



Convention on Nuclear Safety

Nineth National Report of Chile

2022





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INTRODUCTION

This document constitutes Chile's Eighth National Report in compliance with the obligations contracted through the signing of the Convention on Nuclear Safety.

As a result, this report covers the Articles of the Convention corresponding to a Contracting Party that does not own nuclear installations.

The existing nuclear facilities in the country are as follows:

- a) One nuclear research reactor with a power of 5 MWt;
- b) One nuclear fuel fabrication plant
- c) One plant for the conversion of UF₆ to Uranium metal.

There is a second nuclear research reactor, with a power of 2 MWt, which is in extended shutdown condition without nuclear fuel. In 2010, the high enrichment fuel elements of this reactor were delivered to the United States of America government as part of an enrichment reduction program in exchange for low enrichment uranium.

The owner and operating organization of all nuclear facilities in the country is the Chilean Nuclear Energy Commission (CNEC).

SUMMARY

One of the main issues identified in previous reports was the proper and clear separation between the Competent Authority and organizations with responsibilities for the promotion and application of nuclear technologies.

REPORT ARTICLE BY ARTICLE

Article 7. Regulatory and Legislative Framework


7.1 Establishing and maintaining a legislative and regulatory framework

7.1.1 Overview of the primary legislative framework for nuclear safety

During the period from January 2019 to December 2021, no laws affecting Nuclear Safety have been officially approved or published.

The following laws have an impact on Nuclear Safety matters:

- a) Law No. 18,302 - Nuclear Safety Law, published in the Official Gazette on 2 May 1984. This Law consists of six titles, that is:
 - i. TITLE I - OF THE REGULATORY AUTHORITY, set outs the different regulatory bodies and their respective responsibilities.
 - ii. TITLE II - DEFINITIONS
 - iii. TITLE III - NUCLEAR SAFETY establishes the general approach to nuclear safety, including the authorizations and requirements for the operation of a nuclear installation.
 - iv. TITLE IV - INFRACTIONS TO LEGAL AND REGULATORY REQUIREMENTS ON NUCLEAR SAFETY AND PROTECTION, establishes the sanctions that may be applied in the event of non-compliance.
 - v. TITLE V - OF CIVIL LIABILITY FOR NUCLEAR DAMAGES, establishes the amount and form of insurance covering liability for nuclear damage.
 - vi. TITLE VI – RADIOACTIVE FACILITIES, establishes the competent authorities for the control of radioactive facilities and for the preparation of the regulations applicable to these facilities.
- b) LAW N° 18,730 - MODIFIES THE NUCLEAR SAFETY LAW, published in the Official Gazette on August 10, 1988. Modifies TITLE VI, establishing that the Chilean Nuclear Energy Commission is the competent authority for the control of first category radioactive facilities.
- c) LAW N° 19,825 - MODIFIES THE NUCLEAR SAFETY LAW, published in the Official Gazette on October 1, 2002. It modifies TITLE III, establishing that the Chilean



Nuclear Energy Commission is the competent authority in the control of the transport of nuclear substances and radioactive materials.

- d) LAW N° 20,402 - CREATES THE MINISTRY OF ENERGY, published in the Official Gazette on February 1, 2010. It establishes that the Chilean Nuclear Energy Commission relates to the Government through the Ministry of Energy.
- e) LAW N° 19,300 - LAW ON GENERAL ENVIRONMENTAL BASIS, published in the Official Gazette on April 9, 1994. This Law consists of the following titles:
 - i. TITLE I - GENERAL PROVISIONS.
 - ii. TITLE II - OF ENVIRONMENTAL MANAGEMENT INSTRUMENTS: establishes the projects that require environmental evaluation. Projects requiring environmental assessment include nuclear installations and other related facilities.
 - iii. TITLE III - RESPONSIBILITY FOR ENVIRONMENTAL DAMAGE.
 - iv. TITLE IV - OF THE AUDIT.
 - v. TITLE V - OF THE ENVIRONMENTAL PROTECTION FUND.
 - vi. TITLE V - THE ENVIRONMENTAL PROTECTION FUND.
 - vii. FINAL TITLE - OF THE MINISTRY OF THE ENVIRONMENT.

7.1.2 Ratification of international conventions and legal instruments related to nuclear safety

In the period from January 2016 to December 2018, no international conventions and legal instruments related to nuclear safety have been ratified.

The State of Chile has signed and ratified the following conventions:

- a) Convention on Nuclear Safety. Ministry of Foreign Affairs Decree No. 272 of 1997.
- b) Convention on Mutual Assistance in the Event of a Nuclear Accident or Radiological Emergency. Ministry of Foreign Affairs Decree No. 8 of 2004.
- c) Convention on Early Notification in the Event of a Nuclear Accident. Ministry of Foreign Affairs Decree No. 381 of 2005.
- d) Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management. Ministry of Foreign Affairs Decree No. 148 of 2011.

7.2 National safety requirements and regulations

7.2.1 Overview of the secondary legislation for nuclear safety


In the period from January 2019 to December 2021, the Regulation on Physical Protection of Radioactive Materials in First Category Radioactive Facilities, Decree No. 82 of 2019 of the Ministry of Energy, was issued.

Nuclear safety regulations:

- a) Regulations on the Physical Protection of Nuclear Installations and Materials, Decree No. 87 of 1984 of the Ministry of Mining. It is based on document INFCIRC/225/Rev.1 of the International Atomic Energy Agency.
- b) Regulations on Radiation Protection, Ministry of Health Decree N°3 of 1985. Basically, it establishes dose limits (based on ICRP N°26) and requirements for Personal Dosimetry Services provided in the country.
- c) Regulations for the Safe Transport of Radioactive Materials. Decree No. 12 of 1985 of the Ministry of Mining. It is based on the 1985 version of the International Atomic Energy Agency's Safety Guide No. 6, Regulations for the Safe Transport of Radioactive Materials.
- d) Regulation of the Environmental Impact Assessment System. Decree No. 40 of 2012 of the Ministry of the Environment. It establishes a categorization of projects according to the potential environmental damage and the procedure for carrying out the environmental assessment.
- e) Regulation on Physical Protection of Radioactive Materials in First Category Radioactive Facilities, Decree No. 82 of 2019 of the Ministry of Energy. Establishes physical security measures to protect radioactive materials in categories 1, 2 and 3, according to the classification of the Code of Conduct on Technological and Physical Security of Radioactive Sources.

7.2.2 Overview of regulations and guides issued by the regulatory body

The technical requirements for the operation of nuclear research reactors are established in standards approved by the Chilean Nuclear Energy Commission. The regulatory policy in the case of technical aspects not regulated in national standards, including in the case of nuclear facilities, is to adopt the recommendations of the



International Atomic Energy Agency or the regulation of the country of origin of the technology when there is no specific recommendation in IAEA documents.


In the period from January 2019 to December 2021, Safety Standard NS-08.0 was issued, which establishes requirements for the siting, construction, commissioning, operation, and decommissioning of nuclear facilities existing in the country.

Safety standards of the Chilean Nuclear Energy Commission:

1. NCS-DR-01 "Radioactive Waste Management".
2. NCS-PM-01 "Calibration of Ionizing Radiation Detector Equipment".
3. NCS-PP-02 "Authorizations for Operators of Nuclear Research Reactors".
4. NCS-PR-01 "Radiation Protection Standards".
5. NCS-SI-01 "Risk Prevention".
6. NCS-SV-01 "System for Accounting and Control of Nuclear Materials".
7. NS-08.0 "Safety Standards for nuclear and radioactive facilities located within a nuclear facility", Exempt Resolution (DISNR) N°072/2021 of the Chilean Nuclear Energy Commission.

Regulatory Guides of the Chilean Nuclear Energy Commission:

1. NS-AI-01 "Authorization of Facilities for the Concentration of Uranium or Thorium".
2. GR-C-01 "Structural Design Criteria for Nuclear Research Facilities".
3. GR-E-01 "Design Criteria for Electrical Systems for Nuclear Research Facilities".
4. GR-G-02 "Nuclear Safety and Radiation Protection Criteria".
5. GR-G-03 "Research Nuclear Reactor Safety Reports"
6. GR-G-08 "Emergency Plans for Nuclear Research Facilities".
7. GR-G-09 "Commissioning of Research Nuclear Reactors"
8. GR-G-10 "Quality Assurance for the Start-up and Operation of Nuclear Research Facilities".
9. GR-G-11 "Operation of Nuclear Research Reactors"
10. GR-G-13 "Periodic Inspections of Nuclear Research Facilities".
11. GR-G-14 "Organization and Procedures for Nuclear Research Reactors".
12. GR-G-15 "Radiation Protection for Nuclear and Radioactive Facilities".
13. GR-M-01 "Design Criteria for Hydraulic Systems for Nuclear Research Facilities".

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14. GR-N-01 "Design Criteria for Pool Type Research Nuclear Reactor Nuclei
 15. GR-P-01 "Radiation Protection Considerations in the Design of Nuclear Research Facilities".

7.2.3 Overview of the process of establishing and revising regulatory requirements

Law No. 20,500, on Associations and Citizen Participation in Public Management, establishes the right of individuals to participate in State policies, plans, programs, and actions, including the establishment and review of regulatory requirements. In addition, the Law establishes the obligation of each State Administration Body to determine the modalities of participation and evaluate all the opinions received in the respective consultations.

7.3 System of licensing

7.3.1 Overview of the licensing system and processes

Chilean regulations do not establish a procedure for granting licenses to Nuclear Facilities, except as established in the Nuclear Safety Law, which requires authorization for siting, construction, commissioning, operation, shutdown, and dismantling.


The technical requirements for operators of research nuclear reactors are established in standards approved by the CNEC. The regulatory policy in the case of matters not regulated in the national standards, including the case of nuclear facilities, is the adoption of IAEA recommendations or the regulation of the country of origin when there is no specific guidance in IAEA documents.

7.3.2 Involvement of the public and interested parties

Law No. 18,302, the Nuclear Safety Law, does not consider a mechanism for the participation of the public and interested parties in the licensing process for a nuclear facility.

Law No. 18,300 on General Environmental Basis establishes the following in the framework of citizen participation for nuclear facility projects:

- a) The owner of the project or activity must publish an extract from the Environmental Impact Study (EIA).

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- b) Individuals may find out about the contents of the Study (EIA) on the website of the Environmental Assessment Service (SEA) and may submit their observations to this Service.
 - c) The SEA will respond to each person who has made comments, and they will also be available on the Service's website.
 - d) Anyone who has made a comment may file a Claim Appeal.

7.3.3 Legal provisions to prevent the operation of a nuclear installation without a valid license

The Law N°18,302, Nuclear Safety Law, establish the sanctions and procedures for sanctioning non-compliance of legal and regulatory requirements, including the obligation to hold a valid license for the operation of a nuclear facility.

7.4 System of regulatory inspection and assessment

The inspections are performed by personnel of the Chilean Nuclear Energy Commission who, in accordance with the provisions of the Nuclear Safety Law, must be designated by Resolution of the Executive Director of the CNEC.

There are two types of inspections:

- a) Verification of nuclear safety and radiation protection requirements to grant a license or authorization.
- b) Control of the operation of facilities.
- c) Verification of any notified events.

An inspection programme is drawn up annually, including control and licensing inspections, during the years corresponding to the renewal of a license or authorization. In addition, resources are foreseen for possible inspections for the verification of notified events.

7.5 Enforcement of applicable regulations and terms of license

The Nuclear Safety Law empower the CNEC to sanction violations of legal and regulatory standards. The sanctioning procedure is determined in said Law and in Law N°19.880, which Establishes Bases for the Administrative Procedures Governing the Acts of the State Administration Bodies.



Sanctions may be:

1. A fine of between four hundred and four hundred thousand dollars, depending on the severity of the non-compliance.
2. Suspension of license or authorization for any activity related to nuclear energy and nuclear materials for up to one year.
3. Definitive revocation of the license or authorization.

Article 8. Regulatory Body

8.1 Establishment of the regulatory body

Responsibilities for the implementation of the legal and regulatory framework are distributed among different authorities.

The Government is responsible for issuing the mandatory regulatory standards and the authorization of nuclear power plants, at the proposal of the Ministry of Energy.

The Ministry of Energy is responsible for drawing up plans, policies and standards for the proper operation and development of the energy sector. It is also responsible for proposing to the Government authorizations for nuclear power plants following a binding report from the Chilean Nuclear Energy Commission.

The Chilean Nuclear Energy Commission is the only State agency competent in nuclear safety matters and is responsible for the regulation, supervision, control, and inspection of nuclear facilities.

8.2 Status of the regulatory body

Article 2 of the Nuclear Safety Law No. 18,302 establishes that the regulation, supervision, control, and inspection of activities relating to the peaceful uses of nuclear energy and to nuclear facilities and substances are the responsibility of the Chilean Nuclear Energy Commission and, where appropriate, the Ministry of Energy.

Article 4 of the same Law establishes that for the siting, construction, commissioning, operation, closure and dismantling of a facility, plant, inside, laboratory, establishment or nuclear equipment, an authorization from the Chilean Nuclear Energy Commission is required. This group of facilities includes all the facilities currently in operation.

- Research Reactors,
- Nuclear Fuel Manufacturing Facility,
- Installation for the conversion of UF₆ to uranium metal.

In addition, nuclear power plants, enrichment plants, reprocessing plants, and facilities for the permanent storage of radioactive waste require a license issued by supreme decree issued through the Ministry of Energy.

In view of the above, the Ministry of Energy is empowered to authorize facilities covered by the Convention on Nuclear Safety. This Ministry reports directly to the Central Government and the Chilean Nuclear Energy Commission relates to the Government through the Ministry of Energy.

Article 9. Responsibility of the License Holder

The main responsibilities of the licensee are as follows

- a) Carry out only the actions or operations determined in the licenses.
- b) To assume responsibility for nuclear damage that could occur in the facilities under its control.
- c) Have, as required by the regulatory body, the number of personnel authorized to work at each facility, plant, center, laboratory, or nuclear equipment.
- d) Providing the necessary means for the treatment and temporary storage of radioactive waste. Authorization for the storage in the territory of nuclear or radioactive wastes is prohibited, except those originating in the country.
- e) Prepare and maintain revised emergency plans, approved by the regulatory body, for nuclear accidents that might occur at its facilities.
- f) Prevent damages that could occur due to theft, robbery, or loss of nuclear substances.
- g) Provide to the satisfaction of the regulatory body, sufficient guarantee for dismantling and comply with all the requirements established in the regulation, when the license or authorization is renounced in advance.



Article 10. Priority to Safety

The Nuclear Safety Law establishes that the licensee is responsible for the good condition of the nuclear facility and must establish and apply safety measures for the protection of people and the environment.

The technical standards approved by CNEC establish the requirements of the Quality Assurance Programme to be implemented to demonstrate that the activities relating to the commissioning and operation of nuclear research facilities are performed in accordance with the safety requirements. These Programmes should include the organisation, responsibilities, planning and control of safety-related activities and continuous improvement.

Article 11. Financial and Human Resources

National legislation does not require the operator to demonstrate that he has the financial resources to support the radioactive facility during its lifetime. It only considers human resource requirements.

National legislation does not include financial resource requirements for the decommissioning programme and radioactive waste management.

There is no regulation on the qualification, training and retraining of personnel. The law establishes requirements for the qualification of personnel and defines requirements for the qualification of workers.


Since nuclear facilities are state-owned, the financial costs for operation, decommissioning and radioactive waste management are covered by the government.

Nuclear facilities in Chile are state-owned. The State covers the financial costs for operation, decommissioning, and radioactive waste management.

Article 12. Human Factors

Chilean regulations do not include a method to prevent, detect or correct human factors.

As part of the licensing of the CNEC nuclear facilities, risk analysis techniques have been used. The consideration of human errors is included, establishing measures to detect and correct these errors. In addition, the CNEC, as competent authority and



operator of nuclear research facilities, has established programmes for the requalification of operators.

The requirements for operators of research nuclear reactors are laid down in the standards adopted by CNEC. The case of nuclear power plants will be based on IAEA recommendations.

Article 13. Quality Assurance

Chilean regulations do not establish an approach to quality assurance. In some cases, the application of IAEA guidelines has been considered.

The technical standards approved by CNEC establish the requirements of the Quality Assurance Programme for nuclear research facilities, commented on in Article 10.

For the updating of one of the nuclear research reactors (1985-1990), a quality assurance programme based on the American ANSI Standards was used.

Article 14. Assessment and Verification of Safety

Chilean regulations do not establish a procedure for licensing and reporting on safety at the different stages of a nuclear facility, as defined in the Convention.


For the preparation of reports on the safety of research reactors, the CNEC has internal regulations that must be applied. This regulation is in the process of being revised.

Article 15. Radiation Protection

The main legal body containing the requirements on radiation protection in Supreme Decree No. 3 of 1985, of the Ministry of Health, which defines dose limits and establishes the general conditions for radiation protection, as well as the requirements for personal dosimetry services.

The competence to propose new regulations on radiation protection is assigned to the CNEC and the Ministry of Health and has to be proposed by both Ministries (Energy and Health) and promulgated by the Executive.

For the operation of existing nuclear facilities, CNEC has established radiation protection programmes to ensure the protection of workers and the public from unnecessary exposure to ionising radiations.



The CNEC has an Environmental Radiological Surveillance System that covers the nuclear studies centres for the purpose of monitoring emissions from their own facilities.

Article 16. Emergency Preparedness

The Nuclear Safety Law establishes that each licensee must have an emergency plan covering the spectrum of possible events at a given facility.

In this respect, the CNEC has prepared emergency plans for its two nuclear study centres that it considers to be emergencies involving areas external to the sites. Emergency exercises or drills have been developed inside the centers. CNEC has coordinated with firefighters and has taken steps to inform the public about emergency preparedness in the vicinity of the nuclear facility.

The Radiological Emergency Safety Commission (CONSER) was created by Decree 647 of 2015 of the Ministry of the Interior and Public Safety. With an inter-ministerial and intersectoral composition, the mission of this Commission is to advise and support the President of the Republic in strengthening the capacity of the competent institutions to prevent and react to nuclear and radiological events that might affect public safety, the integrity of individuals or the environment.

Article 17. Siting

Chilean regulations do not establish a procedure for granting a site licence, except for the mention in the Nuclear Safety Law that nuclear facilities require a site licence.

In the case of site studies for nuclear research facilities, the CNEC has internal regulations that must be applied.

Article 18. Design and Construction

As previously mentioned, the Chilean regulations do not establish a procedure for design or construction licenses, except for the mention in the Nuclear Safety Law that nuclear facilities require a construction license.

In the case of the design and construction of nuclear research facilities, the CNEC has internal standards that must be applied.

Article 19. Operation

There is no established procedure for granting operating licenses, except for the mention in the Nuclear Safety Law that nuclear facilities require an operating license.

In the case of nuclear research facilities, the CNEC has internal standards that must be applied.

ACTIVITIES TO IMPROVE SAFETY


An IRRSS mission was completed in February 2019. The mission team identified certain issues that need to be improved for their review to improve the overall performance of the regulatory system. The most important were:

- The Government should:
 - Review its legal and regulatory framework for nuclear, radiation, transport and waste safety to ensure full consistency with the latest IAEA safety standards.
 - Ensure that the Regulatory Body is effectively independent in its safety related decision making and that functional separation from entities having responsibilities or interests that could unduly influence its decision making.
 - Provide mechanisms that ensure it has the effective coordination of CCHEN and MINSAL to avoid any omission and undue duplication or conflicting requirements being placed on authorized parties.
- CNEC should:
 - Allocate and manage their resources to allow them to discharge their responsibilities and perform their regulatory functions effectively.
 - Develop and update regulations and guides related to safety to be consistent with the latest IAEA safety standards within respective regulatory responsibilities.

An Action Plan is being prepared to address the recommendations and suggestions of the IRRS mission.

On the other hand, CCHEN as the operating organization is executing, with the support of the International Atomic Energy Agency, a project to upgrade the control systems of the RECH-1 nuclear research reactor. In this context, in July 2022 have been carried out:

- - An Integrated Research Reactor Utilization Review (IRRUR) mission to the La Reina Research Reactor. The mission was a full scope IRRUR mission,



considering all areas of potential utilization. Nuclear energy research is not one of these areas of potential utilization and was therefore excluded from the scope.

- - An Operation and Maintenance Assessment Mission for Research Reactors (OMARR) to the La Reina Research Reactor. The objective of the mission was to review and evaluate the organizational structures, operation and maintenance conditions and procedures, planned, and required modifications and aging management conditions. The mission also advised on the preparation of an action plan to improve the reliability and availability of the RECH-1 reactor for long-term operation, improved reliability, and efficient utilization.


Regarding emergency preparedness and response, in August 2021, the national disaster prevention and response system was established, which includes an early warning system with the purpose of timely and significant, so that people, communities and organizations exposed to any threat are prepared and act adequately and with sufficient advance notice, in order to reduce the possibility of loss or damage. The technical agencies for hazard monitoring correspond to all those entities that belong to the System and that have the technical competencies to maintain permanent monitoring of the different threats.

ACCIONES PARA IMPLEMENTAR LOS DESAFÍOS Y SUGERENCIAS

The Country Review Report for Chile from the Seventh Review Meeting identified four challenges and two suggestions. Regarding these challenges, the actions taken are reported below:

Challenge 1: The main remaining challenge for Chile is the absence of functional separation of the regulatory body.

In May 2018, the Government published the document "Energy Road: Leading Modernization with a Citizen's Seal". This document established seven pillars of action and ten specific commitments. Among them, a commitment was made to modify the institutional framework for energy, including the modernization of CCHEN and the updating of the nuclear safety framework by mid-2020.



To this end, CCHEN prepared a bill for the effective separation of the regulatory body, which was submitted to the Ministry of Energy and is still under review. In addition, the regulation for the physical protection of radioactive materials was approved.

Challenge 2: To achieve the promulgation of the diverse legal texts already drafted.

The proposals for legal texts prepared prior to the Seventh Review Meeting were updated with the 2020 proposal.

Challenge 3: To increase and enhance the competencies of the regulator.

No actions have been implemented for this challenge.

Challenge 4: To define and implement an assessment model and to enhance the regulator procedures and efficiency.

The evaluation procedure was established in Safety Standard NS 08.0, approved by Exempt Resolution (DISNR) N°072/2021 of the Chilean Nuclear Energy Commission. The regulator procedures were updated according to the new safety standard.

In relation to the suggestions, the actions taken are reported below:

Suggestion 1: Next review meeting, Chile should report in more detail on the achieved progress and the addressing of challenges.

The actions taken have been reported in this chapter of the report.

Suggestion 2: Chile should take adequate and effective actions in a timely manner to achieve regulator independence.

Actions taken in this area have been reported in Challenge 1

August 2022.



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