of Spain's environmental radiation monitoring programs (Spanish acronym: PVRA) for the year 2016, because the procedure followed for processing and analyzing samples does not provide the 2017 campaign results on time for inclusion in this report.

Control and monitoring of radioactive effluents

Spain's Regulation on Sanitary Protection against Ionizing Radiation (acronym: PSIR) requires facilities that might generate radwaste, to be equipped with adequate treatment and disposal systems. The aim is to guarantee that any dose due to releases remains under administrative license limits and as low as reasonably achievable.

For nuclear power plants, the CSN requires a program to control radioactive effluents and to keep resulting doses to the public as low as reasonably achievable and always under PSIR values.

The Radioactive Effluent Control Program (Spanish acronym: *PROCER*) is defined in the tech specs of the nuclear power plants and is developed in detail in the Off-Site Dose Calculation Manual (Spanish acronym: *ODCM*), which includes the requirements for effluent control and monitoring, as well as for environmental radiation monitoring. The remaining facilities have similar programs in place, being included in different documents depending on the facility.

Table 5.2.1 includes a summary of radioactive discharge limits for the facilities. Figures 3.2.2.1, 3.2.2.2, 3.2.2.3 and 3.2.2.4 show a graphic representation of radioactive liquid and gaseous effluents in PWR and BWR nuclear power plants.

Each month, the doses of radioactive discharges from the facilities are calculated, with the aim to confirm compliance with applicable limits,

applying simple criteria and conservative values; the methodology and hypothesis used are common for each type of facility, with the exception of specific site parameters. Additionally, according to article 53 of the *PSIR*, doses to the public are calculated annually based on realistic criteria.

The CSN monitors discharge trends and confirms compliance with applicable limits and conditions, with the aim to detect operational incidences and verify proper performance of treatment systems. Furthermore, this control is complemented with radioactive effluent inspections carried out periodically by the CSN on these sites.

Tabla 5.2.1. Discharge limits. Radioactive effluents

	Limits	Discharge	Variable	Value
Nuclear Power Plants	Operational restrictions	Total	Effective dose	0.1 mSv/y
		Gases	Effective dose	0.08 mSv/y (1)
		Liquids	Effective dose	0.02 mSv/y (1)
El Cabril	Dose limits	Gases (2)	Effective dose	0.01 mSv/y
Ciemat	Instant limits	Liquids	Activity concentration of known mixture	$\sum \frac{Ci}{CDAi} \leq 0.1$ (3)
			Activity concentration of unknown mixture	$C_{Emitters\ Alfa} \leq 0.1\ CDA_{Ra\text{-}226}$ $C_{Emitters\ Beta} \leq 0.1\ CDA_{Sr\text{-}90}$
	Dose limits(4)	Total	Effective dose	0.1 mSv/a
Juzbado	Dose limits	Total	Effective dose	0.1 mSv/a
Quercus	Increment over river background	Liquids	Activity concentration Ra-226	3.75 Bq/m^3
	Annual limit	Liquids	Activity Ra-226	1.64 GBq/a
	Annual limit	Gases	Average concentration mineral powder	15 mg/m^3
	Annual limit	Gases	Average concentration concentrate powder	5 mg/m^3
	Dose limit	Total	Effective dose	0.3 mSv/a

(1) Generic values, as liquid and gas distribution differs between sites.
(2) No liquid discharges.
(3) Concentration values resulting from the effective PSIR dose limit to the public, considering an intake rate of 657 l/year.
(4) Applicable to all radioactive liquid and gaseous effluents generated as a result of improvement tasks carried out within the framework of the *PIMIC* Project.

The CSN submits radioactive discharge information to the European Union Commission, the International Atomic Energy Agency (IAEA) and the OSPAR Convention, on a regular basis. Such information, together with that provided by other Member States, is included in periodic publications of these organizations.

Radiological Monitoring near the facilities[1]

Nuclear and radioactive facilities in the nuclear fuel cycle are required to have an Environmental

1 This report presents the results of Spain's environmental radiation monitoring programs (Spanish acronym: PVRA) for the year 2016, because the procedure followed for processing and analyzing samples does not provide the 2017 campaign results on time for inclusion in this report.

Radiation Monitoring Program (Spanish acronym: *PVRA*) that provides information on radioactivity levels in the main potential means of exposure for people in each site. The aim is to confirm, when applicable, the suitability of effluent monitoring programs and environmental radionuclide transfer models.

Facilities currently in the dismantling and/or permanent shutdown phase, implement an environmental radiation monitoring program commensurate with their situation and type of facility. Such facilities are the nuclear power plants of Vandellós I and José Cabrera, the former uranium mineral treatment plant *Lobo-G*, the Uranium factory of Andújar (Spanish acronym: *FUA*) and Ciemat's research center.

Table 5.2.2 provides information on all samples taken as a result of environmental radiation monitoring program implementation in nuclear power plants. Table 5.2.3 includes the total number of samples taken due to monitoring program implementation in nuclear and fuel cycle facilities.

In 2016, as part of the environmental radiological monitoring programs implemented at the facilities, 6,292 samples were taken in operating nuclear power plants (including Santa María de Garoña); 1,368 samples in fuel cycle facilities (Juzbado & El Cabril) and 2,517 samples in dismantling and decommissioning facilities (Ciemat + José Cabrera nuclear power plant + Vandellós I nuclear power plant + Quercus + *FUA* + LoboG).

Tabla 5.2.2. Number of samples taken by nuclear power plants in 2016

Type of samples	Garoña	Almaraz	Ascó	Cofrentes	Vandellós II	Trillo
Total atmosphere	466	785	843	778	828	792
Total water	196	212	129	142	91	157
Total foodstuffs	116	292	119	103	106	137
Total	778	1,289	1,091	1,023	1,025	1,086

Table 5.2.3. Environmental Radiation Monitoring Program: number of samples taken in cycle, shutdown, dismantling and decommissioning facilities in 2016

Facility	Juzbado	Cabril	Ciemat	Quercus/Elefante	José Cabrera	Vandellós I	FUA	LoboG
No of samples	595	773	693	625	771	337	48	43

All results are similar to those obtained in previous years, leading to the conclusion that the environmental quality around the facilities remains acceptable from a radiological point of view, without any risk for people as a result of facility operation or dismantling or decommissioning activities.

Environmental radiation monitoring results obtained by licensees in their areas of influence, are compared to values from CSN control programs (sampling and radiological analyses), known as Independent Environmental Radiation Monitoring Programs (Spanish acronym: *PVRAIN*). These programs are implemented directly or through specific collaboration agreements with five environmental radioactivity measurement university labs integrated within the Network of Sampling Stations (Spanish acronym: *REM*). These labs are in the same Spanish

Autonomous Communities as the facilities. Programs can also be implemented indirectly by contracting the service out to four independent labs (as it is the case in Catalonia and Valencia). Sampling points, the type of samples and the analyses carried out coincide with those of the licensees, with a scope accounting for some 5% of the environmental radiation monitoring program carried out by each site.

Program results for the 2016 campaign are generally equivalent to those obtained by the environmental radiation monitoring program in each site, with no significant deviation.

Radiation Monitoring in the Country

The CSN monitors the environment at a national level by means of a surveillance network known as *Revira*, in collaboration with other institutions. This network is made up of automatic stations that measure atmospheric radioactivity continuously (Spanish acronym: *REA*) and stations that collect air, soil, water and food samples for subsequent analysis (Spanish acronym: *REM*).

Monitoring programs take into consideration the agreements reached by European Union member States with the aim of complying with articles 35 and 36 of the Euratom Treaty. The European Commission drafted a recommendation on June 8, 2000, establishing the minimum scope of monitoring programs in order to comply with the abovementioned article 36. The recommendation considers the development of two monitoring networks:

- A Dense Network, with multiple sampling points to ensure the entire Member State territory is adequately monitored.

  Since 2000, Spain includes the collection of milk and drinking water samples. In 2008, the collection and analysis of typical diet samples was completed.

- A Spaced Network, comprised of only a few sampling points where very low detection thresholds are required to monitor the evolution of activity concentrations over time. In Spain it is comprised of sampling points of the so-called high sensitivity network, implemented in 2000 and including five sampling points for air, drinking water, milk and the so-called typical diet. In 2004, it was expanded to include two sampling points for inland water and another two for coastal water. In 2008, it was completed with the inclusion of a C-14 analysis for typical diet samples, and the addition of a new sampling point in the province of Caceres.

Network of Sampling Stations (REM)

The CSN has a specific agreement with CEDEX (Spain's Center for Public Works Studies and Experimentation) to ensure ongoing radiological monitoring of waters in all Spanish river basins within the dense network. A similar agreement exists for monitoring inland water within the spaced or high sensitivity network.

Figure 5.2.1 shows the points comprising the inland water and coastal monitoring network.

Radiological measurement results for these samples in 2016, confirm the performance observed over the years in the different basins. The main results are as follows:

- Activity index values for total alpha, total beta and other beta mainly reflect the geographical and geological characteristics of stream area soils. Furthermore, values can be sensitive to the incidence of urban waste.

- For total beta activity indexes, stations downstream from large population centers have the highest values due to urban waste.

- Throughout 2016, gamma emitter radionuclides from artificial sources analyzed

Figura 5.2.1. Network of CSN Sampling Stations for Inland Water and Coastal Water

within the dense network program, remained under the corresponding detection limits.

- The Cs-137 activity concentration values are amongst the lowest detected within the space network in the remaining European Union Member States

- Tritium concentration values are not radiologically significant.

The dense network program for environmental radiation monitoring in Spanish coastal waters is comprised of sampling areas some ten miles from the coast. Throughout 2016, samples were collected in the 15 points shown in figure5.2.1. The values for each analytical determination are quite homogeneous in all sampling points and similar to previous campaigns.

The CSN, by means of specific agreements with 20 labs from different universities and Ciemat, carries out a monitoring program for the so-called dense network and high sensitivity network, taking air, soil, drinking water, milk and typical diet samples in sampling points located around university campuses.

The overall result assessment is that values are coherent with background radioactivity levels, and in general remain relatively stable over different periods. The slight variations between the points are attributable to typical radiological characteristics of the different areas.

Network of Automatic Stations (REA)

The CSN's Network of Automatic Stations (Spanish acronym: *REA*) is made up of 25 stations distributed as shown in figure 3.2.2.5 (*REA*) of this report.

Each network station is equipped with instrumentation to measure gamma dose rate, radon concentration, radioiodines and airborne alpha and beta emitters. Online station data is received and analyzed at REA's supervision and control center, located at the CSN's emergency room (Salem).

An agreement between Spain's Weather Agency (Spanish acronym: *AEMET*) and the CSN, establishes that REA stations are located next to automatic AEMET stations, having a common communication system, with the exception of *REA* stations in Madrid (at Ciemat) and Penhas Douradas (Portugal). The latter is in the same location as a station of Portugal's radiological monitoring network. In turn, a Portuguese network station is in the same location as a REA station in Talavera la Real (Badajoz). This enables data comparison.

Throughout 2017, specific agreements to connect the CSN network and the automatic radiation monitoring networks of the Spanish Autonomous Communities of Valencia, Catalonia, the Basque Country and Extremadura, were successfully implemented.

The results of measurements taken in 2017 were characteristic of the environmental radiation background, indicating the absence of radiological risk for people and the environment.

On November 11, 2015, the CSN Board approved the functional proposal for the new Network of Automatic Radiation Monitoring Stations (REA). The new network will replace the old one, in operation since 1992, with the proposal to install 200 fixed stations, a number that can be extended with the installation of portable stations deployed in case of emergency in potentially affected areas. Considering the permanent shutdown of Santa María de Garoña nuclear power plant, it is now considered to install 186 automatic radiation measurement stations instead of the initial 200 included in the abovementioned functional analysis.

Throughout 2017, technical specifications for fixed and portable stations, software and communication systems of the new network, were defined. In 2018, an open tendering process will be launched for this new network. The possible locations of the new fixed stations have also been chosen, both in nuclear power plant planning areas specified in the modification proposal of the Basic Nuclear Emergency Plan (Spanish acronym: *PLABEN*), as well as in the rest of the country.

Intercomparison Campaigns

The CSN carries out an annual program of analytical intercomparison exercises with technical support from Ciemat, in which some 40 labs participate by taking low activity measurements. The aim is to ensure the quality of environmental radiation monitoring program results. These campaigns are a means of proven effectiveness to improve the reliability of program results.

The year 2017 saw the completion of the campaign initiated in 2016, in which the subject matter matrix distributed to participants corresponded to a type of calcareous soil, with natural and anthropogenic radionuclides prepared at the Quality Control Material Preparation Lab (Mat Control), in collaboration with the Environmental Radiology Lab, both from the University of Barcelona. A total of 39 labs participated.

The twenty-fourth session on environmental radiation monitoring was held at the CSN headquarters in November 2017. Campaign participants were presented the results of Ciemat's evaluation, which generally concluded that participating labs offered a satisfactory level of quality in their natural and artificial radionuclide determinations for soil samples with a low activity concentration.

5.3. Protection against Natural Radiation Sources

Throughout 2017, the CSN continued to develop and promote a number of strategies aimed at enhancing compliance with radiation protection regulations on labor activities involving exposure to natural radiation.

Within this work line, the pilot program for inspection of NORM industries (processing or generating radioactive material due to their natural radionuclide content) and work places prone to radon exposure, are worth mentioning. This program, to be developed over the two-year period 2017-2018, covers all sectors listed in the annex to CSN Instruction IS-33. A representative facility in each of these sectors is to be inspected. More specifically, the titanium dioxide factory of *Huntsman P&A SLU y Oligo SA*, in Huelva, and the thermal plant of *La Robla, de Gas Natural Fenosa*, in León, were inspected in 2017.

Furthermore, contacts continued with sector associations and Spanish Regions to promote the implementation of this standard and of Decree IET/1946/2013, which regulated NORM waste management. Gas and petroleum production facilities were requested to submit information to the CSN on NORM waste generation and management in their facilities as of 2013, year when the Decree came into effect. Evaluation of the information received began in 2017.

Collaboration with Spain's Department of Civil Works continued with the creation of a work group to develop specific standards for limiting radon entry into buildings. This standard will be a new section in Spain's new Technical Building Code (Spanish acronym: *CTE*).

In that regard, the Specific Collaboration Agreement between the CSN and the Universities of Barcelona, Cantabria, Las Palmas de Gran Canaria and Catalonia for characterization of radon concentration in representative soils within Spain, ended in 2017.

Based on the conclusions of this agreement, it was concluded that a fully reliable integration of an experimental method to assess radon-related risks associated to a specific construction site, is not possible. As a result, it was decided to select the most widely accepted and proven option within national construction codes, which uses territorial zoning maps to require various levels of protection against building radon. Zoning will be established based on the potential radon map.

In terms of regulatory development, the draft for Spain's Regulation on health protection against hazards associated to ionizing radiation exposure (process of transposing Directive 2013/59/Euratom) significantly increases requirements for control of natural radiation exposure compared to the current regulation. Work activities involving significant natural radiation exposure, will also be included in the Regulation on Nuclear and Radiative Facilities.

6. Follow-up and Control of Irradiated Fuel and Radwaste Management

6.1. High-Activity Radwaste and Irradiated Fuel

The spent nuclear fuel generated in Spain (with the exception of that generated during the operating life of Vandellós I nuclear power plant and that of Santa María de Garoña up until 1982), is currently stored in the spent fuel pools of these nuclear reactors and in dry storage casks in temporary individual storage facilities (Spanish acronym: *ATI*) on the sites of Trillo, José Cabrera and Ascó nuclear power plants.

The high-activity waste category includes fuel reprocessing waste from the Vandellós I nuclear power plant (in France), as well as operating and dismantling waste from nuclear power plants which, due to their activity or long-lasting nature, do not fulfill the criteria for disposal at the El Cabril permanent repository. This category is included under the heading "special waste".

Throughout 2017, the CSN assessed new cask design or modification approvals, in particular those relating to the ENUN 32P dual-purpose casks, suitable for storage and transport of spent fuel from Spanish PWR NPP. The CSN also assessed licenses for temporary individual storage facilities at the Santa María de Garoña, Almaraz and Cofrentes NPP nuclear power plants.

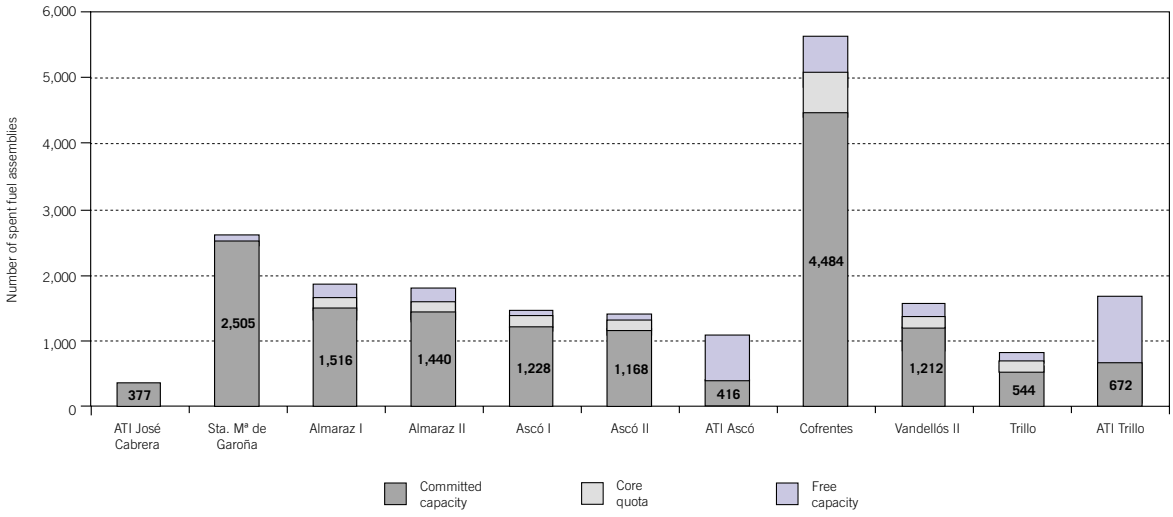
Inventory of High-activity Radwaste and Irradiated Fuel Stored in Nuclear Power Plants

The total number of fuel assemblies stored in nuclear power plants the plants as of December 31, 2017 amounted to 15,562, of which 8,573 were from pressurized water reactor (PWR) plants and 6,989 from boiling water reactor (BWR) plants; Out of this total number of fuel assemblies:

- 14,097 are stored in reactor pools.
- 1,465 are in dry storage casks in temporary individual storage facilities at the sites of Trillo (672 assemblies in 32 ENSA-DPT casks), José Cabrera (377 assemblies in 12 HI-STORM 100Z) and Ascó (416 assemblies in 13 HI-STORM 100 casks).

Figure 6.1. shows the inventory of fuel stored in the spent fuel pools of Spanish nuclear power plants and, where appropriate, at existing temporary individual storage facilities on December 31, 2017.

Figura 6.1. Situation of existing spent fuel storage facilities in nuclear power plants on December 31, 2017



In 2017, the CSN carried out three inspections within the Basic Inspection Plan (Spanish acronym: *PBI*) for control of spent fuel and high-activity or special radwaste management in the nuclear power plants of Santa María de Garoña, Almaraz I & II and Cofrentes. No significant deviations were detected.

6.2. Mid- and Low-Activity Radwaste managed at the Nuclear Power Plants

Nuclear Power Plants

In 2017, the CSN controlled the low- and mid-level radwaste management process stages carried out by Spanish operating nuclear power plants.

Final management of this waste involves its disposal at El Cabril site.

In 2017, operating nuclear power plants generated 3,131 solid radwaste packages of very low-, low- and mid-level activity, with an estimated activity of 30,371 GBq. These packages were conditioned in metallic drums and containers. Table 6.2.1 includes a breakdown of package generation by site as well as transports to El Cabril throughout 2017.

Table 6.2.2 shows, for each site, its percentage in total radwaste package generation in December 31, 2017 for operating Spanish nuclear power plants.

Tabla 6.2.1. Radwaste packages generated by operating nuclear power plants and transferred to El Cabril throughout 2017

Facility	Generated packages	Transported packages to El Cabril
Santa María de Garoña	656	191
Almaraz I & II	513	235
Ascó I & II	522	156
Cofrentes	1,073	444
Vandellós II	215	201
Trillo	152	192
Totals	3,131	1,419

Tabla 6.2.2. Situation of temporary waste storage facilities within operating nuclear power plants on December 31, 2017

Power Plant	Packages stored	Packages stored (equivalent to 220-liter drums)	Storage facility capacity (equivalent to 220-liter drums)	Storage facility usage level (%)
Santa María de Garoña	2,680	4,119	9,576	43.01
Almaraz	8,329	8,573	23,544	36.41
Ascó	5,494	5,847	8,256	70.83
Cofrentes	9,305	9,634	20,100	47.93
Vandellós II	1,673	1,978	9,538	20.74
Trillo	722	722	11,500	6.283
Total	28,203	30,873	82,514	37.42

6.3. Very Low-Activity Radwaste

Nuclear facility waste

Very low-level waste generated in all nuclear facilities, is ultimately managed at a specific site where it is prepared for disposal at the El Cabril center.

Management of this waste in nuclear facilities is similar to the management of low- and mid-level radwaste, although their conditioning is subject to different acceptance criteria. Generation data for 2017 was shown for both radwaste categories combined in section 6.2 of this report.

Waste generated in uranium mine reconditioning activities

Quercus Plant

Process waste

At the static leaching bed of the Quercus plant, some 1,107,896 tonnes of depleted ore with a granulometry of less than 15 mm, are accumulated. In addition, some 941,338 tonnes of neutralization sludges are accumulated in the tailings dam of this plant.

Water treatment waste

Waste is currently generated as a result of treating non-releasable acid waters produced onsite due to rainwater runoff and seepage. Liquid effluent treatment and conditioning continued in 2017. No events occurred during operation of the treatment and release section; effluent releases were interrupted on October 31, 2017.

In 2017, 523.371 m^3 of water were released. During this process, a total 8,143 tonnes of waste were generated in the form of precipitate cake which deposited at the static leaching bed crown. The total amount of this waste accumulated at the end of 2017 was 61,821 tonnes.

Both process waste and water treatment waste are pending definitive disposal, an issue included within the new dismantling and decommissioning project for the Quercus Plant.

6.4. Declassified Radwaste

Spanish nuclear facilities have declassification licenses for waste materials with low radioactivity contents. This allows facilities to manage such materials using conventional methods not subject to radiological regulatory control, without prejudice to the legal framework applicable to them based on their specific characteristics and nature.

No new declassification license was issued by the competent authority in 2017. In 2017, Spain's Department of Energy, Tourism and Digital Agenda requested the CSN to submit the mandatory report on wood declassification license at Ascó nuclear power plant.

6.5. Disused consumer products

Radioactive Lightning Rods

The Resolution of the Directorate General for Energy of June 7, 1993, authorized Enresa to undertake the management of these radioactive lighting rod headers. Removed lightning rods are sent to Ciemat, where radioactive sources are removed and sent to the United Kingdom.

During 2017, 42 lightning rods were removed, for a total number of removed lightning rods amounting to 22,863. No Am-241 sources were sent to the United Kingdom in 2017. The total number of sources now sent to this country stands at 59,796.

7. Nuclear and Radiological Emergencies. Security

7.1. Capacities and Actions of the Spanish Regulatory Body (*CSN*) in case of Emergency

The CSN has an Emergency Response Organization (Spanish acronym: ORE) that guarantees 24/7 manning of the Emergency Room (Salem), with an emergency on-call team of 12 technicians who would clock in at the Salem in less than one hour from activation.

In 2017, the CSN continued to develop and update the procedures elaborating on its emergency response plan, in parallel to procedures describing its participation within Spain's National Emergency System.

In 2017, a scorecard system (Spanish acronym: *SICME*) was commissioned with the aim to facilitate nuclear power plant emergency monitoring.

Furthermore, a new Graphic Safety Parameter Interface was developed. This is basically a new evaluation tool at the avail of the Operational Analysis Group (Spanish acronym: *GAO*) and the Radiological Group (Spanish acronym: *GRA*) of the CSN's ORE for monitoring and evaluation of nuclear power plant emergencies.

7.1.1. Emergency Room

The CSN has an emergency center (*Salem*). Functionally speaking, *Salem* can be defined as a center where emergency information is gathered, validated and analyzed. All equipment, tools and systems needed for the CSN to respond to emergencies are available at or can be managed from *Salem*.

The CSN also has a contingency emergency room (*Salem* 2) at the headquarters of the Military Emergency Response Unit in the airbase of Torrejón de Ardoz (Madrid).

The server platform supporting emergency applications of both *Salem* and *Salem* 2, continued to be renewed in 2017.

7.1.2. National and international exercises and drills

The IAEA has developed a system (Emercon) to officially communicate emergencies and support requests. Emercon has a website (USIE - Unified System for Information Exchange in Incidents and Emergencies) where notices are published and disseminated and events are classified according to the INES scale. The system is regularly checked by means of exercises of different scope.

In parallel, the European Commission has a system ECURIE (European Community Urgent Radiological Information Exchange) for early exchange of notifications and information in case of radiological emergency in European Union Member States.

Throughout 2017, the CSN participated in three IAEA exercises: ConvEx-1a (March 15), ConvEx-3 (June 21-22), ConvEx-1b (August 19).

The European Commission carried out in 2017 two communication tests with *Salem* to check its availability as a national contact reference within the Ecurie system. Test results were satisfactory. Also in 2017, the European Commission carried out an Ecurie exercise (Ecurex-2016) based on a nuclear accident at the Paks nuclear power plant (Hungary).

On November 16, 2017, coinciding with the annual emergency drill at the Trillo nuclear power plant, *Salem* carried out an exercise together with

the French Regulatory Body (*ASN*), applying the ASN- CSN communication protocol for scenarios of nuclear or radiological emergency in either one of the two countries.

Throughout 2017 and in order to comply with the annual program, a number exercises of the Radiological Group were carried out in the five offsite nuclear emergency plans for activities mainly related to radiological access controls (Spanish acronym:*CA*) and classification and decontamination stations (Spanish acronym: *ECD*). A total of eleven exercises involving the participation of the Radiological Group were carried out: offsite nuclear emergency plans *Penbu* (Burgos) and *Penca* (Cáceres) carried out an *ECD* and *CA* exercise each; the offsite nuclear emergency plan *Pengua* (Guadalajara) carried out two *ECD* and a *CA*; the offsite nuclear emergency plan *Penva* (Valencia) carried out an *ECD* exercise and two *CA* exercises, one of them involving the participation of the Military Emergency Response Unit and the CSN in logistical support activities for access and communication controls. Lastly, the offsite nuclear emergency plan *Penta* (Tarragona) carried out an *ECD*.

Furthermore, in 2017 a radiological emergency exercise was scheduled with aim that both the Technical Radiation Protection Unit, contracted out by the CSN to respond to this type of situations, and the CSN's Radiological Intervention Support Unit, could adequately prepare and train their roles in this type of scenarios.

7.1.3. Incidence Monitoring

During 2017, the CSN's Emergency Response Organization was activated twice.

On March 18, ORE was partially activated (a Coordination Group technician and a Radiological Intervention Support Unit technician) to take radiological measurements in order to characterize a radioactive piece located the day before in the municipality of Las Rozas (Madrid). The piece was duly controlled by the person who reported its finding. The *ORE* was also activated in the reduced response mode the night of May 23, due to the emergency alert declared at the Ascó nuclear power plant during its refueling outage. The emergency alert was declared after abundant smoke inside the turbine building was detected due to water falling on some power supply buses in normal operation. The incident was controlled, with no radiological consequences.

Various notifications were received at *Salem* relating to accidental irradiation of technicians or workers, contamination of facilities, loss of low activity radioactive sources used for brachytherapy, failure, deterioration or theft of equipment containing radioactive sources, as well as incidents during the transport of radioactive packages. Notifications were also received in relation to the detection of high radiation levels in containers at sea ports adhering to the Action Protocol for cases of illegal trafficking or inadvertent movement of radioactive material in ports of general interest. No significant radiological consequences took place in none of these cases.

Throughout 2017, *Salem* received three Ecurie warning messages from the European Union, two of them related to the detection of radioactive contamination caused by Th-232 and U-238 in consumer goods at the Port of Rotterdam, inside a container coming from China, and an incident occurred at the reactor Bugey-2 (France), due to low-pressure cooling system failure during a shutdown, with no radiological consequences.

Furthermore, 14 notifications or reports on international radiological events occurred in 2017 were received via the IAEA's website USIE, most of them related to worker overexposure, radioactive material transport events, and theft or disappearance of sources or equipment containing radioactive sources.

Other IAEA notifications were related to events in nuclear power plants caused by safety system actuation or operation failures and by natural phenomena (e.g. high-magnitude earthquakes) near power plants.

Some notifications were also received in relation to three relevant events: the collapse of a tunnel in the underground radwaste repository of Hanford (United States), the abovementioned incident at reactor Bugey-2 (France), and the detection of high levels of isotope Ru-106 in a number of European countries.

In 2017, CSN's *Salem* continued to manage information received from the IAEA in relation to the accident at the Fukushima Dai-ichi nuclear power plants.

7.2. Participation of the Spanish Regulatory Body (*CSN*) in Spain's National Emergency Network

The document "CSN Participation in the National Civil Defense System", approved by the CSN's Board, includes the organization's list of services relating to its collaboration to prepare, plan and respond to nuclear and radiological emergencies.

Activities performed by the CSN within this framework may be grouped into the following lines of action:

- Activities for coordination with the Directorate General for Civil Defense and Emergencies of the Department of Home Security (Spanish acronym: *DGPCE*).
- Activities for collaboration with the Military Emergency Response Unit (Spanish acronym: *UME*).
- Activities for collaboration with the country's security and police forces.
- Activities for coordination with Spanish Regions, mainly in relation to radiological emergencies.
- Activities related to emergency preparation and planning outside nuclear power plants, as well as collaboration with Directorates in charge of those plans (Government Offices and Sub-Offices).
- Other activities for collaboration with public agencies within the national emergency system.

7.3. Onsite Emergency Plans at the Facilities

During 2017, the CSN participated in ten drills carried out by nuclear facilities within the scope of their Onsite Emergency Plans (Spanish acronym: *PEI*). In addition to Salem, which supervised all exercises carried out by nuclear power plant licensees, the Operational Coordination Center (Spanish acronym: *CECOP*) of the corresponding local Government Offices, were activated.

The Onsite Emergency Plans of operating nuclear power plants were reviewed in 2017, with the aim to include a new initiating event based on the lessons learned from the Fukushima accident.

Furthermore, the *PEID* (Spanish acronym for Onsite Emergency Plan during dismantling) for José Cabrera was reviewed, whereas the *PEID* for Santa María de Garoña is being reviewed. In both cases, the aim is to adapt these *PEID* to new and minor radiological risks existing in these sites.

In December, the CSN attended the Vienna meeting on preparation of the evaluation report for the IAEA's ConvEx-3 exercise.

7.4. International Collaboration in case of Emergency and other Activities

During 2017, the CSN continued collaborating in coordination activities with international

authorities, in accordance with article 7 of the IAEA's Convention on Prompt Notification and the European Council's Decision 87/600/Euratom, which demands European Union Member States to promptly notify protection measures implemented following a nuclear or radiological accident. In this sense, the CSN participated in the technical meeting on notification in May.

In September 2017, Lisbon hosted the second meeting of the committee monitoring the technical cooperation protocol between APA-ANPC-IST (Portuguese emergency management authorities) and the CSN, which presented a first draft of the information exchange protocol between Portuguese authorities and the CSN in case of radiological or nuclear emergency in any of the two countries.

The CSN participated in October in the seminar for evaluation of tabletop exercise INEX-5 results relating to notification, communication and interfaces between different organizations involved in large radiological emergencies, held the Nuclear Energy Agency (NEA), Paris.

7.5. Physical Protection of Materials and Nuclear Facilities, Radioactive Sources and Transports

In compliance with Royal Decree 1086/2015, dated December 4, amending Royal Decree 1308/2011 on security of nuclear materials and facilities, as well as of radioactive sources, the Response Unit of Spain's Police Force *Guardia Civil* should be permanently based inside nuclear power plants and other nuclear facilities determined by Law (in line with design base threat). Based on the abovementioned Royal Decrees, the CSN continued collaborating in the implementation of a pilot experience at the Trillo nuclear power plant, participating in a tabletop exercise on March 23, 2017 and a practical field exercise on June 24, 2017.

In 2017, the Basic Inspection Program (Spanish acronym: *PBI*) was applied within the strategic security area of *SISC*. *PBI* was met as expected, with a total number of five inspections carried out at the nuclear power plants of Trillo, Ascó, Almaraz, Vandellós and Cofrentes. Outside *PBI*, two inspections were carried out: a complementary inspection at Ascó nuclear power plant and an unannounced inspection at Vandellós II nuclear power plant following a complaint submitted to the CSN. It is necessary to point out that three of these inspections were carried out jointly between the CSN and Spain's Department of Home Security.

An inspection was also performed at Santa María de Garoña nuclear power plant within the framework of the specific integrated supervision program established for this facility.

The annual meeting of the Technical Commission Monitoring the Specific Agreement signed between Spain's Department of Home Security (State Secretariat for Security) and the CSN on security of nuclear and radioactive materials, activities and facilities, took place in 2017.

The CSN took part in the National Commission on Critical Infrastructure Protection and in the Interdepartmental Work Group on Critical Infrastructure Protection, taking responsibility for managing, analyzing and reviewing Strategic Plans affecting CSN competences.

In the international security arena, the CSN collaborated with international agencies and participated in bilateral and multilateral activities with Regulatory Bodies from other countries. In this regard, the CSN collaborated with Morocco in the preparation of the third international Regulatory Bodies' conference on security, to be held in this African country in 2018.

Nuclear Safety Council Report to the Parliament

Summary of 2017

CSN CONSEJO DE SEGURIDAD NUCLEAR