GOBIERNO DE MÉXICO

SENER
SECRETARÍA DE ENERGÍA

JOINT CONVENTION ON SAFETY IN THE MANAGEMENT OF SPENT FUEL AND ON THE SAFETY IN THE MANAGEMENT OF RADIOACTIVE WASTE

FIRST NATIONAL REPORT

OCTOBER 2020

Nuclear science and technology. Aspects of Mexico's facilities for scientific and technological development, and nuclear power generation in the nuclear field. National Institute for Nuclear Research and Federal Electricity Commission

GENERAL INDEX

SECTION A

INTRODUCTION

A.1 Presentation of the Report

This document represents the First National Report of the Mexican United States (Mexico), designed to satisfy the commitments established by article 32 of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management, convened in Vienna, Austria, on the 5th of September, 1997.

This Joint Convention came into effect (for Mexico) on the 17th of May, 2019. The National Report shall be reviewed in the Seventh Meeting for Review of the Contracting Parties.

The National Report was created by the Department of Energy (Secretaría de Energía, SENER), the Regulatory Body (Comisión Nacional de Seguridad Nuclear y Salvaguardias, CNSNS), the Federal Electricity Commission (Comisión Federal de Electricidad, CFE) and the National Institute of Nuclear Research (Instituto Nacional de Investigaciones Nucleares, ININ), with data available up to the 31st of December, 2019.

For the preparation of the present document, a reference known as *Guidelines Regarding the Form and Structure of National Reports (INFCIRC/604/Rev.3)*, created by the International Atomic Energy Agency, was employed, as established in article 29 of the Joint Convention.

A.2 Situation in Mexico

Mexico is a representative, democratic and federal republic, composed of 32 federative entities. The official language is Spanish, and it has a population of 126,577,691 inhabitants. There are three branches of government: Executive, Legislative and Judicial. The executive branch is solely conformed by the President of the Republic, whose term in office has a duration of six years.

The Centralized Public Administration committee consists of the Office of the President of the Republic, the State Departments, the Legal Counsel of the Federal Executive and the Coordinated Regulatory Bodies on Energy Matters. The decentralized bodies, state-owned companies, national credit, loan, insurance and trusts institutions, form the parastatal public administration committee.

The Political Constitution of the Mexican United States establishes that the use of nuclear energy can only have peaceful purposes. The national policies with regard to nuclear activities is based on the *Reglamentary Law of Article 27 of the Constitution on Nuclear Matters*, which regulates the exploration, exploitation and benefit of radioactive materials, as well as the exploitation of nuclear fuels, the use of nuclear energy, the research in nuclear sciences and techniques, the nuclear industry and all else related to this subject.

Government Institutions of Mexico

The Department of Energy (SENER) establishes heads and coordinates energy policies and practices in Mexico. It also establishes the guidelines related to the exploitation and development of nuclear energies and technologies. The National Commission on Nuclear Safety and Safeguards (CNSNS) is the regulatory body of nuclear matters in the country; it enforces the application of the norms on nuclear safety, radiological safety, physical safety and safeguards, so that the operation of all the nuclear and radioactive facilities is carried out with the strictest precautions, in order to keep all the inhabitants of the country safe.

The National Institute of Nuclear Research (ININ) is a decentralized public body of the Federal Government, with its own legal personality and assets, and carries out activities of research and development in the field of nuclear science and technology, as well as promotes the peaceful use of nuclear energy and informs the country on its achievements, in order to establish a connection with the economic, social, scientific and technological communities of the nation.

The CFE is a Productive Company of the State, of exclusive property of the Federal Government, with its legal personality and assets, and enjoys technical, operational and management autonomy, based on its law of creation. The CFE is the proprietor of the Laguna Verde Nuclear Power Plant.

Nuclear activities commenced in Mexico in the 1950s, when a law that declared that uranium, thorium, and deposits of other substances, containing fissionable isotopes that are capable of producing nuclear energy, are national mining reserves. From that moment on, and with the creation of the National Commission on Nuclear Energy, the first steps were taken with regard to these activities.

In 1968, a TRIGA Mark III research reactor was installed in the "Nabor Carrillo Flores" Nuclear Facility (ININ), and in 1979, the first nuclear law was promoted in Mexico, which would be revised in 1986 and is active to date. By the end of the 1970s, studies were initiated in order to establish a nuclear power program, which came into effect with the commercial operation of Units 1 and 2 of the Laguna Verde Nuclear Power Plant in 1990 and 1995, respectively. The Laguna Verde Nuclear Power Plant is administered by CFE.

Nuclear facilities

Mexico has the Laguna Verde Nuclear Power Plant (CNLV), for the production of electricity. It is located on the coasts of the Gulf of Mexico, in the municipality of Alto Lucero, in the state of Veracruz. The facility has two boiling water-type reactors (BWR/Mark II), type 5, from General Electric. ININ, within its facilities, has a TRIGA Mark III research reactor.

The management of radioactive waste from the operation of the Laguna Verde Nuclear Power Plant, as well as the management of spent fuel, is carried out by the facility itself. At the start of the commercial operations of the facility, the temporary storage of the spent fuel was carried out in the pools created for this purpose, one for each unit. Additionally, an Independent Spent Fuel Storage Facility (dry storage) was constructed within the installations of the Laguna Verde Nuclear Power Plant. A portion of the spent fuel has been transferred to the dry storage containers.

The radioactive waste from non-energy activities are managed by ININ through the Radioactive Waste Treatment Plant (PATRADER) and the Radioactive Waste Storage Center (CADER).

ININ is in charge of the "La Piedrera" and "Peña Blanca" Disposal Sites; the first, resulting from the radiological accident in Ciudad Juarez in 1983, and the second, of uranium tailings and contaminated soil of an experimental facility for the production of uranium in Ciudad Aldama, both in the state of Chihuahua. Additionally, in Mexicali, Baja California, a site known as "San Felipe" was constructed, where steel rods contaminated with cobalt-60 were deposited, which was recovered from the aforementioned accident in Ciudad Juarez, Chihuahua (report CNSNS-IT-001, "Cobalt-60 Contamination Accident").

In figure 1, the storage sites for spent fuel and radioactive waste in Mexico are shown.

FIGURE 1. SITES OF SPENT FUEL AND RADIOACTIVE WASTE IN MEXICO

A.3 Key safety issues in the management of spent fuel and radioactive waste

In Mexico, safety is of capital importance in all the activities which involve nuclear energy and is taken into account from the planification, design,

construction and operation, to the definitive closure and dismantling of the nuclear and radioactive installations, as well as final disposal of all of its waste.

The primary responsibility of safety lies in the holder of the license, permit or authorization that was granted by the national regulatory body, to the physical or moral person that is in charge of the installation and the activities that generate risks associated with ionizing radiations.

Mexico possesses a duly-established legal and governmental framework, with the assignment of responsibilities to the parties involved, that allows them to carry out the safe management of spent fuel and radioactive waste. The commitment of institutions, bodies, and productive state enterprises, with safety, is aligned and fulfills the objectives of the Joint Convention.

SECTION B

POLICIES AND PRACTICES

This section contains the obligations provided in Article 32, paragraph 1, of the Joint Convention.

Article 32. Report presentation

1. In conformity with the dispositions of article 30, each Contracting Party shall present a national report at each review meeting of the Contracting Parties. The report will concern the measures adopted to fulfill each one of the obligations of the Convention. The report of each Contracting Party shall also contain the following:

i) Policies involving the management of spent fuel;

ii) Spent fuel management practices;

iii) Policies involving the management of radioactive waste;

iv) Radioactive waste management practices;

v) Criteria employed in order to define and classify radioactive waste by categories

B.1 Management of spent fuel (policies and practices)

The storage and final disposal of spent fuel are strategic activities of the Nation, handled expertly by the Department of Energy. At this moment, an open cycle of nuclear fuel is being employed, without discarding the possibility of reprocessing in the near future.

In agreement with that provided by the Reglamentary Law of Constitutional Article 27 on Nuclear Matters, the Federal Executive, through the Department of Energy, is responsible for establishing the guidelines related to the exploitation and development of nuclear energies and technologies, and, in agreement with national energy policies, is also in charge of the storage, transport and final disposal of nuclear fuels and radioactive waste, regardless of their origin, and of authorizing the corresponding public bodies with the temporary storage of nuclear fuels and radioactive waste derived from its use.

The development and adaptation of the Mexican system, in order to carry out a safe management of radioactive waste and spent fuel, is based on the consideration that the primary responsibility in the management of radioactive waste lies in those who produce said waste. The State is the last entity responsible for the management of spent fuel and radioactive waste generated within the limits of the national territory.

The Laguna Verde Nuclear Power Plant carries out the management of spent fuel in safe and reversible conditions, in agreement with the best international practices, within its installations. The fuel spent is stored in the temporary storage pools in each one of the units of the aforementioned facility, and in the Independent Spent Fuel Storage Facility, which can also be found within the same installations.

The fuel spent by the TRIGA Mark III is stored within the TRIGA Mark III reactor contention tank. The fuel elements of the SUR-100 research reactor are in the MXA balance area at ININ.

Currently, in Mexico, there are no plans for the development of an installation for the final disposal of spent fuel, nor for the final disposal of high-level radioactive waste.

B.2 Management of radioactive waste (policies and practices)

The Reglamentary Law of Constitutional Article 27 on Nuclear Matters establishes that the Federal Executive, through the Department of Energy, is in charge of the storage, transport, and disposition of radioactive waste, regardless of its origin. The Federal Executive may also authorize the corresponding public bodies, the storage of the radioactive waste derived from its use.

On this manner, the Department of Energy has placed the responsibility of managing the radioactive waste generated during its operation on the Laguna Verde Nuclear Power Plant, as part of the conditions of its operating license.

The radioactive waste produced during the operation of the CNLV is conditioned and stored in installations built for such purpose; these installations are described in section H.

In a similar fashion, the Department of Energy has delegated to ININ, the management of radioactive waste derived from the use of peaceful applications of nuclear energy, not related to the generation of electricity. For this responsibility, it has a Radioactive Waste Treatment Plant (PATRADER), a Radioactive Waste Storage Center (CADER) and two Disposal Sites, which are currently closed. All of the aforementioned activities are regulated by the CNSNS.

In PATRADER, the reception of all solid and liquid radioactive waste, sealed sources in disuse and decontamination materials, is carried out. Likewise, radioactive material transport, characterization, compaction of solid waste, conditioning of sealed sources in disuse, decontamination of materials and equipment, as well as the trituration of solids free of contamination, are some of the operations carried out by this Plant.

Once the radioactive waste has been treated and/or conditioned in PATRADER, some of them are sent to CADER. The latter is an installation whose function is to store the radioactive waste that has been produced in the medical sector, in industrial activities and in research, throughout the national territory. This waste, before being sent to the installation, is immobilized and/or conditioned in containers (original containers of the spent sealed sources) and cans (200-L metallic containers) with concrete, lead, or paraffin, as appropriate.

There are three Disposal Sites currently closed: “La Piedrera”, “Peña Blanca” and “San Felipe”. “La Piedrera” was constructed exprofeso in order to dispose of contaminated materials generated by the accident that occurred in December of 1983 in Ciudad Juarez, Chihuahua. The site of “Peña Blanca” was designed to deposit 65,000 tons of uranium tailings and soil contaminated with tailings from the dismantling of the uranium and molybdenum beneficiation plant in Ciudad Aldama, Chihuahua. This mining plant was operated between 1969 and 1971 by the National Nuclear Energy Commission and the Mining Development Commission. Finally, the sited known as “San Felipe” was constructed to deposit 115 tons of steel rods contaminated with cobalt-60, recovered from the state of Baja California, product of the accident that occurred in Ciudad Juarez, Chihuahua.

Currently, the Nation does not have plans for the construction of other installations for the final disposal of radioactive waste.

B.3 Criteria used in order to define and classify radioactive waste

With regard to the definition of “radioactive waste”, the General Rules of Radiological Safety, in its sixth article, defines radioactive waste as “whatever material that contains or is contaminated with radionuclides at concentrations or levels of radioactivity greater to those indicated by the Commission, in its corresponding technical norm, and for which there is no foreseeable use”. Radioactive waste is classified as *low, intermediate* and *high*.

The technical norm to which this definition refers to is Official Mexican Standard NOM-035-NUCL-2013, “Criteria for the disposal of residues with radioactive material”, in which the dose criteria for the disposal of radioactive waste and, in consequence, for considering a particular waste as radioactive, as well as the activity and activity concentration levels for the unconditional disposal of solid waste and for the conditional disposal of oils contaminated with radioactive materials and other types of waste, was established. This norm is currently being reviewed with the objective of aligning the values presented within with those indicated in the document “Radiological protection and safety of radiation sources: Basic international safety norms. General

Safety Requirements, Part 3 N° GSR", published by the International Atomic Energy Agency (IAEA).

The classification of radioactive waste, for its final disposal, is carried out according to Official Mexican Standard NOM-004-NUCL-2013, "Classification of radioactive waste", in which the following levels are established:

Low-level radioactive waste

These are classes A, B and C. They are classified according to the quantities present or the absence of diverse radionuclides, grouped in the following manner:

- Group 1: C-14, Ni-59, Nb-94, Tc-99, I-129 and alpha-emitters with a half-life greater than 5 years, except for uranium, Pu-241 and Cm-242.
- Group 2: Any radionuclide with a half-life less than 5 years, H-3, Co-60, Ni-63, Sr-90 and Cs-137.

Intermediate-level radioactive waste

These are classified in function of that previously explained for low-level waste.

High-level radioactive waste

Spent nuclear fuel (once declared as waste), liquid or solid waste (from the first cycle of extraction process, and the concentrated waste from subsequent extraction cycles, in the installations for the reprocessing of spent fuel and the solids from the solidification of the liquid waste previously mentioned) and any other radioactive waste with a radioactive concentration greater than 10^4 TBq/m^3.

Mixed waste

Besides the radioactive component, these also contain dangerous residues, such as those established in the guidelines in the Official Mexican Standard NOM-052-SEMARNAT-2005, or any norm that may come to substitute the norm previously mentioned.

Uranium and thorium tailings

The radioactive waste generated from the processing of ore, in a beneficiation plant, where the uranium or thorium contained within the ore is extracted.

The Official Mexican Standard NOM-004-NUCL-2013 is currently in revision, with the objective of aligning the national regulations with that recommended internationally, within the document "*Classification of radioactive waste. Safety Guide N° GSG-1*", published by the IAEA.

SECTION C

AREA OF APPLICATION

This section includes the obligations provided in Article 3 (Area of Application).

Article 3. Area of application

1. This convention will apply to safety in the management of spent fuel, when the spent fuel comes from the operation of nuclear reactors for civilian use. The spent fuel that is found situated in reprocessing facilities, as part as a reprocessing activity, does not apply to the area of this Convention, unless the Contracting Party declares that the reprocessing process is part of the management of the spent fuel.

2. This convention shall also apply to the safety in the management of radioactive waste, when the radioactive waste comes from civilian applications; however, this Convention will not be applicable to waste that only contains natural radioactive materials that do not come from a nuclear fuel cycle, unless these consist of sealed sources in disuse, or that the Contracting Party define them as radioactive waste for the purposes of this Convention.

3. This convention shall not apply to the safety in the management of spent fuel or radioactive waste that may form part of military or defense programs, unless the Contracting Party define these as *spent fuel* or r*adioactive waste* for the purposes of this Convention. Nonetheless, this Convention shall apply to safety in the management of spent fuel and radioactive waste derived from military or defense programs, when these materials are permanently transferred to, and are managed in, exclusively civilian programs.

4. This Convention shall also apply to discharges, as stipulated in articles 4, 7, 11, 14, 24 and 26.

1. In agreement with that established in Article 3 of the Joint Convention, in the case of Mexico, safety measures will apply to:

- the spent fuel from the Laguna Verde Nuclear Power Plant.
- the spent fuel from the TRIGA Mark III research reactor.
- the fuel elements of the SUR-100 research reactor.
- the radioactive waste produced by the Laguna Verde Nuclear Power Plant.
- the radioactive waste from non-energy applications in the peaceful use of nuclear energy.

2. In Mexico, to date, it has not been determined whether the reprocessing process shall be part of the management of spent fuel. The option of using a closed nuclear fuel cycle with reprocessing, in case that such a process would result economically convenient, is available.

3. In the country, no radioactive waste of natural origin (NORM) has yet been declared. When the waste comes from regulated practices and does not comply with the dose criteria for disposal, it can be declared as radioactive waste. There are disposal values for contaminated materials with radionuclides of natural origin for specific situations, such as contaminated oils, reutilization and metal recycling.

According to Mexican regulations, the National Commission on Nuclear Safety and Safeguards shall establish the dose equivalent limits in the cases of increased irradiation from natural radiation sources, for technological purposes. When there are residual

materials which contain natural uranium and thorium, that come from non-regulated practices, the radioactive concentration that is considered for the exemption is 1 Bq/g.

In the country, radioactive materials of natural origin, produced by different industries, have been identified, but not quantified, among which the uranium and metal mining, petroleum and gas extraction, phosphate, fertilizer, geothermal and water purification industries can be found.

Among these NORM materials, there is a quantity of uranium mining residues that is isolated and under control. This material comes from the temporary operation of the uranium mine at Peña Blanca, in the state of Chihuahua (in the north region of the country), and a related beneficiation plant, also found in Chihuahua. The residues, as described in Section H, are mainly found at the Disposal Site at Peña Blanca, with two other minor Fractions of the same material being stored at two sites: CADER and Laguna Verde.

Said residues are enlisted in Section D, “Inventories and lists”.

SECTION D

INVENTORIES AND LISTS

This section includes the obligations provided in paragraph 2 of Article 32 (Report presentation).

Article 32. Report presentation

2. This report shall also include

- i) A list of the installations for spent fuel management, regulated by this Convention, as well as its location, main purpose and essential characteristics;
- ii) An inventory of the spent fuels, regulated by this Convention, which are stored and have had final disposal. This inventory shall contain a description of the materials and, in case it exists, information concerning its mass and total activity;
- iii) A list of the facilities for radioactive waste management, regulated by this Convention, as well as their location, main purpose and essential characteristics;
- iv) An inventory of the radioactive waste, regulated by this Convention, that:
  - a) is stored in radioactive waste management facilities and come from the nuclear fuel cycle;
  - b) have received final disposal or
  - c) are derived from previous practices.

  This inventory shall contain a description of the materials and other types of pertinent information available, such as volume or mass, radioactive activity and specific radionuclides;
- v) A list of the nuclear facilities in the process of closing and the situation of the closure activities of these facilities.

32.2.1. Spent fuel management facilities

In table 1, a list of the existing spent fuel management facilities is provided, as well as their characteristics and location. With regard to their main purpose, given that Mexico has not yet made a choice concerning the recycling or reuse of spent fuel, all the existing facilities are for the storage of spent fuel. In the case of the containment tank of the TRIGA Mark III research reactor, even if its main purpose is related to the use and safety of the nuclear reactor, it also stores the spent fuel that has been removed from the core.

TABLE 1. SPENT FUEL MANAGEMENT FACILITIES

NAME	LOCATION	ESSENTIAL CHARACTERISTICS
U1 Spent Fuel Pool	U1 CNLV	Maintains subcriticality via borated panels, maintains dose to personnel low via water shielding, refrigerates all nuclear fuel assemblies, provides support and rigidity.
U2 Spent Fuel Pool	U2 CNLV	Maintains subcriticality via borated panels, maintains dose to personnel low via water shielding, refrigerates all nuclear fuel assemblies, provides support and rigidity.
Independent Spent Fuel Storage Facility	CNLV	Maintains subcriticality via borated panels, maintains dose to personnel low via high-density concrete shielding, refrigerates all nuclear fuel assemblies, provides support and rigidity.
TRIGA Mark III research reactor containment tank	ININ	Maintains dose to personnel low via water shielding and barite concrete, refrigerates nuclear fuel elements.
MXA balance area	ININ	Nuclear material control site.

32.2.2. Inventory of spent fuel

In table 2, the inventory of existing spent fuel in the country, up to the 31st of December 2019, is shown.

TABLE 2. INVENTORY OF SPENT FUEL

INSTALLATION	URANIUM MASS	NUMBER OF ASSEMBLIES	TYPE OF ASSEMBLY
Unit 1 spent fuel pool	390.31 ton	2252	GE5, GE9B, GE12, GE14
Unit 2 spent fuel pool	302.8 ton	1890	GE6, GE9, GE9B, GE12, GE14
Independent Spent Fuel Storage Facility	15.49 ton	89	GE6, GE9, GE9B, GE12
TRIGA Mark III research reactor containment tank	23,535 g	120 fuels and 3 control bars with fuel monitor	Instrumented LEU (8.5/20), LEU (8.5/20) and control bars with fuel monitor
ININ MXA balance area	3,723.22 g	11	UO_2 and polyethylene discs

Mexico had a critical set, known as *SUR-100*, in the past, which was dismantled. This reactor had a permanent power output of 100 mW, in order to carry out research in the country. It was constructed by the Siemens company. The SUR-100 reactor is a homogenous reactor and its core consists of a mixture of 20% enriched uranium and polyethylene. It reached criticality for the first time in 1971 and was closed definitively in 1989.

The nuclear material from this set is in the MXA Balance Area at ININ, without it having been determined whether it is to be considered as waste or not. Its inventory can be consulted in the last row of table 2.

32.2.3. Radioactive waste management facilities

In table 3, a list of the facilities related to the management of existing radioactive waste in the country, is shown, as well as their main characteristics and the purpose of each one.

TABLE 3. RADIOACTIVE WASTE MANAGEMENT FACILITIES.

NAME	LOCATION	PURPOSE	ESSENTIAL CHARACTERISTICS
On-site Temporary Storage (ATS)	CNLV	Storage	Temporary shelter for moist solid radioactive waste
Dry Solid Radioactive Waste Repository (DDRSS)	CNLV	Storage	Temporary shelter for dry solid radioactive waste
Radioactive Waste Treatment Plant (PATRADER)	ININ	Treatment and conditioning	Facility to carry out the stages of radioactive waste management, from non-energy uses
Radioactive Waste Storage Center (CADER)	State of Mexico	Storage	Storage of low and intermediate level waste, from non-energy uses
“La Piedrera”	Chihuahua	Disposal	Contains materials contaminated with Co-60
“Peña Blanca”	Chihuahua	Disposal	Contains uranium tailings and soil contaminated by tailings
“San Felipe”	Baja California	Disposal	Contains steel rods contaminated with Co-60

32.2.4 Inventory of radioactive waste

In table 4, the national inventory of radioactive waste is shown. In this table, non-nuclear materials are included, that because of their characteristics of rate of exposure and heat generation, are kept stored in the spent fuel pools of the CNLV. only awaiting characterization for the purpose of its classification, according to NOM-004-NUCL-2013.

TABLE 4. RADIOACTIVE WASTE MANAGEMENT FACILITIES.

INSTALLATION	CATEGORY	VOLUME/ QUANTITY	MAIN RADIONUCLIDES	PHYSICAL STATE
ATS	Low level A	2,705.2 m^3	Co-60, Mn-54, Fe-59, Cr-51, Co-57, Co-58, Zn-65	Moist solids
DDRSS	Low level A	2,169.48 m^3	Co-60	Dry solids
PATRADER	Low level	37.44 m^3	H-3, C-14, S-35, Na-22, Co-60, Rb-68, natural U	Solids
PATRADER	Low level	18.512 m^3	H-3, C-14, Na-22, Co-60, Ra-226, natural U, Am-241	Solids
PATRADER	Low level	365 ton	Ra-226	Solids
CADER	Low level	843.36 m^3	Minerals and uranium tailings , Co-60, Cs-137 y Ra-226	Solids
ACG	Pending	1,485 pieces	Irradiated material	Solids

As a special case of radioactive waste, there are those located in the trenches of CADER. These trenches have been a practice of final disposal for radioactive waste in the past and, within them, 1179 meters cubed of radioactive waste, 985 containers of unknown volume and content, 96 tons of rods contaminated with Co-60 (embedded in concrete) and 1870 sealed sources in disuse, can be found.

Up to the 31st of December of 2019, there were 9438 sealed sources is in disuse under the care of ININ, including the 1870 previously-mentioned sources.

In Mexico, there are three disposal facilities, currently closed, known as “La Piedrera”, “Peña Blanca” and “San Felipe”. These facilities are described in section H of the present report and in table 4. In the first of these, there is a volume of 21,018 m^3 of radioactive waste from the accidental melting of a radioactive source of cobalt-60, which occurred in 1983 (“Ciudad Juarez Accident”). In the second, there is a total of approximately 65,000 tons of uranium tailings and soils contaminated with uranium tailings from the dismantling and remediation of a uranium and molybdenum beneficiation mine known as “Villa Aldama”. there is also a Disposal Site known as “San Felipe”, localized 114 kilometers from Mexicali, in the state of Baja California, in which 115 tons of contaminated steel rods, from the previously mentioned accident, were deposited.

32.2.5 Nuclear facilities in the process of closing

At this present moment, there are no facilities in the process of closing in Mexico.

SECTION E

SYSTEMS OF LEGISLATION AND REGULATION

This section includes the obligations provided in the following Articles:

Article 18. Implementation of the measures

Each contracting party shall adopt, in the area of its national legislature, the legislative, reglamentary and administrative measures, as well as any others that are deemed necessary to comply with the obligations derived from this Convention.

Mexico has a legislative, reglamentary and administrative framework that helps it to fulfill the obligations derived from this Joint Convention.

The legislative and reglamentary framework, under which the principles and commitments derived from this Joint Convention, are sustained, is based on the *Political Constitution of the Mexican United States*, from which a series of laws, rules, Official Mexican Standards and technical norms, are obtained.

Additionally, in the annex to the operating licenses emitted by the Mexican regulatory body, a series of requirements designed for safety, and that must be fulfilled by the license holder, are included.

In matters of radioactive waste management, there is an ample variety of Official Mexican Standards for the different stages in the process of management, which are enlisted in Annex L.4, "National Regulatory Framework".

Assessment of compliance

The Mexican legal framework in the nuclear area contains the necessary elements for the fulfillment of the obligations derived from the Joint Convention.

Article 19. Legislative and regulatory framework

1. Each contracting party shall establish and maintain a legislative and regulatory framework, through which the safety in the management of spent fuel and radioactive waste shall be regulated.

2. This regulatory and legal framework will contemplate the establishment of:

i) the applicable requirements and national provisions regarding radiological safety;

ii) a license-granting system for the activities of management of spent fuel and radioactive waste;

iii) a system of prohibition in the operation of facilities for the management of spent fuel and radioactive waste, without the corresponding license;

iv) an appropriate reglamentary system of institutional control, regulatory inspection, documentation and report presentation;

v) the measures for assuring the fulfillment of the applicable rules and conditions of the licenses;

vi) a clearly-defined assignment of responsibilities to the bodies that intervene in the different stages of the management of spent fuel and radioactive waste.

3. When the contracting parties consider radioactive materials as radioactive waste, the contracting parties must take into consideration the objectives of this Convention.

19.1 Legislative framework

Just as mentioned, the basis of the regulatory and legislative framework in Mexico is the Political Constitution of the Mexican United States, which, in its 27th article, establishes that nuclear energy can only be used for peaceful purposes and that the exploitation of these nuclear fuels for the generation of nuclear energy and the regulation of its applications in all areas is a duty of the nation.

Likewise, the Constitution, in its article 89, Fraction 1, allows the president of the Republic to "promote and execute the laws expedited by the Congress of the union, providing in the administrative sphere to its exact observance". In this sense, it is that the federal executive, through the Department of Energy, establishes the guidelines and monitors the fulfillment of the provisions in matters of nuclear safety and safeguards, an attribution based on Article 33, Fraction 13 of the Organic Law of Federal Public Administration.

Additionally, within the Mexican legislative framework, international treaties are included, which, once approved by the Senate of the Republic, acquire a designation of *Mexican Law*. In this sense, Mexico is signatory of the international treaties indicated in annex L.3.

The Reglamentary Law of Constitutional Article 27 on Nuclear Natters (called "Nuclear Law", from this point forward), came into effect the 5th of February of 1985 and has the objective of regulating the exploration, exploitation and beneficiation of radioactive materials, as well as the exploitation of nuclear fuels, the uses of nuclear energy, research in nuclear science and technology, the nuclear industry and all else related.

The "nuclear industry", as defined in Article 11 of the Nuclear Law, includes:

I. the phases of the fuel cycle (from the "refinement" to the "burning" of the same); in other words, up to the fabrication of fuel elements, including, in any case, the enrichment of uranium;

II. the "burning", which is the exploitation of the fuel elements for energy purposes, which results in the generation of electricity or any other use of the heat released;

III. the reprocessing of fuel;

IV. the last phases of the fuel cycle, including the definitive and temporary storage of irradiated fuel or the radioactive waste derived from the reprocessing process;

V. the production of heavy water, in its case, and its use in nuclear reactors;

VI. the design of vapor supply nuclear systems;

VII. the design and fabrication of the equipment and components of the vapor supply nuclear system of nuclear power plants or other nuclear reactors;

VIII. the production and applications of the radioisotopes, as well as the processing, conditioning and final disposal of its radioactive waste, and

IX. the design, fabrication and use of nuclear reactors and radiation sources for research and technological development.

Later on, in Article 18 of the same law, the activities which will be carried out by the Federal Executive, through the Department of Energy, are established, among which there are the following:

- regulate the nuclear, radiological, physical safety and safeguards, as well as assure its fulfillment;
- shall be in charge of the storage, transport and disposal of nuclear fuels and radioactive waste, regardless of their origin;
- can authorize the corresponding public bodies the temporary storage of nuclear fuels and radioactive waste derived from its use, and
- shall be responsible for the observation of the treaties and other subscribed international judicial instruments on nuclear matters, in the area of its competence.

The nuclear law establishes, in its article 19, that "safety is paramount in all the activities that involve nuclear energy and shall be taken into account from the planification, design, construction and operation, up to the definitive closure and dismantling of the nuclear and radioactive facilities, as well as the final disposal of all its waste. "

This law defines two types of facilities: the nuclear and the radioactive facility. The first is defined as

"that in which nuclear fuel or material is fabricated, processed, used, reprocessed or stored", and the second is defined as "that in which radioactive material is produced, stored, or equipment which contains it is used for radioactive waste, is conditioned or stored" (Article 3, Fractions 2 and 3, respectively).

According to the Nuclear Law, nuclear and radioactive facilities must have physical, nuclear and radiological safety systems which satisfy the requirements established in this regard, in ordinances and in reglamentary provisions of said law (Article 22, second paragraph). Likewise, in Article 27, paragraph 3, it is established that "nuclear facilities must have the radiological and nuclear safety personnel required, and the person in charge of the corresponding public body shall be responsible for the strict compliance of the applicable norms".

It is in this same law that the distinct attributions assigned to the Department of Energy, with regard to nuclear and radiological safety, are granted to the National Commission of Nuclear safety and Safeguards (those related to regulatory activities), to the National Institute of Nuclear Research (those related to research, development, promotion and diffusion) and the CFE (the exclusivity for generation of electricity by nuclear means).

Besides the Nuclear Law, there is also the General Law of Ecologic Balance and Environmental Protection, which came into effect on the 29th of January of 1988 and whose decrete, through which this very law is reformed, added on or derogated, came into effect on the 6th of June of 2018. This law, in its Chapter 7, "nuclear energy" (Article 154), establishes that "the Department of Energy and the National Commission of Nuclear Safety and Safeguards, with its participation that, in its case, corresponds to the Department of Health, shall assure that the exploration, exploitation and beneficiation of radioactive minerals, the exploitation of nuclear fuels, the use of nuclear energy and, in general, the activities related with the same, shall be carried out in strict adherence with the Official Mexican Standards concerning nuclear, radiological and physical safety of the nuclear or radioactive facilities, insomuch that risks toward human health are avoided, and ecologic Balance and environmental protection are assured, corresponding to the Department of the Environment and Natural Resources, carrying out the evaluation of environmental impact".

Said law indicates, in its article 154, that, in the case of facilities related to the uses of nuclear energy, the CNSNS and, whenever applicable, the Department of Health, shall be the ones to look out for human health , the preservation of ecologic Balance and environmental protection, corresponding to the Department of the Environment and Natural Resources, the evaluation of environmental impact; However, it is convenient to highlight that the Nuclear Law stipulates that, for nuclear facilities, information concerning environmental impact must be included for its evaluation by the CNSNS and other authorities according to its attributions.

The Federal Law on Metrology and Normalization establishes a uniform procedure for the preparation of Official Mexican Standards by the dependencies of the Federal Public Administration, which is presented next, in the form of a summary:

1. The topics must be included in the National Program of Normalization.

2. The competent dependency must prepare its draft for the norm, along with its Manifestation of Regulatory Impact (MIR), researching if there are any other existing norms related to the topic; if such is the case, the corresponding dependencies shall coordinate, so that in a joint manner, only one Official Mexican Standard is prepared by sector. Likewise, Mexican Norms (NMX) and international norms shall be taken into consideration with regard to the draft.

3. The draft shall be presented to the respective National Advisory Committee on Normalization (CCNN) (the interested parties are considered part of this committee), so that in a period no greater than 75 natural days, pertinent observations are formulated.

4. The dependency that prepared the draft shall answer the observations emitted by the Committee in a period no greater than 30 natural days, starting from the date on which they were presented and, in its case, shall make the corresponding modifications. When the dependency which presented the project does not consider the observations presented by the Committee to be justified, it may solicit to the president of said committee, the approval of the draft without any modification.

5. Once the corresponding CCNN approves the draft, the respective dependency shall send it, together with its MIR, to the National Commission of Regulatory Improvement (CONAMER), for its verdict.

6. The dependency must answer all the observations formulated by CONAMER, concerning the draft and MIR, including in said documents, the pertinent modifications, until CONAMER emits its final verdict.

7. The ruled draft shall be submitted for approval by the CCNN for its publication In the Official Journal of the Federation (DOF) as a NOM project, so that in the following 60 natural days, those interested (including the general public) may submit their comments to the corresponding CCNN.

8. Once those 60 natural days have passed, the corresponding CCNN shall study the comments received and, in its case, proceed to modify the project in a period no greater than 45 natural days.

9. The CCNN shall order the publication (in the Official Journal of the Federation) of the comments received, as well as a modifications to the project, at least 15 natural days before the publication of the NOM.

10. Once approved by the respective CCNN, the NOMs are issued by the competent dependency and published in the DOF for its obligatory observation.

The NOM must also be revised every five years in order to verify its validity, to update or to cancel. The result of this revision shall be notified to the Technical Secretariat of the National Commission of Normalization; if not done, the NOM shall lose its validity.

The General Law of Transparency and Access to Public Information and the Federal Law of Transparency and Access to Public Information, which came into effect on May 4th of 2015 and January 27th of 2017, respectively, establish the guidelines for classifying government information, whether public, proprietary or confidential. With the entry into force of these Laws, the Federal Government designed a National Transparency Platform through which the obligated subjects provide information either periodically, proactively, focused or at the express request of the interested parties.

19.2 Regulatory framework

19.2.1 Requirements and national provisions applicable in matters of radiological safety

The diverse laws, previously mentioned, give way to the establishment of diverse guidelines having to do with radiological safety. These guidelines are the *General Rules of Radiological Safety* (RGSR) and the *Rules for the Safe Transport of Radioactive Material* (RTSMR).

The RGSR came into effect on the 23rd of November of 1988. This document includes a description of the dose limitation system, as well as the limits for *Occupationally-exposed personnel* (POE) of 50 mSv (annually) for stochastic effects, 500 mSv for non-stochastic effects and 150 mSv for eyes, and a tenth part of that mentioned for the general public; in Article 19 of these guidelines, it is indicated that the limits previously mentioned are not applicable to the medical exposure of patients or radiation of natural origin, except those cases of medical exposure for research without direct benefit for the individual exposed and/or when the natural radiation sources are increased due to technological reasons, for which the CNSNS shall establish the applicable limits.

The RGSR contains provisions related to sealed and open radiation sources, generators, radioactive facilities and their conditions of operation, as well as requirements for the evaluation of safety, the inspections, verifications and the licensing of said facilities. In particular, in Articles 201-216, the conditions for the licensing and operation of facilities related to the management of radioactive waste, as well as the restrictions related to the handling that can be done for said materials, are established. Also included are the conditions and restrictions for the disposal of radioactive material to drainage. In this regard, the management of spent sources is contemplated, but high-level waste and sealed sources are left outside of its scope, mentioning that the management activities of this category of radioactive waste shall be covered by the guidelines on nuclear facilities.

Within these conditions, the prohibition of the definitive storage below sea, as well as the definitive storage of inflammable radioactive waste, pyrophoric explosives, waste in liquid state, compressed gases and unknown compounds, Is notable.

Since the creation of the RGSR, a great quantity of NOMs have been emitted; most of these oriented toward the safety during different stages of the management of radioactive waste, in its generation, disposal, treatment and conditioning, and for its definitive storage (including, in this case, the selection of the site, design of the packages, classification). These norms are shown in Annex L.4.

The VRTSMR came into effect the 9th of June of 2017 and established the conditions of radiological safety and nuclear physics which must be fulfilled prior to and during activities of transport of radioactive material within the national territory. This document has given way to the publication of the following Official Mexican Standards: NOM009-NUCL-2017, "Determination and application of the transport index for radioactive materials and the safety index with regard to the criticality for the transport of fissionable substances" and NOM-014-NUCL-2017, "Categories of packages, overpacks and cargo containers which contain radioactive material: marking and labeling". Both norms came into effect on the 7th of June of 2019, as well as the projects of some other NOMs that have not yet been published.

Besides the compliance with the guidelines and the NOMs previously mentioned, the permit holders must also comply with that solicited in the annexes of the licenses, permits and/or authorizations which have been emitted by the CNSNS. The annexes are specific and oriented toward the type of facility, activities to be carried out and based on the evaluation of safety presented for its licensing. In these annexes, the requirement of the presentation of an *Annual Relevant Activities in Radiological Protection* report , is included, designed so that the permit holder demonstrates that the radiological protection program proposed in the initial solicitation for the license is an operation, or that the CNSNS be informed of any change that this program has suffered and its consequences.

In the case of nuclear facilities, from the beginning of the Laguna Verde Nuclear Power Plant project, government authorities decided that, besides the application of the guidelines set by the international Atomic Energy Agency, the country-of-origin's regulations regarding the vapor supply nuclear system would also apply. This requirement, of a binding character, appears in the 3rd condition of the *Authorization of Commercial Operation* in both units of the CNLV.

As a result of this, parts 20 , 21, 26, 50 , 51, 54, 55, 61, 70, 71, 72 , 73 and 100 of Title 10, "Energy", of the Federal Code of Regulations of the United States of America, were established as obligatory requirements, as well as all the norms and industrial guidelines considered in Title 10. Likewise, some guidelines emitted by the Nuclear Regulatory Commission of said country have been adopted in conformity with the applicability analysis process, which is part of the internal processes of the CNSNS. The requirements have been extended toward the TRIGA mark 3 research reactor via condition 3 of its own operating license.

19.2.2.1 License-granting system for radioactive waste management facilities

Within the Mexican regulatory framework, the radioactive waste management facilities are considered as radioactive facilities, for which the process of license-granting for these is established in the RGSR, where the minimum documentation required must be presented by the party interested in order to obtain a permit, authorization or license. Additionally, given that the activities carried out by the CNSNS are found within the area of that regulated by the Federal Law of Administrative Procedure (which came into effect on the 1st of June of 1995 and whose last version was published in the Official Journal of the nation the 18th of May of 2018), the administrative part related with the evaluation, requirements of missing information, granting or denegation of permits, authorizations or licenses, is found regulated by this law. Nonetheless, for the case of facilities that manage radioactive waste generated from energy uses, its licensing conditions are included within the operating license of the nuclear facility to which they belong.

The National Commission of Regulatory Improvement (CONAMER), based on Article 25, Fraction 5, of the General Law for Regulatory Improvement, has created the Federal Registry of Formalities and Services, which consists of a total inventory of the formalities and services of the Federal Public Administration and was created with the purpose of granting judicial safety to the persons, provide transparency, simplify the regulatory compliance and promote the use of information technologies; it is of a binding and public character for the regulatory entities. The applications related to radioactive waste management facilities are found registered as formalities in this registry , for which the CNSNS presented (to CONAMER) the list of solicited information, as well as a legal basis for requiring said information and the characteristics it must fulfill.

The official forms to which the following paragraphs refer, were created to fulfill the requirements of CONAMER have with regard to registering the different formalities that are carried out for CNSNS and have the purpose of manifesting, in a single document, the information that is required for the technical evaluation. In some cases, such as, for example, the applications related to the management of radioactive waste, there exists no official form; in this case, the information required is

found documented In the formality file. In any case, the applicant may see the list of the information that must be presented for each formality in the official website: www.gob.mx/cnsns.

Also, the CNSNS has an institution-wide Quality Assurance Plan since the year 1999 and a documented Quality Management System (SGC) , which is kept updated. Within the system, all the processes that are carried out for the fulfillment of the functions of regulation of nuclear and radioactive facilities, are identified. This quality management system is based on the adoption of the requirements of norm ISO 9001:2015 and its implantation through the Quality Manual and the procedures associated with the processes. In this manner, and given that within this system, there are procedures for the evaluation and licensing of waste management facilities, it is guaranteed that the evaluation processes of these is uniform and oriented towards safety.

The RGSR indicates that in order to obtain an operating license for a radioactive waste warehouse, the following must be submitted: application in the official format, articles of incorporation that include the storage of radioactive material in the corporate purpose, analytical memory of the facility, plans of architectural structures in which the adjacent areas and their use are indicated, radiological safety procedures manual, risk analysis and emergency plan, proposal of the person in charge of radiological safety and Occupationally-Exposed Personnel, maximum activities of radioisotopes, procedure and record of reception and delivery of radioactive materials and characteristics of ionizing radiation-detecting equipment.

It is also indicated that to request authorization for the processing, conditioning, dumping and definitive storage of radioactive waste of low and intermediate levels (including activities of construction, operation, modification, cessation of operations, dismantling or definitive closure), the following must be submitted: application in the official format, copy of the company charter, radiological safety report, radiological safety manual and bond or surety of an institution or company legally authorized to guarantee damages to third parties. The aforementioned safety report has the purpose of describing the radiological safety characteristics that will be applied from the conception of the project, the calculation methods and controls for procedures and materials used and must include: facilities and proposed activities, evaluation of options, location, facility design and quality assurance program, applicant organization, radiation safety policy, quality assurance program, radiation safety group, radiation sources, estimation of dose equivalents, radiation safety program, analysis of risks and emergency plan, environmental impact and cessation of operations, dismantling and definitive closure.

In order to request the authorization of the definitive storage of radioactive waste, the documentation mentioned in the previous paragraph must be presented, in addition to a program for the definitive closure of the facility and the maintenance that will be provided after the active use of it is finished. Plans should be included for the immobilization of radioactive materials and their isolation from the environment as effectively as can reasonably be achieved, as well as for monitoring the retention of radioactive contaminants and the stability of the facility.

For radioactive waste incineration activities, the permittee must demonstrate to the CNSNS that the radioactive releases involved in the process do not result in the exposure of the general public to dose equivalents that exceed the authorized limits.

In Part 3 of the Official Mexican Standard NOM-022/3-NUCL-1996, the criteria for the construction, operation, closure, post-closure and institutional control are established for definitive storage facilities for low-level radioactive waste near the surface.

Sealed sources with activities higher than those indicated in the corresponding technical standard (that do not meet the dispensing criteria established in NOM-035-NUCL-2013, “Criteria for dispensing waste with radioactive material”), may only be disposed of in two ways: by sending them to a definitive radioactive waste warehouse or by sending them abroad, with prior export authorization. In any case, the permit holder must previously request the corresponding authorization from the CNSNS, providing the following information: radioisotope, activity and date on which it is valid, brand, model and serial number of the source, number and date of issue of the authorization, permit or license in which it is covered, reason for withdrawal, type, brand and model of the container with which it is intended to transport the source and its proposed destination.

The Federal Law of Administrative Procedure dictates, among other things, that, unless something different is established in another legal provision, the resolution time cannot exceed three months and once this period has elapsed without

any resolution being issued, its denegation is implied.

This Law also indicates that, in the event that the request does not contain the data or does not comply with the applicable requirements, the interested parties must be warned in writing and only once so that they correct the omission within the term established in less than five business days from when the notification takes effect. In the event that the corresponding period elapses and the prevention is not released, the procedure will be discarded. Similarly, the CNSNS is obliged to carry out said prevention within the first third of the response period for the requested procedure, in case of not complying with this time, the procedure may not be discarded because it is incomplete. In the event that both the prevention and its relief are carried out within the established times, the response time will resume from the business day immediately following the one on which the interested party has answered, having to respond within the period established for the procedure in question.

Permits, authorizations and licenses issued by the CNSNS for radioactive facilities have a validity of between 2 and 5 years, depending on the type of facility or activities that are authorized; therefore, according to the provisions of the RGSR, the permit holder must submit the corresponding renewal request at least 30 days before its expiration, together with a detailed report of the experiences in radiological protection acquired, and, in case the conditions under which the authorization was issued have changed, the permit holder must request the corresponding modification separately from the renewal.

19.2.2.2 License-granting system for spent fuel management facilities

Within the Mexican regulatory framework, spent fuel management facilities are considered nuclear facilities; therefore, although they are subject to the limits of the dose limitation system and other conditions and requirements established in the RGSR and some NOMs in relation to the training of the personnel that works in them, the control of radioactive contamination and the release of radioactive material into the environment, the conditions for licensing these facilities are not specified in said regulations. Due to this, the CNSNS has made the decision to follow what is indicated by the regulatory framework of the country of origin concerning the nuclear reactors in Mexico; that is, what is established in the Federal Code of Regulations of the United States of America. It is important to say that the process of application, evaluation and issuance or denial of authorizations, permits and licenses is subject to what is indicated in the Federal Law of Administrative Procedure, previously mentioned, and is within the System of Quality Management of the CNSNS, ensuring that evaluations are carried out in a standardized and safety-oriented manner.

Since the existing spent fuel management facilities in the country are mainly the spent fuel pools of each of the nuclear reactors, the licensing process for these was the general process for licensing nuclear facilities and was considered during the evaluation. of the reactor to which each one corresponds. Similarly, the renovation evaluation is part of the renovation evaluation of the nuclear installation as a whole.

In the specific case of the Independent Spent Fuel Storage Facility, at the request of the CFE, during 2013, the CNSNS issued a document informing the CFE of the national and international documents that should be considered for the preparation of the documentation that would be submitted for evaluation and possible licensing of the dry warehouse. The document in question also indicates the minimum necessary information and its characteristics, which must be submitted to the CNSNS for the evaluation and issuance of the operating license for a dry spent fuel warehouse.

Operating licenses for nuclear facilities, as indicated in the Nuclear Law, must be issued by the Department of Energy, upon recommendation of the CNSNS, for which reason the CNSNS prepares a technical opinion called the “Safety Assessment Report”, containing the recommendations and conclusions of the evaluation; this document is sent to SENER. However, in accordance with the SENER Internal Regulations, in its Chapter XII, Article 42 section XX, published in the DOF the 31st of October of 2014, the General Director of the CNSNS has been delegated the power to grant the Site Authorizations , Design, Construction, Operation, Modification, Cessation of Operations, Final Closure and Dismantling of nuclear facilities.

19.2.3. System of prohibition of operations without the corresponding license

In accordance with the provisions of Article 26 of the Regulatory Law of Constitutional Article 27 on Nuclear Matters, which establishes that “The siting, design, construction, operation, modification, cessation of operations, definitive closure and dismantling of nuclear facilities and radioactive,

requires the authorization of the Department of Energy ". Also, in Article 29 of the same Law, it establishes that the" acquisition, import, export, possession, use, transfer, transport, storage and final destination or storage of radioactive material and ionizing radiation-generating devices may only be carried out with authorization issued by the Department of Energy through the National Nuclear Safety and Safeguards Commission, regardless of other authorizations ".

The RGSR indicates, in its article 189, that any activity with ionizing radiation sources is prohibited when the respective authorization, permit or license is lacking. Furthermore, the RGSR also indicates, in its article 181, the conditions under which it is considered that there is danger or imminent risk, being the operation without permission, authorization or license the first of these conditions and, in its article 183,in it indicates that, under this condition, the CNSNS will proceed to withhold, secure or deposit ionizing radiation sources or the equipment that contains them.

19.2.4. Regulatory system of institutional control, regulatory inspection, documentation and reporting

Inspection, verification, audit and recognition visits are based on the Federal Law of Administrative Procedure, the RGSR and the procedures of the SGC of the CNSNS. For the specific case of radioactive waste management facilities, the routine inspection, verification, audit or recognition process is carried out on an annual basis.

The Federal Law on Administrative Procedure indicates, in its article 62, that in order to verify compliance with legal and regulatory provisions, the authorities may carry out ordinary or extraordinary verification visits. According to this Law, verifiers must be provided with a written order issued by the authority, indicating the place or area to be verified, the purpose of the visit, its scope and the legal provisions that support it; this order must be exhibited, along with the valid credential with a photograph that accredits the verification function at the beginning of the visit, and a copy must be left to the owner, manager, manager or occupant of the establishment, who is obliged by this same Law to allow access and provide facilities to verifiers. The authority keeps a copy of the visit order with the name, signature and position of the person receiving the diligence, as well as the date of receipt.

Once carried out, the person receiving the diligence is ordered to behave truthfully; in case of not doing so, in accordance with the Federal Criminal Code, the penalties incurred are from 4 to 8 years in prison and from 100 to 300 days of fine. You are also informed of your right to designate 2 witnesses of the proceedings and that, in the event of not making use of that right, the CNSNS will designate them, in accordance with article 66 of the Federal Law on Administrative Procedure, which also establishes that a detailed record must be drawn up of all diligence and a copy of this must be left in the establishment, even if the person who attended refused to sign.

The act referred to must include: name, denomination or business name of the visited, time, day, month and year in which the diligence begins and ends, full address and contact information of the place visited, number and date of the visit order, name and position of the person with whom the diligence was carried out, name and address of the 2 witnesses, data related of the action, statement of the visited (if he decided to make any), name and signature of those who intervened in the diligence, including those that carried it out.

The RGSR, in its eleventh title on administrative procedures, also includes some guidelines in relation to the performance of proceedings; among them, it is indicated that proceedings may be authorized on non-working days and hours, which must be expressly indicated in the corresponding visit order. Regarding the order, it is also indicated that it must have the names of the persons who will carry out the diligence, who can carry out said diligence jointly or separately. In the information that the minutes must contain, the RGSR, in addition to the information previously indicated, indicates that it must be included that the person with whom the diligence of their right to make comments and observations was made known, establishing them within the minutes. or within a period of 10 business days from the diligence.

The RGSR also indicates that, within 20 business days after the diligence, the CNSNS will send the corresponding opinion, indicating the anomalies and deficiencies found, the deadlines to correct them and the measures that must be adopted to correct them. The foregoing, although it can be corroborated by the CNSNS, must be communicated to the CNSNS within the established deadlines. Inspectors are empowered to apply preventive or safety measures in case situations of danger or imminent risk are found during the procedure (both preventive measures and situations that can be considered of danger or imminent risk are clearly established in the RGSR, articles 181 to 183). If the possible commission of a crime emerges from

what is contained in the act, the CNSNS will inform the competent authority of the matter.

Regarding the regulatory system for documentation and reporting, through the annex of the operating license, as mentioned above, permit holders must submit an annual report of relevant activities in radiological protection, in this document, in addition to submitting the documentation that demonstrates compliance with various NOMs in relation to continuous training of personnel, medical surveillance, the calibration of detector equipment and others that are applicable, should indicate any abnormal situation that has occurred in the installation, regardless of the reports of abnormal situations referred to by the RGSR in its articles 176, 177 (within the first 24 hours after the incident occurred) and 178 (within 15 days of the incident). This document also notifies any administrative or technical change that has occurred in the facility, regardless of the modification process that must have been carried out prior to its completion.

19.2.5 Measures to ensure compliance with the regulations and license conditions

In addition to inspection, audit, verification or recognition procedures, administrative sanctions may be applied to ensure compliance with the regulations and license conditions. Regardless of what other authorities may determine, violations of radiological safety, which may be determined from the results of the minutes of the proceedings carried out, and the resolutions derived from it, will be sanctioned by the CNSNS as follows:

- A fine of five to five thousand times the general minimum wage in effect in the place and time in which the violation is committed. In the event that the infraction persists and the term granted for its correction has expired, fines may be imposed for each day that elapses without the respective mandate being obeyed, provided that it does not exceed the indicated limit and regardless of other sanctions;

- Suspension of authorization, permit or license;

- Cancellation of authorization, permit or license.

For the quantification and imposition of sanctions, the seriousness of the offense, the economic conditions of the offender and the recidivism, if any, will be taken into account.

Article 255 of the RGSR indicates the situations under which the imposition of a fine is applicable, which refer to non-compliance with specific articles of the RGSR.

Article 258 of the RGSR indicates the conditions under which the suspension of the permit, authorization or license proceeds; these conditions are: non-compliance with the conditions of this, non-compliance with the physical or radiological safety regulations, having provided information or false documentation or not having a radiological safety officer.

Article 259 of the RGSR indicates the conditions under which the cancellation of the permit, authorization or license proceeds, which are: negligence is demonstrated in the activities that involve sources of ionizing radiation, or after the deadlines to correct anomalies and deficiencies have expired, these are not have been appropriately corrected.

19.2.6 Assignment of responsibilities to the different bodies involved

As already mentioned, the bodies involved in the management of radioactive waste are the CNSNS as a regulatory body, the CFE with the management activities of waste produced in the energy sector and the ININ with the management activities of waste produced in the non-energy sector. Likewise, for the management of spent fuel, the bodies involved are the CNSNS as the regulatory body, and the CFE and the ININ with the activities to manage the spent fuel generated at the CNLV and in the TRIGA Mark III research reactor, respectively.

In Article 50 of the Regulatory Law of Constitutional Article 27 on Nuclear Matters, the powers of the CNSNS are established, among those related to the management of radioactive waste and spent fuel, which are described in article 20 of this report, which include the proposal, interpretation and monitoring of compliance with nuclear, radiological, physical and safeguard standards, monitoring of compliance with legal provisions and international treaties to which Mexico is a signatory, the ordering of audits, inspections, verifications and recognitions, as well as the application of the enforcement measures and the appropriate administrative sanctions.

Although the activities related to the nuclear fuel cycle and its reprocessing are assigned directly to the Department of Energy, the sixth transitory article of the same Law stipulates that the CFE will be in charge of these activities as long as the Department is not able to carry them out by itself.

In 1989, the Department of Energy instructed ININ to carry out all the activities of collection, treatment, transportation, storage and custody of radioactive waste derived from the use of radioactive materials in medical, industrial and research applications.

19.3 Regulation of radioactive materials as radioactive waste

With the exception of some specific NOMs for the management of radioactive waste and which are indicated in Annex L3 of this report, the regulatory framework and the licensing and inspection systems are applicable to ionizing radiation sources in general, for which reason, the required safety conditions cover radioactive material before and after being declared as radioactive waste and there are specific regulations to consider radioactive material as radioactive waste.

Compliance assessment

From the foregoing, it is observed that there are elements to guarantee the safety of the management of spent fuel and radioactive waste, which are described in the Mexican legislative framework. In addition, the regulations of the country of origin of the nuclear steam supply system are used, in the case of the CNLV.

Article 20. Regulatory body

1. Each Contracting Party shall establish or designate a regulatory body that is in charge of the application of the legislative and regulatory framework referred to in Article 19, and that is endowed with the authority, competence and adequate financial and human resources to fulfill the responsibilities that are assigned to it.

2. 1. Each Contracting Party, in accordance with its legislative and regulatory framework, shall adopt appropriate measures to ensure effective independence between regulatory functions and other functions when they concern entities that are involved both in the management of spent fuel or radioactive waste and in its regulation.

20.1 Establishment of the regulatory body

By virtue of article 17 of the Organic Law of the Federal Public Administration, the State Departments are authorized, in order to give a more effective attention and an efficient dispatch of the matters within their competence, to have decentralized administrative bodies that they will be hierarchically subordinate to them and will have specific powers to decide on the matter and within the territorial scope that is determined in each case, in accordance with the applicable legal provisions. It is by making use of this authorization and by means of the Internal Regulations of the Department of Energy, that it has the National Nuclear Safety and Safeguards Commission as a decentralized body, whose attributions, established in article 50 of the Nuclear Law are:

I. To monitor the application of the norms of radiological safety, nuclear safety, physical safety and safeguards, so that the operation of nuclear and radioactive facilities are carried out with the maximum safety for the inhabitants of the country;

II. Monitor that the territory of the Mexican United States complies with the legal provisions and international treaties to which Mexico is a signatory, in matters of nuclear safety, radiological safety, physical safety and safeguards;

III. Review, evaluate and authorize the bases for the siting, design, construction, operation, modification, cessation of operations, definitive closure and dismantling of nuclear and radioactive facilities; as well as everything related to the manufacture, use, handling, storage, reprocessing and transport of nuclear materials and fuels, radioactive materials and equipment that contains them; processing, conditioning, dumping and storage of radioactive waste, and any disposal made of them;

IV. Issue an opinion, prior to the authorization granted by the Secretary of Energy on the siting, design, construction, operation, modification, cessation of operations, definitive closure and dismantling of nuclear facilities;

V. Issue, revalidate, replace, modify, suspend and revoke, the permits and licenses required for radioactive facilities in accordance with the legal provisions, as well as collect and remove, where appropriate, existing utensils, equipment, materials and, in general, any contaminated personal property in said facilities;

VI. Recommend and advise regarding nuclear safety, radiological safety, physical safety, safeguards and administrative safety measures that proceed in anomalous or emergency conditions, in the case of nuclear and radioactive facilities; as well as determining and executing in these cases, when it is technically advisable to retain, secure or deposit ionizing radiation

sources or equipment that contains them, or the partial or total, temporary or definitive closure of the place where they are located or those others that have been affected, without prejudice to the measures adopted by other competent authorities;

VII. Prior to the start of operations, review, evaluate and authorize the plans that for the management of anomalous or emergency conditions must be established in nuclear and radioactive facilities;

VIII. Establish and manage the national system for the registration and control of nuclear materials and fuels;

IX. Issue an opinion prior to the authorization of imports and exports of radioactive materials and equipment containing them, as well as nuclear materials and fuels, for the purposes of safety, registration and control;

I. Propose the standards, review, evaluate and, where appropriate, authorize the bases for the design, construction, adaptation, preparation, operation, modification and cessation of operations of facilities for the extraction and treatment of radioactive minerals, as well as setting the criteria for interpreting the aforementioned standards;

II. Propose the standards, and set the interpretation criteria, relative to nuclear safety, radiological safety, physical safety and safeguards, with regard to the activities referred to in section III above, as well as proposing safety, registration and control criteria that regulate the import and export of nuclear materials and fuels;

III. Order and practice audits, inspections, verifications and surveys to verify compliance and observance of the legal provisions on nuclear safety, radiological safety, physical safety and safeguards, as well as to impose the enforcement measures and the administrative sanctions that proceed in accordance with the provisions of this Law and its regulations;

IV. Require and verify the information and documentation that it deems pertinent for the exercise of the attributions that this Law confers on it, in the terms of the applicable provisions;

V. Intervene in the celebration of the cooperation agreements or agreements that are made by the Department of Energy with other national entities in matters of nuclear, radiological and physical safety and safeguards;

VI. Establish the requirements that technical training programs on aspects related to nuclear safety, radiological safety, physical safety and safeguards must satisfy, and advise on them;

VII. Assist the authorities in charge of the prevention, prosecution and administration of justice, in cases in which nuclear materials and fuels or radioactive materials are the object of a crime, are lost or are involved in incidents, as well as the customs authorities in the terms of the respective Law;

VIII. Request the assistance of the public force when necessary to enforce its determinations, in the terms of the Law; and

IX. Others that are conferred in this Law and in the legal provisions in effect.

In addition to this, articles 13, 17, 18, 19, 23, 28, 29, 32, 33, 34, 35, 36 and 37 of the Nuclear Law (amended in 1985) support its functions.

The CNSNS does not have statutes because it is a decentralized body of the Department of Energy, which is why it lacks its own assets and legal personality. However, in compliance with article 19 of the Organic Law of the Federal Public Administration, it has an Organization Manual, which contains information on the organic structure of the agency.

The Mexican Regulatory Body is made up of a General Directorate, an Internal Control Body and five Deputy General Directorates that report to the General Directorate. The Deputy General Directorate has the following objectives:

- Deputy General Directorate for Nuclear Safety, in charge of proposing regulations on nuclear and radiological safety, as well as monitoring their application in nuclear facilities.

- Deputy General Directorate of Environmental Radiological Surveillance, Physical Safety and Safeguards, in charge of operating the National System of Environmental Radiological Surveillance, of maintaining the National System of Safeguards and that of Physical Safety in nuclear and radioactive facilities, as well as proposing the regulations in matters of radiological safety in the management of radioactive waste and to monitor its application in the facilities related to said activities.

- Deputy General Directorate of Technology, Regulation and Services, in charge of updating and adapting the regulatory framework; Likewise, it contributes to the technical support in matters of nuclear safety, radiological safety, physical safety and safeguards of the CNSNS and manages the computerized and telematic system.

- Deputy General Directorate of Finance and Administration, in charge of managing the human, financial and material resources, assigned to the Regulatory Body, in accordance with the applicable regulations and with the established policies, processing or providing timely services that are generally required for the maintenance and conservation of the facilities and their assets.

Likewise, there is the Directorate of Legal and International Affairs and the Organization of Nuclear Contingencies (OCN) and Organization of Radiological Contingencies (OCR), that report to the General Directorate.

Currently, the CNSNS has the personnel shown in Table 5, in which only the positions that are part of its structure are presented. In this regard, it is important to emphasize that since 2009 there has been, with some intermittences, a variable number of temporary places.

TABLE 5. NUMBER OF POSITIONS IN THE REGULATORY BODY

GENERAL ORGANIZATIONAL STRUCTURE	NUMBER OF POSITIONS		
	2018	2019	DIFFERENCE
General Management	9	6	-3
Deputy General Directorate for Nuclear Safety	41	37	-4
Deputy General Directorate of Radiation Safety	54	43	-11
Deputy General Directorate of Radiological Surveillance Environmental, Physical Safety and Safeguards	28	21	-7
Deputy General Directorate of Technology, Regulation and Services	35	21	-14
Deputy General Directorate of Finance and Administration	40	37	-3
Total	207	165	-42

Within the Deputy General Directorate of Environmental Radiological Surveillance, Physical Safety and Safeguards, there is the Directorate of Waste Management and Environmental Radiological Impact, which has had 5 structural positions during 2018 and 2019 and, with some intermittencies, with a temporary place.

It is also important to mention, in this regard, that the 6 positions assigned to the Internal Control Body, and whose financial resources were covered by the CNSNS during 2018, have been transferred and their resources are now covered by the Department of Public Function.

With all of the above, the allocation for "Personal Services" in the CNSNS is shown in Table 6. "Budget assigned under the concept of "Personal Services" to the Regulatory Body".

TABLE 6. BUDGET ASSIGNED UNDER THE CONCEPT OF "PERSONAL SERVICES" TO THE REGULATORY BODY

FISCAL EXERCISE	"PERSONAL SERVICES"		
	STRUCTURAL	EVENTUAL	TOTAL
2018 (Mexican pesos)	92,452,812.00	10,712,315.00	103,165,127.00
2018 (American dollars)	4,944,000.64	572,851.07	5,516,851.71
2019 (Mexican pesos)	70,853,239.00	9,000,299.00	79,853,538.00
2019 (American dollars)	3,788,943.26	481,299.44	4,270,242.70

20.2 Independence of the regulatory body.

The main challenges facing the CNSNS are related to the financial and human resources it has; Aware of this, in recent years, the CNSNS budget has been propped up by assigning it part of the uses paid by the Laguna Verde Nuclear Power Plant. The additional resources have been allocated mainly to operating expenses of the regulator, but they have also made it possible to finance collaboration agreements with universities and national and foreign research institutions, as well as the hiring of private companies to carry out different tasks, such as the evaluation of various safety issues, the strengthening of the management system and

the development of information systems to make internal processes more efficient.

The Internal Regulations of the Department of Energy stipulate the functions for each one of the Undersecretaries that make up the Department, as well as those of its decentralized bodies.

Regarding financial resources, because the CNSNS is a decentralized body dependent on the Department of Energy, it does not receive its own income from its operation. The fees paid by users of radioactive material for their licensing, handling and transportation, as well as the payment made by the Laguna Verde Nuclear Power Plant, are deposited directly to the Federal Treasury. Each fiscal year, the CNSNS budget is assigned by SENER.

Regarding human resources, in order to ensure the acquisition of appropriate skills, as well as the achievement and maintenance of adequate levels of competence, the CNSNS has made an effort to ensure that its officials participate in training programs, establishing a program of training on an annual basis that includes general content training connected with the public service and specialized technical training aimed at carrying out its functions. Mexico, like most countries, faces a generational shortage of professionals trained in matters related to nuclear and radiological safety, which is why new staff generally have insufficient knowledge and experience in relation to issues of nuclear and radiological safety.

In order to standardize the knowledge of professionals from different universities and study programs and give staff a sufficient basis to act for their safety and that of the companies and institutions under surveillance, the CNSNS has a basic training program which includes the fundamentals of nuclear safety, radiological safety and an introduction to the areas and matters that are the responsibility of the CNSNS. Another measure that has been adopted by the CNSNS to develop and maintain the competence of its personnel has been participation in training programs of other regulatory bodies, the IAEA and the European Commission, through international agreements and technical cooperation projects. It is important to mention that in accordance with the provisions of the Regulation of the Law of the Professional Career Service in the Federal Public Administration in article 55 section I, public servants, in no case should receive less than 40 effective annual hours of training.

Compliance assessment

Based on the foregoing, it can be concluded that the CNSNS has SENER as the head of the sector, has technical independence and management of its processes, as well as the organizations in charge of managing radioactive waste and spent fuel. However, being a decentralized body of the Department of Energy, since its foundation, this Regulatory Body has been conducted with technical independence. It is also important to mention that according to what is established in Article 39 of the Internal Regulations of the Department of Energy, its decentralized bodies have technical and operational autonomy and executive powers to carry out their functions.

SECTION F

OTHER GENERAL PROVISIONS RELATING TO SAFETY

This section includes the obligations set forth in the following Articles:

Article 21. Responsability of the license holder

1. Each Contracting Party shall ensure that the primary responsibility for the safety of spent fuel or radioactive waste management rests with the holder of the corresponding license and shall adopt the appropriate measures to ensure that said holder assumes his responsibilities.

2. In the absence of a licensee or other responsible party, responsibility will rest with the Contracting Party that has jurisdiction over the spent fuel or radioactive waste.

21.1 License holder

The responsibilities are established in the Mexican regulatory framework that has been described previously. This section will describe the regulatory framework regarding the responsibilities of the licensee and the Mexican State, and the measures that have been taken and may be taken in the future to ensure compliance.

The Nuclear Law establishes in article 19 that safety is paramount in all activities that involve nuclear energy and must be taken into account from the planning, design, construction and operation, to the definitive closure and dismantling of nuclear and radioactive facilities, as well as the dispositions and final destination of all its waste. It also establishes that nuclear and radioactive facilities must have physical safety, nuclear safety and radiological safety systems that satisfy the requirements established in this regard in other legal systems and in the regulatory provisions of the Law.

On the other hand, article 27 of the same Law establishes that the permit holders of nuclear and radioactive facilities must have the required safety personnel, who will be in charge of activities related to radiological protection within the workplace. The authorization holder will be directly responsible for radiological safety and also the head of the radiological safety staff (in charge of radiological safety), his assistant, if any, the occupationally-exposed personnel and the authorization holder. They must comply with the requirements and obligations established in the Law, the RGSR and other legal provisions. In nuclear facilities, the head of the corresponding public body will be responsible for strict compliance with the applicable regulations.

The RGSR establishes, in article 147, that the permit holder will be directly responsible for the radiological safety of the institution or company before the National Commission for Nuclear Safety and Safeguards, and in article 148, his obligations are established, which are the following:

I. Register with the CNSNS the occupationally-exposed personnel and the members of the Radiological Safety Staff, documenting the level of studies and training, which must be consistent with the work and functions that will be assigned to them in the facility;

II. Support the person in charge of radiological safety in all aspects related to the preparation, execution, supervision and modification of the Radiation Safety Program;

III. Provide all occupationally-exposed personnel with training, information, clothing, equipment, accessories and radiological protection devices suitable for the work they carry out and the necessary medical attention in cases of radiological accidents;

IV. Comply with the commitments contained in the Radiological Safety Report, approved by the CNSNS, and with the conditions of the license, permit or authorization;

V. Give notice and deliver the reports to the CNSNS in the event of radiological accidents, regardless of the warnings that must be given to other dependencies;

VI. Immediately notify the CNSNS of any theft or loss of ionizing radiation sources;

VII. Monitor that the person in charge of radiological safety fulfills his functions, analyzing and evaluating together with him the reports and records that are presented to him on radiological safety;

VIII. Ensure that periodic reviews and analysis of the work procedures, the equipment used and the facilities are carried out in accordance with what is indicated in the Radiological Safety Report;

IX. Prepare and maintain the Emergency Plan in operational conditions;

X. Prepare, and make known to all occupationally-exposed personnel, the Radiological Safety Manual;

XI. Issue to occupationally-exposed personnel the annual certificates at the end of the employment relationship, of the individual dose equivalents received in the previous 52 weeks and of the total dose accumulated to date. A copy of these documents will be sent to the CNSNS with the signature received from the individual;

XII. Keep a record of the medical examinations performed on occupationally-exposed personnel, which will be carried out under the terms and conditions referred to in the corresponding technical standard (NOM-026-NUCL-2011);

XIII. Keep a record of all release, dumping and destination or final disposal of radioactive materials;

XIV. Ensure that the radioactive material storage facilities keep records of the entry and exit of the material;

XV. Periodically verify the inventory of radioactive material according to what is indicated in the Radiological Safety Report;

XVI. Grant the facilities that are required during the inspections, audits, verifications and surveys carried out by the CNSNS;

XVII. Provide the information required during the proceedings referred to in the previous section;

XVIII. Present to the inspectors the manuals, records or documents related to radiological safety, when requested;

XIX. Carry out the tests and operations that are required during the inspection, audit, verification or recognition;

XX. Allow the CNSNS inspectors to take enough samples to carry out the pertinent analyses and checks;

XXI. Correct the deficiencies and anomalies detected in the inspections, audits, verifications and surveys, and send to the CNSNS, in due time, the corresponding correction report;

XXII. Provide the information and documentation required by the CNSNS, within the deadlines that it sets in this regard;

XXIII. Sign and initial all the documentation that is sent or presented to the CNSNS;

XXIV. Where appropriate, cover all expenses derived from radiological accidents, including compensation to third parties;

XXV. Notify the CNSNS, for its authorization, of the sale, loan, lease, donation, assignment or any other act that implies the transfer of ownership and deposit of sources of ionizing radiation;

XXVI. Immediately notify the CNSNS when you stop using or permanently possessing the authorized radioactive material;

XXVII. Take all radiological and physical safety measures that are required to safeguard the integrity of radiation sources in the event of a strike or stoppage;

XXVIII. Notify the CNSNS of the outbreak and termination of the strike or stoppage that occurs at the facility; and

XXIX. Comply with those other obligations imposed by this Regulation.

In some of these obligations, the radiological safety staff is mentioned, which must be established in the organization chart of the company or institution, the head of this group is called Radiation Safety Manager. To occupy this position, the requirements that must be met, according to the classification of the installation and to article 154 of the RGSR, are:

I. Establish radiological and physical safety procedures applicable to the acquisition, import, export, production, possession, use, transfer, transport, storage and destination or final disposal of radioactive materials and ionizing radiation- generating devices, for review and approval, where appropriate, by the CNSNS;

II. Train and qualify occupationally-exposed personnel in the correct application of radiological and physical safety standards and procedures, as well as monitor their compliance during operations carried out with ionizing radiation sources;

III. Establish the radiological surveillance program for the determination, registration, analysis and evaluation of the dose equivalents received by occupationally-exposed personnel;

IV. Ensure that occupationally-exposed personnel are provided with appropriate radiation protection clothing, equipment, accessories and devices and ensure that they use them properly;

V. Identify the areas, places, operations and conditions that could potentially cause radiation exposure;

VI. Immediately notify the permit holder of any fact that, in his opinion, may imply an increase in the risk of radiation exposure during the handling of ionizing radiation sources in order to apply the pertinent corrective measures;

VII. Immediately notify the CNSNS of any theft or loss of ionizing radiation sources;

VIII. To develop projects, procedures and methods to keep the exposure to radiation of occupationally exposed personnel and the public as low as reasonably achievable, but below the dose equivalent limits established in these Regulations;

IX. Prepare and supervise the program for testing the proper functioning and calibration of all ionizing radiation detector and meter equipment;

X. Prepare, supervise and participate in training programs for occupationally-exposed personnel;

XI. Keep a record of the dose equivalents received by occupationally-exposed personnel, attaching the dose equivalent received in previous jobs when the respective certificates have been submitted;

XII. Ensure that the management and disposal of radioactive waste are carried out in accordance with the applicable radiation safety standards;

XIII. Carry out leak tests on ionizing radiation sources at the time of receipt and in the periods established in the conditions of the license, authorization or permit, as well as after a radiological accident has occurred;

XIV. Keep a record of the leak tests, calibration and proper functioning of the ionizing radiation sources and of the equipment detecting and measuring said radiation, in the terms of this Regulation;

XV. Be present during the development of the inspections, audits, verifications and recognitions that the CNSNS carries out to the permit holder;

XVI. Provide the information requested by the inspectors in the course of the proceedings indicated in the previous section;

XVII. Correct the deficiencies and anomalies detected in the inspections, audits, verifications and surveys;

XVIII. Prepare and collect the necessary documentation for obtaining the timely renewal of licenses, permits and authorizations;

XIX. Prepare, update, control and file the plans, reports, records and writings related to the Radiological Safety Report and with the inspections, audits, verifications or surveys carried out by the CNSNS;

XX. Participate in the preparation, updating and application of the Radiation Safety Manual and the Emergency Plan of the facility;

XXI. Immediately go to the facility in the event of a radiological accident to coordinate and supervise the operations to be carried out, notifying the CNSNS of the fact, in accordance with the provisions of Title 9, Chapter I of the RGSR;

XXII. Prepare a training program for emergencies, which includes both potential radiological accidents during routine operations, as well as those that could occur as a result of a fire, explosion, flood, collapse or other accidents, which includes periodic drills with occupationally-exposed personnel;

XXIII. Provide the information or documentation required by the CNSNS, within the terms it sets in this regard; and

XXIV. Comply with the other obligations indicated by the RGSR.

Likewise, taking into account the classification of the installation, at the request of the CNSNS or at the request of a party, the registry of assistants of the person in charge of radiological safety can be authorized, who must send the permit holder all the documentation related to inspections, audits, verifications and recognitions carried out by the CNSNS and in which it intervenes as a substitute for the person in charge of radiological safety.

On the other hand, Occupationally-Exposed Personnel, in accordance with article 160 of the RGSR, have the following obligations:

i. Know and correctly apply the basic principles of radiation safety;

ii. Avoid any unnecessary radiation exposure to your person and the public;

iii. Take care and monitor that when ionizing radiation sources are no longer used, they are in adequate conditions of radiological and physical safety; the radioactive material in its containers and the equipment containing the sources or the device that generates ionizing radiation in the "off" position;

iv. Check when you leave an area where there is a risk of radioactive contamination, that your person and clothing are not contaminated;

v. Know and correctly apply the rules, instructions and procedures contained in the Radiological Safety Manual and in the facility's Emergency Plan;

vi. Know the correct handling and use of ionizing radiation sources, radiation detector and measuring equipment, accessories and radiological safety devices, and shielding, distance and time factors, to the extent required by their functions and responsibilities ;

vii. Carry personal dosimeters required in accordance with the provisions of the Radiological Safety Manual during the working day;

viii. Ensure that the least amount of radioactive waste is produced in the development of its activities;

ix. Know and correctly apply the procedures authorized by the person in charge of radiological safety for the elimination of radioactive waste;

x. Find out about the dose equivalents that he/she has received in the performance of his/her duties with the periodicity with which they are noted in the corresponding registry;

xi. Submit to taking biological samples that are required for medical surveillance and for bioassay tests;

xii. Truthfully provide the data that are required during the inspections, audits, verifications and surveys carried out by the CNSNS;

xiii. Know the appropriate behavior in the event of a radiological accident;

xiv. The personnel who provide their services in various facilities and are professionally exposed must inform the radiological safety manager of each one of them, so that all have the complete dosimetric history; and

xv. Inform the person in charge of radiological safety about any high-risk situation, incident and/or radiological accident.

Article 203 of the same RGSR states that the holder of the authorization of a site for the final disposal of radioactive material will take the pertinent corrective actions to maintain the stability and integrity of the facility during the duration of their responsibility; In this regard, the regulations do not specify the time in which the authorization holder must maintain responsibility for the site once the installation is not in active operation.

Regarding the measures to guarantee that the license holder assumes his responsibilities, the Law

of Civil Liability for Nuclear Damages, issued on the 29th of December of 1974, indicates in article 4 that: "The civil liability of the operator for nuclear damage is objective "; that is, the installation operator is responsible for the potential damages caused by the installation. On the other hand, a system of sanctions and enforcement measures has been established in case of non-compliance, based on both the Nuclear Law and the RGSR. The measures taken in the context of the aforementioned system of sanctions and enforcement measures do not exclude civil, criminal or labor liability that, where appropriate, may be borne by the holder of the authorization for damages to people or their property.

21.2 Responsabilities of the Mexican State

Article 28 of the Constitution, which talks about the prohibition of monopolies, monopolistic practices, watertight and tax exemptions, deals in the fourth paragraph with the functions that the State will exercise exclusively in strategic areas, which includes the nuclear area. In this sense, article 14 of the Nuclear Law specifies that the strategic activities that will be exclusive to the State are:

I. The beneficiation of radioactive minerals;

II. The nuclear fuel cycle that includes: the "refining" of the uranium concentrate, the "conversion", the "enrichment", the "reconversion", the manufacture of "pellets", the manufacture of "fuel rods", and the manufacture of "fuel assemblies";

III. The "reprocessing" of fuel, which consists of a series of chemical processes to recover the unused uranium, as well as the plutonium produced;

IV. The permanent or temporary storage and transportation of irradiated fuel or the waste product of its reprocessing;

V. The production of heavy water and its use in nuclear reactors; and

VI. The application of nuclear energy with the purpose of generating steam to be used in industrial complexes, water salting and other applications that may be necessary to promote the economic and social development of the country.

Therefore, the management of spent fuel and high-level radioactive waste, as well as the responsibility for its safe management, corresponds solely to the Mexican State.

Compliance assessment

From the aforementioned, it stands out that the national regulatory framework assigns responsibilities to the licensees of the spent fuel and radioactive waste management facilities, with the CNSNS with powers to regulate activities in nuclear matters.

Article 22. Human and financial resources

Each Contracting Party shall adopt the appropriate measures to ensure that:

a. The necessary qualified personnel for safety-related activities are available during the operational life of a spent fuel and radioactive waste management facility;

b. Sufficient financial resources are available to maintain the safety of spent fuel and radioactive waste management facilities during their operational life and for decommissioning;

c. Financial arrangements are made to allow the continued application of appropriate institutional controls and radiological surveillance activities / measures for the period deemed necessary after the closure of a facility for the final disposal of radioactive waste.

22.1 Qualified personnel

The Laguna Verde Nuclear Power Plant contemplates, within its annual budget, financial resources for the recruitment, training, training and retraining of the personnel of that nuclear facility. With this, the transmission of knowledge and compliance with nuclear regulations is guaranteed.

At the Laguna Verde Nuclear Power Plant, the Systematic Training Method, MSE (SAT) has been applied since 2006 to regulate the training of personnel who carry out safety-related activities. This methodology applies to those positions referred to in the 10 CFR 50.120 regulation; the other important positions for safety are governed by training programs that are also covered by the Quality Assurance Plan.

In order to obtain the abilities that need to be developed and maintained by the personnel who occupy a certain position that is under the MSE methodology, the result of the analysis of the position (list of tasks that require training) is taken as a starting point, and based on the available information, decides the method for obtaining the abilities.

In addition to the training programs obtained by analyzing the position, the "Training Needs" are continuously collected, which are analyzed in order to identify whether changes to processes, procedures, modifications to the plant , re-workings, the use of new technology, real or potential performance weaknesses, external or internal operational experience, among others, require training or the implementation of other actions to avoid or correct performance weaknesses.

NOM-034-NUCL-2016, "Requirements for the selection, qualification and training of nuclear power plant personnel" is applicable to the CNLV and specifies the academic training, experience and other minimum skills necessary to fulfill various functions within the facility.

In this regard, during the years 2018 and 2019, of the 1,400 permanent worker positions available to the CNLV, 32 permanent workers were assigned to radioactive waste management activities and 14 permanent workers assigned to spent fuel management activities.

On the other hand, for radioactive facilities, including those for the management of radioactive waste generated by non-energy practices, each permit holder must request the registration of the personnel in their operating license, authorization or permit, presenting documented evidence that demonstrates that the proposed persons comply with what is indicated in the RGSR for the level at which their registration is requested, namely:

Article 149.- The person in charge of radiological safety will be classified as A, B or C, according to the type of radioactive facility he is in charge of.

Article 150.- To be in charge of radiological safety class A, the following is required:

I. Degree in the areas of physical-mathematical or chemical-biological areas, duly registered, and professional license issued by the corresponding authority.

II. Certificate or proof of approval of an advanced radiation safety course recognized by the CNSNS;

III. Certificates that demonstrate three years of experience in radiation safety:

IV. Certificates that certify one year of experience in radiological protection aspects, related to the use that the permittee makes of radiation sources;

V. Reside in the town where the facility is located; and

VI.Have authorization from the CNSNS regarding their training and education.

Article 151.- To be in charge of class B radiological safety, the following is required:

I. Degree and identity card in the terms of section I of the previous article;

II. Certificate or proof of approval of an advanced radiation safety course recognized by the CNSNS;

III. Certificates that demonstrate one year's experience in radiation safety;

IV. Proof of six-month experience in radiological protection aspects related to the use that the permit holder gives to ionizing radiation sources;

V. Reside in the town where the facility is located; and

VI. Have authorization from the CNSNS regarding their training and education.

Article 152.- To be in charge of class C radiological safety, the following is required:

I. Degree and identity card in the terms of section I of article 150 or letter of intern in the areas of physical-mathematics or chemical-biological; and

II. Proof of training on radiological safety in the use that the permit holder gives to ionizing radiation sources recognized by the CNSNS.

Article 155.- The number of assistants that the person in charge of radiological safety must have is determined by the type and group of installation in question, activity, characteristics, number and specific use that is given to ionizing radiation sources. The assistants may be class A or B.

Article 156.- To be auxiliary to the person in charge of radiological safety, class A, the following is required:

I. Possess degree and identity card in the terms of section I of article 150;

II. Accredit one year of experience in radiation safety;

III. Accredit six months of experience in radiological protection aspects related to the use that the permittee gives to ionizing radiation sources;

IV. Demonstrate having taken and passed a radiation safety course, recognized by the CNSNS; and

V. To have authorization from the CNSNS regarding their training and education.

Article 157.- To be auxiliary to the person in charge of radiological safety, class B, the following is required:

I. Possess degree and identity card in the terms of section I of article 150, or a letter of intern in the physico-mathematical or chemical-biological areas;

II. Accredit the approval of a radiation safety course recognized by the CNSNS or demonstrate six months of experience in the specific use that the permittee gives to ionizing radiation sources; and

III. Have authorization from the CNSNS regarding their training and education.

Article 159.- Occupationally-exposed personnel must:

I. Be registered with the CNSNS;

II. Be, at least, 18 years old;

III. Possess a certificate of studies, as stipulated by the corresponding technical standard. This certificate must be issued by the corresponding authority; and

IV. Have authorization from the CNSNS regarding their training and education.

Additionally, candidates for occupationally-exposed personnel must comply with the provisions of NOM-031-NUCL-2011 "Requirements for the training of personnel occupationally exposed to ionizing radiation", which implies demonstrating that the proposed person has satisfactorily completed a course in Radiation Protection, according to the level at which registration is requested, taken in an institution or company authorized to teach the course in question, as well as a course in the installation's emergency plan and procedures manual, taught by Radiological Safety Staff of the same.

Likewise, as part of the Annual Report on Relevant Activities in Radiological Protection, each year, evidence must be submitted that all personnel registered in the license or authorization have satisfactorily completed a retraining course given by the Radiological Safety Manager of the facility.

During 2018 and 2019, ININ had 21 people working in radioactive waste management activities and related administrative activities (17 workers at PATRADER and 4 at CADER).

22.2 Sufficient financial resources

The financial resources for the operation and maintenance of the Laguna Verde Nuclear Power Plant come from the Federal Government and are required through the budget at the level of strategic and operational programs, which guarantee its safe and reliable operation.

At the CNLV, operation and maintenance expenses take precedence over the rest of the CFE facilities, since they must comply with the requirements of the Mexican regulatory body to maintain compliance with the Operation Authorization of the two CNLV units.

The process for the management of financial resources contributes to the fulfillment of the safety standards of the Plant during normal operation and programs for refueling nuclear fuel and major maintenance.

In accordance with Article 27 of the Constitution, the generation of nuclear energy and the regulation of its applications correspond exclusively to the Mexican State; therefore, it is responsible for allocating the budget annually and guaranteeing financial resources for the safe operation of the facility.

In the activities for the management of radioactive waste and spent fuel, the CNLV and ININ had sufficient financial resources during 2018 and 2019 to maintain the safety of their facilities, both for the management of spent fuel and for the management of radioactive waste. The annual

budget that both organizations have includes items for the management of spent fuel and radioactive waste.

22.3 Financial provisions for institutional control

The radiation protection measures that must be taken during the institutional control period are established in NOM-022/3-NUCL-1996, "Requirements for a facility for the definitive storage of low-level radioactive waste near the surface. Part 3. Construction, operation, closure, post-closure and institutional control ". This NOM indicates that, during the post-closure period, the necessary programs must be established for the activities to monitor the operation of the storage units to demonstrate that they maintain their integrity and comply with the requirements for a minimum period of 5 years. Basic criteria is established in the first part of said standard (NOM-022/1-NUCL-1996, "Requirements for a facility for the definitive storage of low-level radioactive waste near the surface. Part 1. Design").

It also establishes that after the post-closure period, the facility will be transferred to the authority or institution that will be responsible for institutional control, with authorization from the CNSNS, for which it must be demonstrated that the systems for environmental surveillance activities during the institutional control function in accordance with the provisions and that the storage units comply with the provisions of part 1 of the aforementioned standard.

On the other hand, it is indicated that for this period it should be established:

a. The control necessary to prevent the intrusion of people, animals and plants into the facility that could compromise its safety, including physical surveillance of the facility;

b. Implement a maintenance program for the facility;

c. Maintain an environmental surveillance system as required in appendix A of part 3 of the aforementioned standard (this surveillance system is described more fully in article 23 of this Report), taking into account the history of operation, closure and stabilization of the installation;

d. Establish a quality assurance program with the necessary mechanisms to detect any deviation in the application of the actions established to comply with the previous paragraphs, as well as mechanisms that allow their correction.

Compliance assessment

Based on the aforementioned, it is observed that Mexico has the human and financial resources necessary to comply with the obligations derived from the Joint Convention.

Article 23. Quality assurance

Each Contracting Party shall take the necessary measures to ensure that adequate quality assurance programs are established and implemented with respect to the safety of spent fuel and radioactive waste management.

During the CNLV's operating phase, the execution of activities important to safety is governed by the Quality Assurance Plan (QAP), which was designed to meet the requirements established in Appendix B of the 10 CFR regulation 50, subpart G of regulation 10 CFR 72 and NUREG-0800, Rev. 2, in accordance with the regulatory framework required for the licensing of the CNLV. Said plan has, as a means to achieve its implementation, a series of procedures that are reviewed biennially or every five years according to their importance for safety.

Likewise, the PGC requires compliance with the Regulatory Guides of the United States of America, established in the Safety Reports, as well as compliance with the controls and requirements established in ANSI / ANS-3.2-1982, with the exceptions to be agreed with the CNSNS.

The PGC also describes the quality assurance requirements and controls that will be applied to CNLV units 1 and 2 until the end of their useful life, including dismantling. In addition to the scope established in the PGC, in relation to the four categories of quality assurance (plus protection against fire and radioactive waste), it has an additional scope since it covers the Technical Operation Specifications (ETO), the software classified as important for safety, the radiation protection program, training activities and the Internal and External Radiological Emergency Plan, among others, and three categories established for equipment, systems, materials, processes and services related to the Independent Installation for Storage of Spent Fuel. In the case of category 3, this includes components, subsystems, systems, class 1E equipment, structures, processes and services that

process or contain radioactive waste, the release of which, due to the failure of a component, could cause a person in the site limits a whole body dose or its equivalent in any part of the body, greater than 5 mSv.

In order to maintain a very high level of quality in other systems necessary to meet the objectives of minimizing fire risks and control of radioactive waste, two additional quality categories were defined, to which partial compliance with the 18 Quality Criteria of Appendix B of the 10 CFR 50 regulation, these being:

- Category GC-SPCI: Classification assigned to components of the fire protection system that do not belong to the Fire Protection System for Safe Shutdown of the Reactor during an Earthquake (SSEFPS), but that are used to protect areas that contain equipment with category quality assurance.

- Category GC-RW: Classification assigned to process equipment, pipes and valves that are not safety class 1, 2 or 3, but which form the pressure barrier for radioactive waste.

Likewise, the following Quality Assurance Categories are included for dry storage:

- ITS-A Category: Classification assigned to structures, systems and components (ESC) whose failure can directly result in a condition that negatively affects the health and safety of the public. Failure of any ESC classified as ITS-A may cause loss of primary containment; causing the release of radioactive material, loss of shielding or an unsafe geometry, compromising criticality control.

- ITS-B Category: Classification assigned to structures, systems and components whose failure or malfunction may indirectly result in a condition that negatively affects the health and safety of the public. The failure of any ESC classified as ITS-B, along with the failure of another ESC can result in an unsafe condition.

- ITS-C Category: Classification assigned to structures, systems and components whose failure or malfunction would not significantly reduce the effectiveness of the packaging and would not result in a condition that negatively affects the health and safety of the public.

In the event that the CNLV adopts an internationally-accepted quality system, such as the ISO standard, the CNSNS would review the comparison of these international standards against Appendix B of the 10 CFR 50 regulation and, based on this review, the CNSNS would determine if any additional requirements are required to those already established in the current regulation.

In relation to the implementation of the Total Quality Institutional Program, in compliance with the guidelines of the CFE General Directorate and as part of the Institutional Programs, the Nuclear Power Plant Management (GCN) permanently maintains a policy of continuous improvement of its Global Quality System. Due to this, the Central has been certified in the Quality, Environmental and Safety Management Systems, and Occupational Health, since September 1997, in January 1999 and in November 2002, respectively. and these have remained in force.

In 2005, as a result of the evolution of the Management Systems in the GCN, the Comprehensive Certification of the Quality, Environmental and Safety Management System, and Occupational Health was achieved. Subsequently, in 2007, the GCN, as an organization that is part of the Generation process of the Operation Directorate (DDO) of the CFE, participated in the establishment, implementation and maintenance of an Integral Management System (SIG) Multi-sites (applicable to all DDO work centers). It included aspects in terms of Quality, Environment and Safety and Health at Work, based on the requirements established in the current standards ISO-9001, ISO-14001, and NMX-SAST-001, which help to continuously improve efficiency and the effectiveness of the GCN Management System, as well as its competitiveness, to meet the requirements of customers and stakeholders, achieving SIG certification in October 2008 and recertifications in November 2011 , in June 2015 and June 2018.

The Quality Assurance Plan contains measures for the establishment and execution of a system of audits and surveillance planned to verify the correct implementation of the PGC requirements in all the organizations responsible for providing the required service. The audits include an objective evaluation of the practices, procedures, instructions, activities, performance of the areas, among many others, as well as the review of documents and records to ensure that the Quality Assurance Plan is implemented in a appropriate and effective. The surveillance is carried out by the GCN's quality assurance organization.

The GCN has established as a policy that the maximum interval between audits, for the same functional area, is two years; however, for areas that require further attention due to the recurrence of problems or the status they present, audits could be performed less than two years frequently. Likewise, in the Operational Technical Specifications it is established to carry out semi-annual and annual audits in some specific areas.

The CFE's quality assurance organization evaluates and qualifies all suppliers of equipment, components and services that are important for the CNLV's safety. The evaluation is carried out through a direct audit by the CFE of the implementation of the vendor's or supplier's quality programs, or through audits carried out under the cooperation program of the "Nuclear Procurement Issues Committee" (NUPIC for its acronym in English), of which the CFE is a member. Ratings are generally based on ANSI / ASME N 45.2.12, "Requirements for Auditing Quality Assurance Programs for Nuclear Power Plants", and on ANSI / ASME N 45.2.13, "Quality Assurance Requirements for Control of the Acquisition of Articles and Services for Nuclear Power Plants".

The CNSNS evaluates the CNLV's Quality Assurance Plan and its changes during the construction and operation phases, to verify that it complies with the requirements established in Appendix B of the 10 CFR 50 regulation and in NUREG-0800 Rev. 2 , as described in the regulatory framework required for the licensing of the CNLV.

In the case of the corrective action program, both the resident inspectors (on a monthly, semi-annual and annual basis), as well as the central office staff (on a biennial basis), verify: (1) the effectiveness of the corrective action program to identify and solve problems according to the degree of importance they have on safety; (2) specific problems that have generic implications; (3) the impact of the combination of some problems that, individually, have no impact on safety, and (4) if the CNLV authorization holder is collecting the information in an appropriate manner.

Additionally, continuous communication has been established between the CFE Quality Assurance Department and the CNSNS to follow up on the corrective actions of the findings documented during the inspections carried out by the CNSNS to the CNLV, in order to reduce the time response and implementation of corrective, preventive and improvement actions.

Finally, through the evaluation of the indicators and the results of the inspections to the Maintenance Rule (regulation 10 CFR 50.65) it is verified if the CFE is following up on those matters that may affect the operation and availability of the equipment. that are under this regulation.

Regarding ININ, currently the Quality Management System (QMS) is based on compliance with the ISO 9001:2015 standard, applicable to the main certifiable production areas: TRIGA Mark III research reactor, Radioisotope Production, Gamma Irradiation, Radioesterilized Tissue Bank, among others. This Quality Management System applies to safety in the management of spent fuel and radioactive waste.

The current normative documents are the following:

- PL.CAL-1, Strategic Quality Plan 2019-2021.
- M.CAL-1, Quality Manual.
- PR.GC-13, Quality Assurance Program (applicable for activities in the CNLV).
- PL.GC-1, Software Quality Assurance Plan.

The procedures that are applicable in the areas of the Institute are the following:

- P.SGC.DG-01, Document Control.
- P.SGC.DG-02, Records Control.
- P.SGC.DG-03, Audit.
- P.SGC.DG-04, Control of Non-Conformities.
- P.SGC.DG-05, Improvement and Corrective Action.
- P.SGC.DG-06, Planification.
- P.SGC.DG-07, Monitoring, Measurement, Analysis and Evaluation.
- P.SGC.DG-08, Measurement of Internal Customer Satisfaction.
- P.SGC.DG-09, Review by Management.

In CADER, in addition to the requirements established in the ININ SGC, due to the requirements of the operating license, the quality management system must comply with the provisions of the respective regulations and with

the IAEA recommendations contained in the GS-R-3 "The Management System for Facilities and Activities", GS-G-3.1 "Application of the Management System for Facilities and Activities" and GS-G-3.3 "The Management System for the processing, handling and storage of radioactive waste" , with the understanding that in case of contradictions, the national regulations will be applicable.

For this reason, since 2008, the CADER Comprehensive Management System (SIG) was designed and developed, in addition to the application of the ININ Quality Management System (QMS).

The main characteristics of the CADER SIG are the following:

- Comply with the objective of providing the guidelines to establish, implement, evaluate and continuously improve a Management System that integrates safety, health, environment, protection, quality and economic elements, to satisfy the requirements established by the IAEA.

- Develop and establish a step-by-step approach to determine how system requirements will apply to products and activities.

The SIG has three levels in its structure:

Level 1 (from the SGC of ININ and current normative documents).

i. Institutional vision, mission and goals.

ii. Policy statement.

iii. Institutional structure.

iv. Levels of authority and responsibilities.

v. Structure of the system documentation.

vi. Overview of institutional processes.

vii. Responsibilities of the personnel in charge of the processes.

viii. Agreements to measure and evaluate the effectiveness of the system.

Level 2 (in the CADER SIG).

i. Process map of the system, including interactions between processes.

ii. Responsibilities and lines of communication in each area of activity.

iii. Objectives and specific activities.

iv. Activities to do detailed work.

Level 3 (in the CADER SIG).

i. Documents to perform detailed work.

ii. Job description.

In the CADER SIG, the analysis and efficiency of the processes is paramount, which is why they were developed with the following tools:

- Description of the process.
- Process diagram.
- Participants in the process.
- Process inputs and outputs.
- Process specifications.
- Analysis of positions by process.
- Documentation of the process.
- Resource analysis.
- Verification of the process.

As can be seen from the additional requirement established for CADER, within the regulatory framework there are some specific requirements for the quality assurance system of radioactive facilities (which includes management facilities for radioactive waste generated in non-energy activities), during the evaluation process for licensing, and in accordance with the provisions of articles 220 and 221 of the RGSR, both for the issuance of a construction permit and for the issuance of the operating license of any radioactive facility, the applicant must submit before the CNSNS the Quality Assurance Program that will be followed in the requested activities.

Within the Annual Report of Relevant Activities in Radiological Protection, the permittee presents the results of internal audits, as well as any proposed modification to the Procedures Manual, Emergency Plan or the Quality Assurance Program, which should not be integrated into the document until

been approved by the CNSNS, who must have a valid copy of each of these documents.

Additionally, within the specific NOMs for each type of installation, in some cases requirements related to the Quality Assurance Program are included, these cases are described below:

NOM-018-NUCL-1995, "Methods to determine the activity concentration and total activity in radioactive waste packages", establishes that, when presenting the activity concentration and total activity concentration values in radioactive waste packages to the regulator, The quality assurance program must be presented that guarantees the correct application of the proposed method, as well as the verification of the correct application of the technique.

NOM-020-NUCL-1995, "Requirements for radioactive waste incineration facilities", indicates that adequate quality assurance programs must be established for the construction, operation, closure and dismantling stages of the facility. The Quality Assurance Program, established for each of the different stages, must have at least the following elements: organization, control of documents, supplies, elements and processes, inspection and control of tests, control of non-conformities, measures corrective measures, audits and records.

NOM-022/1-NUCL-1996, "Requirements for a facility for the definitive storage of low-level radioactive waste near the surface. Part 2. Design ", indicates that the design of the installation must be carried out following a Quality Assurance Plan that considers a series of numerals in relation to the materials used, the minimum durability required of the installation depending on the type of waste that are stored in it, among others.

NOM-022/3-NUCL-1996, "Requirements for a facility for the definitive storage of low-level radioactive waste near the surface. Part 3. Construction, operation, closure, post-closure and institutional control ", establishes the various parts of environmental monitoring (pre-operation, post-closure operation and during institutional control), as well as the minimum elements that it must contain the Quality Assurance Program associated with said surveillance, which are: quality of the equipment and instruments used for this purpose, training and experience of the personnel, frequency of calibration and maintenance of the equipment and instrumentation and monitoring of results.

NOM-035-NUCL-2013, "Criteria for the dispensing of radioactive material waste" requires the establishment of a waste management system in the generating facilities that facilitates the separation and guarantees the traceability of the generated waste.

Finally, NOM-036-NUCL-2001, "Requirements for radioactive waste treatment and conditioning facilities", indicates that the Quality Assurance Program must guarantee that the facility's cessation of operations will be carried out in accordance with the established program and the applicable regulations.

Compliance assessment

From the aforementioned, it is observed that in Mexico quality assurance plans have been implemented for all spent fuel and radioactive waste management facilities, thus complying with the obligations of the Joint Convention on the issue of guarantee quality.

Article 24. Operational radiological protection

1. Each Contracting Party shall take appropriate measures to ensure that during the operational life of a spent fuel or radioactive waste management facility:

a. Radiation exposure of workers and the public caused by the installation is reduced to the lowest level that is reasonably achievable, taking into account economic and social factors;

b. No person is exposed, in normal situations, to radiation doses that exceed the national prescription of dose limitation, that take due account of internationally approved radiation protection standards;

c. Measures are taken to prevent unplanned and uncontrolled releases of radioactive materials to the environment.

2. Each Contracting Party shall adopt the appropriate measures to ensure that discharges are limited so that:

a. Exposure to radiation is kept at the lowest level that can reasonably be achieved, taking into account economic and social factors; and

b. No person is exposed, in normal situations, to radiation doses that exceed the national prescription for dose limitation, which take due account of internationally approved radiation protection standards.

3. Each Contracting Party shall adopt the appropriate measures to ensure that, during the operational life of a regulated nuclear facility, in the event of an unplanned or uncontrolled release of radioactive materials to the environment, appropriate corrective measures are applied to control the emission and mitigate its effects.

24.1 Operation of the facilities

24.1.1 Reduction of radiological exposure

The RGSR, in its article 7, indicates that the doses received as a result of exposure to sources of ionizing radiation and of practices that involve irradiation with ionizing radiation or incorporation of radioactive material, will be subject to a dose limitation system whose foundations are :

a. Any practice that can produce doses to workers will not be approved unless there is a positive net benefit.

b. The design, planning, use and subsequent application of sources and practices should be done in a way that ensures that exposures are kept as low as can reasonably be achieved, taking into account social and economic factors.

c. The establishment of limits for dose equivalent.

The effective dose equivalent limit for occupationally-exposed personnel established in the RGSR is 50 mSv / year and 500 mSv / year for stochastic and deterministic effects, respectively. For the public, a limit is ten percent of that prescribed for occupationally-exposed personnel. Additionally, a provision is included for members of the public who may be exposed for prolonged periods to an effective dose equivalent equal to or close to the annual limit, which indicates that measures must be adopted in order to reduce their effective dose equivalent. for life at an annual average value of 1 mSv.

Operationally, the CNLV has established its administrative level of effective dose equivalent at 20 mSv per year, so that any activity carried out in the CNLV, including the management of radioactive waste and spent fuel, must be carried out under the controls and measures to ensure that staff will not receive a dose higher than the annual dose limit.

In order to limit the doses to operating personnel, the buildings of the Laguna Verde Nuclear Power Plant were divided into five categories by zones, considering radiation levels, according to the following extreme cases:

· Zone 1, of unlimited permanence with an exposure ratio of less than 250 μSv / h that, integrated annually, will not exceed the dose limit of 0.005 Sv / year.

· Zone 5, is the zone with the highest radiation, whose access is restricted and controlled.

Likewise, to direct and promote the implementation of the ALARA criteria in all the activities carried out by CNLV personnel, the structure of the Radiological Protection Department has a specific group called the “Radiological Exposure Analysis and Control Group” , whose function is the analysis, evaluation, control and optimization of the radiation exposure of the personnel in their respective activities.

Additionally, the definition of the aforementioned areas also includes areas with radioactive material suspended in air, which must differentiate those in which the value of NOM-041-NUCL-2013 is exceeded and those are normally not occupied. that can be occupied by personnel and in which the concentration, averaged over the time the personnel stay in the area, is greater than 25% of the concentration established in NOM-041-NUCL-2013.

24.1.2 Exposure in normal situations

The CNLV, in addition to the annual report on the radioactive waste management plan, must present a quarterly report, which includes the presentation of radiation levels around the radioactive waste management facilities and the results of dosimetry in the points that were previously selected. In the case of radiation levels, there is an administrative level that, if exceeded, would imply a dose close to the limit for the public, assuming that the Central’s personnel who are not occupationally exposed remain close to the facilities throughout their annual working day. (2,000 hours). In the case of dosimetry, in the same way, it must be verified that the limit for the public is not exceeded.

The RGSR defines the levels of registration, investigation and intervention: the first of them as the value of dose equivalent, effective dose equivalent or incorporation of radionuclides,

above which the information is of interest for its registration and conservation; the second as the value of dose equivalent, effective dose equivalent or radionuclide incorporation that is considered important to justify an investigation in case of being exceeded; the third as the value of any quantity used in radiological safety, which if it is exceeded, corrective measures must be taken.

The levels of registration, investigation and intervention are established for each licensed facility, depending on the activities that will be carried out in the facility, an adequate establishment of these levels allows the permit holder to identify an increase in the doses to the personnel to take actions oriented to the optimization of said doses.

An adequate establishment of the levels of registration, investigation and intervention allows the permit holder and the regulatory body to identify abnormal situations that have caused an increase in any of these magnitudes and, therefore, in the dose to occupationally-exposed personnel, the investigation and the measures corrective measures that may be necessary to prevent dose equivalents from exceeding the limit, as well as to keep them as low as reasonably possible.

An important challenge in the area of dosimetric control has to do with the fact that some permit holders have more than one operating license and the occupationally-exposed personnel frequently serve in more than one of these licenses, which makes it difficult to discriminate the practice under which each Fraction of the total dose received by the staff has been received, in order to identify, if necessary, abnormal situations that may have occurred in one of these practices, and to which practice it corresponds.

24.1.3 Unplanned and uncontrolled emissions to the environment

The management of liquid and gaseous radioactive waste generated during CNLV operation follows a protocol established in the Central's procedures manual and aims, among others, to avoid unplanned and uncontrolled emissions to the environment.

In accordance with the provisions of the corresponding procedure for the case of liquid radioactive waste, chemical analyzes are carried out to determine its possible reuse. If not, the discharge procedure requires gamma analysis and characterization, the information of which is compared with the limits established in NOM-041-NUCL-2013, which, if exceeded, imply that the waste cannot be discharged and other options for its management must be considered. On the other hand, if the waste in question complies with the established limits, samples are taken in duplicate for a new analysis of the isotopic content; after this, its download is authorized and notified. If the alarms are activated during material discharge, the release must be suspended.

On the other hand, for gaseous radioactive waste, the procedure is the identification and notification of the emissions, thus, it focuses on the analysis and management of the filters used at the different points where there are gaseous streams. Depending on the origin of the filters, they are analyzed for alpha radiation and radionuclides of strontium or iodine, particles, noble gases and tritium. With this information the activity and the off-site dose are calculated, which, in case of exceeding the values established in the Technical Specifications of Operation of the facility, must be notified to the CNSNS in the effluent release report that is presented each 6 months.

24.2 Limitation of discharges

24.2.1 Reduction of radiological exposure

NOM-041-NUCL-2013, "Annual limits of incorporation and concentrations in releases", has been established in order to comply with the dose limitation system indicated in the RGSR, it indicates the limits derived for the release of quantities dispersible residuals of radioactive material from the normal operation of radioactive and nuclear facilities. This standard establishes the annual incorporation limits, the derived concentration in air, the concentration limits in air and in water, and the monthly average concentration for each radionuclide of interest that can be released by a facility.

Nuclear facilities and those radioactive facilities that, due to their activities and possible environmental impact, justify the imposition of an environmental radiological monitoring program, are required to submit an annual report to the CNSNS showing the results of said monitoring. The facilities subject to this control are the CNLV, CADER and the ININ (as a whole). It is important to mention that the only facility dedicated to the management of radioactive waste that receives specific radiological monitoring is the CADER, the others are monitored as part of the follow-up to the ININ or the CNLV. In this report, dosimetry results of certain areas must be presented, as a result of the analysis of alpha, beta and gamma radiation carried out on various samples of water,

soil and food collected in the area. In addition to evaluating the environmental radiological monitoring reports, the CNSNS, through the Deputy General Directorate of Environmental Radiological Surveillance, Physical safety and Safeguards, carries out an independent monitoring program for the purpose of corroborating the results.

24.2.2 Exposure in normal situations

The doses are calculated from the emissions of the Laguna Verde Nuclear Power Plant in accordance with the models established by the CNLV's Technical Operating Specifications, this impact has resulted in all cases in a small Fraction of the corresponding limits. In the case of non-energy waste management facilities, an estimate of the dose is also made from the results of the environmental monitoring performed at the facilities.

24.3 Corrective measures for unplanned or uncontrolled releases to the environment

The RGSR establishes the obligation of the permit holder to keep a record of all radioactive material emissions that take place at the facility, in addition to giving notice and delivering the corresponding reports in the event of an accident to the CNSNS and, where appropriate, to other agencies. The reports referred to in this paragraph are indicated in articles 176, 177 and 178 of the RGSR, which indicate that during the first 24 hours after an accident, the CNSNS must be reported, among other information, quantity, physical characteristics and Chemicals of the radioactive material released into the environment and the estimation of the dose of each of the people who have been involved in it; Additionally, a second report must be submitted within 15 business days, including a description of the measures taken to prevent the accident from recurring.

In accordance with the provisions of section VIII of article 181 of the RGSR, the release of radioactive material outside the facility that exceeds the limits set in the license or permit is considered a situation of danger or imminent risk. Being considered as a situation of danger or imminent risk, in accordance with articles 182 and 183 of the aforementioned regulation, the CNSNS can take preventive and safety measures consisting of the retention, assurance or deposit of the sources when the release does not exceed double the established limit or proceed to the temporary, total or partial closure of the facility, if twice the established limit is exceeded. The foregoing, regardless of the corresponding sanctions according to the RGSR and those that derive from non-compliance in the area of competence of other authorities other than the CNSNS.

It is also established that the CNSNS may authorize releases that exceed the established limits, upon justification and request.

Compliance assessment

From the aforementioned, it is reported that Mexico complies with the indications of operational radiological protection in spent fuel and radioactive waste facilities, as mentioned in the Joint Convention.

Article 25. Preparation for emergency cases

1. Each Contracting Party shall ensure that before and during the operation of a spent fuel or radioactive waste management facility there are appropriate emergency plans that are applicable within the site, and, if necessary, off site. Such emergency plans should be tested with the appropriate frequency.

2. Each Contracting Party shall take appropriate measures for the preparation and testing of emergency plans for its territory to the extent that it may be affected by a radiological emergency at a spent fuel or radioactive waste management facility located in the vicinity of its territory.

Article 28 of the Nuclear Law establishes that: "Authorizations for the construction and operation of a nuclear facility will only be granted when it is accredited by presenting the relevant information, how the safety objectives will be achieved and what they will be. The procedures and methods to be used during the siting, design, construction, operation, modification, final closure and dismantling phases of the facility. Additionally, the corresponding radiological emergency plan will be presented. This information must observe the terms and forms provided in the regulatory provisions of this law. "

In the same way, in article 50, section VII of the Nuclear Law, the CNSNS is defined as attribution and responsibility: "Prior to the start of operations, review, evaluate and authorize the plans for the management of anomalous or emergency conditions must be established in nuclear and radioactive facilities. "

In a particular way, the RGSR establishes in article 124 that "Before the start of operations, every

radioactive facility must have an Emergency Plan consistent with the guidelines of the National Civil Protection System and based on the study of the radiological consequences of the accidents that may happen in the facility ".

For the radioactive waste and spent fuel management facilities located within the CNLV, additionally, condition 13 of the Units' Operating Authorizations emphasizes the need to keep radiological emergency plans updated. The response to emergencies at the CNLV is made up of two complementary plans: the Internal Emergency Plan (PEI) and the External Radiological Emergency Plan (PERE).

All dependencies and institutions that are members of the emergency response organization have a controlled copy of the Plan, which is kept up-to-date regarding the modifications or amendments determined by the subcommittees or Task Forces validated by the Technical Secretary of the Planning Committee. Radiological Emergencies. In addition, response personnel are trained in accordance with current procedures and manuals; the verification of human and material resources is controlled based on current procedures as well as information to the public, and they are scheduled with the corresponding Task Forces; the drills are carried out according to the procedures with the participating agency that schedules their training; and the integrated exercises to evaluate the effectiveness of the plan are carried out in accordance with the regulations and / or the regulatory body so indicates. Within the PERE, the responsibilities that each institution must fulfill to keep said plan current and operational are defined. During the integrated exercises, it is verified that the task forces have the personnel, training and resources necessary for their intervention in the event of a probable activation of the plan, with the CNSNS, SENER or another government institution being able to be observers. In the last exercise carried out in November 2019, the Secretariat of Energy, the National Intelligence Center and the CNSNS were present as observers.

On the other hand, for radioactive waste management facilities generated in non-energy practices, by means of the annex to the corresponding operating license, it is required to have a visible copy of the current version of the emergency plan in all areas where radioactive material is handled. In addition, it must demonstrate, prior to the registration of the people proposed to work as occupationally-exposed personnel, that they have specific training in the radiological safety manual and in the emergency plan of the facility (paragraph 5.3.1.2 of NOM-031 -NUCL-2011 "Requirements for the training of personnel occupationally exposed to ionizing radiation"), as well as annual training in which updates and modifications to the manual and the emergency plan must be considered (paragraph 6.2.3 of the same rule). In the annual report of relevant activities in radiological protection, the results of the drills that have been carried out at the facility must also be indicated.

Compliance assessment

With the aforementioned, it is verified that in Mexico it complies with what is indicated in the preparation for emergency cases of the Joint Convention.

Article 26. Closure

Each Contracting Party shall adopt the appropriate measures to guarantee safety during the decommissioning of a nuclear facility. These measures will ensure that:

- i) Qualified personnel and adequate financial resources are available;
- ii) The provisions of Article 24 are applied with respect to operational radiological protection, unplanned and uncontrolled discharges and emissions;
- iii) The provisions of Article 25 are applied with respect to emergency preparedness; and
- iv) Records of important information are kept for the closure.

26. 1 Personnel and financial resources.

The provision of expenses for the dismantling, handling and final disposal of the radioactive waste of the Plant at the end of its useful life is recorded and observed in the financial reports. Likewise, it is calculated based on the provision issued jointly by the CNLV and the CFE accounting company, which indicates that the CNLV will integrate a fund of 1,206.13 million US dollars (as of 2015) for both units, in accordance with the methodology established by regulation 10 CFR 50.75, with data from NUREG-1307 Rev. 15. Said amount must be periodically updated in accordance with the data of the new revisions issued from NUREG-1307. This fund will be integrated into production costs, for future storage of radioactive waste and for decommissioning.

The procedure to be used for the closure consists of immediate decommissioning or DECON, which is in accordance with the provisions of NUREG / CR-6174, and which defines four work stages:

1. Pre-dismantling engineering and planning. Prior to the cessation of activity, it is the planning, engineering and regulatory review stage.

2. Deactivation of the reactor for safety storage. The cessation of activity and the preparation of the warehouse is carried out.

3. Safety storage and control of spent fuel. Period of safety storage at the plant and operations in the spent fuel pool until your fuel inventory is zero.

4. Dismantling. The decontamination and dismantling of the radioactive parts of the plant is carried out in search of the termination of the nuclear reactor license.

As part of the extended period for the safe storage of spent fuel, you have the following:

Prior to the end of the useful life of the Independent Spent Fuel Storage Facility, located within the CNLV, the Multipurpose Containers (MPC), which house the spent fuel, will be transferred from their over-packaging called HI-STORM FW to a shipping container called HI-STAR for off-site transportation, that is, to an approved site for final disposal.

Because MPC containers are designed to store, transport, and dispose of spent fuel, the fuel assemblies will remain within this sealed container, so decontamination of the MPC container will not be required for transportation to a repository.

After the transfer of the MPC containers off-site, the dry warehouse can be dismantled, identifying and removing the residual radioactive material, carrying out a final radiological report.

The CFE will evaluate and modify the existing study for the dismantling of CNLV Units 1 and 2 to include the financing cost for the dismantling of the Independent Spent Fuel Storage Facility.

26.2 Operational radiation protection, unplanned and uncontrolled discharges and emissions

The Nuclear Law establishes that nuclear and radioactive facilities must satisfy the requirements for siting, design, construction, operation, modification, cessation of operations, definitive closure and dismantling established in the regulatory provisions. These requirements are determined taking into account the risk related to the operations in which the radioactive material is involved and based on the activity and radiotoxicity of the isotopes that are present. It also indicates that authorizations for the construction and operation of a facility will only be granted when it is proven how the safety objectives will be achieved, the procedures and methods that will be used during the phases from its siting to its dismantling, in addition to presenting the corresponding radiological emergency plan and the information regarding the impact on the environment.

In the case of the CNLV, it must satisfy, among others, what is indicated in the regulation 10 CFR parts 20 and 50 on the termination of operating licenses and dismantling of power reactors, by virtue of the provisions of condition 3 of its Operating license.

In the case of radioactive facilities, a Radiological Safety Report must be submitted to the CNSNS before closure, verifying that the conditions established in the Report submitted together with the application for an operating license have been met.

As can be seen in Annex L3, there are some NOMs that are applicable to a specific case of facilities, in particular, to radioactive waste incineration facilities that may exist in the future in Mexico, design conditions are established, operation and closure in NOM-020-NUCL-1995. For the closure, it is indicated that a program must be established that includes procedures, planning of the works to be carried out, special training required by the personnel who will carry out the dismantling, equipment and instrumentation required, estimation of the waste that will be produced and the way in which will be managed.

NOM-022/3-NUCL-1996, "Requirements for a low-level radioactive waste definitive storage near the surface facility. Part 3. Construction, operation, closure, post-closure and institutional control", establishes the requirements for closure, indicating that before starting the closure of the facility, it must be demonstrated to the CNSNS:

i. A closure plan to ensure that activities related to facility decommissioning, including support facilities, will not affect the CNSNS-approved design features.

ii. Activities related to support facilities decommissioning will be carried out in such a way as to ensure that the generation of radioactive waste is kept to a minimum and that exposure to personnel is consistent with the ALARA philosophy and legal limits.

iii. A Quality Assurance Program has been established to guarantee that the design characteristics accepted by the CNSNS will be met.

iv. The necessary procedures are in place to close the storage units and decommission the auxiliary facilities.

v. The safety evaluation is in force considering the current conditions in the facility, otherwise a re-evaluation has been carried out, in order to demonstrate that accomplish the basic safety criteria.

For the case of radioactive waste treatment and conditioning facilities, whose design, operation and cessation requirements are established in NOM-036-NUCL-2001, it is indicated that their design, construction, operation and cessation of operations must be carried out in such a way that the resulting average annual effective dose equivalent is minimized as far as reasonably possible and does not exceed 0.25 mSv for the critical individual of the population and for occupationally-exposed personnel, complying with the provisions of the RGSR. In addition, for the cessation of operations, it is indicated that an organization must be established with the functions, responsibilities, qualifications and lines of authority and communication clearly defined between each of the members and with the technical and administrative capacity required to carry out the cessation of operations of the facility, in addition to a program of cessation of operations that includes procedures, planning of the works to be carried out, special training required for the personnel who will carry out the decontamination and dismantling, equipment and instrumentation required to carry out the decontamination and decommissioning and estimating the radioactive waste that will be produced and how it will be managed.

26.3 Preparedness for emergencies

Although there are no specific national regulations for emergency preparedness during the decommissioning of nuclear or radioactive facilities, in the case of nuclear facilities, in accordance with the provisions of their operating license, the recommendations of the IAEA and the provisions of the 10 CFR regulation on the matter.

With regard to radioactive facilities, as established in article 223 of the RGSR, in the case of requesting a license for the cessation of operations or dismantling, they must present a detailed list of the procedures to follow, since the manual of The procedures mentioned are made up of 3 sections: administrative procedures, technical procedures and emergency procedures. This requirement implies that the facility has an emergency response plan in place also during decommissioning activities.

In the particular case of small radioactive facilities, which do not require a license for the cessation of operations or dismantling due to the type of activities and sources they have, they are obliged to notify the regulator once they cease to operate. use radioactive material, presenting evidence that there is no radioactive material or contamination in the facility, therefore, until the moment of their discharge as permit holders, they have an emergency plan appropriate to the facility and the site in which they found.

26.4 Record keeping

In the case of nuclear facilities, as mentioned above, the regulations to be followed are the provisions of 10 CFR of the United States, which in chapter 50.71 talks about the maintenance of records and the making of reports, which must be maintained, either by what is required in the same 10 CFR, by license condition or by technical specifications, for the period specified in the requirement, and, if not specified, until the regulator concludes the license of the installation, this chapter also specifies that the permittee must keep the Final Safety Report (FSAR) updated until the license is terminated.

On the other hand, 10 CFR chapter 50.75, indicates that each licensee must keep records of important information for a safe and effective facility decommissioning until license is considered concluded. The following information, according to the same document, is considered important

1. Records of leaks or other unusual events involving the dispersal of contamination in and around the facility, its equipment or the site These records may be limited to cases where significant amounts of contamination remain after cleanup procedures, or where there is a

reasonable possibility that contaminants have been dispersed to inaccessible areas. These records should include any known information on the radionuclides involved, amounts, forms, and concentrations.

2. Construction drawings and modifications of structures and equipment in restricted areas, where the radioactive material is used and/or stored and for points of possible inaccessible contamination.

3. Records of cost estimates for the decommissioning plan and the method of funding used to ensure those funds.

4. Records of: licensed site, including a site map, and any acquisition or property use, other than that originally licensed for the purpose of receiving, possessing or using the licensed materials. The licensed activities carried out on the property and the release the site and final disposition of any property recorded in this section. The history of site assessments oriented to release the site; radiation measurements taken in order to document the property release; methods used to ensure that property meets the radiological criteria established at the moment of property release.

Finally, in the case of radioactive facilities, on the one hand, the RGSR indicates the minimum information that must be kept in records for occupationally-exposed personnel, sealed sources, open sources and ionizing radiation generating equipment; both these and other additional records are indicated in the specific conditions of each operating license and, finally, throughout the different NOMs the following requirements can be seen:

NOM-020-NUCL-1995, "Requirements for radioactive waste incineration facilities", indicates that documents and records must comply with the applicable quality assurance requirements and be generated in such a way that they can be preserved, recovered and modified during the lifetime of the incineration facility, including information derived from the commissioning program. It also establishes that the complete safety analysis report must be kept, together with the safety-related procedures, available to all members of the operation group. This standard establishes the minimum documents that must be maintained in relation to the management of radioactive waste.

NOM-028 / NUCL-2009, "Handling of radioactive waste in radioactive facilities that use open sources", requires an updated record of radioactive material and radioactive waste stored in the facility, as well as those that have left it , indicating your destination.

Compliance assessment

In Mexico, the closure of any spent fuel facility has not been carried out, however, it has what is requested by the Joint Convention to guarantee the safety of the facilities at the time it is required, so it is considered that it has been taken care of this article.

SECTION G

SAFETY IN THE MANAGEMENT OF SPENT FUEL

This section includes the obligations set forth in the following Articles:

Article 4. General safety requirements

Each Contracting Party shall take appropriate measures to ensure that at all stages of spent fuel management, people, society and the environment are adequately protected against radiological risks.

To this end, each Contracting Party shall take the appropriate measures to:

i) Ensuring that due attention is paid to criticality and removal of residual heat produced during spent fuel management;

ii) To ensure that the generation of radioactive waste due to the management of spent fuel is kept at the lowest possible level, in accordance with the type of fuel cycle policy adopted;

iii) Take into account the interdependencies between the different stages of spent fuel management;

iv) Provide effective protection of people, society and the environment by applying adequate protection methods at the national level, approved by the regulatory body, within the framework of its national legislation that duly takes into account internationally approved criteria and standards;

v) Take into account the biological, chemical and other risks that may be associated with the management of spent fuel;

vi) To strive to avoid actions whose reasonably-foreseeable repercussions on future generations are greater than those permitted for the present generation;

vii) Try to prevent undue burdens from being imposed on future generations.

The measures adopted in relation to compliance with the general safety requirements specified in the sections of this article are described below.

The existing legal framework in Mexico establishes the licensing process for nuclear facilities, defines the obligations of their owners and the responsibility they acquire for the safety of the facilities.

Spent fuel management facilities are classified as nuclear facilities and therefore follow the licensing process described in CNSNS official letter A00.130.001 / 2013 based on the Regulatory Law of Constitutional Article 27 on Nuclear Matters, the Internal Regulations of the Ministry of Energy, the General Law of Ecological Balance and Environmental Protection, and the CNLV's operating license conditions (condition 3), which refers, among others, to the following documents of Title 10 of the Code of Federal Regulations from the United States Nuclear Regulatory Commission (CFR for its acronym in English):

- *10 CFR 20 "Standards for Protection against Radiation".*
- *10 CFR 21 "Reporting of Defects and Noncompliance".*

- *10 CFR 50 "Domestic Licensing or Production and Utilization Facilities".*
- *10 CFR 55 "Operators Licenses".*
- *10 CFR 70 "Domestic Licensing of Special Nuclear Material".*
- *10 CFR 73 "Physical Protection of Plants and Materials".*
- *10 CFR 100 "Reactor Site Criteria".*
- *10 CFR 72 "Licensing Requirements for the Independent Storage of Spent Fuel, High-Level Radioactive Waste, and Reactor-Related Greater than Class Waste".*

The maintenance of subcritical conditions and adequate heat removal are safety requirements that are part of the criteria and design bases that are incorporated through the application of technical and administrative systems, subjected to analysis, evaluation and surveillance, whose description has to be contained in the documentation that supports a construction and operation request. In this way and in accordance with what is required in the aforementioned regulation, it is contemplated:

- The Preliminary Safety Study for the construction authorization application must contain the criteria followed in the design of the components and systems on which the safety of the installation depends and an analysis of the foreseeable accidents and their consequences, which includes the criteria and analysis for the prevention of criticality and heat removal. The Safety Report (IS) for the application for the operating authorization must contain the information necessary to carry out an analysis and evaluation of the safety and risks derived from the operation of the installation, both in normal operation and in accident conditions.
- The Technical Operation Specifications (ETO) that are presented for the application for the exploitation authorization must include the limit values of the variables that affect safety, the action limits for automatic protection systems, the minimum operating conditions , the program of reviews, calibration and periodic inspections of the systems and components.

The existing spent fuel management facilities in Mexico are:

a) the spent fuel storage pools of the two nuclear reactors in operation, included in the initial design and licensing process of the CNLV reactors;

b) the Independent Spent Fuel Storage Facility, built on the site of the Laguna Verde Nuclear Power Plant, in operation since the end of 2018;

c) the containment tank of the ININ TRIGA Mark III research reactor;

d) the ININ's nuclear material warehouse for the fuel for the SUR-100 research reactor.

The CNLV's safety studies contain the design criteria, the regulations, the description of the methods and systems used to achieve these criteria, as well as the analyzes carried out to guarantee the maintenance of subcritical conditions and adequate heat removal.

Similarly, the safety study of the CNLV's Independent Spent Fuel Storage Facility and that of the containers themselves, contains the criteria, methods and criticality and thermal analysis.

In general, the design criteria used in existing spent fuel storage facilities take as a reference, by decision of the CNSNS, the regulations of the country of origin of the design of the nuclear reactors in which the spent fuel is used, or of the design of containers in the case of dry storage of the Plant, in addition to the IAEA recommendations. In this way:

- The reference standard for the Nuclear Plant's spent fuel storage pools is 10 CFR 50 (Appendix B), due to the fact that they are US technology.
- The criteria used in the CNLV's Independent Spent Fuel Storage Facility design and in the spent fuels dry storage cask´s design, authorized for use in this storage facility, are those contained in the 10 CFR 72 standards, due to the fact that they are US technology.

Methods for maintaining subcritical conditions

The design criteria adopted both for storage in swimming pools and for storage in dry spent fuel containers is that the neutron multiplication factor (keff) is less than 0.95 under normal operating conditions, accident, uncertainties and situation. more reactive.

In general, the methods used to maintain these subcritical conditions under normal, abnormal or accident conditions are the following: maintenance of a safe geometric configuration, the use of

neutronic poisons (integrated in the structures of the storage racks) and limitation of the initial enrichment.

- The 5% subcriticality margin is maintained by limiting the initial enrichment of the fuel, a geometrically safe configuration, and the incorporation of poison into the stainless steel of the storage racks.

- The methods used to prevent criticality in the storage containers, currently in use at the Independent Spent Fuel Storage Facility of the Laguna Verde Nuclear Power Plant, are the incorporation of neutron poison material within the fuel frame structure, neutron absorbers, control of the geometry of the relative positions of the fuel assemblies, in addition to limiting the enrichment of the design base fuel to 5% by weight of U-235. The frame, which contains the 89 fuel assemblies, is comprised of at least 10% by weight boron carbide (B4C) within the main Metamic HT material, ensuring that the container remains subcritical.

The description of the characteristics of these systems, the data on the analyzes and evaluations carried out and the surveillance measures are set out later in this section G.

In the particular case of the fuels of the TRIGA Mark III research reactor, they are low-enriched, such as: a) low uranium content and low enrichment (LEU8.5 / 20) and b) high content of low-enriched uranium (LEU 30 / twenty). Of the LEU 8.5 / 20 fuels, there are a total of 118 fuels, 2 instrumented fuels and 3 control rods with fuel tracker. All fuels and control rods that have been used in the reactor are decaying in the reactor pool.

For its storage, the criterion is to maintain a multiplication factor keff <0.9 as established in the Reactor Safety Report "Technical Operation Specifications", authorized by the CNSNS. Criticality and storage calculations are performed with MCNP 5 (Monte Carlo N-Particle Transport Code) and XDEEP 32 software, respectively. It is estimated that under current storage conditions there is a keff of 0.69278 ± 0.00041, well below that established by the CNSNS.

In the case of the nuclear material that was used in the SUR-100 research reactor, due to its composition, no additional measures are required to control its criticality. These are located in the ININ nuclear material warehouse, under strict physical safety measures.

Systems for heat removal

a) Spent fuel storage pools.

The spent fuel pool cooling system fulfills the safety functions of removing the decay heat generated by the spent fuel assemblies without exceeding the established limit temperatures, and maintaining a minimum level of water above the spent fuel elements. in any situation, which guarantees adequate shielding. They are designed to meet the applicable criteria of 10 CFR 50 (2, 4, 5, 44, 45, 46, 61, and 63 in Appendix B).

The design modification carried out in the pools of the two units of the Central, between 1992 and 1998 for the expansion of the CNLV's capacity by changing the racks for other more compact ones, involved the analysis and calculation of heat residual and reevaluation of cooling systems. As a result of these reevaluations, minor modifications were made that affected only the cooling system discharge pipes inside the pool. The description of the characteristics of these systems, the data on the analyzes and evaluations carried out and the surveillance and control measures (contained in the ETO) are described later in this section G.

a) Release of residual heat from the Independent Spent Fuel Storage Facility of the Laguna Verde Nuclear Power Plant.

Adequate heat removal is defined as keeping fuel cladding temperatures below the short-term temperature limit. The HI-STORM FW MPC container is designed to release the heat generated by fuel assemblies into the environment through passive convection, conduction and radiation mechanisms. To ensure that there is an effective passive heat removal capability for satisfactory long-term performance, several thermal design features are incorporated into the storage system. These are the following:

- The MPC fuel basket is formed by a Metamic-HT plate honeycomb structure that allows unhindered heat conduction from the center of the basket to the periphery. The cavity of the MPC is equipped with the ability to internally circulate helium for natural buoyancy effects and transport heat from the inner region of the container to the peripheral region.

- The containment limit of the MPC ensures that the inert gas (helium) atmosphere within the MPC is maintained during normal, unusual, and accidental storage and transfer conditions.

The MPC confinement limit keeps helium in the confinement atmosphere below design temperatures and pressures.

- The MPC thermal design keeps fuel rod cladding temperatures below peak cladding temperatures such that the fuel cladding does not experience degradation during long-term storage.

- The HI-STORM FW is optimally designed, with cooling vents and an MPC that maximizes airflow by ensuring a turbulent flow regime with maximum heat loads.

- Eight inlet ducts located circumferentially around the bottom of the overpack and the outlet vent that circumscribes the entire HI-STORM FW lid make the venting action insensitive to changing wind conditions.

The description of the design characteristics for the elimination of heat from the container and the warehouse, the data on the analyzes and evaluations carried out, and the surveillance measures are detailed later in this section G. In compliance with the functions attributed in its Law of creation, the CNSNS evaluates the supporting documentation presented and grants the authorizations and approvals provided for in the legal framework.

In addition to evaluating the Periodic Safety Reviews (RPS) and on the occasion of recharging, the CNSNS monitors the periodic daily, monthly and annual information that it receives from the CNLV, as well as periodic inspections within the Program Basic Inspection and inspections associated with recharging.

Given the current practice of spent fuel storage in Mexico, the safety requirement to reduce the generation of waste applies to waste from the reactor core and secondary waste resulting from the purification of water from storage pools of spent fuel in the central.

The current practice of the length of the operating cycles of reactors to eighteen months has a direct impact on the reduction of the amount of spent fuel that is generated, although not on the reduction of activity.

However, the Radioactive Waste and Spent Fuel Management Plan (PGDRyCN) contemplates the measures to minimize the generation of waste as a result of the management of spent fuel, at the lowest possible level, required by the CNSNS and which is currently in implementation process.

The application of the safety requirement aimed at favoring the continuity of the spent fuel management stages, so that decisions taken in one stage do not negatively affect subsequent stages, affects the management planning and licensing of the facilities and in the definition of interfaces and responsibilities of the organizations involved, in addition to other technical and administrative aspects related to the transfer requirements.

In accordance with observed international practices, decisions have been made regarding the storage of spent fuel at the Plant, which will allow such fuel to be recovered for reprocessing in the future or transferred for final disposal.

The legal and regulatory framework in force in Mexico does not contain explicit instructions on this safety requirement and its implications in the broadest sense of the planning of the spent fuel management stages from its generation, however, it does establish the responsibilities and bases for the development of interfaces between the managers involved, as explained in Section E.

The legal framework in force in Mexico, in the nuclear field, contains a set of provisions for the protection of people and the environment from the risks derived from nuclear and radioactive facilities. These provisions apply to spent fuel management facilities, both those located within the plant's reactor buildings, as well as independent on-site facilities, as these are treated as nuclear facilities.

The measures taken to ensure that workers' radiation exposure is kept at the lowest level reasonably achievable are described in article 24 of section F of this report on radiation protection. Given that the existing fuel storage facilities are the spent fuel pools and the Independent Spent Fuel Storage Facility, the measures are part of the measures applied in the CNLV.

In relation to the racks change operations carried out in the CNLV pools, it is noted that an evaluation of the radiological impact was carried out in each case and measures were taken to apply the ALARA criterion during the operation.

Regarding the measures for the control and monitoring of effluents, these are governed by the standard NOM-041-NUCL-2013 "Annual limits of incorporation and concentrations in releases".

The prevention of risks other than radiological ones associated with the operation of spent fuel management facilities is regulated by the

regulations common to other industrial activities that address these types of risks, as indicated in Section E.

In the particular case of spent fuels from the TRIGA Mark III research reactor, removal of the heat of decay during storage is achieved by natural convection of the pool water. It is important to emphasize that the heat of decay of the fuels in the reactor core, after it has been operated for continuous periods of 20 h, for the production of Sm-153, is achieved by the natural convection of the water surrounding the core.

In the event of a sudden loss of water from the pool and in which the core was left uncovered, while the reactor was operating, it would shut down due to the lack of neutron moderation produced by the water, the increase in temperature in the fuels it would not represent a risk to their integrity, since they would be cooled by natural air convection. Additionally, the facility has an emergency cooling system that would only be used to spray the reactor core, causing the temperature of the fuels to decrease rapidly, ensuring its integrity.

For its part, the nuclear material that was used in the SUR-100 research reactor does not generate significant amounts of heat, so it does not require measures to remove it.

It should be noted that the existing legal framework in the nuclear field guarantees the protection of the public in periods of normal operation of the existing spent fuel management facilities, and others that are foreseen. This framework also contains requirements regarding keeping radioactive waste first and foremost after disposal, spent fuel once declared as waste, and waste from reprocessing spent fuel. This includes activities to be demonstrated from the design and site selection of the facilities to their institutional control and the release of the site.

From the above, Mexico complies with the requirements related to the maintenance of subcritical conditions and heat removal and has an appropriate legal framework for the safe operation of the existing spent fuel management facilities, in terms of worker protection. , the public and the environment are concerned.

Likewise, the legal framework establishes the bases to take into account the interdependencies between the management stages and the minimization of the generation of waste resulting from the management of spent fuel.

Regarding the protection of future generations, it must be taken into account that according to article 19 of the Nuclear Law, safety is paramount in all activities that involve nuclear energy and the dispositions and final destination of all its waste . This includes activities to be demonstrated from the design and selection of the site of the facilities, their construction, operation, dismantling, to the institutional control and release of the site in the case of the facilities for the final disposal of radioactive waste.

Those generations that may be exposed to the operation of nuclear or radioactive facilities authorized in the present will continue with -at least- the same protection as the present generation; this as long as the annual dose equivalent limits established in the RGSR are not modified. However, if these were modified, the trend would be to align with current international recommendations, which currently establish lower limits than those legally in force in the country.

On the other hand, the radioactive waste classification system in force in the country takes into account, among other things, the activity concentrations of long-half-life radionuclides (and their short-half-life precursors) of which a Potential hazard after institutional control, disposal method, and disposal methods are no longer effective.

In the design of facilities for the final disposal of low-level radioactive waste, in accordance with Mexican regulations, three essential elements must be considered to safeguard the safety of the personnel who operate the facility, the population and that of the environment (considering the time required for radionuclides to decay to activity levels such that they are no longer a radiological hazard); these elements are:

1) The package that contains the radioactive waste and that includes the matrix in which the same waste is immersed;

2) The barriers and engineering structures provided to the facility to prevent the dispersion of radioactive pollutants into the environment; and

3) The characteristics of the site that will contribute to the isolation of radioactive waste from the environment accessible to man.

All this is aimed at prolonging the isolation of waste for the time necessary to reduce the impact on the environment and on future generations, in

such a way that they will have adequate protection comparable to that of the current generation.

However, for intermediate and high-level waste, the country recognizes the need for a policy and strategy for the management of radioactive waste and spent fuel that, among other things, includes the allocation of responsibilities, financial resources and development of regulations for final disposal.

Currently, there are no spent fuel final disposal activities in Mexico.

Compliance assessment

From the foregoing, it is noted that Mexico complies with the requirements related to the maintenance of subcritical conditions and heat removal and has an adequate legislative framework for the safe operation of spent fuel facilities.

Article 5. Existing facilities

each Contracting Party shall take appropriate measures to review the safety of any spent fuel management facility in existence at the time the Convention enters into force with respect to that Contracting Party and to ensure that, if necessary, all procedures are carried out. reasonably feasible improvements to increase the safety of said facility.

In Mexico, there are spent fuel management storage facilities, which can be classified into those produced in non-energy activities and those generated in energy applications.

5.1 Spent fuel facilities at the ININ

a. The TRIGA Mark III research reactor containment tank. The spent fuel is stored in the reactor tank, where there are racks on the walls for this purpose. This facility provides cooling and shielding. The building and physical safety systems provide protection from these fuels. The tank and the other areas of the reactor building are monitored 24 hours a day, through detection systems, surveillance cameras and an adequate response force.

b. The ININ nuclear material warehouse where fuels from the SUR-100 research reactor are kept. This fuel consists of 11 polyethylene discs with 20% enriched uranium oxide. Sub-criticality is ensured by storing these disks separate from each other. On the other hand, the nominal power of 100 mW and the little time of use that it had, makes the radiation levels negligible, which indicates very little accumulation of fission products. This warehouse is covered by the TRIGA Mark III reactor operating license. Physical safety consists of cameras, controlled biometric and card accesses, motion sensors, and surveillance and response forces 24 hours a day.

5.2 CNLV spent fuel storage pools

The CNLV spent fuel storage pools are located inside the reactor building, with a pool for each of the reactors.

The ventilation system is integrated into the ventilation and filtration system of the reactor building. The pools, built of reinforced concrete, have their walls internally covered with welded stainless steel sheets to prevent leaks and are designed as structures capable of withstanding extreme external events, being also provided with a system to detect and collect possible leaks.

Frames made of borated stainless steel provide the necessary structural support to maintain a fixed configuration and incorporate absorber plates within their structure.

The spent fuel pools, whose initial capacity has been increased by changing the racks for other high-density ones, have a reserve to house a complete reactor core if necessary, this being a requirement for the operation of the Plant.

Between 1991 and 1999, the fuel racks of the two spent fuel pools in operation were changed to other high-density ones made of borated stainless steel, to allow the storage of a greater number of fuel assemblies. those originally planned.

The licensing documentation submitted with the application contained, in addition to the description of the modification, the frame materials, the applicable regulations, the frame design criteria (neutronic, thermohydraulic and mechanical design) and the corresponding structural analysis, analysis of criticality and evaluation of the capacity of the pool's cooling system taking into account the increase in temperature inherent to the increase in capacity.

Regarding the removal of heat and the cooling system, compliance with the safety criteria was evaluated following the guidelines set forth in the Standard Review Plan (NUREG-0800) in its chapter 9.1.3.

The pools have been subject to the general review programs carried out since the beginning of their operation (to maintain the level of safety required in the authorizations and improve it in accordance with the advances in technology and the new regulatory requirements), Among which the measures derived from the implementation of Post-Fukushima actions stand out as described below:

Each of the Spent Fuel Pools (ACG) has the Spent Fuel Pool Water Level and Temperature Instrument System (SFPIS), which has the ability to measure the level and temperature inside the pools, capable of to operate under Severe Accident and Event conditions beyond the design basis, in order to help operators know the status of the cooling system and trends in level changes, in order to take immediate action. This system includes two Heat-Thermo Type water level and temperature measurement Sensor (HTTS) sensors, one primary (Northwest corner) and the second one for backup (southeast corner). This system allows the water level in the ACGs to be known at all times, from the normal level to the top of the spent fuel rack. It also provides cooling water temperature indication. With this, the order of NRC EA-12-051 is complied with.

5.3 Independent Spent Fuel Storage Facility

This facility was built in 2016 and has been in operation since the end of 2018, with a capacity to house 130 containers. The installation site is located within the controlled area of the CNLV, it includes a total area of 18,336 m2. The storage platform has a dimension of 77.3 m long by 47.3 m wide, which is designed to store 11,523 spent fuel assemblies from the fuel pools of units 1 and 2, which originated as part of the commercial operation of both units.

The main structures of the Independent Installation are:

- Storage platform (ISFSI Pad for its acronym in English).
- Fuel Transfer Area (CTF).
- Approach platform.
- Manufacturing platform.
- Electrical room building.
- Main access.
- Secondary access.

The main platform is the concrete area where the dry spent fuel storage containers will be housed.

The fuel transfer area is the area where the transfer of the MPC container from the HI-TRAC VW transfer container to the HI-STORM FW container takes place, considered as the final packaging or over-packaging for storage. The build platform is the area used to prepare the HI-STORM FW containers for concrete placement, assembly, touch-up paint, storage and maintenance.

The electrical building is located near the storage platform, it is divided into three rooms: personnel office, electrical panel room and diesel generator room. The electrical building provides suitable environmental conditions for the physical safety guard personnel during the movement of the containers and access to the facilities during a campaign. The electrical building also provides a common termination point for safety equipment wiring. The electrical building also houses a generator backup diesel engine, an associated transformer and UPS (Uninterruptible Power Supply) batteries.

The main and secondary entrances, as their names indicate, are the areas destined for the access of both personnel and transport vehicles and containers during fuel transfer campaigns. On the other hand, the area of the manufacturing platform is the area destined to the manufacture and placement of the fluid concrete filling of the HI-STORM FW overpack.

Around the site of the Independent Spent Fuel Storage Facility there is a physical safety system whose main functions include intruder detection, alarm monitoring, storage of safety records, generation of reports, monitoring through a closed circuit system of television, intrusion detection systems, vehicular barriers, perimeter mesh and lighting.

The geological and environmental characteristics of the facility are site specific. Dry spent fuel container design criteria for geological and environmental conditions represent credible or potential site hazards without prejudice to their safety function.

The Independent Spent Fuel Storage Facility is designed to fulfill the following functions:

- Limitation of the dose rate outside the facility.
- Maintaining the temperature below the limits required in the container design.

The fulfillment of these functions is achieved through the design of the container itself and using a passive ventilation system by natural circulation, which guarantees at all times a maximum temperature of the containers that is lower than the maximum conservatively foreseen in their design.

HI-STORM FW container

The HI-STORM FW container has been designed to safely store 89 BWR fuel elements. The design meets the requirements of 10 CFR 72 and IAEA Safety Series Number 6. The essential characteristics of the container for the fulfillment of the conditions of subcriticality, the removal of heat, confinement, shielding, materials and handling are the following:

- The dry storage system chosen for use at the Plant site is the HI-STORM FW MPC system. The system consists of a stainless steel multipurpose sealed container (MPC) within a shield constructed of a combination of steel and concrete.

- This system provides removal of the heat of decay during processing and final storage of the multipurpose sealed container (MPC). The transfer cylinder conducts heat from the MPC until the MPC is transferred to the shield where convection cooling is established.

- The HI-STORM FW container maintains the confinement of radioactive material in normal, abnormal and hypothetical accident conditions; will maintain subcriticality control; it will reject the heat of decay of stored radioactive materials to the environment by passive means and will keep radiation doses within regulatory limits. All components of the MPC assembly that may come into contact with the spent fuel pool water or the environmental environment are made of stainless-steel alloy or aluminum / aluminum alloy materials. Among the aluminum-based materials used in the MPC is the Metamic – HT neutron absorber network that comprises the fuel basket.

- The HI-STORM FW system, Metamic-HT is the trade name for the metal matrix compound made by embedding aluminum oxide nanoparticles and fine boron carbide powder at the grain boundaries of aluminum, which improves the structure and properties resistance to elevated temperatures.

- Criticality is controlled by the geometry and the neutron absorbing materials in the fuel basket. The entire basket is made of Metamic-HT, in a uniform dispersion of boron carbide and alumina nanoparticles in an aluminum matrix, which serves as a neutron absorber. This accumulates four main safety and reliability benefits:

  I. Higher B-10 area density in Metamic-HT allows for higher enriched fuel (i.e., BWR fuel with flat average initial enrichments greater than 4.5% by weight of U-235) without relying on gadolinium or burn credit .

  II. The neutron absorber cannot be removed from or moved within the basket.

  III. The axial movement of the fuel with respect to the basket has no reactivity consequences because the entire length of the basket contains the B-10 isotope.

  IV. The higher B-10 area density in Metamic-HT reduces the dependence on soluble boron credit during fuel loading / unloading, for BWR only.

The system includes a HI-TRAC-VW transfer cylinder consisting of a robust, thick-walled cylindrical steel container. The cylinder guides, retains, protects and supports the MPC during cargo handling and transfer operations, including immersion in the spent fuel pool where the MPC is loaded.

While submerged, the transfer cylinder prevents most of the MPC's exterior surfaces from becoming contaminated by avoiding contact with the spent fuel pool water. When removed from the pool, the transfer container provides protection to maintain exposure of ALARA personnel and facilitates the transfer of heat from the MPC to the surroundings.

Radiation protection

The confinement boundary design prevents radiation exposure due to the release of material from the storage system. The confinement boundary is designed to maintain its integrity during all normal, abnormal and accident conditions, including natural phenomena. Radiation exposure due to direct radiation is minimized as much as possible by using the philosophy of "time, distance and shielding". This is implemented in the Plant's Independent Spent Fuel Storage Facility through access control, minimization of required maintenance and the design of the HI-STORM FW MPC System.

Compliance assessment

From the foregoing, it is concluded that the existing spent fuel storage facilities meet the necessary

characteristics to operate safely and measures have been taken to comply with the general safety requirements derived from the ratification of the Joint Convention applicable to the facilities. existing.

Article 6. Location of the projected installations

1. Each Contracting Party shall take appropriate measures to ensure the establishment and application of procedures at a planned spent fuel management facility in order to:

i) Evaluate all pertinent factors related to the site that may affect the safety of said installation during its operational life;

ii) Evaluate the probable consequences of said installation for the safety of people, society and the environment;

iii) Provide the public with information on the safety of said facility;

iv) Consult the Contracting Parties that are in the vicinity of said installation, insofar as they may be affected by it, and provide them, upon request, with the general data related to the installation that allow them to assess the probable consequences of the installation. installation for the safety of the territory.

2. To this end, each Contracting Party shall adopt the appropriate measures to ensure that said facilities do not have unacceptable effects on other Contracting Parties, locating them in accordance with the general safety requirements of Article 4.

There are no facilities designed for the management of temporary or final disposal spent fuel.

In the event that a new facility is required for the management of spent fuel, the licensing process and the regulations in force contemplate both public information and the CNSNS evaluation mechanism of the possible impact of the release of radioactive waste from a nuclear facility, therefore, it is concluded that in Mexico the necessary measures have been adopted to comply with the requirements of Article 6 of the Convention.

Article 7. Design and construction of the facilities

Each Contracting Party shall adopt the appropriate measures to ensure that:

i) Spent fuel management facilities are designed and constructed so that adequate measures are in place to limit the possible radiological consequences for people, society and the environment, including uncontrolled discharges or emissions;

ii) Conceptual plans and, where appropriate, technical provisions for the decommissioning of a spent fuel management facility are taken into account at the design stage;

iii) The technologies incorporated in the design and construction of a spent fuel management facility are supported by experience, testing or analysis.

The development of this article includes the exposition of the basic safety principles and the procedures followed in Mexico to request, analyze and grant construction authorizations to the owners of spent fuel management facilities, as well as the methods followed to monitor construction and ensure compliance with design requirements.

The spent fuel storage pools of the CNLV have been evaluated and authorized within the Central's own licensing process.

The CNLV's pool licensing process contemplates that modifications in the design, or in the operating conditions that affect the nuclear safety or radiological protection of a facility, as well as the performance of tests in it, must be analyzed. previously by the holder to verify if the criteria, rules and conditions on which the authorization is based are met. If as a result of said analysis, the holder concludes that the aforementioned requirements are still being guaranteed, he may carry out the modifications, periodically informing the competent regulatory authorities. If, on the contrary, the design modification implies a modification of the criteria, norms and conditions on which the operation authorization is based, the holder must request modification authorization from the regulatory authorities prior to its execution. Regardless of the aforementioned authorization, when in the opinion of the regulatory authorities the modification is far-reaching or involves significant construction or assembly works, the owner must necessarily

request an authorization for the execution and assembly of the modification.

The pool storage option is used in practice in all light water nuclear power plants. The benefits of this technology are mainly associated with the efficiency of water as a coolant and as a shield, as well as the flexibility it gives the operator in its policy of managing the core of its reactors, as it facilitates safeguards of nuclear material and inspections and spent fuel examinations.

The accumulated experience on storage in swimming pools exceeds 50 years. For light water and spent fuel reactors with Zircaloy and ZIRLO jackets, there does not appear to be a time limit applicable to this storage modality, unless adverse water chemical conditions are present that could contribute to the corrosion deterioration of the jacket, which constitutes the first barrier of radioactive material for the purpose of its confinement.

The dry storage option in the Independent Spent Fuel Storage Facility (in an inert gas atmosphere, typically helium, nitrogen or argon) is used as a complement to that of the swimming pools, once the storage capacity of these. There is more than 20 years of worldwide experience of this technology for power jet fuel and more than 30 years for research jet fuel elements.

Dry storage takes place in containers, as explained in previous paragraphs, consisting of welded metal cylinders or with bolted closures that provide a watertight confinement barrier, which in turn are enclosed in an additional metal, concrete or made of another material that gives the set shielding and structural support properties against external events. Some of these containers are used both for storage (outdoors or in a building) and for transporting spent fuel.

Article 8. Evaluation of the safety of the facilities

Each Contracting Party shall adopt the appropriate measures to ensure that:

i) Prior to construction of a spent fuel management facility, a systematic safety assessment and environmental assessment is conducted, consistent with the risk posed by the facility and spanning its operational life;

ii) Prior to the operation of a spent fuel management facility, updated and detailed versions of the safety assessment and environmental assessment are prepared when deemed necessary to complement the assessments mentioned in paragraph i).

The licensing procedure for each of the authorizations for nuclear facilities requires the submission by the holder of a series of documents, including the corresponding safety assessment, with the content specified in each case, which is indicated below for the authorizations referred to in this article:

- In the application for construction authorization, the applicant is required to present a Preliminary Safety Study that contains, among other aspects, the description of the installation that includes the criteria followed in the design of those components or systems of the which depends on the safety of the installation and an analysis of the foreseeable accidents and their consequences.

- In the application for authorization of operation, the applicant is required to present, among other documents, a safety assessment that contains the information necessary to carry out an analysis and assessment of safety and risks derived from the operation of the facility, both in normal operation as in accident conditions.

- Additionally, design modifications that involve a change in the criteria, norms or conditions on which the operation authorization is based require a modification authorization accompanied by the corresponding technical description, the safety analysis carried out and the identification of the operating documents that are affected by said modification.

- The licensing of the pools associated with the design of the Power Plant is integrated into the licensing of the Power Plant itself and is currently subject to the process of Periodic Safety Reviews.

- Modifications to the design or operating conditions carried out in the pools themselves have been made in accordance with the provisions of the applicable legal framework and have been subject to a specific process of authorization of the modification when required.

On the other hand, the safety analysis includes sections referring to:

a. The spent fuel pool and the types of racks used specifying the design bases related to safety and additional design bases, the codes and standards applicable to the design, the description of the facilities, the safety assessment and the tests and inspections periodic if applicable. The safety assessment indicates the criticality analysis, the design of the racks used for the spent fuel, and the protective characteristics of the spent fuel storage facility.

b. The spent fuel pool cleaning and cooling system specifying the design bases related to safety and the design bases related to power generation, the description of the system, the safety assessment and the periodic tests and inspections if applicable .

c. The fuel handling system specifying the design basis, the description of the system listing the maintenance tools and equipment, describing the use of the main maintenance tools and equipment, describing safety aspects where applicable, the safety assessment, the periodic tests and inspections if applicable and associated instrumentation of maintenance tools and equipment.

The safety analysis includes the analysis of the fuel handling accident in the building where the ACG is located. Likewise, it is indicated within the construction testing program, including fuel handling equipment testing, cooling system testing, and cleaning of spent fuel pools.

The licensing of the Independent Spent Fuel Storage Facility was carried out as a design modification of the Plant, according to the procedure established for that purpose in the legal framework. The design of the Independent Installation and its safety analysis are based on the characteristics of the HI-STOMR FW container. In order to be able to store containers of other types, duly authorized, the necessary verifications and analyzes must be carried out in advance, as well as the request for authorization from the regulatory body.

The Container Safety Analysis Report was carried out in accordance with Regulatory Guide 3.61, “Standard Format And Content For a Topical Safety Analysis Report For a Spent Fuel Dry Storage Cask” of the Nuclear Regulatory Commission (NRC), consisting of:

- Chapter 1 General Description.
- Chapter 2 Main Design Criteria.
- Chapter 3 Structural Evaluation.
- Chapter 4 Thermal Evaluation.
- Chapter 5 Shielding Evaluation.
- Chapter 6 Criticality Assessment.
- Chapter 7 Confinement.
- Chapter 8 Operating Procedures.
- Chapter 9 Maintenance Program and Acceptance Criteria.
- Chapter 10 Radiation Protection.
- Chapter 11 Accident Analysis.
- Chapter 10 Controls and Limits of Operation.
- Chapter 11 Quality Assurance.

Through the aforementioned safety evaluations, documented in the safety analysis report, it was determined that the container design is safe and adequate to carry out dry spent fuel storage.

The HI-STORM FW containers currently in use at the Independent Spent Fuel Storage Facility were designed for that purpose. The licensing requirements for storage are clearly defined, and the licensing process has been evaluated by the CNSNS, through:

- The inspections carried out to verify compliance with the design specifications and quality procedures, as well as the verification tests carried out on the first two containers manufactured.
- The evaluation of the documentation of the design modifications made to adapt it to the manufacturing needs.

The approvals for storage were reviewed for the incorporation of the necessary design modifications as a result of the manufacturing and verification tests and for their updating in accordance with the practice and regulations of the country of origin of the container design, adjusting the limits and conditions of operation to the NUREG 1745 standard “Standard Format and Content for Technical Specifications for 10 CFR 72 Cask Certificate of Compliance”. All this was incorporated into the approval of the use of containers in storage facilities, which follows the Certificate of Compliance format

contemplated in the 10 CFR 72 regulation. This approval:

- Establishes ownership of the container design.
- Identifies the documentation on the basis of which approval is granted and the regime for subsequent design reviews and modifications.
- Specifies the regulations that are considered applicable for the purposes of manufacturing, testing and use of the container.
- It limits the period of validity of the license to 20 years and defines the procedure and conditions for its extension.
- Includes the description of the essential characteristics of the container model.
- Specifies the basic design parameters of the fuel to be stored.
- It specifies that the container may be stored in facilities that meet the conditions of use, the limits and operating controls (or technical specifications) of the container itself.
- Submits all container design, manufacturing, and operation activities including testing, maintenance and surveillance to quality assurance programs.
- Requires handling, loading and unloading, surveillance and maintenance operations to be carried out, in accordance with written procedures consistent with Operation and Maintenance Manuals.
- Defines the minimum content of the information to be sent annually to the CNSNS, which includes data on operating experience.
- Defines the procedure for the periodic update of the container safety scan.

The Final Safety Studies presented by the head of the Power Plant contain several sections dedicated to the Independent Installation of Spent Fuel Storage, the cooling system and the management systems, which include the design bases, acceptance criteria, regulations applicable, the description of the systems and methods adopted and the analyzes carried out to demonstrate compliance with the acceptance criteria of all essential functions (prevention of criticality, heat removal, confinement of the activity and shielding).

The Safety Analysis Report of the Independent Spent Fuel Storage Installation or Monitored Retrievable Storage Installation (Dry Storage) was made in accordance with Regulatory Guide 3.48 "Standard Format and Content for the Safety Analysis Report for an Independent Spent Fuel Storage Installation or Monitored Retrievable Storage Installation (Dry Storage)" Rev.1 of the Nuclear Regulatory Commission, consisting of:

- Chapter 1 Introduction and General Description of the Installation.
- Chapter 2 Site Features.
- Chapter 3 Main Design Criteria.
- Chapter 4 Installation Design.
- Chapter 5 Operating Systems.
- Chapter 6 Confinement and Management of Waste Generated by the Site.
- Chapter 7 Radiation Protection.
- Chapter 8 Accident Analysis.
- Chapter 9 Execution of Operations.
- Chapter 10 Controls and Limits of Operation.
- Chapter 11 Quality Assurance.

Through the aforementioned safety evaluations, documented in the facility's safety analysis report, it was determined that the facility's design is safe and adequate to carry out the storage of spent fuel containers dry.

In accordance with the above, it is concluded that the safety of the facilities is rigorously evaluated and analyzed, from prior to their construction and operation, being a prerequisite for the regulatory body to grant the permits and licenses to operate said facilities, adopting the safety measures established in the Safety Analysis Reports.

In the case of the TRIGA Mark III research reactor located in the ININ, the selection of the site was based on the following characteristics: its location with respect to Mexico City (36 km away), which facilitates communication by road from this city, and at the same time, far enough away to represent a risk to the population, to the availability of space, access roads (600 m from the highway) and water supply and proximity to the electricity network.

The TRIGA Mark III research reactor facilities, where the spent fuels from this reactor are located, as well as the nuclear material from the SUR-100 research reactor, were designed and built following the civil engineering requirements and the criteria indicated by the construction regulations for nuclear facilities that were in force on the date of their construction (1964-1968). The physical safety of the facility is carried out in accordance with the Physical safety Plan of the ININ, which is executed by members of the Secretariat of National Defense and the National Guard. Likewise, there is a system of surveillance towers and safety cameras.

Regarding the radiological safety of the facility, it remains in accordance with the requirements of the facility's safety assessment and licensing, established by the CNSNS. The safety report and the corresponding evaluation is carried out periodically. The radiological safety report was prepared in accordance with the current regulatory framework and considers different aspects, some of them being the general specifications of the installation, organization of the installation, safety policy, quality assurance program, design characteristics in relation to radiation safety, estimates of dose equivalents to occupationally-exposed personnel and the public, radiation safety program, risk analysis and emergency plan, environmental radiological impact in normal operation and in abnormal situations, environmental radiological surveillance program, cessation of operations , dismantling and closure, among others.

Article 9. Operation of the facilities

Each Contracting Party shall adopt the appropriate measures to ensure that:

i) The operating license of a spent fuel management facility is based on appropriate evaluations, as specified in Article 8, and is conditional on the completion of a commissioning program that demonstrates that the facility, such as has been built, conforms to design and safety requirements;

ii) The operational limits and conditions derived from tests, operational experience and evaluations, as specified in Article 8, are defined and revised as necessary;

iii) The operation, maintenance, radiological surveillance, inspection and testing activities of a spent fuel management facility are carried out in accordance with established procedures;

iv) The necessary engineering and technical support services are available in all disciplines related to safety throughout the operational life of a spent fuel management facility;

v) The holder of the corresponding license notifies in a timely manner to the regulatory body significant incidents for safety;

vi) Programs are established to collect and analyze relevant operational experience and act on the results, where appropriate;

vii) Plans for the decommissioning of a spent fuel management facility are prepared and updated, as necessary, using information obtained during the operational life of that facility and that the regulatory body reviews these plans;

The operating license of the existing spent fuel management facilities in the country refers to the spent fuel storage pools (ACG) within the Plant itself and the dry spent fuel warehouse. The ACGs currently in operation have been evaluated and authorized within the licensing process of the Plant itself and, therefore, the design requirements and operating limits and conditions included in the safety and environmental evaluations are part of the the operating authorization granted to the licensee, once the commissioning program (testing program) has been completed, which shows that the installation, thus constructed, complies with the design and safety requirements.

The operating authorization in force empowers the holder to possess and store slightly enriched fuel assemblies, in accordance with the limits and technical conditions contained in the safety analysis of the recharging of each cycle and with the limits and conditions associated with the specific authorizations of storage of irradiated nuclear fuel.

In the CNLV's operation regarding spent fuel storage pools, various aspects are taken into account, such as those indicated below:

- Movements of heavy loads on the storage of spent fuel.

Restricting the movement of loads greater than the nominal weight of a fuel assembly and associated maneuvering tool, over other assemblies of spent or irradiated fuels in the storage pool ensures that in the event that it becomes detached:

a) the release of radioactivity will be limited to that considered in the accident of falling a fuel element and

b) any possible distortion of the fuel in the storage racks will not produce a critical configuration.

Regarding the Independent Spent Fuel Storage Facility, the storage containers are placed on a concrete platform, which is located within a protected area separate from the original protected area of the Plant. The storage platform is designed to store up to 130 HI-STORM FW storage containers. Each loaded storage container measures approximately 5.5 meters high, 3.5 meters in diameter and weighs approximately 159 tons. The centers of the containers are 5 meters apart, and the concrete storage pad covers an area of approximately 47.5 meters by 77.5 meters.

The ETOs establish the operating limit conditions, the applicability, the necessary actions and the surveillance requirements necessary to comply with the limit conditions in the aspects related to the storage of spent fuel.

Likewise, the ETO contain the limit values of the variables that affect safety, the action limits of the automatic protection systems, the minimum operating conditions, the program of reviews, calibration and periodic inspections or tests of various systems and components., and its operational control.

To develop and detail the ETO surveillance requirements, surveillance procedures are drawn up and carried out by the different departments involved in the operation of the Plant.

The CNLV has various procedures that regulate the performance of various activities related to the operation, maintenance, radiological surveillance and inspections of the structures, systems and equipment that are part of the spent fuel storage. Among these, the following can be highlighted:

- Operating procedures for the spent fuel pool cooling and purification system. They attend to the different modes of operation of said system including the indications and alarms of temperature and level, ways of repositioning the level, etc.
- Pool leak check procedure.
- Fuel handling procedures. They affect all the equipment and tools involved in handling fuel at the plant, covering possible incidents.
- Radiation protection procedures. They attend to all radiological safety aspects of the controlled area that apply to the spent fuel storage area, as well as actions in the event of an accident in the handling of fuel.
- Pool water chemistry monitoring procedures. The presence of certain chemical compounds is monitored, limiting them to the values recommended by the regulations in order to preserve the integrity of the fuel.

The facilities have detailed inventories of the fuel assemblies stored in the spent fuel pool, with the following information on each of the stored items:

- Identification and technical characteristics (manufacturer, model and type);
- Burning history and burn value reached;
- Isotopic composition of the element;
- Storage position;
- Physical state of the element, existence of rod failures and inspections carried out on it;
- Defective rods extracted from fuel elements.

This information is updated at the end of each operating cycle.

The CNLV provides engineering services and technical support to facilitate compliance with and verification of safety criteria in spent fuel storage areas. Within the contracts established with the suppliers and / or manufacturers of nuclear fuel, technical support is contemplated in relation to the fuel assemblies supplied, which include the characteristics and design of the assemblies, their operating limits for the guarantee of the fuel and the plans and data that the Central requires as a result of the contracts established between the Central and the companies competent in irradiated fuel services.

Within the ETO of the Plant, the conditions under which special reports are made are established (for example, violation of a Technical Operation Specification, exceeding dose limits in the case of the Independent Spent Fuel Storage Facility, to mention a few) when significant incidents for the safety of spent fuel storage facilities may occur.

Reportable events are defined in the RGSR and in regulations 10 CFE 50.72 and 10 CFR 50.73 for

CNLV units, as well as in regulations 10 CFR 72.75 in the case of the Independent Installation of Spent Fuel Storage. These must be communicated to the CNSNS and to the competent government authorities. The special reports will be sent to the CNSNS as established in the ETOs. Within the monthly operation report that is sent with that periodicity to the CNSNS, information is provided on the storage status of the spent fuel pools and its possible variations with respect to the previous report, indicating the list of existing assemblies, accumulated burns and the date. reactor discharge.

Annually, the CNLV submits to the IAEA the declaration per fuel element of the fissile material in the spent fuel pool. Specifically, the following periodic reports and notifications are made:

- Fuel accountability.
- Containment of fuel through key measurement points and monitoring units of fuel movements.
- Periodic inspections on accounting and containment.

Within the procedures of the nuclear power plants, the analysis of own and other people's operating experience is contemplated, by the corresponding specialists, which can lead to the performance of improvement actions both in design aspects and operating procedures. Reportable event reports and special reports are analyzed within internal operational experience.

Regarding external operational experience, the following reports are analyzed, among others:

- Required by the CNSNS.
- Generated by INPO / WANO.
- Experience disclosed by the US-NRC.
- Suppliers: Reports required by regulation 10 CFR 21 and technical bulletins.

Measures taken as a result of the actions of September 11, 2001 and the Fukushima nuclear accident.

After the accident that occurred on March 11, 2011 at the Fukushima Dai-ichi Nuclear Power Plant (CN), actions were taken at the international level to verify the safety measures of the nuclear power plants, in order to confirm that they have the safety measures in place. response to face situations beyond the design bases.

In Mexico, the National Commission for Nuclear Safety and Safeguarding requested the CNLV to implement the mitigation strategies indicated in the 10 CFR 50.54 regulation. Said section, which arose in response to the terrorist attacks of September 11, 2001, is the formalization of the USNRC's licensing requirements for its regulators to face the challenges related to core cooling, containment, and the spent fuel pool. derived from large explosions or fires. Subsequently, the CNSNS informed the Central that it considered appropriate to follow the guidelines of NEI 06-12 Rev.2, "B.5.b Phase 2 & 3 Submittal Guidance" for the implementation of the mitigation strategies indicated in the regulations. 10 CFR 50.54.

In the European Union, the regulatory bodies of the countries and industry representatives, agreed that the European Nuclear Safety Regulatory Group (ENSREG) with the technical support of the Western European Nuclear Regulators Association (WENRA for its acronym in English) would prepare a proposal for the technical content of stress tests and define the method to carry them out. The proposal prepared by WENRA was approved by ENSREG and approved by the European Council in June 2011. Subsequently, the regulatory bodies of Argentina, Brazil, Spain and Mexico, in conjunction with the IAEA, defined the scope of the Stress Tests. that should be carried out by the Nuclear Power Plants in this region, taking into account the experiences arising from the accident that occurred at the Fukushima Dai-ichi NPP. The CNSNS asked the Laguna Verde Nuclear Power Plant to comply with said Resistance Tests.

In response to the events at Fukushima, the World Association of Nuclear Operators (WANO) published SOER 2013-2, "Post-Fukushima Daiichi Nuclear Accident Lessons Learned", in cooperation with the Institute of Nuclear Power Operations (INPO for its acronym in English). The SOER relies heavily on the information included in INPO 11-005 "Addendum, Lessons Learned from the Nuclear Accident at the Fukushima Daiichi Nuclear Power Station". This SOER documents the actions required as a result of the problems experienced at Fukushima Dai-ichi following the March 11, 2011 earthquake and subsequent tsunami. The Laguna Verde Nuclear Power Plant has committed to following up on the SOER 2013-2 recommendations as part of its actions to improve the power plant's ability to cope with a similar event.

Also, in 2013, the CNSNS required the implementation of Post-Fukushima Dai-chi Orders, issued by the USNRC for compliance by the United States plants, considering the following documents:

- EA-12-049 "*Issuance of Order to Modify Licenses with regard Requirements for Mitigation for Strategies for Beyond-Design-Basis External Events*", siguiendo las recomendaciones de la guía JLD-ISG-2012-01 *"Compliance with Order EA-12-049, Requirements for Mitigation for Strategies for Beyond-Design-Basis External Events"* y aceptando la metodología descrita en el NEI-12-06 *"Diverse and Flexible Coping Strategies (FLEX) Implementation Guide"*.

- EA-13-109 *"Modified NRC Order for Containment Venting Systems*", considerando lo indicado en el SECY-12-0157 *"Consideration of Additional Requirements for Containment Venting Systems for BWR with Mark II Containment"* y siguiendo la metodología del NEI-13-02 *"Industry Guidance for Compliance with order EA-13-109"*.

- EA-12-051 *"Issuance of Order to Modify Licenses with regard Reliable Spent Fuel Pool Instrumentation"* siguiendo las recomendaciones de la JLD-ISG-2013-03 *"Compliance with Order EA-12-051 Reliable Spent Fuel Pool Instrumentation"* y aceptando la metodología descrita en el NEI-12-02 *"Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation"*.

The implementation of the lessons learned in the field of nuclear fuel and waste management was focused on the installation of reliable wide-range instrumentation in the Spent Fuel Pool of Units 1 and 2 of the Laguna Verde Nuclear Power Plant. This instrumentation allows the CNLV to significantly improve the information that the operators of the units have in such a way that the resources they have are allocated effectively in the event that an event occurs beyond the very low probability design bases. The installation of the wide-range instrumentation was carried out in accordance with the provisions of Order EA-12-051 and was completed in 2016.

Additionally, monitoring the documentation to comply with the 10 CFR 50.54 regulation has meant that the CNLV is developing strategies to replace water in the spent fuel pool in scenarios beyond the design bases, either with internal equipment. (installed) or with external equipment (laptop). In the case of the replacement of water to the spent fuel pool with installed equipment, the CNLV has the capacity to use the diesel fire pump, while the replacement to the ACG with external means is achieved by means of a portable pump. These strategies ensure the replacement of at least 500 gpm in supply mode and 200 gpm in spray mode in case the normal water supply to the spent fuel pool is inoperable or unavailable.

Regarding what is indicated in NEI 12-06 or FLEX Mitigation Strategies, for compliance with EA 12-049, in the event of an ELAP (Extended Loss of Alternating Current) and LUHS (Loss of the Last Heat Sink) , the CNLV has the capacity to replenish the spent fuel pool by means of the portable FLEX pumping, through pipes located in the Reactor building. The connection can be made by interconnecting the residual heat removal system RHR (E12) "A" with the fire protection system (G41) and providing 200 gpm.

Another option for the replacement of water to the spent fuel pool is the connection to the Fire Hose Station (FP / M23A), located on level 10.15 of the reactor building, to discharge with 2½ "hoses to the Pool to through the Hose Stations located on the reactor recharging floor. It is also possible to reach the recharging floor by connecting to the Fire Protection System Hose Station for Safe Shutdown of the Reactor During Earthquake located on level 10.15 of the reactor building and which communicates to the Hose Station located on the floor. recharge 49.90 m from the reactor building. The above is applicable for both units considering that the FLEX pump has the capacity to supply 200 gpm to the ACGs of Units 1 and 2 of the CNLV simultaneously.

Compliance assessment

From all the foregoing in each of the sections corresponding to the safety requirements that make up this article, it is concluded that in Mexico the operations carried out in the existing spent fuel management facilities meet the necessary characteristics to ensure compliance with the different measures required by the Joint Convention, in its article 9, applicable to existing facilities.

Article 10. Final disposal of spent fuel

If, in accordance with its legislative and regulatory framework, a Contracting Party decides to dispose of fuel in a facility for final disposal, this final disposal of such spent fuel will be made in accordance with the obligations of Chapter 3 regarding the final disposal of radioactive waste.

Currently, there are no plans for the final disposal of the spent fuel.

SECTION H

SAFETY IN RADIOACTIVE WASTE MANAGEMENT

This section includes the obligations set forth in the following Articles:

Article 11. General safety requirements

Each Contracting Party shall adopt appropriate measures to ensure that at all stages of radioactive waste management, people, society and the environment are adequately protected against radiological and other risks.

To this end, each Contracting Party shall adopt the appropriate measures to:

i) Ensuring that due attention is paid to criticality and removal of waste heat produced during radioactive waste management;

ii) Ensure that the generation of radioactive waste is kept at the lowest possible level;

iii) Take into account the interdependencies between the different stages of radioactive waste management;

iv) Provide effective protection of people, society and the environment by applying adequate protection methods at the national level, approved by the regulatory body, within the framework of its national legislation that takes due account of internationally approved criteria and standards;

v) Take into account the biological, chemical and other risks that may be associated with the management of radioactive waste;

vi) To strive to avoid actions whose reasonably-foreseeable repercussions on future generations are greater than those permitted for the present generation;

vii) Try to prevent undue burdens from being imposed on future generations.

The protection of people, society and the environment against radiological and other risks is subject to the Mexican legislation on nuclear and radiological safety as detailed in Section E and to the legislation on environmental protection (Ley General del Equilibrio Ecológico and Environmental Protection and its associated regulations).

The compliance with legal requirements on nuclear safety and radiation protection is verified and applied by the regulatory body. It is mainly about the licensing, verifications and inspections carried out by the National Nuclear Safety and Safeguards Commission. The protection of the environment against dangers other than radioactivity is verified in the licensing process and environmental audits carried out by the Federal Attorney for Environmental Protection (PROFEPA).

11.1 Measures to ensure the maintenance of subcritical conditions and the removal of heat

A. Radioactive waste from non-energy applications

The control of criticality and the removal of residual heat from radioactive waste management facilities, when applicable, are analyzed and authorized during the licensing process and are monitored during operation. These points are described in the safety report, where they are presented with the license application and are reviewed and authorized by the regulatory body. Safety-relevant

changes to a radioactive waste management facility, including equipment and procedures, also require authorization.

Radioactive waste of non-energy origin has a wide variety of characteristics as regards the identity of the radionuclides that compose them, their activity and their physical presentation; It talks about sealed sources, plastics, rubber, gloves, paper, wood, metal objects, glass, laboratory animals, sludge, precipitates, liquid solutions and other materials that contain different types of radioisotopes. They do not produce heat and are not susceptible to detonation or decomposition or explosive reactions under normal conditions of temperature and pressure, or when in contact with water. The management of these wastes is carried out by the National Institute for Nuclear Research.

B. Radioactive waste from energy applications

Radioactive waste generated in the CNLV, by its nature, is not susceptible to reaching critical conditions. The radioactive waste managed at the Plant does not produce heat.

11.2 Measures taken to ensure that the generation of radioactive waste is kept as low as possible.

National legislation requires users of radioactive material and producers of radioactive waste to implement the necessary mechanisms so that, in the design and operation of nuclear facilities, the generation of these wastes is kept to a minimum.

Article 160 of the General Regulations on Radiation Safety establishes the obligation to minimize the generation of radioactive waste for the Radiological Safety Manager. This is verified in the course of radiological audits carried out at the facilities by the regulatory body. An additional incentive for minimization is the charge made for receiving the waste.

The National Nuclear Safety and Safeguards Commission granted the commercial operating license in 1990 to Unit 1 and in 1995 to Unit 2 of the CNLV. In this license, the Laguna Verde Nuclear Power Plant undertakes to temporarily maintain and store the radioactive waste generated as a result of the operation of both units, in accordance with radiological standards and controls, as long as it is not available in the country of a designated place for final disposal.

As a result of this commitment, the CNLV has a plan to manage radioactive waste, which considers all those activities that must be carried out to generate, manage, classify, store and dispose of those "materials for which no use is planned," and that contains or is contaminated with radionuclides at concentrations or levels of activity greater than those established by NOM-035-NUCL-2000 "Criteria for the dispensation of waste with radioactive material", or the one that replaces it "(ref. NOM- 004-NUCL-2013 "Classification of radioactive waste").

The CFE in Chapter 11 of the Final Safety Report (FSAR) documented the CNLV license base, describes compliance with regulatory requirements including some important parameters, regarding the control in the generation and management of radioactive waste for the operation of nuclear power generation plants, as required by 10 CFR 50 and NUREG-0800; reason for which the FSAR is used as a base and guide in the elaboration of this document.

11.3 Measures adopted that consider the interdependence between the different stages of radioactive waste management.

As described in section E of this report, the legal framework for radiological safety in Mexico has established requirements from the planning and design of activities involving nuclear energy to the cessation of operations and the final destination of all its waste.

From an operational point of view, in 1989 the Secretary of Energy instructed the ININ to manage the radioactive waste produced in non-energy activities, on the basis that the Institute has the personnel, facilities and equipment to carry out said activities. .

The measures to take into account the interdependencies between the different stages of the management of the spent fuel generated in the production of electricity by the CNLV, are those specified in Section G.

Regarding the radioactive waste generated in the production of electrical energy, they are managed by the CFE, which operates the two nuclear reactors of the Laguna Verde Nuclear Power Plant.

For this purpose, the requirements for the management of radioactive waste, its components and the final products obtained, are defined in terms derived from the safety and radiological

protection conditions established and regulated by the CNSNS.

Additionally, the regulations related to radioactive waste management contemplate technological interdependence in the different stages of management, that is, that there is harmony between them and one stage is not in dissonance with the next. To this end, the following standards serve this purpose:

- NOM-036-NUCL-2001, "Requirements for radioactive waste treatment and conditioning facilities". It applies to radioactive waste facilities.
- NOM-019-NUCL-1995, "Requirements for packages of low-level radioactive waste for storage near the surface". It is applied in generators of waste packages.
- NOM-021-NUCL-1996, "Leaching tests for specimens of solidified radioactive waste". It is applied in generators of radioactive waste packages.
- NOM-022/2-NUCL-1996, "Requirements for a facility for the definitive storage of low-level radioactive waste near the surface. Part 2. Design". It is applied in permanent storage facilities.
- NOM-022/3-NUCL-1996, "Requirements for a facility for the definitive storage of low-level radioactive waste near the surface. Part 3. Construction, operation, closure, post-closure and institutional control". It is applied in permanent storage facilities.
- NOM-036-NUCL-2001, "Requirements for radioactive waste treatment and conditioning facilities". It is applied in radioactive waste facilities.

In general, it can be established that the transport, storage and use of radioactive materials is carried out in compliance with the applicable national and international regulations, seeking the protection of workers, the public and the environment. The various stages of radioactive waste management, especially their conditioning, are aimed at avoiding inheriting loads to future generations.

11.4 Measures to provide effective protection for people, society and the environment

The national legal and regulatory framework applicable to the management of radioactive waste is mainly made up of a set of laws, regulations and official standards, the purpose of which is to guarantee that radioactive waste is managed and finally disposed of in such a way that the health of people and of the environment are protected, without imposing excessive burdens on future generations.

The measures provided by law in Mexico for the protection of people, society and the environment were detailed in section E of this report. In summary, Chapter IV of the Nuclear Law sets out Mexico's commitment to Nuclear, Radiological and Physical Safety, and Safeguards, as primary measures to protect people, society and the environment. As already mentioned, the CNSNS is in charge of monitoring compliance with these provisions.

On the other hand, all those activities that involve the peaceful uses of nuclear energy in its different applications, as well as the management of the waste produced in them, absolutely require a license, permit or authorization issued by the CNSNS, in which the safety and protection requirements of people and the environment are established with a graduated approach, which the user will have to fully comply with. Examples of these are the annual report of relevant activities in radiological protection and the reports of the environmental radiological surveillance program, when applicable.

11.5 Measures to prevent biological, chemical and other risks that may be associated with the management of radioactive waste

The radioactive waste handled at the ININ is low-level from radiation applications in medicine, research and industry, which do not produce heat. The handling of biological materials is done by deactivating them with calcium hydroxide. By license condition, the reception of explosive or pyrophoric radioactive waste is not allowed.

The waste generated in the production of electricity by the CNLV is classified as low and medium level in accordance with the official Mexican standard NOM-004-NUCL-2013 "Classification of radioactive waste", they do not contain materials that generate heat or that react exothermically, however, mixed waste is produced, that is, they contain dangerous substances, fuels such as lubrication oils and chemicals.

The containers are stored at room temperature, in rooms isolated from heat sources that could affect them.

In Mexico, mixed wastes with biological-infectious characteristics are generated mainly in nuclear medicine and medical research, the vast majority of these contain radionuclides with a very short half-life (less than one year), which is why they are stored for their decay in the generating institution and subsequently managed as hazardous waste, as established by the legal framework on environmental material.

The General Regulation of Radiological Safety deals with the management of radioactive waste in different sections. Article 206 establishes that the information necessary for the authorization process for the processing, conditioning, dumping and final disposal of radioactive waste of low and intermediate levels are established in articles 219, 220 and 221. For this purpose, Article 207 indicates that the CNSNS will classify radioactive waste according to its specific activity, speed of exposure on the surface of the container or packaging, half-life, radiotoxicity, chemical and physical form and, taking into account its origin, properties of the radionuclide, risk of external irradiation, characteristics of the container, packaging or package, ecological dispersion mechanism and form of release to the environment.

PROFEPA is in charge of approving and auditing all activities that may have an impact on the environment due to chemical, biological compounds and other types of non-radiological risks.

11.6 Measures to avoid that the repercussions on future generations are greater than those allowed for the present generation

Mexico does not explicitly establish special measures to avoid that the repercussions on future generations are greater than those allowed for present generations. However, Mexican legislation establishes the principles of dose limitation and as a Member State of the International Atomic Energy Agency, it applies the fundamental safety principles established in the IAEA Safety Standards, as well as the Waste Management Objectives. Radioactive.

The General Regulation of Radiological Safety establishes the dose limitation system for workers and members of the public, in which the maximum dose limits that in extraordinary situations are allowed to be received by both workers and the population are indicated, and are requires those responsible for the application of practices that involve the handling of radioactive material, determine the derived levels that allow them to identify abnormal situations in the operation of the facility that require the execution of mitigation actions.

National regulation requires that releases to the environment meet the criteria established in the official Mexican standards in this regard, their compliance will guarantee that the impact on the environment is negligible, additionally, the use of technologies that allow minimizing the generation of radioactive waste is encouraged.

11.7 Seek to avoid imposing undue burdens on future generations

The Mexican legal framework establishes a structure and defined responsibilities regarding the role assumed by each of the institutions or governmental entities involved in the management of radioactive waste. In this way, the Nuclear Law establishes that the Federal Executive, through the Secretary of Energy, will regulate the exploration, exploitation and benefit of radioactive minerals, as well as the use of nuclear fuels, the uses of nuclear energy, research nuclear science and techniques, the nuclear industry and everything related to it, including radioactive waste and spent fuel.

To fulfill this mandate, the Ministry of Energy coordinates with three Federal Government institutions with very specific assignments: a) Federal Electricity Commission, which is the only entity in Mexico that can generate electricity from the use of nuclear fuels; b) the National Nuclear Safety and Safeguards Commission, whose function is to act as the regulatory body on the matter; and c) the National Institute for Nuclear Research, whose function is to carry out research and development in the field of nuclear science and technology, as well as to promote the peaceful uses of nuclear energy and to disseminate the advances made to link them to economic, social and scientific development. and technology of the country.

Regarding the protection of future generations, it must be taken into account that according to article 19 of the Nuclear Law, safety is paramount in all activities that involve nuclear energy and the dispositions and final destination of all its waste . This includes activities to be demonstrated from the design and selection of the site of the facilities, their construction, operation, dismantling, to the institutional control and release of the site in the case of the facilities for the final disposal of radioactive waste.

Those generations that may be exposed to the operation of nuclear or radioactive facilities

authorized in the present will continue with -at least- the same protection as the present generation; this as long as the annual dose equivalent limits established in the RGSR are not modified. However, if these were modified, the trend would be to align with current international recommendations, which currently establish lower limits than those legally in force in the country.

On the other hand, the radioactive waste classification system in force in the country takes into account, among other things, the activity concentrations of long-half-life radionuclides (and their short-half-life precursors) of which a Potential hazard after institutional control, disposal method, and disposal methods are no longer effective.

In the design of facilities for the final disposal of low-level radioactive waste, according to Mexican regulations, three essential elements must be considered to safeguard the safety of the personnel operating the facility, the population, and that of the environment (considering the time required for radionuclides to decay to activity levels such that they are no longer a radiological hazard); these elements are:

1) The package that contains the radioactive waste and that includes the matrix in which the same waste is immersed;

2) The barriers and engineering structures provided to the facility to prevent the dispersion of radioactive pollutants into the environment; and

3) The characteristics of the site that will contribute to the isolation of radioactive waste from the environment accessible to man.

All this is aimed at prolonging the isolation of waste for the time necessary to reduce the impact on the environment and on future generations, in such a way that they will have adequate protection comparable to that of the current generation.

However, for intermediate and high-level waste, the country recognizes the need for a policy and strategy for the management of radioactive waste and spent fuel that, among other things, includes the allocation of responsibilities, financial resources and development of regulations for final disposal.

Compliance assessment

In accordance with what is stated in each of the previous sections, it is considered that in Mexico the general safety requirements established in Article 11 of the Joint Convention are met..

Article 12. Existing facilities and previous practices

Each Contracting Party shall adopt appropriate measures in due course to examine:

i) The safety of any radioactive waste management facility existing at the time the Convention enters into force with respect to that Contracting Party and ensuring that, where appropriate, all reasonably feasible improvements are made to increase the safety of such facility;

ii) The results of the previous practices in order to determine if an intervention is necessary for reasons of radiological protection, bearing in mind that the reduction of the detriment derived from the reduction of the dose will have to be sufficient to justify the damages and costs, including the social costs of the intervention.

12.1 Safety of existing radioactive waste management facilities

A) Safety of radioactive waste management facilities of non-energy origin.

- Radioactive Waste Treatment Plant (PATRADER);
- Radioactive Waste Storage Center (CADER);
- Three currently closed Disposal Sites: 1) “La Piedrera”, 2) “Peña Blanca” and 3) “San Felipe”.

B) Safety of energy-source waste management facilities.

- Temporary Warehouse on Site (ATS) at the CNLV;
- Dry Solid Radioactive Waste Repository (DDRSS)

12.1.1 Radioactive Waste Treatment Plant

This facility aims to carry out the following activities:

i) reception of solid and liquid radioactive waste, disused sealed sources and materials for decontamination;

ii) compaction of solid waste;

iii) conditioning of disused sealed sources;

iv) decontamination of materials and equipment; as well as the crushing of solids free of contamination;

v) Characterization of radioactive waste.

PATRADER is located in the central part of the reactor building at ININ, on the Mexico-Toluca Highway, La Marquesa, Ocoyoacac, State of Mexico. This facility has a total area of 1,897.36 m2. In turn, the ININ occupies an area of approximately 150 acres, at an average altitude of 3,050 m above sea level. The selection of the site was based on the following characteristics: its i) location with respect to Mexico City (36 km away), which facilitates road communication from this city, and at the same time is far enough away to considered to present a risk to the population, due to the availability of space, access roads (600 m from the highway) and water supply and proximity to the electricity network.

The PATRADER, like ININ, were designed and built following the civil engineering requirements and the criteria indicated by the construction regulations for nuclear facilities that were in force on the date of their construction (1964-1968). Likewise, many of the equipment installed in the area were selected based on the technical specifications of that time.

The physical safety of the facility is carried out in accordance with the ININ's Physical Safety Plan. In particular, PATRADER's physical safety is robust as the facility is located alongside the TRIGA Mark III research reactor. Both facilities are guarded by members of the Secretariat of National Defense and the National Guard. Likewise, there is a comprehensive physical safety system consisting of video surveillance and access control. Additionally, there are various physical barriers that prevent the entry of people outside the facility. On the other hand, the sealed sources in disuse are protected in a safety vault, waiting to be conditioned and / or immobilized, or failing that they are conditioned as soon as possible.

On the other hand, the radiological safety of the facility is maintained in accordance with the requirements of the facility's safety assessment and licensing requirements, established by the CNSNS. The safety report and the corresponding evaluation are carried out periodically, the most recent safety report was carried out in 2018. The radiological safety report was prepared in accordance with the current regulatory framework and considers the following aspects:

- General specifications of the installation, such as: location, description of the installation, selection and characteristics of the site, storage capacity.
- Organization of the facility, such as: organization chart, functions, responsibilities and qualifications of personnel.
- Safety policy.
- Quality assurance program.
- Radiation safety staff.
- Radiation sources.
- Design characteristics with regard to radiation safety.
- Estimates of dose equivalents to occupationally-exposed personnel and the public.
- Radiation safety program, including: ionizing radiation measurement equipment, equipment maintenance and calibration, personnel dosimetry, radiation protection equipment and clothing, personnel training, operating procedures under normal and emergency conditions.
- Risk analysis and emergency plan.
- Radiological environmental impact in normal operation and in abnormal situations.
- Cessation of operations, dismantling and closure.
- Physical safety plan.
- Environmental radiological surveillance program.
- Both the program and the respective environmental radiological surveillance report were evaluated and authorized by the CNSNS.

Regarding the licensing conditions, these are continuously evaluated allowing the renewal of the license. In this sense, the facility maintains its operating authorization conditions in accordance with the current license A00.400 / 025/2019. The renewal of the license is based on the Safety Report, the Quality Assurance Program, the Procedures Manual and the Annual Report of Relevant Activities in Radiological Protection. It should be noted that the facility's quality assurance system is consistent with the IAEA documents GS-R-3 "The Management System for Facilities and Activities"

and GS-G-3.1 "Application of the Management System for Facilities and Activities".

In the Annual Report of Relevant Activities in Radiological Protection, the CNSNS is notified generically, with at least the following information:

- Inventory of radiation sources and their respective leak tests.
- Updated list of occupationally-exposed personnel, as well as evidence of their continuous training.
- Medical reports of occupationally-exposed personnel.
- List of the acquisition, import, waste or export movements of radiation sources.
- Records of ionizing radiation levels.
- Organizational changes and changes in the installation procedures manual.
- Report on incidents that occurred at the facility.

In particular, PATRADER has particular radiological safety requirements, so the facility is obliged to:

- Do not store nuclear material from its use in power or research reactors.
- Maintain exposure levels below 0.75 μSv/h at any point outside the facility.
- Ensure that exposure levels (by contact) on the surfaces of containers with conditioned radioactive waste are less than 500 μSv/h.
- Carry out the storage of radioactive waste in exclusive areas separated from the traffic of occupationally-exposed personnel.
- Maintain the record of the manufacturing and/or calibration certificates and the last leak test of the sealed sources that the installation receives for its conditioning.
- Do not discharge disposable liquids that contain hazardous waste, without the corresponding environmental authorization.
- Additionally, it must be guaranteed that the conditioned radioactive waste must not generate or contain toxic gases, vapors or fumes. In the case of pyrophoric materials, they must be previously treated and conditioned, in such a way that they are not flammable.

12.1.2 Radioactive Waste Storage Center

The CADER is a facility whose function is to store radioactive waste produced mainly in the medical sector, and to a lesser extent from industrial and research activities throughout the national territory. Before being sent to the facility, these wastes are immobilized and / or packaged in containers (original shielding of the spent sealed sources) and drums (200 L metal containers) with concrete, lead or paraffin, as applicable.

The site where CADER is located was selected based on the study entitled "Evaluation of different factors with a view to the location of a radioactive waste cemetery for the CNEN of Mexico", which was carried out by the Radiological Safety Directorate of the then National Commission of Nuclear Energy (CNEN) in the 1960s, whose conclusion was that "there was an area approximately 150 kilometers long and 40 kilometers wide that covers part of the states of Hidalgo, Mexico and Tlaxcala, which met the conditions required for the installation of radioactive waste deposits. " This study was carried out based on the technical recommendations contained in the IAEA document entitled "Disposal of radioactive wastes", published in 1960. The objective of carrying out the site study was to find the appropriate place to install the deposit, in which The radioactive waste that was being generated in Mexico would be confined, due to the use of radioactive material in hospitals, laboratories and industries.

In this context, CADER began its operations in 1970. It is located at kilometer 18.5 of the Tizayuca-Otumba highway, in the municipality of Temascalapa, State of Mexico, 57 km from Mexico City by road. The closest towns are: Maquixco located 1 km and San Juan Teacalco, 1.5 km; and has an area of approximately 16.4 hectares. The property is relatively flat, although it presents a drop of 15 m in the southeast-northeast direction. The monthly summaries of meteorological information show that the dominant wind has a northeast component and its average speed ranges between 7.1 and 8.7 m / s. The annual values of the average temperatures in the area fluctuate between 12.4 and 16.8 ° C. Average annual rainfall fluctuates between 390.6 and 672.2 mm.

From an operational point of view, it is part of the Radioactive Waste Department, a unit dependent on the Radiological Safety Management, which belongs to the Technological Research Directorate of the National Institute for Nuclear Research.

In general terms, CADER is made up of:

- A warehouse to store equipment, vehicles and tools.
- Main building with offices, dining room and kitchen, toilets, machine room and meteorological station.
- Guardhouse.
- Old office booth.
- Three radioactive waste warehouses and spent sealed sources.
- Trench area, in which packages with radioactive materials and waste were deposited, in accordance with license SR / 1226/83 issued on October 26, 1983. This practice was canceled in 1991 in order to comply with the new provisions established in the operating license A00.2.1 / 1132/91 issued on November 5, 1991.

Radioactive waste warehouses are designated as I, II and III. Warehouse I has a capacity of 300 m3, and warehouses II and III have a capacity of 3,664 and 1,108 drums, respectively. Likewise, the trench area is made up of 5 trenches of 190 m in length and a depth that ranges from 1.5 to 4 m.

The practice of depositing radioactive waste in trenches was carried out from 1981 to 1989. In these trenches, there are mainly:

- Rods contaminated with Co-60 as a result of the accident that occurred in Ciudad Juárez, Chihuahua.
- Uranium minerals and tailings.
- Contaminated soil.
- Compactable solids with short and intermediate half-life.
- Gelled organic materials and cemented sludge.
- Activated equipment and resins.
- To a lesser extent, rubble, vegetables, plastics and contaminated scrap metal.

Regarding the physical safety of the facility, the ININ controls the access of people to CADER through a physical safety plan, which establishes the requirements for entering the facility. There are safety personnel from the Secretariat of Citizen Safety of the State of Mexico and the National Guard, whose activities are supervised by the Department of General Services of the ININ. Additionally, the radioactive material warehouses have a physical safety system made up of video surveillance and access control, motion sensors, acoustic alarms and continuous video recording 365 days a year. From an administrative point of view, CADER is part of the Radioactive Waste Department, a unit dependent on the Radiation Safety Management, which belongs to the ININ's Directorate of Technological Research. From an operational point of view, the facility has a radiological safety officer and a permanent staff of specialized technicians who, together, carry out inventory control of stored radioactive waste and maintenance of the facilities. Additionally, the personnel of the Department of Radioactive Waste is supported by the Department of Maintenance and Works of the ININ for the tasks of conventional maintenance of facilities and equipment.

On the other hand, the radiological safety of the facility is based on the principles of radiological protection and on the dose limitation system established in the RGSR, whose fundamental philosophy establishes the justification of the practices that involve exposure to ionizing radiation, the optimization of protection and dose limitation to POE and the public. In this context, the facility manages radiation safety in accordance with the requirements of the facility's safety assessment and licensing established by the CNSNS in authorization No. A00.400 / 044/2019, valid until March 22, 2021. This authorization endorses the temporary storage of radioactive waste from the application of radioactive materials in medicine, industry and research, in warehouses I, II, III. As well as the activities related to the control and remedial actions of the radioactive waste existing on the premises of the Radioactive Waste Storage Center.

In this context, the license establishes general and particular radiation safety measures for the facility. The general measures are similar to those listed in section 12.1.1. In the case of particular measures, these are described below:

- The storage of radioactive waste generated by the operation of nuclear power plants, nor nuclear waste from the fuel cycle is not authorized.
- The facility is prohibited from receiving radioactive waste that is not previously characterized and properly conditioned.

- The reception of radioactive waste that has explosive, pyrophoric or corrosive properties, as well as waste in a liquid state, is prohibited.

- CADER is obliged to keep a record of the radioactive waste received and stored, as well as the location of these within the warehouses. The records must contain the following information: weight, volume, radioisotope, activity, exposure to contact and one meter, and the date, name and signature of the personnel who recorded the movement.

- The dose rate at any accessible point outside the controlled area should not exceed 0.75 µSv/h.

- Carry out leak tests on sealed sources prior to any operation or maneuver to avoid dispersion of radioactive material when its tightness has been compromised.

Likewise, CADER has an Environmental Radiological Surveillance Program (PVRA), the purpose of which is to determine whether the activities related to the operation of the facility result in the release of radioactive isotopes into the environment that contributes significantly to exposure to the radiation from the population in the vicinity or pollution of the environment. The current PVRA was approved by the CNSNS and in accordance with the indications of this regulatory body, a report of the results is presented each year for evaluation. It should be noted that the PVRA includes the periodic measurement of radioactivity of soil samples from the property and surrounding areas, potable and surface water in the area, plants such as prickly pears and nopales from the property and the area, as well as continuous air sampling. The sampling points selected in the PVRA make it possible to monitor the main routes of exposure to the population, in order to verify compliance with the limits established for the operation of the CADER. Based on the results obtained from the PVRA it has been possible to establish that the limits established in articles 20, 21 and 37 of the RGSR have never been exceeded.

Additionally, the CNSNS periodically carries out verifications, inspections and audits to corroborate compliance with CADER's operating conditions in accordance with the facility's authorized operating license.

Based on the available evidence, it can be concluded that the preventive or safety measures of the instruments provided in the legal regulatory framework to carry out the storage of radioactive waste are sufficient and adequate to manage the radiological safety of workers, population and environment.

12.1.3 "La Piedrera"

This site was built expressly to dispose of the contaminated materials generated in the accident that occurred in December 1983 in Ciudad Juárez, Chihuahua. In this event, a cancer treatment unit with a Co-60 source was abandoned and melted down, contaminating several scrap metal, foundry, rod and other metal products businesses, as well as hundreds of buildings.

"La Piedrera" is located at coordinates 310° 13 '45 "north latitude and 106° 034' 30" west longitude, approximately 55 km south of Ciudad Juárez. The facility is called "La Piedrera" after the name of the ranch to which it belonged. The site is located in an area of hills, near the dunes of Samalayuca, Chihuahua. The nearest town is 15 km northeast.

The Disposal Site originally consisted of 9 vaults with 20 cm thick concrete lining and one of them without lining. The dimensions of these are 40 m long, 15 m wide and 5 m deep, where various materials, contaminated soil and slag were placed. The final fill with normal soil was compacted and mounds of a height of approximately 2 m above ground level were formed. In 2006, an additional 9 m long by 4.3 m wide vault was built, in which the contaminated slag found on the site's surface was deposited.

The materials that were deposited and their original activity are described below:

- Rods and similar materials.

- Metal drums containing pellets, soil, filled with concrete and/or sealed with concrete covers.

- Remains of a truck with a 50 cm layer of concrete.

- Teletherapy head with the stem of the original source.

- 20,000 m^3 of soil, mill scale and refractory material from steel furnaces, without prior conditioning.

- 2,000 m^3 of scrap metal, without prior conditioning.

Considering that in January 1984, the accident source had an activity of 450 Ci, it is estimated that as of December 2019, the activity was approximately 4.32 Ci.

As an additional measure of radiological safety, environmental radiological surveillance of the site is carried out periodically. This surveillance consists of sampling and radiological analysis of representative samples of soil and well water. The results of the analysis are used to prepare the corresponding report. The latest environmental radiological surveillance reports were sent to the CNSNS in 2004, 2006, 2012 and 2015.

12.1.4 "Peña Blanca"

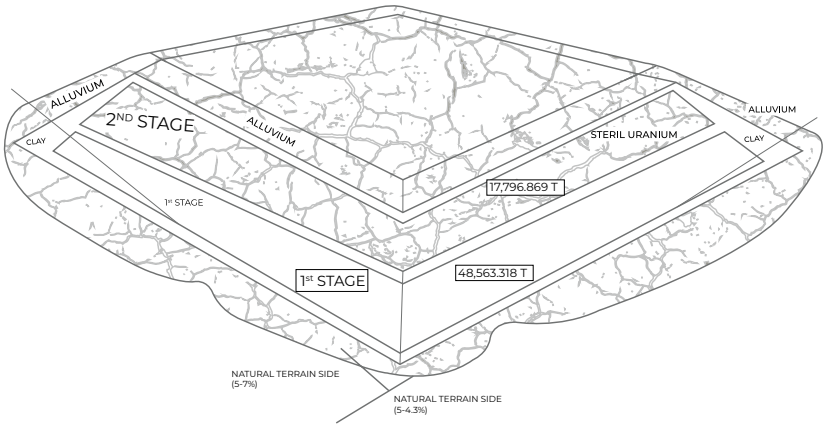
The "Peña Blanca" Disposal Site consists of a barren uranium dam, which is located in the uraniferous zone of the Sierra de Peña Blanca, in the municipality of Chihuahua, Chihuahua at coordinates 29 ° 08 'north latitude and 106 04 'west longitude. At this site, 65,000 tons of uranium tailings and soil contaminated with tailings were deposited, originating from the dismantling of the uranium and molybdenum processing plant in Ciudad Aldama, Chihuahua. This mining plant was operated between 1969 and 1971 by the National Nuclear Energy Commission and the Mining Development Commission. The plant had a nominal capacity of 80 metric tons per day of ore and operated with a conventional alkaline process with sodium carbonate and bicarbonate as leaching agents. The mineral came from the Sierra de Gómez, Chihuahua.

During the years of operation, around 45 tons of uranium concentrates and approximately 35,000 tons of sterile uranium were generated. The latter were stored in a dam 120 m to the west of the plant. The original tailings dam did not have protective membranes at the bottom and no cover at the top. Therefore, the Mexican government considered that these tailings constituted a potential radiological risk for the neighboring population. In this sense, between 1994 and 1997 a confinement site was built following the national and international recommendations indicated in the technical report of the International Atomic Energy Agency No. 335. "Current practices for the Management and Confinement of Uranium Mill Tailings" of the year 1992 ; and in the document entitled "Criteria for the long-term management of uranium mill tailings".

Broadly speaking, the site consists of a platform with a slope of 7% in the E-W direction and 5% in the N-S direction, with two terraces to reduce the slope to a value between 0.5 and 2%. The land platform occupies an area of approximately 40,000 m2 (200 by 200 m). Along the axis (N-S), a double slope was formed in the shape of an asymmetric "V", to form a channel to capture and lead any water that managed to infiltrate to the outside of the pile. Two beds of compacted clay with a thickness of 15 cm each were placed on the prepared ground, in such a way that they were crossed, later each one of the beds was compacted up to 90% of the Procter standard test.

The sterile uranium was deposited on the lower clay bed in such a way that it formed a truncated pyramid with a surface area of 10,000 m² and slopes 2 m wide. The waste pile was protected against rain, erosion, and possible intrusion by small animals with a two-layer cover. The first layer was of the same clay used in the intermediate and lower bed and of a similar thickness. The second layer consisted of alluvial material 40 cm thick, suitable to prevent the intrusion of small animals. This last layer was stabilized, against erosion, by planting on its surface plant species with short roots typical of the region. The repository scheme is shown in Figure 2, where the volumes stored in the two stages of the storage process are indicated.

FIGURE 2. "PEÑA BLANCA" REPOSITORY SCHEME



In general, to guarantee the radiological safety of the site, the following criteria were used:

- Sterile uranium and its associated contaminants are contained in such a way that they will remain isolated from the environment for as long a period of time as the best available technology allows, supported by site characteristics.
- The sterile ones should be arranged in such a way that no active maintenance is required to preserve the effectiveness of the containment.
- Economic activity on the site must be minimal in a foreseeable time.
- The site must be dry, both in terms of rainfall and the accumulation of water in water tables, since water is a means of transport of radioisotopes to the human environment, through trophic chains.
- Volcanic and seismic activity must be low, in order to avoid fracturing, landslides and tailings exposure. The entire northern part of the country meets this criterion.
- The site should not be in the course of surface water currents because they can erode the protective covering. Wind erosion should be minimized with a plant cover on site.
- The sterile site and stacking must be physically and chemically stable, such that it does not require active maintenance, so that they remain isolated from the environment for as long a period of time as the best available technology allows.
- Stacking must allow control of the migration of hazardous and radioactive elements from sterile ones to the environment.

Additionally, a baseline environmental radiological analysis was performed on representative samples of air, soil, plants and water in order to establish a comparison for subsequent studies. It should be noted that the site's main safety features are its remoteness from population centers, the absence of economic activities and that there are uraniferous formations in the surrounding area.

12.1.5 "San Felipe"

The Disposal Site called San Felipe is located on the highway to San Felipe, 114 km from Mexicali in the state of Baja California. It was built in 1984 to house 115 tons of rods contaminated with Co-60, recovered from the accident in Ciudad Juárez, Chihuahua. The site is characterized by low agricultural and livestock use, remoteness from human settlements, low rainfall, deep groundwater, and geologically stable lands. The current activity concentration (average concentration of Co-60 15Bq / g) of the rods does not pose a risk to the public or the environment.

12.1.6 Laguna Verde Nuclear Power Plant

Mexico does not have a facility for the final disposal of radioactive waste, therefore the radioactive waste generated at the Laguna Verde Nuclear Power Plant is deposited in the following warehouses:

12.1.6.1 Temporary On-Site Warehouse

The Temporary On-Site Warehouse (ATS) is located in the CNLV, within a fenced and secure area. Its function is to responsibly and safely store low-level wet solid radioactive waste classes A, B and C, such as spent resins, cleaning sludge, pre-layer sludge, activated carbon and concentrates, the latter packaged in 200 L metal drums, immobilized with cement and asphalt and the rest packaged in High-Integrity Containers (HIC).

Access to the ATS facility is controlled in accordance with the Central's physical safety program carried out through the application of operational and administrative procedures.

It is designed for long-term storage of wet radioactive waste packages (i.e. up to 100 years). A physical safety program is in place in accordance with the requirements of 10 CFR 50.54. This design was carried out considering the evaluations of basic events such as:

Fire Evaluation

The ATS design incorporates fire detection, by audible and visual alarm, with an automatic and manual fire suppression system depending on the zone. For some areas of the building, the fire suppression system will be activated automatically in case it is required, the visual alarms are activated at the central alarm station. In addition, the smoke detection system isolates the inlet and outlet air handling in the units, turning off the fan motors and providing an external alarm to the radioactive waste control room. Likewise, there are several manual fire extinguishing systems. These systems are periodically reviewed by personnel from the industrial safety area in accordance with the applicable procedures.

Warehouses I and II and the truck bay contain an automatic fire suppression system designed to activate in a short period of time when the fire starts.

For the additional areas in the ATS there are alarms and a manual fire protection system that provides sufficient manual and automatic pressure, and a fire department on site 24 hours a day and 7 days a week for intervention, if required.

Wind evaluation

The ATS was designed to withstand the effects of a probable maximum hurricane (PMH) with a wind speed of 275 km / h, a design base tornado with a wind speed of 241 km / h, or a design wind with a 180 km / h wind speed. These wind speeds are defined as acting horizontally at a height of 10 m higher degree. PMH has a recurrence period of 1,000 to 10,000 years.

The inherent stability of the facility provides protection, with the mass of radiological shielding built into the walls and ceiling of the structure providing protection against wind and missiles.

The structure is designed with a minimum of 0.4 m thick walls and 0.35 m thick roof structures to test tornado missiles, this test was carried out by Sandia Laboratories and applying the EPRI Report of April 1976 NP-148 on Las "Large-scale tornado missile impact tests" showed that there would be no significant tornado missile damage to the ATS walls, only limited damage from possible detachment with no concrete fragments that could cause any significant damage to the stored HICs. , or structural failure leading to significant radiological releases.

With regard to flood risks, according to section 11.4A of LVNPS-1 and 2 of the Final Safety Report (FSAR), the flooding of the ATS site is not a consideration, since the topography of the site in the Central is such that the flooding for natural causes are not probable. However, the facility is built above the maximum groundwater elevation, which is 2.8 m above the plant level.

Also, for seismic events, according to LVNPS-1 and 2 of the Final Safety Report (FSAR), section 11.4A, the ATS is designed and built to withstand the operational base earthquake (OBE). For the design, a seismic acceleration of 0.16 g was used, which has a recurrence time of 50 years. The seismic design parameters for the CNLV were originally developed from a conservative assessment of the potential for earthquakes in eastern mainland Mexico and the adjacent Gulf of Mexico area and are based on site-specific studies, prior to 1979.

Also, in the exterior and interior areas of the ATS, a routine verification program of warehouse operability is carried out in accordance with procedure DR-9940 "Temporary Storage on Site and verification of warehouse operability", said program consists of a visual inspection of the physical conditions outside and inside the warehouse and the physical conditions of the packages in order to detect any anomaly and attend to it in a timely manner. It has a structural stability based on engineering barriers, just as the containers provide physical stability to the radioactive waste contained, because they are qualified containers for these types of waste, the HICs are built to last for 300 years.

In addition, the ATS carries out periodic reviews of the procedures related to the safety of the warehouses, in the event that any improvement is observed in the procedure, its modification is carried out, although its revision is not yet applicable.

12.1.6.2 Dry Solid Radioactive Waste Repository

The Dry Solid Radioactive Waste Repository (DDRSS) is located in the CNLV within a fenced and secure area, its function is to responsibly and safely store dry solid radioactive waste of low level class A, B and C, such as waste compactables (rags, plastic, paper, among others) and non-compactables (metal waste, earth, concrete, among others).

Access to the DDRSS facility is controlled in accordance with the Central's physical safety program carried out through the application of procedures.

The DDRSS is where compactable and non-compactable dry solid waste is stored. It is a concrete block structure that is located 1 km away from the Radioactive Waste Building in the CNLV, outside the restricted area. It has 2 warehouses with the capacity to house 8,290 drums (1,728.47 m3) according to the Final Safety Analysis. The warehouse is classified as Not Safety Related.

This warehouse has trenches in the perimeter area to collect liquids in the event of a flood event, taking the water that was in the storage area to the two sumps that the facility has (FSAR Chapter 11 Section. 11.4A. 7).

At the entrance to the warehouse site there is an office and a personnel monitoring area separated

by a partial wall. It has a stationary and portable lighting system to facilitate radiological inspections.

To prevent the occurrence of a fire event in the storage area, a modification is programmed to include a fire detection system, however, the warehouse is provided with fire extinguishers on the periphery if required, although it is not required. awaits the occurrence of a fire.

Also in the exterior and interior areas of the DDRSS, a routine verification program of warehouse operability is carried out in accordance with procedure DR-9940 "Temporary Storage on Site and verification of warehouse operability", said program consists of a visual inspection of the physical conditions outside and inside the warehouse and the physical conditions of the packages in order to detect any anomaly and attend to it in a timely manner. This temporary warehouse has a structural stability based on engineering barriers, as well as the containers provide physical stability to the radioactive waste contained, since they are qualified containers for these types of waste.

In addition, the DDRSS carries out periodic reviews of the procedures related to the safety of the warehouses, in the event that any improvement is observed in the procedure, its modification is carried out, although its revision is not yet applicable.

Results of previous practices

It has not been determined to carry out an intervention of this type, since the ATS and DDRSS warehouses are temporary, not definitive, in both warehouses there is only a dose speed restriction per operating license of 2.5 μSv / h in the perimeter fence, the which is controlled by routine radiological inspections.

The procedures applicable in the CNLV regarding the operation of the facilities for the management of radioactive waste are listed below, without being limited to:

Procedures used in the ATS and DDRSS.

- MG-4904 Equipment lubrication.
- MG-4914 Pulley alignment and belt tensioning (fans).
- MP-3976 Belt-driven centrifugal fans.

Specific procedures, instrumentation maintenance.

- 2-MI-9822 Maintenance. preventive, corrective and / or calibration of the instrumentation and controls of the temporary warehouse on site (ATS) of the CNLV.

Generic electrical maintenance procedures.

- MP-3756 480 Vac horizontal induction motors.
- MP-3661 480 Vac non-critical boards.
- MP-3906 Motor control center, A/C control boards.
- MPE-019 Maintenance and calibration of molded case circuit breakers.

Specific industrial safety procedures.

- 2-CI-9965 Operation of the M23J-P-001 pump and alignment of the valves of the fire protection system of the medium and low-level radioactive waste store (ATS).
- 2-CI-9966 Checking the level of the fuel storage tank and operation of the pump operated with diesel engine (1-FP-P-002) of the fire protection system of the medium-level radioactive waste warehouse (ATS).
- CI-9967 Verification of the alignment of the automatic valves of the fire water aspersion system of the temporary medium-level radioactive waste store (ATS).
- CI-9968 Verification of the water volume of the storage tank of the firefighting system of the temporary medium-level radioactive waste store (ATS).
- CI-9963 Inspection and testing of fire alarm / extinction alarm systems.

Generic operational procedures for radiation protection.

- PR-6500 Radiological inspections at the CNLV.
- PR-6506 Pollution control.
- PR-6784 Storage of materials and waste with radioactive material and dry active waste.
- PASGO-12 CNLV radioactive waste management.

Specific operational procedures for radioactive waste operation.

- DR-9948 Operation of the auxiliary systems of the Temporary On-Site Warehouse.
- DR-9940 Temporary storage on site and verification of warehouse operability.
- ITPCP Technical instructions for the process control program.

Specific operational maneuvering procedures:

- ·MG-4946 General instructions for the operation of traveling cranes of the CNLV.
- Procedures related to the management of radioactive waste in the CNLV.

Generic mechanical maintenance procedures.

- MG-4900 Alignment in couplings (pumps).
- MG4901 Vibration measurement (pumps).
- MO-4300 Valve packing.
- MO-4313 Valve maintenance.
- MO-4327 Flange torque.

Generic electrical maintenance procedures.

- MP-3664 480 Vac Non-Critical Starters.
- MP-3629 Back-lighting.
- MME-001 Maintenance and calibration of A/C and D/C voltmeters.
- MME-002 Maintenance and calibration of ac and dc ammeters.

Generic radiological protection operational procedures:

- PAP-05 Control of operating activities.
- PR-6505 Routine monitoring program.
- PR-6735 Classification of radioactive waste.
- PR-6725 Processing of waste generated in restricted areas of the CNLV.
- PR-6781 Application of the criteria for the disposal of waste with radioactive material.
- PAG-30 Administrative control of effluents, solid radioactive waste and their environmental impact.
- PAG-33 Radioactive waste minimization program.

Specific operational procedures of the chemical group:

- QR-8370 Radioactive sampling.
- QR-8372 Preparation of samples for counting.
- QR-8388 Activity control and analysis in wet solid waste.

Specific operational maneuvering procedures:

- MG-4909 Procedure to carry out lifting maneuvers at the CNLV.
- MG-4937 Maneuvers with telescopic towlines and transfer of forklifts, crane trucks and tractor trucks.

Compliance assessment

In accordance with what is stated in each of the sections of this article, it is considered that in Mexico adequate measures have been developed and implemented to examine the safety of radioactive waste management facilities, both of energy origin and non-energy origin.

Article 13. Location of the projected installations

1. Each Contracting Party shall take appropriate measures to ensure the establishment and implementation of procedures for a planned radioactive waste management facility in order to:

i) Evaluate all pertinent factors related to the site that may affect the safety of said facility during its operational life, as well as that of a final disposal facility after closure;

ii) Evaluate the probable repercussions of said installation on the safety of people, society and the environment, taking into account the possible evolution of the conditions of the location of the facilities for final disposal after closure;

iii) Provide information to members of the public about the safety of said facility;

iv) Consult the Contracting Parties that are in the vicinity of said installation, insofar as they may be affected by it, and provide them, upon request, with the general data related to the installation that allow them to assess the probable consequences of the installation. for safety in your territory.

2. To this end, each Contracting Party shall adopt the appropriate measures to ensure that said facilities do not have unacceptable effects for other Contracting Parties, locating them in accordance with the general safety requirements of Article 11.

At this time, the Mexican State does not contemplate new sites or the construction of new nuclear facilities for radioactive waste or final disposal.

Article 14. Design and construction of the facilities

Each Contracting Party shall adopt the appropriate measures to ensure that:

i) Radioactive waste management facilities are designed and constructed so that adequate measures are in place to limit possible radiological consequences for people, society and the environment, including uncontrolled discharges or emissions;

ii) The design stage takes into account conceptual plans, and where appropriate, technical provisions for the decommissioning of a radioactive waste management facility other than a facility for final disposal;

iii) At the design stage, technical provisions are prepared for the closure of a facility for the final disposal of radioactive waste;

iv) The technologies incorporated in the design and construction of a radioactive waste management facility are supported by experience, testing or analysis.

All the facilities designated for the management of radioactive waste from energy applications are part of the nuclear facility, for which all pertinent factors that may affect the safety of said facilities are evaluated during their operational life, these evaluations are activities registered in the procedures applied at the Plant and evaluated through periodic inspections carried out by the National Commission for Nuclear Safety and Safeguards, as well as other international organizations such as EPRI. Regarding a final disposal facility in Mexico, there is still no such facility.

The site where the final Disposal Site will be located has not currently been selected. In the event that the Laguna Verde Nuclear Power Plant is an option for its location, then the probable repercussions of said installation on the safety of people, society and the environment will be evaluated.

The CNLV maintains constant communication with nearby populations through the application of external emergency plans, these activities are applied through operational and administrative procedures, as well as evaluated by the regulatory body.

The CNLV environmental laboratory carries out samplings in the nearby area to ensure that there are no radiological risks in the vicinity of the Plant.

The appropriate measures to ensure that said facilities do not have unacceptable effects for other Contracting Parties and in accordance with the general requirements in terms of safety of Article 11., were evaluated and authorized by the Mexican regulatory body through the Safety Reports delivered by the CFE to obtain the construction and operating license of the two units that the Laguna Verde Nuclear Power Plant has.

14.1. Construction authorization-granting process

The Reglamentary Law of Constitutional Article 27 on Nuclear Matters, in its articles 15, 19, 20, 21, 25, 26, 28, 32 and 34, in general terms, establishes the requirements that nuclear facilities must satisfy from the design phase, during its construction and in the operation stage.

The licensing procedure for each of the nuclear facility authorizations requires the presentation by the holder of a series of documents, including the corresponding safety assessment, with the content specified in each case, at least:

- In the application for construction authorization, the applicant is required to present a Preliminary Safety Study that contains, among other aspects, the description of the installation that includes the criteria followed in the design of those components or systems of the that depends on safety and an analysis of foreseeable accidents and their possible consequences.

- In the case of the application for authorization of operation, it is necessary for the applicant to present, among other documents, a safety assessment that contains the information necessary to carry out an analysis and evaluation of safety and the risks derived from the operation of installation, both in normal operation and in accident conditions.

Additionally, design modifications that imply a change in the criteria, standards, or conditions on which the operation authorization is based require a modification authorization accompanied by the corresponding technical description, the safety analysis carried out and the identification of the documents. of operation that will be affected by said modification.

During this stage, the CNSNS reviews the design criteria (characteristics of structures, systems and components, safety analysis) and in particular, all matters related to the impact of site characteristics on the design of structures, systems and components. of the installation and the impact of the installation itself on the environment.

The review of the safety reports by the CNSNS includes the formulation of questions to the applicant in order to resolve the doubts in the documents, specify modifications to the design or impose additional requirements if it is considered that the current ones do not guarantee safety. After reviewing these reports, it issues a technical opinion for the issuance of the Construction Permit. The opinion includes recommendations and conclusions on the safety of the installation.

During the construction of the facilities, the CNSNS monitors through verifications, audits and inspections that it is built in accordance with the provisions of the safety report and under the conditions established in the construction authorization.

14.2. Technical provisions for the decommissioning of radioactive waste management facilities

As described in section E, Mexican legislation contemplates that radioactive facility operators consider the options conducive to the safe closure and, if necessary, remediation, of said facilities. These activities will have to be regulated and supervised, case by case, by the CNSNS.

In the case of the radioactive waste management facilities of the Laguna Verde Nuclear Power Plant, the CNSNS has defined their authorization.

For the Dismantling authorization, the holder of an operating authorization must deliver to the CNSNS a Report on the Dismantling Safety Analysis which demonstrates compliance with the following requirements:

- Define geographical limits of the area to be dismantled.
- Presentation of the Partial Dismantling Plan.
- Dismantling Quality Assurance Plan, following Appendix B of 10 CFR 50.
- Justifications for new or untested methodologies through optimization analysis.

Additionally it must:

- Document and maintain records of the decommissioning procedures.
- At the end of the activities, the licensee must submit a Final Dismantling Report of the facility describing its final state.
- Facilitate access to the CNSNS for inspection activities of decommissioning activities.
- Present a Partial Site Remediation Plan, focused on reaching the expected radiological state.

14.3. Technical provisions for the closure of the radioactive waste final disposal facility

The Mexican State does not have final Disposal Sites for radioactive waste. However, current legislation provides for radioactive facility operators to consider options conducive to the safe closure and, if necessary, remediation of said facilities.

14.4. Technologies incorporated in the design and construction of radioactive waste management facilities in nuclear power plants

For the CNLV's radioactive waste management facilities, the technologies that are incorporated in the design and construction of the facilities are evaluated by the regulatory body, as part of the requirements established to grant the Design and Construction Stage Authorizations. Likewise, during the construction stage, a commissioning

program is delivered to the CNSNS through which the equipment, structures and components and systems of the installation are tested in order to verify that they comply with the design specifications and operating criteria.

The CNLV carried out, from 2013 to 2018, a modernization of the waste treatment systems, among the recently implemented technologies are the advanced treatment system for high-activity and high-conductivity liquid radioactive waste, microwave drum dryer, modernization of equipment hoisting, solid waste compactor, technologies that are widely used in the nuclear industry.

Article 15. Assessments of the safety of the facilities

Each Contracting Party shall adopt the appropriate measures to ensure that:

i) Prior to the construction of a radioactive waste management facility, a systematic safety assessment and environmental assessment is conducted, consistent with the risk posed by the facility and the spanning of its operational life;

ii) In addition, prior to the construction of a facility for the final disposal of radioactive waste, a systematic safety assessment and an environmental assessment for the period after closure is carried out and the results are evaluated based on criteria established by the regulatory body;

iii) Prior to the operation of a radioactive waste management facility, updated and detailed versions of the safety assessment and environmental assessment are prepared when deemed necessary to complement the assessments mentioned in paragraph i).

15.1. Systematic safety assessment and environmental assessment of radioactive waste management facilities.

The safety assessment report is part of the documentation required by Mexican regulations prior to construction for each license for a nuclear or radiological facility, including radioactive waste management facilities. An Environmental Impact Assessment is required at the Operating license and Construction License stage based on the General Radiation Safety Regulations. The CNSNS conducts comprehensive safety assessment reviews.

As described in section H, the radiological safety of radioactive facilities is maintained in accordance with the requirements of the facility safety assessment and licensing, established by the CNSNS. As described in section E, the process of applying for authorization to operate any radioactive facility implies, broadly speaking, that the applicant submits, among other documents, a safety assessment that contains the information necessary to perform an analysis and evaluation. of safety and of the risks derived from the operation of the installation, both in normal operation and in accident conditions. Additionally, design modifications that imply a change in the criteria, standards or conditions on which the operation authorization is based require a modification authorization accompanied by the corresponding technical description, the safety analysis carried out and the identification of the documents. of operation that will be affected by said modification. In general, the safety report includes (at least):

- General specifications of the installation, such as: location, description of the installation, selection and characteristics of the site, storage capacity.
- Organization of the facility, such as: organization chart, functions, responsibilities and qualifications of personnel.
- Safety policy.
- Quality assurance program.
- Radiation safety staff.
- Radiation sources.
- Design characteristics in relation to radiation safety.
- Estimates of dose equivalents to occupationally-exposed personnel and the public.
- Radiation safety program, such as: ionizing radiation measurement equipment, equipment maintenance and calibration, personnel dosimetry, radiation protection equipment and clothing, staff training, operating procedures under normal and emergency conditions.
- Risk analysis and emergency plan.
- Environmental radiological impact in normal operation and in abnormal situations.
- Cessation of operations, dismantling and closure.

- Physical safety plan.
- Environmental radiological surveillance program.

The evaluation of the facility's safety report results in the issuance, by the CNSNS, of an operating license that considers generic and particular safety measures for each facility. It is important to point out that, during the period of validity of the license, the permit holder is obliged to report annually the relevant activities in radiological protection that have occurred or implemented in the facility.

On the other hand, and derived from the facility safety report, the facility operator is required to develop and implement an Environmental Radiological Surveillance Program (PVRA), from which the Environmental Radiological Surveillance Program Report (IPVRA) of each installation. The general objective of the PVRA is to maintain periodic surveillance of the environmental radiological situation of the site and its surroundings, compared with the original background radiation levels, that is, prior to the start of operations of the radioactive facility. In Mexico, in the case of radioactive facilities associated with waste management, the PVRA considers (at least):

- The description of the site, location and types of radioactive waste that will be managed.
- Environmental and socioeconomic characterization of the site (surroundings and ecosystem), which includes demography, land uses, ecosystems, hydrology, recreational and cultural aspects of the area, and meteorology.
- Source term.
- Routes of exposure, critical group and dose estimation.
- Monitoring program, indicating the sites and frequency of sampling, sites and frequency of measurements, methods and techniques of preparation and analysis of samples, measurement methods and techniques.
- Reference values.

For its part, IPVRA presents, among others, the results of the monitoring program and the technical-scientific analysis of the results and trends.

15.2. Systematic safety assessment and environmental assessment of final disposal facilities

The Mexican State has not contemplated in the short term the construction of final Disposal Sites for radioactive waste. However, current legislation contemplates that final disposal operators consider the conducive options to carry out the safety evaluation before the construction of facilities for the final disposal of low-level radioactive waste near the surface, covering this evaluation from the selection of the site to design, construction, operation, closure, post-closure and institutional control. In addition to the above, the Environmental Radiological Impact Assessment, the Environmental Radiological Surveillance Program, among other regulatory instruments that the CNSNS or the national environmental authority may consider.

15.3. Updated and detailed safety and environmental assessments

The safety assessment must be carried out at each stage for facilities that require a license, that is, for their operation and, when applicable, for their construction and dismantling. Nuclear facilities and those related to the management of their radioactive waste are evaluated every 10 years, but not other radioactive facilities.

Safety evaluations of radioactive waste management facilities are also updated and detailed in cases of technical amendments or modifications to licenses, permits or authorizations, the permittee of a radioactive facility must demonstrate to the CNSNS that the conditions of the evaluation of security have not been modified, or submit the corresponding amendments for evaluation, in the cases:

- Before granting the Operating license.
- Application for Renewal of Operating Authorization.
- Amendments to the Current Operating Authorizations.

Compliance assessment

In accordance with what is stated in each of the sections of Article 15, it is considered that in Mexico the appropriate measures have been developed and implemented to carry out the safety assessment of the facilities for the management of radioactive waste.

Article 16. Operation of the facilities

Each Contracting Party shall adopt the appropriate measures to ensure that:

i) The license to operate a radioactive waste management facility is based on appropriate evaluations, as specified in Article 15, and is conditional on the completion of a commissioning program that demonstrates that the facility, such as has been built, conforms to design and safety requirements;

ii) The operational limits and conditions derived from tests, operational experience and evaluations, as specified in Article 15, are defined and revised, as necessary;

iii) The activities of operation, maintenance, radiological surveillance, inspection and testing of a radioactive waste management facility are carried out in accordance with established procedures. In the case of a facility for the final disposal of radioactive waste, the results thus obtained will be used to verify and examine the validity of the alleged facts and to update the evaluations, as specified in article 15, for the period after the closing;

iv) The necessary engineering and technical support services are available in all disciplines related to safety throughout the operational life of a radioactive waste management facility;

v) Procedures are applied for the characterization and segregation of radioactive waste;

vi) The holder of the corresponding license notifies the regulatory body in a timely manner of significant safety incidents;

vii) Programs are established to collect and analyze relevant operational experience and act on the results, where appropriate;

viii) Plans for the decommissioning of a radioactive waste management facility, other than a final disposal facility, are prepared and updated, as necessary, using information obtained during the operational life of that facility and reviewed by the regulatory body these plans;

ix) Plans for the closure of a facility for final disposal are prepared and updated, when necessary, using the information obtained during the operational life of that facility, and that the regulatory body reviews these plans.

16.1. Operating licenses for radioactive waste management facilities based on safety assessments

The operating license for a nuclear facility, including management facilities for radioactive waste generated in energy production, is granted, among other things, based on the safety report. The regulatory body oversees the construction of the facility and ensures that it is built in accordance with the Construction License.

16.1.1 Operating licenses for radioactive waste management facilities generated in non-energy applications

As described in the sections corresponding to articles 11, 12 and 15, for the management of radioactive waste of non-energy origin, Mexico has 2 facilities: PATRADER and CADER. As well as three closed Disposal Sites: La Piedrera, Peña Blanca and San Felipe. All facilities were built with the design and construction requirements of the 1980s and in accordance with the corresponding Radiological Safety Report. These safety reports are constantly updated according to the regulatory requirements of the country and at the request of the CNSNS.

As mentioned in Section E of this Report, one of the minimum documents required in the RGSR when requesting a license to operate radioactive facilities, including those for the management of radioactive waste generated in non-energy applications, is the safety report of the proposed facility.

A. Radioactive Waste Treatment Plant

As described in section 12, before PATRADER started operations, the site where it is located (Centro Nuclear “Dr. Nabor Carrillo Flores”), was subjected to a rigorous safety assessment and an environmental assessment. as it was part of the TRIGA Mark III research reactor nuclear facility. In addition to being located 170 m from the JS-6500 industrial irradiator. Regardless, PATRADER has an operating license and safety report, authorized by the CNSNS.

During the routine operation of the installation, evaluations (verifications, inspections and audits by the regulatory body and the internal quality assurance body) have been carried out in normal operation and evaluations in abnormal operation of the installation. The frequency of the evaluations is directly related to the radiological risks derived from

the normal operation of the facility, which has not had significant changes in the last 25 years.

B. Radioactive Waste Storage Center

In the particular case of CADER, in 1992 additional studies and evaluations were carried out in order to determine the feasibility of permanently depositing (safe and controlled) radioactive waste from the fuel cycle of nuclear power plants, low and medium level. This study consisted of a new safety analysis for the characterization of the site. As indicated in the report, the stratigraphy of the site showed that in the first 120 m of depth, it is observed "that the andesitic basalts or basalts are massive and fractured; the fractures are generally filled with clay "and" the main hydrogeological unit is made up of massive, vesicular basalt, with a high degree of fracture that gives it high permeability".

As a result of this analysis, it was determined that CADER would only be used as a temporary surface storage site, which would host radioactive waste from non-energy activities. During the routine operation of this facility, different types of periodic evaluations have been carried out (verifications, inspections and audits) that comprise the normal operation of the facility. These periodic evaluations have been carried out by qualified personnel, who have mastered the aspects of safety evaluation and analysis. The frequency of assessments is directly related to the radiological risks arising from the Radioactive Waste Storage Center or activity and to substantive changes to the facility or activity, if any. As a result of these evaluations, barriers have been established as defense in depth in Warehouse I of sources and heads, and it has been determined that the design fulfills the safety functions.

C. "La Piedrera" Disposal Site

The "La Piedrera" site does not have an operating license that allows it to receive more radioactive waste, so current activities only include the periodic monitoring of its impact on the environment, the state of the trenches and the signs and fences. It has an Institutional Surveillance Plan which allows evaluation activities based on the following safety controls:

- Perimeter. At the perimeter of the land, there is an external fence of six barbed wire strands, supported by concrete and metal posts, thereby preventing the intrusion of large animals.

- Signaling. There are 50 x 40 cm-sheets attached to the posts with wire, signs with legends of prohibition of passage and federal property on the internal and external fences.

- Confinement design. The site was built to the design requirements set out in IAEA documents from the 1980s.

- Periodic revision. The site is inspected periodically, according to a specific procedure that includes a checklist. The inspection reports are sent to the CNSNS and to the Directorate of Urban Development and Ecology of the government of the state of Chihuahua to report the situation of the site.

- Disruptive events (contingencies). The only disruptive event that is considered important is intrusion with the intent to steal metal products that have survived moisture and can be sold as scrap or construction rebar. No other event is considered important to declare a contingency (emergency). This scenario has a low probability of occurrence for the following reasons: i) it is possible that the metallic products are highly oxidized, ii) they are radioactive, which would make their distribution difficult since practically all the traders of metallic products in the country have radiation detectors , iii) the inhabitants of the area would notify the ININ of any movement with machinery in the area. iv) intruders do not know in which pit the rod and metal products are located.

- Mechanisms of deterioration in the installation. The main mechanism of deterioration of the mounds and that would require corrective maintenance is erosion caused by rain and wind, forming cracks that can be enlarged by rodents and crawling animals. In order to adopt corrective or mitigation measures due to the probable deterioration of the mounds of the pits, the inspections that are carried out are documented in order to budget for the necessary actions. In the event of deterioration in the mounds, they are reshaped considering two options according to the degree of deterioration: i) mechanical maintenance, using backtracking when there are mounds collapses and the material deposited is practically uncovered, which is unlikely what happens. ii) Manual maintenance, when minor mound repair actions have to be carried out.

- Administration. The site is under the management of ININ, which carries out environmental radiological surveillance and maintenance of the facility, fences, mounds.

A. "Peña Blanca" Disposal Site

The Peña Blanca site does not have an operating license that allows it to receive more waste. It has an Institutional Control Plan which allows evaluation activities based on the following security controls:

- Perimeter. At the perimeter of the land, it has barbed wire fences supported by metal supports, which prevents the intrusion of large animals during institutional control.

- Signaling. At different points of the fence there are sheets of 50 x 40 centimeters attached to the posts with the legends of prohibition of passage and federal property.

- Characteristics of the confinement design. The main security feature of the confinement is its remoteness from population centers. On the other hand, and related to safety is that the site is very dry, mountainous and with little economic activity. Radiation levels are negligible and the main route of exposure to man is exposure to radon if houses are built on tailings.

- Periodic revision. The site is inspected periodically, according to a specific procedure that includes a checklist. The inspection reports are sent to the regulatory body.

- Disruptive events (contingencies). No disruptive events have been identified during institutional control. No action of natural or artificial origin can give rise to significant exposures to humans or people that indicate the need for additional protective measures.

- Mechanisms of deterioration in the installation. The fauna found in the region is mainly crawling animals, field rats, squirrels, kangaroo rat, rabbit, fox, raccoon, armadillo, deer and coyote. From what was observed in the repository is that it is free of holes or rodent nests. In the event of severe deterioration, due to natural events, the material would be recovered from the repository and reconfigured again. There has been no erosion in the repository, so that the outer cover has not lost its function of facilitating the runoff of rainwater. To adopt corrective or mitigation measures due to the probable deterioration of the repository, the inspections that are carried out will be documented, in order to budget for the actions to be carried out. In the event of deterioration of the repository, it would be reconformed by proposing two options according to the degree of deterioration: i) mechanical maintenance, using back-up when the exterior cover collapses; ii) manual maintenance, when minor actions have to be carried out. For installation in general, maintenance activities are performed when necessary.

- Administration. Currently, ININ is responsible for the site, which implies carrying out environmental radiological surveillance and maintenance of the facility, fences, padlocks and locks.

16.1.2 Operating licenses for radioactive waste management facilities generated in energy applications

For the management of radioactive waste of energy origin, Mexico has 2 facilities: Temporary Warehouse on Site (ATS) and Deposit of Dry Solid Radioactive Waste (DDRSS), built in the mid-1980s on the premises of the Nuclear Power Plant. Green lagoon. The facilities were designed for the storage of low-level radioactive waste in accordance with the final safety report (FSAR) appendix 11.4 A and under the regulatory requirements established by the CNSNS based on the regulations of the Nuclear Regulatory Commission (NRC for its mainly the Generic Letter (GL) 81-38 entitled "Storage of Low-Level Radioactive Waste at Power Reactor Sites" and other regulatory guides of the nuclear industry from the IAEA and the Electric Power Research Institute. The low-level radioactive waste generated at the CNLV will remain safely protected in the ATS and DDRSS facilities until its removal for final management and / or disposal once the permanent facilities are built in Mexico.

A. The Temporary On-Site Warehouse consists of two buildings

- Warehouse I is the original building built for the protection of wet solid radioactive waste such as: sludge, resins, concentrates, asphalted and cemented generated in the Laguna Verde Nuclear Power Plant, starting operations in 1992 until 2009, which was when the filling capacity of warehouse I was reached. The license for warehouse I was granted by the CNSNS for the safeguarding of radioactive waste stored to date until its withdrawal for management or final disposal.

- The ATS II warehouse that is currently operating and in the process of renewing the authorization for use for 10 more years, since it is about to expire on December 31, 2020. The ATS Warehouse II was authorized by the CNSNS (Official letter A00.110.523 / 2010) for the storage of radioactive

waste formed by resins, sludge and concentrates that are generated in the CNLV, protected in high integrity containers (HIC), in use of the powers that the Regulatory Law of Article 27 Constitutional Law on Nuclear Matters granted to the CNSNS and based on the provisions of Article 39 of the Internal Regulations of the Ministry of Energy.

A. Dry Solid Radioactive Waste Repository

The DDRSS facility made up of two units. Since 1993, it has been authorized by the CNSNS for the storage of compact and non-compactable dry solid radioactive waste during the operational cycle of the Laguna Verde Nuclear Power Plant.

16.2 Operational limits and conditions derived from operational experience and evaluations

The CNSNS supervises and inspects the start-up and operation of each nuclear facility, including radioactive waste management facilities. This includes the review and approval of the operating conditions for the particular nuclear facility. Any change requires a permit from the CNSNS. In addition, it has the competence to review the operational limits and conditions as necessary for safety reasons.

16.2.1 Operational limits and conditions derived from operational experience and evaluations of radioactive waste management facilities generated in non-energy applications

A. Radioactive Waste Treatment Plant

As a result of the aforementioned evaluations, improvements in radiation protection have been made and it has been determined that the radiological risks are very low and are being controlled within the limits and restrictions specified in the safety report and in the safety procedures. job. This is regularly reported to the regulatory body.

B Radioactive Waste Storage Center

As a result of the aforementioned evaluations, radiological protection measures have been implemented and it has been determined that radiological risks are being controlled within the limits and restrictions specified in the Safety Report, and these risks have been reduced to the lowest level. which is reasonably possible to achieve. This is periodically reported to the regulatory body in the Relevant Activities Report.

C. “La Piedrera” Disposal Site

As a result of the evaluations and activities that are periodically carried out in “La Piedrera”, provisions have been made regarding radiological protection and it has been determined that radiological risks are being controlled within the limits and these risks have been reduced to the lowest level that is reasonably achievable. This is periodically reported to the CNSNS.

D. “Peña Blanca” Disposal Site

As a result of the evaluations and activities that are periodically carried out at Peña Blanca, provisions have been made regarding radiological protection and it has been determined that the radiological risks are being controlled within the limits and these risks have been reduced to the lowest level that is reasonably achievable. This is regularly reported to the regulatory body.

16.2.2 The operational limits and conditions derived from the operational experience and the evaluations of radioactive waste management facilities generated in energy applications

The limits and conditions established by the CNSNS based on the evaluation and compliance with the design bases cited in the final safety report (FSAR) appendix 11.4 A, radiological, physical and industrial safety controls applied at the Laguna Verde Nuclear Power Plant for the handling, storage, inspection and monitoring of radioactive waste temporarily stored in the ATS and DDRSS facilities, are described below:

A.Temporary On-Site Warehouse

The ATS warehouse use permit II is an integral part of operating licenses No. CNLV-1/1 and CNLV-2 / therefore it is subject to the same conditions and regulatory framework indicated in said licenses.

The temporary storage of wet radioactive waste made up of sludge, resins, filters, and concentrates generated in the CNLV, protected within high integrity containers.

The storage of high integrity containers in vertical stacks of 3, using suitable stowage structures to support the weight and separate the containers during storage.

Use of approved procedures to control the activities of operation, maintenance, physical

safety, radiological safety and internal audits to determine compliance with the warehouse safety conditions and for the protection of the public and the environment.

The dose rate level at any point on the ATS warehouse II perimeter fence must not exceed 0.25 mrem / h (2.5 μSv / h).

The radiation monitoring system located in the discharge of the ventilation system consists of two radiation monitors installed in the discharge of the normal and filtering ventilation, so that said monitors detect in a timely manner the presence of any radioactive particle in the air before of its discharge into the atmosphere.

Incorporation of the ATS to the CNLV's Environmental Monitoring Program in accordance with the Final Safety Report section 11.4 A.3.3.2.

In the event of any non-compliance with the points indicated above, the CNLV must stop operating activities of the facility, establish compensatory radiological safety actions for the protection of the public and the environment, and notify the CNSNS, requesting the CNLV the respective authorization for the restart of ATS warehouse activities.

B. Dry Solid Radioactive Waste Repository

The DDRSS use permit is an integral part of the operating licenses No. CNLV-1/1 and CNLV-2/1, therefore it is subject to the same conditions and regulatory framework indicated in said licenses.

Authorized for the temporary storage of compact and non-compactable dry solid radioactive waste in metal containers (boxes or drums), stable pallets and with adequate arrangements to facilitate the inspection of the containers.

Incorporation of the DDRSS into the CNLV's Environmental Monitoring Program in accordance with the Final Safety Report section 11.4 A.3.3.2.

The dose rate level at any point on the perimeter fence of the DDRSS warehouse must not exceed 0.25 mrem / h (2.5 μSv / h).

Use of approved procedures to control the activities of operation, maintenance, physical safety, radiological safety and internal audits to determine compliance with the warehouse safety conditions and for the protection of the public and the environment.

In the event of any non-compliance with the points indicated above, the CNLV must stop operating activities of the facility, require compensatory radiological safety actions for the protection of the public and the environment, and notify the CNSNS, requesting the CNLV the respective authorization for the restart of activities of the DDRSS warehouse.

16.3. Operation, maintenance, radiological surveillance, inspection and testing activities at radioactive waste management facilities

The operation, maintenance and monitoring of nuclear facilities are specified in the Operating license. The CNSNS reviews the corresponding procedures described in the installation's operating documents; its correct implementation is a condition for issuing the permit to begin operating.

16.3.1. Operation, maintenance, radiological surveillance, inspection and testing activities at radioactive waste management facilities generated in non-energy applications

A. Radioactive Waste Treatment Plant

For the processes and activities identified in the Radioactive Waste Treatment Plant, operating and emergency procedures were established as part of the ININ's ISO 9001: 2015 Quality System. Some of these procedures are:

- P.DR (PATRADER) -01 Installation operation.
- P.DR (PATRADER) -02 Attention to emergencies.
- P.DR (PATRADER) -03 Decontamination of personnel.
- P.DR (PATRADER) -04 Maintenance of the installation.
- P.DR (PATRADER) -05 Operational radiological surveillance.
- P.DR (PATRADER) -06 Pollution control.
- P.DR (PATRADER) -10 Decontamination of equipment and materials.
- P.DR (PATRADER) -11 Decontamination of radiological protection clothing.
- P.DR (PATRADER) -12 Decontamination of surfaces.

- P.DR (PATRADER) -15 Reception of radioactive material.
- P.DR (PATRADER) -19 Storage of radioactive waste.
- P.DR (PATRADER) -20 Inventory of stored radioactive waste.
- P.DR (PATRADER) -21 Preparation of remittances.
- P.DR (PATRADER) -24 Dilution and discharge of aqueous effluents.
- P.DR (PATRADER) -27 Treatment of compactable solids.
- P.DR (PATRADER) -29 Elimination of decayed solids.
- P.DR (PATRADER) -30 Transitory storage of sealed sources.
- P.DR (PATRADER) -31 Conditioning of spent sealed sources.
- P.DR-36 Lot formation of liquid radioactive waste.

B. Radioactive Waste Storage Center

For the processes identified in the facility and activities, a Management System was established, which as part of the ININ's Quality Management System ISO 9001; 2015, are applied in CADER. The process procedures are as follows:

- Reception and storage of radioactive waste (P.DR (CADER) -01).
- Radioactive waste management (P.DR (CADER) -02).
- Use of machinery and equipment (P.DR (CADER) -03).
- Use of personal protective equipment (P.DR (CADER) -05).
- Radioactive waste storage (P.DR (CADER) -06).
- Radioactive waste inventory (P.DR (CADER) -07).
- Operation (P.DR (CADER) -09).
- Emergencies (P.DR (CADER) -10).
- Maintenance (P.DR (CADER) -11).
- Operational radiological surveillance (P.DR (CADER) -12).

C. "La Piedrera" Disposal Site

For the processes and activities identified in the facility, the ININ's Quality Management System ISO 9001; 2015 is applied in La Piedrera, the procedures of the processes are as follows:

Inspection of the confinement site of "La Piedrera" (P.DR (LP) -01). The results of the assessment activities are reported to the appropriate hierarchical levels and used to carry out long-term safety assessments.

D. "Peña Blanca" Disposal Site

For the processes and activities identified in the facility, the ININ's Quality Management System ISO 9001; 2015 is applied in Peña Blanca, the process procedures are as follows:

Inspection of the Peña Blanca confinement site (P.DR (PB) -01). The results of the assessment activities are reported to the appropriate hierarchical levels and used to carry out long-term safety assessments.

16.3.2. Operation, maintenance, radiological surveillance, inspection and testing activities at radioactive waste management facilities generated in energy applications

Administrative controls, maintenance program (preventive and corrective), tests, inspections and periodic surveillance are applied to the operation activities of the ATS and DDRSS warehouses by the areas of operation of radioactive waste, radiological protection, physical safety and industrial safety. , to ensure the proper functioning of the Structures, Systems or Components during the time that the radioactive waste remains stored until its removal for treatment and / or final disposal.

At the CNLV weekly field trips are carried out by the operation and radiological protection personnel, timely identifying any malfunction or degradation condition of the ESCs of the ATS and DDRSS warehouses (electrical panels, lights, transformers, air conditioning equipment, HVAC equipment, filtration equipment, monitoring system, building structures, ducts, paint, grilles, doors, fire-fighting system, fire detection system, monitoring system, CCTV, electrical substation, ground cleaning, perimeter mesh, among others) being documented in report DR-9940 annexes 3 and 4, which results in the generation of anomalies to correct the identified

condition, which are addressed according to the Central planning process. By attending to these anomalies, it is ensured that the integrity of the ESC is maintained, and consequently the fulfillment of its design functions.

Likewise, radiological protection personnel carry out periodic tours to monitor the radiological conditions of the ATS and DDRSS facilities, in accordance with procedure PR-6505 "Routine Monitoring Program" and the corresponding report is sent to the CNSNS every two months; the verification of the fire extinguishers is carried out monthly by the Industrial Safety personnel, through the application of the CI-9975 procedure "Inspection, Maintenance and Recharging of Fire Extinguishers in buildings in the controlled area, two mouths, "El Farallón" camp and PERE points"; the status of the facilities is verified weekly by the radioactive waste operating personnel according to report DR-9940 "Temporary Storage on Site and verification of warehouse operation."

Therefore, the functionality of the equipment, as well as compliance with rounds and industrial safety and radiological protection requirements, is guaranteed by complying with the design functions and conditions of use established by the CNSNS for the operation of the ATS warehouses and DDRSS.

Radioactive waste management and operation procedures include segregation, treatment, conditioning, characterization and storage activities. As well as administrative and operational controls for the minimization of radioactive waste applied by the different areas of the CNLV, supporting the safe operation of the ATS and DDRSS facilities. The applicable procedures are listed below, without being limited to.

Generic mechanical maintenance procedures:

- MG-4900 Alignment in couplings (pumps).
- MG4901 Vibration measurement (pumps).
- MG-4904 Equipment lubrication.
- MG-4914 Pulley alignment and belt tensioning (fans).
- MP-3976 Belt-driven centrifugal fans.
- MO-4300 Valve packing.
- MO-4313 Valve maintenance.
- MO-4327 Flange torque.

Specific procedures, maintenance instrumentation:

- 2-MI-9822 Maintenance. preventive, corrective and/or calibration of the instrumentation and controls of the ATS at the CNLV.

Generic procedures, electrical maintenance:

- MP-3664 480 Vac Non-Critical Starters.
- MP-3629 Back-lighting.
- MP-3756 480 Vac horizontal induction motors.
- MP-3661 480 Vac non-critical boards.
- MP-3906 Motor control center, A/C control boards.
- MPE-019 Maintenance and calibration of molded case circuit breakers.
- MME-001 Maintenance and calibration of A/C and D/C voltmeters.
- MME-002 Maintenance and calibration of ac and dc ammeters.

Specific industrial safety procedures:

- 2-CI-9965 Operation of the M23J-P-001 pump and alignment of the valves of the fire protection system of the medium and low-level radioactive waste store (ATS).
- 2-CI-9966 Checking the level of the fuel storage tank and operation of the pump operated with diesel engine (1-FP-P-002) of the fire protection system of the medium-level radioactive waste warehouse (ATS).
- CI-9967 Verification of the alignment of the automatic valves of the fire water aspersion system of the temporary medium-level radioactive waste store (ATS).
- CI-9968 Verification of the water volume of the storage tank of the firefighting system of the temporary medium-level radioactive waste store (ATS).
- CI-9963 Inspection and testing of fire alarm/ extinction alarm systems.

Generic radiological protection operational procedures:

- PAP-05 Control of operating activities.
- PR-6500 Radiological inspections at the CNLV.
- PR-6505 Routine monitoring program.
- PR-6506 Pollution control.
- PR-6735 Classification of radioactive waste.
- PR-6725 Processing of waste generated in restricted areas of the CNLV.
- PR-6784 Storage of materials and waste with radioactive material and dry active waste.
- PR-6781 Application of the criteria for dispensing waste with radioactive material.
- PASGO-12 CNLV Radioactive Waste Management.
- PAG-33 Radioactive waste minimization program.
- PAG-30 Administrative control of effluents, solid radioactive waste and its environmental impact.

Specific operational procedures for radioactive waste.

- DR-9948 Operation of the auxiliary systems of the Temporary On-Site Warehouse.
- DR-9940 Temporary on-site storage and verification of warehouse operation.
- ITPCP Technical instructions for the process control program.

Specific operational procedures of the chemical group:

- QR-8370 Radioactive sampling.
- QR-8372 Preparation of samples for counting.
- QR-8388 Activity control and analysis in wet solid waste.

Specific operational maneuvering procedures:

- MG-4946 General instructions for the operation of traveling cranes of the CNLV.
- MG-4937 Maneuvers with telescopic towlines and transport of forklifts, crane trucks and tractor trucks.
- MG-4909 Procedure for carrying out lifting maneuvers at the CNLV.

Mexican nuclear regulations:

- NOM-008-NUCL-2011, Control of radioactive contamination.
- NOM-018-NUCL-1995, Methods to determine the activity concentration and total activity in radioactive waste packages.
- NOM-004-NUCL-2013, Classification of radioactive waste.
- NOM-028-NUCL-2009, Management of radioactive waste in radioactive facilities that use open sources.
- NOM-035-NUCL-2013, Criteria for dispensing waste with radioactive material.
- NOM-036-NUCL-2001, Requirements for radioactive waste treatment and conditioning facilities.
- NOM-019-NUCL-1995, Requirements for low-level radioactive waste packages for their final storage near the surface.

16.4. Engineering and technical support services for radioactive waste management facilities

The CNSNS inspects and supervises the qualification of personnel for nuclear facilities, including radioactive waste management facilities. You have the competence to intervene if you determine that the lack of technical or engineering support impacts the safety of the facility.

16.4.1 Radioactive waste management facilities for non-energy applications

A. Radioactive Waste Treatment Plant

PATRADER has various engineering and technical support services, which are provided by personnel from the radioactive waste department and from other areas of the ININ. In general, the following needs are covered:

- Maintenance and works.
- Design and construction engineering.
- Industrial safety and civil protection.

- Medical service.
- Safeguards and additional protocol.
- Quality assurance.
- Safety and radiation protection.
- Physical safety.
- Environmental radiological surveillance.
- Personal dosimetry.
- Information technology.
- Characterization of radioactive waste.

B. Radioactive Waste Storage Center

CADER has various engineering and technical support services, which are provided by personnel from the radioactive waste department and from other areas of ININ. In general, the following needs are covered:

- Maintenance and works.
- Design and construction engineering.
- Industrial safety and civil protection.
- Medical service.
- Safeguards and additional protocol.
- Quality assurance.
- Safety and radiation protection.
- Physical safety.
- Environmental radiological surveillance.
- Personal dosimetry.
- Information technology.

C. "La Piedrera" Disposal Site

"La Piedrera", like the previous facilities, has engineering services and technical support from ININ staff. Due to the characteristics of the site, only the services of:

- Maintenance and works.
- Quality assurance.
- Safety and radiation protection.
- Environmental radiological surveillance.
- Personal dosimetry.
- Contracting third party services.

D. "Peña Blanca" Disposal Site

The "Peña Blanca" site has engineering services and technical support from ININ staff. Due to the characteristics of the site, only the services of:

- Maintenance and works.
- Quality assurance.
- Safety and radiation protection.
- Environmental radiological surveillance.
- Personal dosimetry.

16.4.2. Radioactive waste management facilities for energy applications

The ATS and DDRSS warehouses have various engineering services and technical support, which are evaluated and approved by the technical staff of the Design Engineering department and provided by the different areas of the CNLV. In general, the following needs are covered:

- Maintenance and works.
- Design and construction engineering.
- Industrial safety and civil protection.
- Safeguards and additional protocol.
- Quality assurance.
- Licensing.
- Safety and radiation protection.
- Physical safety.
- Industrial Safety.
- Environmental radiological monitoring.
- Personal dosimetry.

- Characterization of radioactive waste.

16.5. Procedures for the characterization and segregation of radioactive waste.

16.5.1. Non-energy application waste management facilities

A. Radioactive Waste Treatment Plant

PATRADER, for the waste characterization process, has a laboratory specialized in waste characterization, where the chemical and radiological analysis of liquid waste is carried out. For this activity, there are procedures with sampling and measurement methodologies authorized by the regulatory body.

Additionally, there is a Radioactive Waste Characterization System which is used for the characterization of solid waste. Regarding waste segregation, this is carried out with procedures authorized by the CNSNS.

B. Radioactive Waste Storage Center

Does not apply.

C. "La Piedrera" Disposal Site

Does not apply.

16.5.2 Energy-application waste management facilities

The process of characterization of radioactive waste consists of determining the chemical, physical and radiological properties of these wastes. In the case of wet solid radioactive waste, the process consists of taking a representative sample for each batch generated in the Plant. Nuclear Laguna Verde, these samples are analyzed by the chemical area to determine their properties already mentioned, in the CNLV only the gamma emitters are determined, the above is done by applying the procedures: QR-8370 "Radioactive sampling", QR-8372 "Preparation of samples for counting ", QR-8388" Control and analysis of activity in wet solid waste "and ITPCP" Technical Instructions for Process Control program "; To determine the activity concentration of emitters that are difficult to measure, such as pure alpha and beta emitters, representative samples of the batches are sent to a laboratory abroad, thus completing the radiological characterization.

With the results of the activity concentration of the pure alpha and beta emitters, scaling factors are obtained, which are applied to the rest of the population of the batches and the classification of the packages with wet solid waste is carried out through the procedure PR-6735 "Classification of Radioactive Waste", determining if they are low-level class A, B, C or Intermediate level waste.

In the process of characterizing dry solid radioactive waste, the chemical and physical properties are determined during the waste segregation activities, applying procedures PR-6725 "Processing of waste generated in restricted areas of the CNLV" and instructions ITPCP. For the radiological properties, a radioactive waste characterizing equipment is used, with which the gamma emitters found in this type of waste are obtained, for the determination of the pure alpha and beta emitters the same scaling factors used in the characterization of wet solid waste, using the PR-6735 procedure, determining whether it is low-level class A, B, C or Intermediate level waste.

16.6. Communication of significant incidents to the regulatory body

The Ninth Title, Chapter I of the General Regulations on Radiological Safety establishes the reports that must be submitted to the regulatory body in the event of a radiological accident, namely:

Article 175.- The permit holder, the person in charge of radiological safety or the occupationally-exposed personnel, must immediately inform the CNSNS of any radiological accident, regardless of the notices that must be given to other Dependencies.

Article 176.- The permit holder must deliver a written report of the radiological accident to the CNSNS within the next 24 hours.

Article 177.- The report referred to in the previous article will contain:

I Description of the accident that occurred;

II. Probable causes of the same;

III. Sources of radiation involved and, where appropriate, quantity and physical and chemical form of the radioactive material released into the environment;

IV. Immediate actions that were taken and people who intervened in them;

V. Estimation of the dose equivalent received by occupationally exposed personnel;

VI. Estimated dose equivalent received by members of the public who were exposed;

VII. Data of the people involved in the accident, such as: Name, address, telephone number, sex, date of birth, occupation, affiliation number of the IMSS or ISSSTE and, relationship with the permit holder, and

VIII. The signature of the permit holder and the person in charge of radiological safety, on the margin of each of its pages and at the foot of the last page.

Article 178.- The permit holder, within 15 business days after delivery of the report referred to in Article 176, shall deliver a report in writing to the CNSNS that contains:

I. Description of the accident, its magnitude and specific causes that led to it;

II. Description, brand, model, serial number and physical and chemical form of the radiation sources involved and, where appropriate, the amount of radioactive material released into the environment;

III. Actions that were taken to manage the accident, people who carried them out and calculation of the dose equivalent received by them;

IV. Measures that have been taken to prevent the accident from recurring;

V. Calculation of the effective dose equivalent received by occupationally exposed personnel due to the accident;

VI. Calculation of the effective dose equivalent received by members of the public who were exposed due to the accident;

VII. The data referred to in section VII of the previous article;

VIII. The signature of the permit holder and the person in charge of radiological safety in the terms of section VIII of the previous article, and

IX. Attach, if applicable, a copy of the record issued before the Public Ministry due to the accident.

Article 179.- The permit holder will provide the CNSNS with the additional information required in relation to the accident that occurred.

16.6.1. Non-energy application waste management facilities

A. Radioactive Waste Treatment Plant

Notification to the regulatory body of significant safety incidents is carried out depending on the category of the incident. Notification can be made by telephone and / or in expedited writing or through annual activity reports.

B. Radioactive Waste Storage Center

The notification of significant safety incidents is carried out in accordance with the emergency response procedure and the licensing conditions. In these cases, from category 2 emergencies, the alert and notification can be by telephone and / or in writing in reports sent to the regulatory body immediately or in the annual report of relevant activities.

C. “La Piedrera” Disposal Site

The notification of significant safety incidents is carried out in accordance with the emergency response procedure. In these cases, from category 2 emergencies, the alert and notification can be done by telephone and / or in writing in reports sent to the CNSNS immediately or in the annual report of relevant activities.

D. “Peña Blanca” Disposal Site

The notification of significant safety incidents is carried out in accordance with the emergency response procedure. In these cases, from category 2 emergencies, the alert and notification can be made by telephone and / or in writing in reports sent to the regulatory body immediately or in the annual report of relevant activities.

16.6.2. Energy application waste management facilities

At the Laguna Verde Nuclear Power Plant, all significant or non-significant incidents related to the management of radioactive waste, authorization for the use and operation of temporary ATS and DDRSS warehouses are notified to the CNSNS, documenting the event through the processes previously established in the CNLV (reportable nuclear events report, findings or condition reports) for immediate correction and attention and to prevent similar future events from occurring.

Additionally, the CNLV has physical, radiological and industrial safety plans to attend to incidents that arise during the management and operation of the ATS and DDRSS temporary warehouses.

16.7. Programs to collect and analyze operational experience

In general, the collection and analysis of operational experience is done through the annual safety reports. This information is collected by the CNSNS.

16.7.1. Non-energy application waste management facilities

A. Radioactive Waste Treatment Plant

The compilation and analysis of operational experience are reflected in the preparation of reports that are sent to the Head of the Department of Radioactive Waste and to the Radiation Safety Management. Likewise, they are exposed, analyzed and discussed in the training courses for Occupationally-exposed personnel.

B. Radioactive Waste Storage Center

The compilation and analysis of operational experience are reflected in the preparation of reports that are sent to the Head of the Radioactive Waste Department and to the Radiological Safety Management. Likewise, they are exposed, analyzed and discussed in the training courses for Occupationally-exposed personnel.

C. “La Piedrera” Disposal Site

The collection and analysis of the experience acquired in the institutional control of the site is documented in the records of the site inspection procedures. Likewise, a safeguard is maintained for the records and reports that are sent to the regulatory body. These are public for all citizens.

D. “Peña Blanca” Disposal Site

The collection and analysis of the experience acquired in the institutional control of the site is documented in the records of the site inspection procedures. Likewise, a safeguard is maintained for the records and reports that are sent to the regulatory body. These are public for all citizens.

16.7.2. Energy application waste management facilities

The compilation and analysis of internal and external operational experience is analyzed by the Operational Evaluation and Experience Office (EYEO), documenting itself through the corresponding report sent to the Head of the Radioactive Waste Department and the Radiation Safety Headquarters for its evaluation and application in the Laguna Verde Nuclear Power Plant, taking immediate actions for its implementation in the procedures, processes and dissemination with the POE.

16.8. Plans for the decommissioning of radioactive waste management facilities

16.8.1. Non-energy application waste management facilities

A. Radioactive Waste Treatment Plant.

The facility decommissioning plan is part of the facility’s safety report and is periodically reviewed, incorporating information and experience obtained during the facility’s operation. When the facility is to be closed, a detailed plan will be drawn up and sent for review and authorization by the CNSNS. This must establish the general and specific guidelines that must be met.

B. Radioactive Waste Storage Center

The facility decommissioning plan is part of the facility’s safety report and is periodically reviewed, incorporating information and experience obtained during the facility’s operation. It should be noted that CADER can only cease operations when there is another facility for the storage or disposal of radioactive waste in the country.

16.8.2. Energy application waste management facilities

The closure plan of the ATS and DDRSS facilities are part of the final safety report (FSAR) in its section 11.4 A.6, complying with the provisions of the 10 CFR 20 part E regulations and using the limits presented in table I “Acceptable Levels of Surface Pollution” of the regulatory guide for nuclear plants 1.8 and when the facility is to be closed down, a detailed plan will be drawn up and sent for review and authorization by the CNSNS, establishing the general and specific guidelines that must be comply. It should be noted that the ATS can only stop operating when there

is another facility for the storage or disposal of radioactive waste in the country.

16.9. Plans for the closure of final disposal facilities

The Mexican State does not have radioactive waste Disposal Sites in operation. However, current legislation provides for radioactive facility operators to consider options conducive to the safe closure and, if necessary, remediation of said facilities.

Compliance assessment

In accordance with what is stated in each of the previous sections, it is considered that the current legislation makes it possible to ensure that the operators of the radioactive waste management facilities comply with the provisions of Article 16 of the Joint Convention.

It also provides that radioactive facility operators consider the options conducive to the safe closure and, if necessary, remediation, of said facilities. These activities will have to be regulated and supervised, case by case, by the CNSNS.

Article 17. Institutional measures after closure

Each Contracting Party shall take appropriate measures to ensure that after the closure of a facility for the final disposal of radioactive waste:

i) The records of the location, design and inventory of that facility required by the regulatory body are preserved;

ii) Active or passive institutional controls are carried out, such as radiological surveillance measures or access restrictions, if necessary; and

iii) If during any period of active institutional control an unplanned release of radioactive materials into the environment is detected, intervention measures are applied, if necessary.

At the moment, Mexico does not have radioactive waste disposal sites in operation.

SECTION

CROSS-BORDER MOVEMENTS

This section includes the obligations provided for in Article 27 (cross-border movements).

Article 27. Transboundary movements

1. Each Contracting Party that intervenes in transboundary movements shall adopt the appropriate measures to ensure that said movement is carried out in a manner consistent with the provisions of this Convention and the relevant binding international instruments.

To this end:

i) A Contracting Party that is the State of origin shall adopt the pertinent measures to ensure that the transboundary movement is authorized and takes place only with the prior notification and consent of the State of destination;

ii) Transboundary movement through transit States will be subject to international obligations related to the particular modes of transportation used;

iii) A Contracting Party that is the State of destination will consent to a transboundary movement only if it has the administrative and technical capacity, as well as the regulatory structure necessary to manage spent fuel or radioactive waste in a manner consistent with this Convention;

iv) A Contracting Party that is the State of origin shall authorize a transboundary movement only if it can verify that, in accordance with the consent of the State of destination, the requirements of paragraph iii) are met before proceeding with the transboundary movement;

v) If a transboundary movement is not carried out or cannot be carried out in accordance with this article, the Contracting Party that is the State of origin shall take appropriate measures to allow readmission to its territory, unless an arrangement can be made. safe alternative.

vi) The Contracting Parties shall not grant a license to dispatch their spent fuel or radioactive waste to a destination south of 60 degrees South latitude for storage or final disposal.

2. None of the provisions of this Convention prejudge or affect:

i) The exercise of the rights and freedoms of maritime, river and air navigation that, as stipulated in international law, corresponds to the ships and aircraft of all States;

ii) The rights of a Contracting Party to which radioactive waste is exported for processing to be returned, or to make arrangements to return radioactive waste and other products to the State of origin after processing;

iii) The right of a Contracting Party to export its spent fuel for reprocessing;

iv) The rights of a Contracting Party to which spent fuel is exported for reprocessing to be returned, or to adopt provisions to return radioactive waste and other products derived from reprocessing activities to the State of origin.

On April 4, 1988, Mexico signed the Convention on the Physical Protection of Nuclear Materials, which entered into force in the national territory on May

4, 1988, and whose amendment covers the physical security of nuclear facilities and materials. nuclear power during transportation. This document is of particular importance in the case of the transboundary movement of spent fuel and high-level waste.

In April 2010, preparations and various administrative activities began for the replacement of high-enrichment fuel elements with low-enrichment ones, between Mexico and the United States of America, in the TRIGA Mark III reactor, with the intervention of the IAEA. Mexico delivered the following items:

Spent fuel:

- 26 standard elements with 70% enrichment, 7,111 kg of U-235.
- 3 control bars.

Fresh fuel:

- 22 standard elements.
- 3 instrumented elements.
- 3 control bars.

In total, 57 fuel elements were shipped. This move was made as part of a joint effort between the IAEA, the United States of America, and Mexico to convert the TRIGA Mark III research reactor to a low-enrichment fuel reactor (maximum 20% U-235). As a low-enrichment fuel, Mexico received 125 elements with an enrichment of 19.75 from U-235.

Because there are no companies that manufacture sealed sources or nuclear fuel in Mexico, imports of nuclear material are limited to new nuclear fuel for the CNLV and radioactive materials for use in various non-energy applications.

The RGSR indicates that disused sealed sources may only have 2 routes for final management, these routes being sent to a facility for disposal (since there is no authorized facility for these activities, currently they are sent for storage to CADER), or its export, with prior authorization.

In the case of shipment abroad of disused sealed sources of category 1, once the corresponding export authorization has been granted, the permit holder must request an issuance authorization for the transport of radioactive material to the customs office of exit. On the other hand, once the issuance authorization has been issued, for category 1 remittances, the interested party must request the Mexican State, through the CNSNS, for their custody during transport.

For the issuance authorization request, the basis of which is found in the RTSMR, it must be proven that the vessel to be used, due to its design or due to a special freight regime, is only used to transport radioactive material. The name and registration number assigned to the person in charge of radiological safety must also be presented to the CNSNS; the description of the radioactive content and type of package for transport; copy of the design certificate of the package for the transport of radioactive material in special form and of the package to be used; description of the controls for the preparation, loading, transport, stowage, unloading and handling of the consignment; mode of transport; type of transport unit and planned route; physical safety plan; risk analysis and emergency plan; sending or receiving country in case of international transport; civil liability insurance to guarantee payment of possible damages.

In case of international transport, multilateral approval must be submitted in accordance with the applicable treaties and conventions. Units for the transport of fissile substances or other radioactive materials must have at least means of detection of access to unauthorized persons, two-way communication systems or devices, global positioning systems or other means available for said purpose, overpacks and means. restraint that delay any unauthorized removal attempts and physical safety and emergency plans. The physical safety plan must foresee the action of a sufficient response force to face the threats to which the material is subjected, including the design base threat.

Prior to the issuance of the corresponding Issuance Authorizations, the CNSNS may require, based on the radiological characteristics of the radioactive material in question, the contracting of insurance with an institution authorized to do so, which covers the damages that may be caused to third parties on their property and people, in the event of an accident during the transport of said materials. The coverage will be determined considering the risk implied by the radiological characteristics of the radioactive materials that are part of the specific consignment that is intended to be transported, in accordance with the corresponding regulations.

On the other hand, in relation to the export authorization, according to what is established by

the RGSR, the permit holder must present to the CNSNS the authorization, permit or license number that protects the possession of the radioactive material to be exported; the characteristics of radioisotopes, their activity, physical and chemical form; the specifications of the equipment containing the material; Customs where the export is intended; name, address and telephone number of the recipient; physical and radiological safety plan; original of the radioactive material transport authorization and copy of the export request. Once this authorization is granted, which has a validity of 6 months from its issuance, the permit holder is required to notify the CNSNS, within a period of 5 business days after the export has been carried out, that it has been carried out. finished.

The permit holder is obliged to notify, at least seven days prior to shipment, to the competent authorities of other countries, through which the radioactive material will be transported, the dispatch of consignments consisting of type B (U) or Type C containing radioactive material with activity greater than 3 X 10^3 A1, or 3 X 10^3 A2, as appropriate, or 1000 (both A1 and A2 specified in the RTMR), Type B (M) packages and those made under of special arrangements.

As of the cut-off date of this report, the transboundary movement of sealed sources under the figure of repatriation has not taken place. However, to the extent possible, Mexico encourages the return of disused sealed sources to the country of origin.

Compliance assessment

Mexico complies with the cross-border movement agreements derived from international conventions signed at the binational or multinational level.

SECTION J

SEALED SOURCES IN DISUSE

This section includes the obligations provided for in Article 28 (Disused sealed sources).

Article 28. Sealed sources in disuse

1. Each Contracting Party shall adopt, within the framework of its national legislation, the appropriate measures to ensure that the possession, reprocessing or final disposal of disused sealed sources takes place safely.

2. The Contracting Parties shall allow the readmission into their territory of disused sealed sources if, within the framework of their national laws, they have accepted their return to a manufacturer authorized to receive and possess the disused sealed sources.

28.1 Measures to ensure that possession, reprocessing or final disposal takes place in a safe manner

The Mexican State does not explicitly have a national strategy for the management of disused sealed sources. However, through the CNSNS it maintains strict control of the sources through its regulatory control. This control considers the different legal responsibilities of all the parties involved: manufacturers, suppliers, owners and users of the sources throughout the useful life of the radioactive material.

In general, the use of sealed sources of radiation is regulated by the General Regulations for Radiation Safety and its corresponding regulations. Radiation protection regulations require the minimization of radioactive waste, so disused sealed sources should, as far as possible, be returned to their country of origin, reused in an activity equal to that for which it was conceived, recycled in some distinct activity or managed as radioactive waste. Disused sealed sources that are not exported as described in section I, must be delivered to the National Institute for Nuclear Research, where they are conditioned at PATRADER to be delivered to the Radioactive Waste Storage Center, where they are stored. temporarily until a Disposal Site is available in the country. For now, there is no technology in Mexican territory for the re-manufacture of sealed sources.

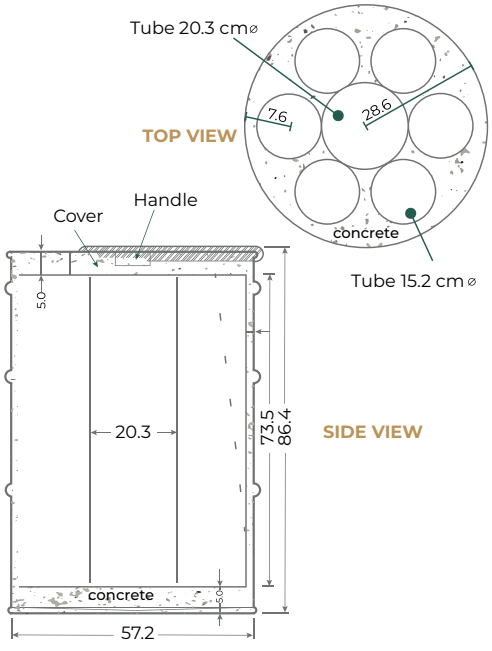
In particular, the national legislation regarding the management of disused sealed sources is based on Article II of the General Regulations on Radiological Safety. This article establishes that all practices that involve radioactive materials such as research, medicine and industry, are subject to licensing by the regulatory body with the intention of guaranteeing safety. Therefore, in Mexico, radioactive materials may not be used or stored without the express authorization of the regulatory body. Likewise, the transfer of all radioactive material in national territory is subject to prior authorization. It is worth mentioning that the official Mexican standard: NOM-039-NUCL-2011 “Specifications for the exemption of practices and sources attached to any practice, which use sources of ionizing radiation”, of any or all of the regulatory conditions, establishes the amounts of radioactive material exempted from regulatory control, in accordance with IAEA recommendations.

As described, the disused sealed sources that have been cataloged as radioactive waste are sent to PATRADER for conditioning and later sent to CADER for temporary surface storage. In the future if required, the sources can be recovered from the containers.

Conditioning consists of confining the sources in drums designed for this purpose. Depending on the emitting radionuclide, sources can be confined to concrete, lead and concrete or paraffin and concrete cylinders. This conditioning fulfills two safety functions: a) shielding the radioactive source, necessary for its handling, transport and storage; and b) physical barrier to reduce the risk of tampering or theft. The concretes used in this operation comply with the requirements established in the official Mexican standard NOM-019-NUCL-1995 "Requirements for low-level radioactive waste packages for their final storage near the surface." In all cases, the material that serves as containment and shielding is prepared in 208 L metal drums. The consolidation of the container ensures that radiation levels do not exceed 0.5 mSv / h on the drum surface and 0.05 mSv / h at 1 m distance, so in each case the thickness of the material used as shielding is calculated.

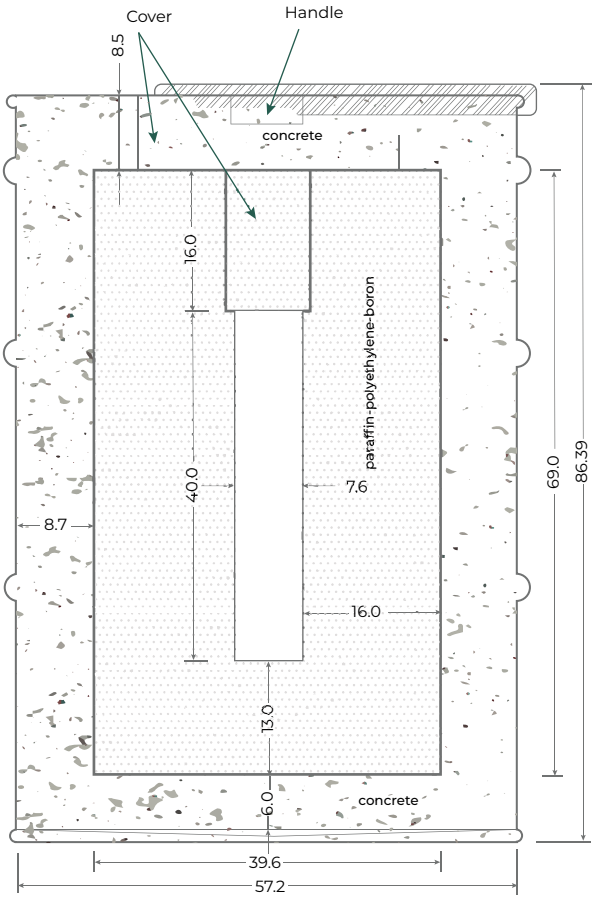
Containers for alpha- and beta-emitting sources are prepared by placing 15.2 and 20.3 cm diameter polyvinylchloride (PVC) tubes inside the metal drum and pouring concrete around them, as shown in Figure 3. For simplicity, in the side view only shows the center tube.

FIGURE 3. DIAGRAM OF A CONTAINER FOR ALPHA- OR BETA-EMITTING SOURCES, WEIGHING APPROXIMATELY 250 KG



In the case of neutron-emitting sources, a mixture of 70% paraffin, 20% polyethylene and 10% boron by weight is used. With this mixture, a cylinder like the one shown in figure 4 is prepared, with an interior space 40 cm long and 7.6 cm in diameter, with a lid made of the same material. This cylinder is placed inside a metal drum and concrete is poured around it until it reaches the edge.

FIGURE 4. DIAGRAM OF A CONTAINER FOR NEUTRON-EMITTING SOURCES, WEIGHING APPROXIMATELY 390 KG



For gamma emitting sources, there are two drum geometries:

a. those that contain radionuclides such as Co-60, Kr-85, Ra-226, and Cs-137, which, due to the energy of the gamma radiation they emit and the number of sources received, require a larger shield, fixed in 8 cm of lead;those radionuclide sources such as Na-22, Cr-51, Mn-54, Fe-59, Eu-152, which are received in fewer numbers and require a minimum shield, set at 1.5 cm of lead.

For the first case, lead cylinders with a single cavity are manufactured as shown in figure 5a. In the second case, the lead cylinders have very thin walls and up to seven cavities (figure 5b), each one to confine different isotopes. The total weight of the cylinder-concrete-drum assembly is approximately 810 and 560 kg, respectively.

FIGURE 5. DIAGRAM OF THE CONTAINERS FOR CONFINING GAMMA EMISSION SOURCES

A) FOR A SINGLE RADIONUCLIDE

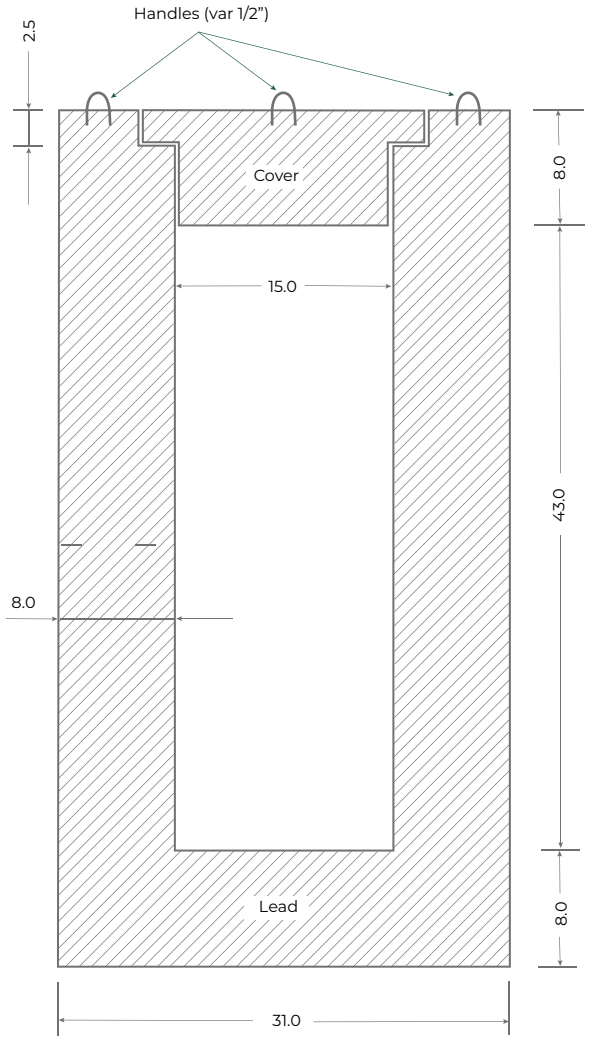
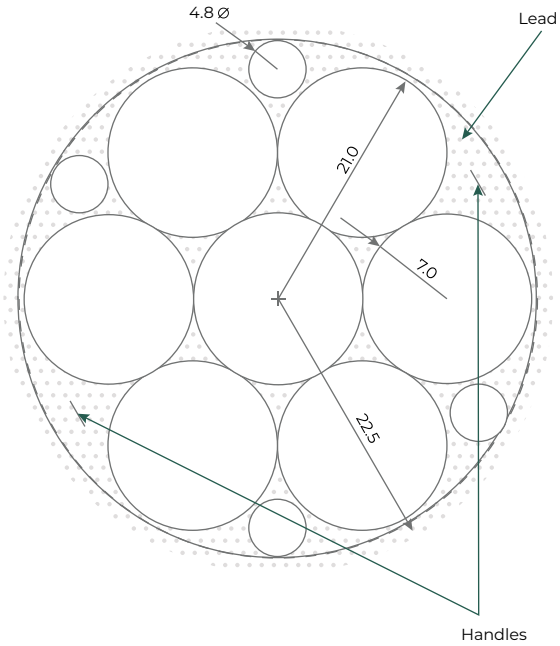


FIGURE 5. DIAGRAM OF THE CONTAINERS FOR CONFINING GAMMA EMISSION SOURCES

B) FOR VARIOUS RADIONUCLIDES



It should be noted that in no case are sources of different radionuclides introduced into the same well, nor are beta emitting sources introduced in a container with alpha emitting sources. In the case of sources containing alpha or beta emitting radionuclides, if the number of sources of the same radionuclide is not sufficient to fill a container, single isotope sources can be placed in each well. Likewise, in order to maintain control of the total activity of each container, from each source that is introduced into a container, the company name of the generator, brand, serial number, initial activity and date of manufacture are captured in a format of specific record. Finally, the drums with conditioned sources are transported to the CADER for temporary storage on the surface.

28.2 Readmission in to the territory and return to manufacturers

There are still no manufacturers of sealed radioactive sources in Mexico. Therefore, no authorization has been required for the re-entry into Mexican territory of disused sealed sources of Mexican origin for the purpose of re-manufacture or disposal. However, Mexico would allow the re-entry into its territory of disused sealed sources if the facilities authorized to manufacture and re-manufacture such devices existed in Mexico. The prerequisites for said import

would be established by the Mexican regulatory authority.

As for the sealed source manufacturing countries, they have repatriation programs for their disused sealed sources. In this sense, Mexico is open to this option, such is the case of the Memorandum of Understanding signed between the United States of America and Mexico in 2019. With this memorandum, the repatriation of teletherapy sources and blood irradiators (Co-60 and Cs-137) from the United States of America and Canada, as well as the return of transuranium sources, mainly Am-241, Am / Be-241, Cf-152 and Ra-226.

Compliance assessment.

In accordance with what is described in both sections of Article 28, it can be established that Mexico has the appropriate legal and operational provisions to ensure the control of disused sealed sources.

SECTION K

GENERAL EFFORTS TO IMPROVE SAFETY

The following are measures that Mexico has undertaken or plans to undertake to improve safety in the management of spent fuel and in the management of radioactive waste.

1. Development of a national policy for the management of spent fuel and radioactive waste in the country.

Although the country has an appropriate regulatory framework and a nuclear regulatory body (the National Commission for Nuclear Safety and Safeguards) that exercises adequate and safe control over the management of spent fuel and radioactive waste, Mexico is aware of the need to have a National Policy document that complements the current management system with plans for definitive future management.

As mentioned by Mexico at the 6th Review Meeting of the Contracting Parties of the Joint Convention on Safety in the Management of Spent Fuel and on Safety in the Management of Radioactive Waste, the country is in the process of preparing a National Policy.

A National Policy for the management of spent fuel and radioactive waste will provide the highest level of safety for the public, society and the environment, both for current and future generations, and will provide the population with the assurance that the measures are being taken. appropriate decisions and the required planning is being carried out. Likewise, the National Policy document that is prepared in Mexico will include the following elements:

- It will incorporate a management strategy for spent fuel (CG) and all types of radioactive waste (DR) oriented to the medium and long term, including final disposal;
- It will define the responsibilities of each of the entities of the nuclear sector;
- It will establish the bases for the creation of a managing organization of CG and RD in the country;
- Determine the mechanisms to finance the short and long-term management activities of CG and DR;
- It will allow unifying criteria and establishing the specifications and acceptance criteria for the final disposal of CG and DR, minimizing additional costs in the future, and
- It will make it possible to identify the actions that require immediate attention.

The Department of Energy, in collaboration with the entities of the sector, has worked in recent years on a proposal for a national policy for the management of radioactive waste. Likewise, advice has been obtained from international organizations such as the International Atomic Energy Agency and the European Commission for this purpose.

2. Project 2012-2015 of the Mexico-European Commission.

Mexico was the subject of an evaluation by international experts regarding its management of spent nuclear fuel (SF) and radioactive waste (RW) during the development of a collaborative project carried out with the European Commission. Mexico requested and established the collaboration project for the purpose of analyzing the current status of

management activities and jointly developing a proposal for a spent fuel and radioactive waste management policy for the country. The project lasted for more than 3 years, from April 2012 to October 2015.

For this work, the European Commission selected as a consultant a consortium that included ENRESA, the entity in charge of radioactive waste in Spain; COVRA, the Netherlands Radioactive Waste Organization; BELGOPROCESS, responsible for implementing the radioactive waste policy in Belgium; EMPRESARIOS AGRUPADOS, a Spanish company that builds waste facilities; IBERDROLA, a Spanish construction company of radioactive waste facilities, and WESTINGHOUSE, an engineering company specialized in the nuclear sector. On the part of Mexico, the National Institute for Nuclear Research coordinated the participation and work of the Secretariat of Energy, the National Commission for Nuclear Safety and Safeguards and the Laguna Verde Nuclear Power Plant.

The European consortium carried out, in the first place, an information survey among the participating entities of the Government of Mexico to find out the current regulations, the organizational framework, implemented processes, operating procedures, existing facilities, financing mechanisms and material inventories. existing. The experts from this consortium visited and analyzed the processes carried out in the spent fuel and radioactive waste facilities of the CNLV and ININ.

The CNLV visited the temporary warehouses for low-level wet radioactive waste and dry solids, the warehouses for contaminated materials that could be decontaminated, and the spent fuel pools of the reactors. The ININ facilities visited included the radioactive waste treatment plant and the radioactive waste storage center located in Maquixco, State of Mexico. The project was developed with an ambitious work program that was divided into 3 main parts of research and evaluation.

In the first part called "National Policy for the management of GC and RW in Mexico", observations and comments were analyzed, evaluated and provided on the following topics:

- Detailed evaluation of the legal framework.
- Analysis of the organic structure for the management of SF and RW in the country.
- Comparison with SF and RW management activities in different European countries.
- Environmental considerations.
- Public participation.

In the second stage, called "Strategic Plan for the implementation of the national policy," the following issues were evaluated:

- Required legislation.
- Analysis of the national inventory of SF and RW.
- Need for a SF and RW management organization in the country.
- Financing of SF and RW management activities.
- Characterization, classification and RW registration system.
- RW treatment, conditioning and storage.
- RW acceptance criteria.
- SF and RW transport and transport acceptance criteria.
- Strategic aspects of dismantling and management of the resulting waste.
- SF storage.
- SF and RW final disposal options.
- Involvement of the local public and society in SF and RW management decisions.

The third stage was called "Strategy for the optimization of SF and RW management in the CNLV" and included evaluations on the following matters:

- Analysis of the current management strategy of SF and RW in the CNLV.
- RW generation and waste minimization policies.
- Waste processing technologies.
- RW storage and acceptance criteria.
- SF storage options and their implications for final disposal.

Throughout the project, a total of 8 meetings were held between the European experts and the Mexican counterparts in Mexico. A kick-off meeting was held to agree on the work program and other details of the project, 4 progress meetings for discussions on specific topics with Mexican technical counterparts and a visit to the facilities, a special meeting to define proposals for a national policy, a workshop of work to finalize the project documents and a final meeting with the representatives of the Secretariat of Energy of Mexico to deliver the results.

The European Commission also invited the Mexican technical counterparts to carry out study visits to radioactive waste management organizations and their facilities in Europe. The purpose of the visits was to study the organization, operation and financing of the SF and RW management entities in each country to take as a basis the eventual establishment of a similar organization in Mexico. In this way, meetings were held with ENRESA officials from Spain and the "El Cabril" facilities for medium, low and very low-level radioactive waste were visited. Meetings were also held with representatives of COVRA from the Netherlands and visited their storage facilities for radioactive materials of natural origin (NORM), low and medium level waste and their facility for high level radioactive waste.

During the study visit to France, meetings were held with ANDRA representatives and the disposal facilities for medium and low-level radioactive waste at L'Aube and the facility for very low-level radioactive waste at Morvilliers were inspected. Later, meetings were held with officials from BELGOPROCESS and ONDRAF-NIRAS, Belgium's radioactive waste and fissile materials organization, and the radioactive waste facilities of BELGOPROCESS were visited.

At the end of the project, a total of 24 technical reports were generated containing the results of the evaluations and recommendations to improve the activities and topics analyzed.

Among the main recommendations are the following:

- Establish a National Policy and a National Strategy for spent fuel and radioactive waste that includes plans for their final disposal.
- Update the corresponding legislation.
- Strengthen legislation on public participation.
- Updating of the Institutional Framework regarding the creation of an Organization for the Management of Spent Fuel and Radioactive Waste.
- Launch a program to build a low-level radioactive waste disposal facility.
- Establish a dismantling policy.
- Establish a Research and Development program to be coordinated by the Management Organization.
- Creation of a Fund for the management activities and final disposal of Radioactive Waste and Spent Fuel.
- Establish an Advisory Committee for the selection of a site for the disposal of low level waste.

3. Missions of the IAEA's Integrated Regulatory Review Service (IRRS) to Mexico.

Between November 26 and December 5, 2007, the IAEA carried out an IRRS (Integrated Regulatory Review Service) mission in Mexico, under the technical cooperation projects MEX / 0/016, RLA / 9/053 and RLA / 9/055. The purpose of these missions was to promote regulatory improvements based on the experiences gained and shared by the regulatory bodies of the Member States that submit to them. During the mission carried out in Mexico, the national regulatory framework and the effectiveness of the Mexican regulatory body in fulfilling its functions were evaluated.

The IRRS team conducted a review of the following relevant areas: legislative and governmental responsibilities, authority, responsibilities and functions of the regulatory body, organization of the regulatory body, authorization process, review and analysis, inspections and compliance, development of regulations and guidelines , emergency preparedness and regulatory body management system.

The scope requested by CNSNS for this mission included: nuclear facilities (nuclear power plant and research reactor), radiological protection applied to industrial, medical (except X-rays for diagnosis) and research practices, transport of radioactive material, preparation for cases of emergency, control of public exposure, management of radioactive waste, remediation of contaminated sites and decommissioning.

As a result of the mission, the following findings and observations were noted at the time:

- The CNSNS effectively regulates nuclear and radiological safety in the country;

- It was observed that -de jure- the CNSNS is neither technically nor financially independent, although it is recognized that de facto it seems to function with technical independence;

- The moratorium on standards, effective as of April 29, 2005, has a significant impact on the updating of regulatory requirements with a view to improving nuclear and radiological safety;

- The CNSNS faces significant staff challenges due to federally mandated hiring practices.

Additionally, the following good practices were identified by the CNSNS:

- The implementation of a nuclear power plant safety indicator program to monitor and track the safety results at the plant;

- The periodic summary and evaluation of inspection findings provides a good way to monitor security results at permit holders;

- CNSNS personnel involved in the licensing of nuclear power plant personnel receive the same technical training as operators;

- The implementation of a training program for scrap metal recyclers and the support of the CNSNS to update the ININ environmental monitoring program to meet international standards.

The evaluation team considered that the following recommendations and suggestions should have high priority, either because they were identified in several areas of review or because it was considered that this would contribute significantly to the strengthening of the overall results of the regulatory system:

- The role of the CNSNS as a regulatory body should be clarified during the preparation of regulations and guidelines;

- The CNSNS must continue its efforts to address the impact of human and organizational factors on safety during the operation;

- The CNSNS must develop a human resources management plan to face future challenges;

- The CNSNS should continue the development of its comprehensive management system, including the development and approval of internal operating procedures.

4. Change from radioactive waste classification to IAEA format.

The radioactive waste classification system used in Mexico, which is detailed in Section B of this Report, is established in the Official Mexican Standard NOM-004-NUCL-2013. Currently, this standard is under review by the regulatory body to adopt the IAEA classification system. This new classification will incorporate (among other aspects) the category of very low-level waste, that of very short half-life waste and will include a clear definition of what is considered a radioactive waste.

The revision of the standard has at this moment with a substantial progress of around 80%. Because the process of preparing and publishing a standard in Mexico depends on a number of stages that involve different government entities and include a public consultation, it is expected that the review and publication of the new version of the standard will be concluded in a 12-24 month period.

5. Program for the repatriation of disused sealed sources.

In Mexico, they are working on a program for the repatriation of a part of the used sealed radioactive sources found in the territory. This program is being carried out in collaboration with the Department of Energy (DOE) of the United States of America. With this program, the United States of America will receive material originating from that country and Canada and will store it and then confine it definitively in facilities in both countries.

For this purpose, a Memorandum of Understanding was signed in September 2019 between the Department of Energy of the United States of America and the National Institute of Nuclear Research of Mexico. The project is expected to be executed in two stages:

- A first stage, in which it is planned to send transuranium sources to the United States of America, such as Cf-252, Cm-244, Am-241, Am / Be-241, Ra-226 and Ra / Be-226.

- In the second stage, 81 radiation therapy heads of American and Canadian origin will be sent to the United States of America.

SECTION L
ANNEXES

L.1 Glossary of terms and abbreviations

A/C - Alternate current.

ACG - Spent Fuel Pool.

ALARA - As Low as Reasonably Achievable.

Almacenamiento, almacenamiento temporal - Placing spent fuel, radioactive waste or radioactive sources in a facility prepared for their containment, with the intention of recovering them.

ATS - Temporary warehouse on the site of the Laguna Verde Nuclear Power Plant.

CADER - Radioactive Waste Storage Center, administered by ININ.

CCNN - National Advisory Committee for Standardization.

CCTV - Closed-circuit TV. Circuito cerrado de televisión.

CFE - CFE.

CFR - Code of Federal Regulations of the Nuclear Regulatory Commission of the United States of America.

CNLV - Laguna Verde Nuclear Power Plant.

CNSNS - National Commission for Nuclear Safety and Safeguards.

CONAMER - National Commission for Regulatory Improvement.

D/C - Direct current.

DDO - Directorate of Operation of the CFE.

DDRSS - Dry Solid Radioactive Waste Repository.

DFC - Damaged Fuel Container.

Disposal, final disposal - Placing of spent fuel, radioactive waste or radioactive sources in an appropriate facility without the intention of recovering them.

Dr. Nabor Carrillo Flores Nuclear Facility - Also called the Nuclear Center of Mexico. Site where the offices and facilities of the National Institute for Nuclear Research are located.

ELAP - Extended Loss of Alternating Current.

ENSREG - European Nuclear Safety Regulators Group.

EPRI - Electric Power Research Institute.

ESC - Structures, systems and components.

ETO - Technical Specifications of Operation.

EU - United States of America.

EYEO - Office of Evaluation and Operational Experience of the Laguna Verde Nuclear Power Plant.

Federal Executive - Executive Branch of the Government of the United Mexican States.

FSAR - Final Safety Analysis Report.

GCN - Management of Nuclear Power Plants of the CFE.

GL - Generic Letter.

HI-STORM FW MPC - Spent fuel container from Holtec International company.

HI_TRAC VW - Variable weight transfer container for spent fuel maneuvers.

HIC - High-Integrity Containers.

HTTS - Heat Thermo Type water level and temperature measurement Sensor.

ININ - National Institute of Nuclear Research.

INPO - Institute of Nuclear Power Operations.

IPVRA - Report of the Environmental Radiological Surveillance Program.

IRRS - Integrated Regulatory Review Service.

IS - Informe de Seguridad.

ISFSI - Independent Spent Fuel Storage Installation.

ISO - International Organization for Standardization.

ITPCP - Technical Instructions for the Process Control Program.

La Piedrera - Disposal Site in the State of Chihuahua, Mexico for contaminated materials produced in the smelting accident of a Cobalt-60 source in 1983.

LUHS - Last Heat Sink Loss.

LVNPS 1&2 FSAR - Laguna Verde Nuclear Power Station Units 1 and 2 Final Safety Analysis Report.

MCNP - Monte Carlo computational code for transport of neutrons, photons and electrons. Trademark registered by TRIAD NATIONAL SAFETY LLC.

MIA - Environment impact manifestation.

MPC - Multi-Purpose Container.

NOM - Official Mexican Standard

NORM - Naturally-Occurring Radioactive Materials.

NRC, USNRC - United States Nuclear Regulatory Commission.

Nuclear Law - Reglamentary Law of Constitutional Article 27 on Nuclear Matters.

NUPIC - Nuclear Procurement Issues Committee.

OBE - Operating-Base Earthquake.

OCN - Organization of Nuclear Contingencies of the National Commission for Nuclear Safety and Safeguards.

OCR - Organization of Radiological Contingencies of the National Commission for Nuclear Safety and Safeguards.

OIEA - International Atomic Energy Agency.

PATRADER - Radioactive Waste Treatment Plant, administered by ININ.

PEI - Internal Emergency Plan.

Peña Blanca - Disposal Site in the State of Chihuahua, Mexico, for contaminated material from uranium and molybdenum beneficiation activities.

PERE - External Radiological Emergency Plan.

PGC - Quality Assurance Plan.

PGDR y CN - Radioactive Waste Management Plan and Nuclear Fuel for the Laguna Verde Nuclear Power Plant.

PMH - Probable maximum hurricane.

PNT - National Transparency Platform. An Internet portal of the Government of Mexico to consult government public information.

PROFEPA - Federal Attorney's Office for Environmental Protection.

PVC - Polyvinylchloride.

PVRA - Environmental Radiological Surveillance Program.

RGSR - General Regulation of Radiological Safety.

RHR - Residual Heat Removal System.

RPS - Periodic Safety Review.

RTSMR - Regulations for the Safe Transport of Radioactive Material.

RW - Radioactive waste.

SDER - Significant Operating Experience Report.

SENER - Department of Energy

SF - Spent fuel.

SFPIS - Spent Fuel Pool water level and temperature Instrument System.

SGC - Quality Management System of the National Institute for Nuclear Research.

SGI - Comprehensive Management System.

SIG - Comprehensive Quality Management System for the CADER Facility.

Spent fuel - Nuclear fuel that has been irradiated in a reactor and is not intended to be reused.

SSEFPS - Fire Protection System for Safe Shutdown of the Reactor during an Earthquake.

TRIGA Mark III - Research reactor of the National Institute for Nuclear Research.

UE - European Union.

USNRC, NRC - United States Nuclear Regulatory Commission.

vca - Volt alternating current.

WANO - World Association of Nuclear Operators.

WENDA - Weatern European Nuclear Regulators Association.

Zircaloy - Zirconium alloy used in nuclear fuel cladding.

ZIRLO - Zirconium Low Oxidation.

L.2 National legislative framework

- Political Constitution of the United Mexican States.
- Vienna Convention on Civil Liability for Nuclear Damage.
- Convention on the Physical Protection of Nuclear Materials and its Amendment.
- Convention on the Prompt Notification of Nuclear Accidents.
- Convention on Assistance in the Event of a Nuclear Accident or Radiological Emergency.
- Nuclear Safety Convention.
- Reglamentary Law of Constitutional Article 27 on Nuclear Matters.
- Organic Law of the Federal Public Administration.
- Law of the CFE.
- Law of Civil Liability for Nuclear Damage.
- Federal Law of Parastatal Entities.
- Federal Law on Environmental Responsibility.
- Federal Law of Transparency and Access to Public Information.
- Federal Law on Metrology and Standardization.
- General Law of Transparency and Access to Public Information.
- General Law of Ecological Balance and Environmental Protection.
- Law that Declares National Mining Reserves the Uranium, Thorium and other Substances from which Fissionable Isotopes that can Produce Nuclear Energy are obtained.
- Federal Law of Administrative Procedure.
- General Law of Civil Protection.
- Mining Law.
- General Regulations for Radiation Safety.
- Regulations for the Safe Transport of Radioactive Material.

- Internal Regulations of the Department of Energy.
- Regulation of the Federal Electricity Commission Law.
- Regulation of the Federal Law of Transparency and Access to Public Government Information.
- Regulation of the Federal Law on Metrology and Standardization.
- Regulations of the Mining Law.
- Regulation of the Law that declares National Mining Reserves the Uranium, Thorium and other Substances from which Cleavable Isotopes that can produce Nuclear Energy are obtained.
- Regulation of the General Civil Protection Law.

L.3 International treaties signed by Mexico on nuclear matters

NAME	DATE OF SIGNATURE	EFFECTIVE DATE	COMMENTS
Statute of the International Atomic Energy Agency.	December 7, 1956	April 7, 1958	The signing of this Statute makes Mexico a Member State of the IAEA. It contains an amendment to Art. VI, adopted in Vienna on September 28, 1970, which is in force and to which Mexico is a party.
Agreement on Privileges and Immunities of the International Atomic Energy Agency.	July 1, 1959	October 19, 1983	The representatives of the Member States will accept the privileges and immunities for IAEA officials and experts.
Treaty for the Prohibition of Nuclear Weapons in Latin America.	February 14, 1967	September 20, 1967	By virtue of the provisions of Article 14, Mexico undertakes to present semiannual reports on the application of safeguards to nuclear materials in the country.
Treaty on the Non-Proliferation of Nuclear Weapons.	July 1, 1968	January 21, 1969	This Treaty obliges Mexico to carry out the accounting and control system for nuclear materials subject to IAEA safeguards.
Agreement for the application of safeguards in relation to the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Treaty on the Non-proliferation of Nuclear Weapons.	September 27, 1972	September 14, 1973	Article 7 obliges Mexico to establish and maintain an accounting and control system for all nuclear material subject to safeguards. Article 63 obliges Mexico to submit reports of changes in the inventory of nuclear materials and reports of balance of nuclear materials.
Subsidiary Arrangements Relating to the Agreement for the Application of Safeguards in Relation to the Treaty for the Prohibition of Nuclear Weapons in Latin America and the Treaty on the Non-Proliferation of Nuclear Weapons.	September 17, 1972	September 14, 1973	Under these arrangements, Mexico is obliged to provide information on nuclear facilities and materials located outside of these, accounting reports and changes in inventory, balance of materials, together with the corresponding physical inventory report and the transfer of nuclear materials outside of them. Mexico or to our country.
Additional Protocol to the Agreements between Mexico and the IAEA for the application of safeguards.	March 29, 2004	March 4, 2011	Mexico must submit information to the IAEA about nuclear facilities and those outside them. As well as a report on research and development activities related to the nuclear fuel cycle, safeguards operational activities at facilities and locations outside the facilities where nuclear material is used routinely, make annual declarations on exports and imports of nuclear material safeguards (basic materials that have not reached the appropriate composition for the manufacture of fuel) and material that has been exempted from safeguards and dual-use non-nuclear equipment and material.

NAME	DATE OF SIGNATURE	EFFECTIVE DATE	COMMENTS
Vienna Convention on Civil Liability for Nuclear Damage.	April 25, 1989	July 25, 1989	It obliges our country to cover the damages caused by a nuclear accident that occurs in a nuclear facility in the country.
Convention on the Physical Protection of Nuclear Materials.	April 4, 1988	May 4, 1988	It obliges Mexico to adopt appropriate measures within the framework of its national legislation and in accordance with international law to ensure that nuclear materials are protected during transport, use and storage.
Amendments to the Convention on the Physical Protection of Nuclear Materials.	Does not apply	August 1, 2012	These amendments update various issues reflected in the convention, expanding coverage to nuclear facilities and the transport of nuclear material.
Convention on the Early Notification of Nuclear Accidents.	September 26, 1986	June 10, 1998	This agreement obliges Mexico to be prepared to attend radiological and nuclear emergencies, to facilitate the exchange of information with the IAEA and the signatory countries; in addition to providing information to the IAEA on any radiological or nuclear accident. Establish contact points for this assistance, in addition to participating in exercises scheduled by the IAEA.
Convention on Reciprocal Assistance in the event of a Nuclear Accident or Radiological Emergency.	September 26, 1986	June 10, 1998	Provide and / or receive assistance in the event of a nuclear or radiological accident. Establish contact points for this assistance, in addition to participating in exercises scheduled by the IAEA.
Convention on Nuclear Safety.	November 9, 1994	October 24, 1996	Prepare the triennial report on nuclear safety adopted in Mexico's power reactors, participate in the meetings of the Contracting Parties and respond to the questions raised by other Contracting Parties.
Comprehensive Nuclear Test Ban Treaty.	September 24, 1996	December 27, 1999	The CNSNS was appointed as an adviser to the coordination of the Ministry of Foreign Affairs in the national technical component for this treaty regarding the radionuclide station of the International Monitoring System. In addition, in the near future she will collaborate in the administration of the national data center.
Cooperation Agreement for the Promotion of Nuclear Science and Technology in Latin America and the Caribbean.	May 11, 1999	September 5, 2005	Through this agreement, the Latin American countries develop technical cooperation projects, under the auspices of the International Atomic Energy Agency.
International Convention for the Suppression of Acts of Nuclear Terrorism.	January 12, 2006	July 7, 2007	Nuclear crimes are established, obliges States to establish jurisdiction over these crimes, as well as the exchange of information and assistance between the Parties.
Joint Convention on the Safety of Spent Fuel Management and Radioactive Waste Management.	February 2, 2018	May 17, 2018	Mexico must present a national report on the policy that our country follows in this matter, in addition to participating in the annual meetings of the parties to this Convention.

L.4 National regulatory framework

This annex presents the list of regulations and official Mexican standards of the nuclear series (only the documents whose compliance is monitored by the CNSNS) that are of general application or of specific application to radioactive waste or spent fuel management facilities. , as well as the type of facility or activity for which they apply. It is worth mentioning that, for aspects not covered by national regulations, it is common practice to take the IAEA's international recommendations in a supplementary manner, incorporating them into the facility's license conditions.

- General Regulations for Radiation Safety. It is applied in nuclear and radioactive facilities.
- Regulations for the Safe Transport of Radioactive Material. It is applied in the transport of nuclear and radioactive material.
- 10 CFR, Federal Code of Regulations of the United States of America. It is applied in nuclear facilities by license condition.

- NOM-001-NUCL-2013, "Factors for calculating the dose equivalent". It is applied in nuclear and radioactive facilities.
- NOM-003-NUCL-1994, "Classification of facilities or laboratories that use open sources". It is applied in radioactive facilities with open sources.
- NOM-004-NUCL-2013, "Classification of radioactive waste". It is applied in nuclear and radioactive facilities.
- NOM-008-NUCL-2011, "Control of radioactive contamination". It is applied in nuclear and radioactive facilities.
- NOM-009-NUCL-2017, "Determination and application of the transport index for radioactive materials and the safety index with respect to criticality for the transport of fissile substances". It is applied in the transport of nuclear and radioactive material.
- NOM-012-NUCL-2016, "Requirements and performance criteria that ionizing radiation instruments and direct reading dosimeters must meet". It is applied in nuclear and radioactive facilities.
- NOM-014-NUCL-2017, "Categories of packages, overpacks and cargo containers containing radioactive material: marked and labeled". It is applied in the transport of radioactive material.
- NOM-018-NUCL-1995, "Methods to determine the activity concentration and total activity in radioactive waste packages". It is applied in nuclear and radioactive facilities.
- NOM-019-NUCL-1995, "Requirements for packages of low-level radioactive waste for storage near the surface". It is applied in generators of waste packages.
- NOM-020-NUCL-1995, "Requirements for radioactive waste incineration facilities". It is applied in radioactive waste incineration facilities.
- NOM-021-NUCL-1996, 2 Leaching tests for specimens of solidified radioactive waste". It is applied in generators of radioactive waste packages.
- NOM-022/1-NUCL-1996, "Requirements for a facility for the definitive storage of low-level radioactive waste near the surface. Part 1. Site". It is applied in permanent storage facilities.
- NOM-022/2-NUCL-1996, "Requirements for a facility for the definitive storage of low-level radioactive waste near the surface. Part 2. Design". It is applied in permanent storage facilities.
- NOM-022/3-NUCL-1996, "Requirements for a facility for the definitive storage of low-level radioactive waste near the surface. Part 3. Construction", operation, closure, post-closure and institutional control. It is applied in permanent storage facilities.
- NOM-026-NUCL-2011, "Medical surveillance of personnel occupationally exposed to ionizing radiation". It is applied in nuclear and radioactive facilities.
- NOM-027-NUCL-1996, "Specifications for the design of radioactive facilities Type II Classes A, B and C". It is applied in radioactive facilities with open sources.
- NOM-028-NUCL-2009, "Management of radioactive waste in radioactive facilities that use open sources". It is applied in radioactive facilities with open sources.
- NOM-031-NUCL-2011, "Requirements for the training of personnel occupationally exposed to ionizing radiation". It is applied in radioactive facilities.
- NOM-034-NUCL-2016, "Requirements for the selection, qualification and training of nuclear power plant personnel". It is applied in nuclear installations.
- NOM-035-NUCL-2013, "Criteria for dispensing waste with radioactive material". It is applied in nuclear and radioactive facilities.
- NOM-036-NUCL-2001, "Requirements for radioactive waste treatment and conditioning facilities". It is applied in radioactive waste facilities.
- NOM-039-NUCL-2011, "Specifications for the exemption of practices and sources attached to any practice, which use sources of ionizing radiation, of some or all of the regulatory conditions". It is applied in nuclear and radioactive facilities.
- NOM-041-NUCL-2013, "Annual incorporation limits and concentrations in releases". It is applied in nuclear and radioactive facilities.

L.5 Synoptic matrix of Mexico

TYPE OF OBLIGATION	LONG-TERM MANAGEMENT POLICY	FINANCING OF OBLIGATIONS	CURRENT PRACTICES / FACILITIES	PLANNED FACILITIES
SPENT FUEL	There is no decision on reprocessing. Spent Fuel and / or High-Level Reprocessing Waste to be disposed of in a future deep geological repository. It will include Spent Fuel from the nuclear power plant and the research reactor.	The current temporary storage financed by the nuclear plant and its owner the CFE. The future deep geological repository will be financed with a future Radioactive Waste Management Fund.	Spent fuel is currently stored in the spent fuel pools inside the reactor buildings of the nuclear power plant. A dry storage facility for spent fuel has been constructed on site for the temporary storage of spent fuel. Research reactor fuel is stored within the reactor core container tank.	Deep geological repository. Undefined date.
WASTE FROM THE NUCLEAR FUEL CYCLE	The low and mid-level waste will be disposed of in a future near-surface low- and mid-level waste facility.	The temporary storage of low and medium level waste is financed by the nuclear power plant and its owner, the CFE. The future definitive installation of low and medium level waste will be financed with a future Radioactive Waste Management Fund.	Low and mid-level waste from the nuclear power plant is temporarily stored at the plant. The facilities are: Temporary On-Site Warehouse (ATS) for wet solid waste. Dry Solid Radioactive Waste Repository (DDRSS) located at the site of the nuclear power plant.	Low and medium level waste disposal facility close to surface. Undefined date.
APPLICATION WASTE	Low and medium level wastes with a short half-life will be disposed of in a future near-surface disposal facility for low and medium level waste. Low and medium level long half-life wastes will be disposed of in a future deep geological repository.	Producers are charged a nominal fee for the collection of their waste. The current temporary storage costs are supplemented with state funds through ININ's annual budget. The near-surface low- and mid-level waste facility and the deep geological repository will be funded by the future Radioactive Waste Management Fund.	SENER has delegated to ININ the collection, conditioning and temporary storage of radioactive waste from non-energy applications. The wastes are characterized and conditioned in the ININ PATRADER. The waste is stored in CADER, operated by ININ.	Facility close to low and medium level waste disposal area. Deep geological repository. Undefined dates.
DISMANTLING	Low and medium level wastes with a short half-life of dismantling will be disposed of in a future facility near the low and medium level waste disposal surface. High and intermediate level wastes with a long half-life from dismantling will be disposed of in a future deep geological repository. The very low-level waste will be disposed of in a future near-surface repository for very low-level waste.	The dismantling, waste processing, storage and transportation operations to the Disposal Sites will be financed with the Dismantling Fund of the nuclear power plant, established for that purpose. The disposal of all dismantling waste will be financed by a future Radioactive Waste Management Fund.	There are no decommissioning activities at present.	Very low-level waste repository near the surface. Low and medium level waste disposal facility close to surface. Deep geological repository. Undefined dates.
SEALED SOURCES IN DIUSE	The short half-life sources will be disposed of in a future facility near a low and medium level waste disposal area. The long half-life sources will be placed in a future deep geological repository.	The temporary storage of sources is currently financed by the State through the ININ's annual operating budget. The final disposal will be financed by a future Radioactive Waste Management Fund.	Disused sealed sources that can be repatriated are exported. The rest of the sources are stored in CADER.	Facility close to low and medium level waste disposal area. Deep geological repository. Undefined dates.

Este documento se terminó de imprimir el xx de xxxxx de 2020

en Xxxxxx Xxxxxxxxx.

Se imprimieron 000 ejemplares.

Esta publicación ha sido elaborada con papel reciclado

y con certificación de gestión medioambiental.

GOBIERNO DE
MÉXICO