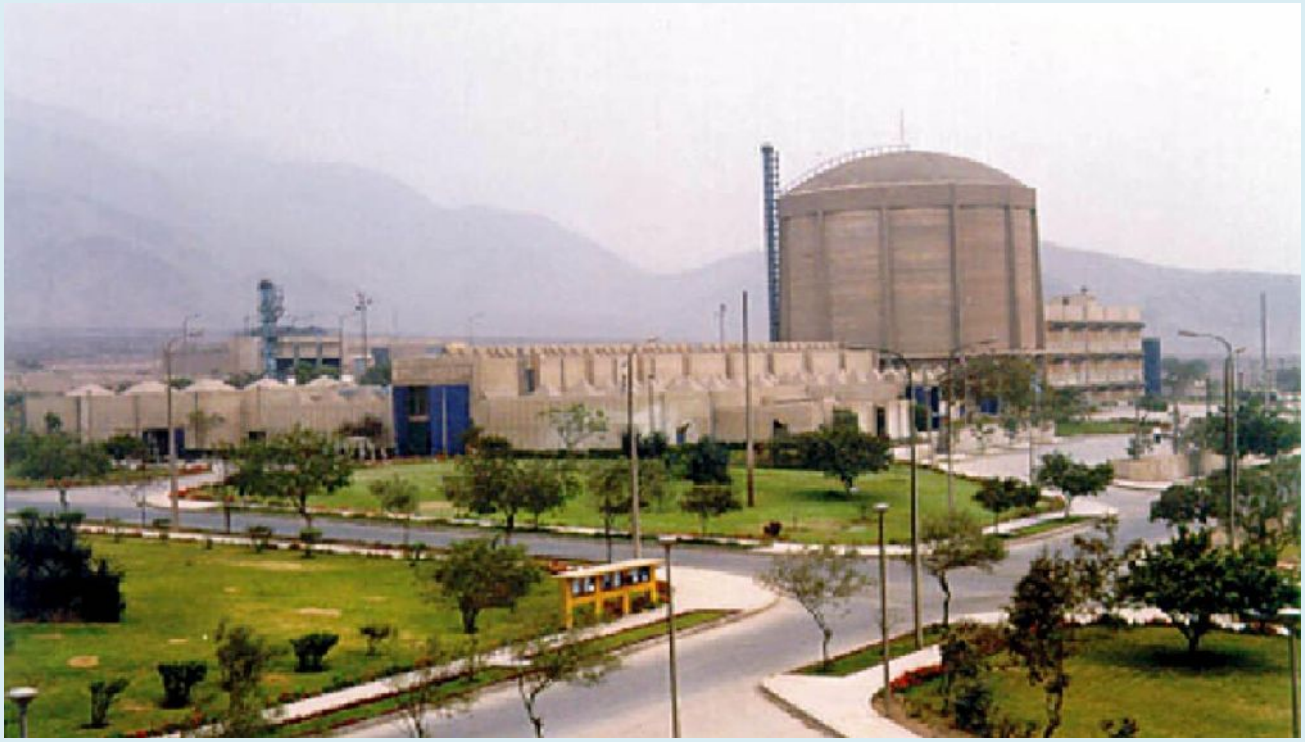
PERU

Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management



Peruvian Second National Report

SECTION A. INTRODUCTION

The Joint Convention was adopted on September 05 1997 in Vienna, Austria and opened for signature on September 29, 1997. Peru signed the Joint Convention June 04 1998, ratified it by means of the Supreme Decree N°070-2015-RE signed by the President of the Republic on December 16 2015, the ratification document was deposited on February 08, 2016, and came into force on 08 May 2016.

By means of the Decree Law Nº. 21875, organic law of the Peruvian Institute of Nuclear Energy – (IPEN), this public organization has two functions mainly: control of the use of radiation sources and promotion of science and nuclear technology in the country. According with Law 28028 IPEN is also the National Authority commissioned to regulate and control the safe use of radiation sources in a wide sense.

This Law establishes that IPEN is the unique national regulatory body in the country for controlling the ionizing radiation sources.

The execution of regulatory procedures have been delegated to the Technical Office of National Authority (OTAN), a branch of IPEN, that acts as first instance. In accordance with the Rule of Organization and Functions approved by Supreme Decree No. 062-2005-EM, OTAN depends for these purposes directly from the President of IPEN.

As indicated before, Peru acceded to the Joint Convention on the Safety of Spent Fuel Management and on Safety of Radioactive Waste Management (the Joint Convention) on 8 February 2016 and become a Contracting Party on 8 May 2016.

This is Peru´s Second Report on the implementation of the Convention measures.

The Peruvian Institute of Nuclear Energy (IPEN) has the primary responsibility for the implementation of Peru´s obligations under the Joint Convention, for this purpose coordinates and make consultations with other governmental organizations

Peru has no nuclear power reactors; the country operates two research reactors located in Lima. Both research reactors are operated by the Peruvian Institute of Nuclear Energy (IPEN), the public organization that promotes the peaceful uses of science and nuclear technology and at the same time regulates the use of ionizing radiation in the country.

The RP 10 Research Reactor is located inside Oscar Miroquesada de la Guerra (RACSO) Nuclear Center, 40 km far from Lima city. RACSO is a research technological complex that also includes among others, a Radioisotope Production Plant; a Radioactive Waste Management Plant (RWMP); a National Dosimetry Laboratory and Chemical and Physical Laboratories.

The RP 10 research reactor is a pool type reactor used currently for radioisotope production, neutron activation analysis, basic and applied research in nuclear physics, reactor physics, thermo-hydraulic and training.

In 2019, the fuel elements of the core of RP 10 was changed from Uranium oxide (UOx) fuel elements (LEU enriched less than 20%) to silicide uranium (USix) fuel elements (also LEU).

Twenty eight spent fuel elements of the first core of RP10, has been already repatriated to the United States of America in 2017.

The RP-0 reactor is in fact a critical assembly facility (power less than 1 W) that was used mainly for research and training purposes, but it did not operated since 2013.

Radioactive materials are used in Peru in medicine for diagnostic and therapeutic procedures, food irradiation for life extension, preservation and disinfestations, industrial radiography, nuclear gauging in mining and industries, road construction, exploration, manufacturing and petrochemical industries and well logging among others.

The Radioactive Waste Management Plant (RWMP) located at the RACSO Nuclear Center, has an extension of 4 hectares and is the national centralized facility for storing of radioactive waste from users throughout the country. They are not authorized to store them, until they reach the exemption level or have declared the sources in disuse.

Peru currently has no power plant reactors (NPP), and so far there are no plans to start a nuclear power project, but in the Policy of Energy for Peru 2010-2040 has been considered the promotion the projects of nuclear power plants (D.S. 064-2010-EM) as part of the diversification of the energy matrix.

SECTION B. POLICIES AND PRACTICES

The top objective of the Peruvian State is to prevent and protect people, the environment and property from the harmful effects of ionizing radiation.

In order to protect the health of people, the environment and property, the Peruvian state has established through Law 28028, regulations for the use of Ionizing radiation sources. This Law regulates practices that give rise to exposure or potential exposure to ionizing radiation in order to prevent and protect, from its harmful effects, human health, the environment and property and, in its article 5, “Obligation to comply with International Conventions”, establishes that persons who use nuclear material or related elements or that can be related to their use in the national territory, in addition, must comply with the physical protection and safeguards provisions, in accordance with the International Treaties and conventions signed and ratified by the State.

There is no an approved specific policy document on radioactive waste management aspects but in Peru the policies usually are given through laws and regulations. In this way, according with the disposition of Article 73 of the Regulation of Law 28028, the sources declared in disuse must be re-exported to the country of origin or delivered for its management at the national Radioactive Waste Management Plant.

The spent fuel elements of the reactor RP10 are stored in the grid of the auxiliary pool designed for this purpose, where they are stored until their repatriation is possible.

As informed, in Peru the Radioactive Waste Management Plant (RWMP) is a centralized warehouse for radioactive waste and disused sources from users of the medical and industrial sectors mainly. The inventory mainly includes nuclear gauges sources, radioactive sources used in medicine, sources used in industrial gammagraphy and in research.

SECTION C. SCOPE OF APPLICATION

In Peru the Convention applies to the safety of spent fuel management and to the safety of radioactive waste management because these result from the operation of civilian peaceful uses of science and nuclear technology.

As no reprocessing facilities exist in Peru, the information contained in this report does not include waste coming from reprocessing activities.

SECTION D. INVENTORIES AND LISTS

The RP 10 research reactor has:

- 55 Fuel Elements made with USix or UOx with an enrichment less than 20%

The RP0 critical facility has:

- 13 fuel elements made with UOx with an enrichment less than 20%

As indicated before in this report, 28 spent fuel elements were repatriated to the United States of America in 2017.

Additionally, solid wastes are generated in the reactor operation including ion exchange resins used in water purification, air purification system filters, failed irradiation targets, tools, parts resulting from minor repairs, work clothes and others that are stored in the same facility for decay and then eventually be sent to the RWMP it would be necessary.

At the RWMP there are disused sources coming from nuclear gauges, Braquiteraphy sources, Radio 226 needles, Cesium 137, Cadmium 109, Cobalt heads, Teletherapy units and radioactive lightning rods.

The detailed information is in the **ANNEX 1** at the end of this report.

SECTION E. LEGISLATIVE AND REGULATORY SYSTEM

Following the dispositions of Article 18 of the Joint Convention, the Republic of Peru has undertaken the legislative, regulatory and administrative measures to fulfill it is obligations under the Joint Convention and these are informed in this report:

The legal framework for radiation safety and waste management in Peru is provided primarily by two Laws:

- The *Law on Regulation of the Use of Ionizing Radiation Sources* (Law No. 28028), that is the top level legal regulation, and the

- *Law of Prohibition for Importing Used Goods, Machines and Equipment Using Radiation Sources (Law No. 27757).*

a) The Law No. 28028, Law on Regulation of the Use of Ionizing Radiation Sources was approved by Congress in July 2003. This is the top level legal regulation and its main features are:

   - The scope is over all practices and radiation sources, including nuclear reactors and nuclear materials. The purpose of law is to protect and prevent harmful radiation effects to the people, environment and property.

   - It designates to the Peruvian Institute of Nuclear Energy (IPEN) as national authority (national regulatory body) to regulate, authorize, control and enforce the radiation and nuclear safety, physical security and safeguards

   - It establishes the obligation to comply with provisions of Treaties and Conventions related to safety, security and safeguard as approved by the Government

   - It establishes the obligation to any legal person for applying an authorization to carry out activities involving nuclear material and radiation sources.

   - It empowers IPEN to inspect and enforce the regulations.

   - It empowers IPEN to apply sanctions when regulations are breached.

   - It establishes obligations to provide enough budget to assure the safety regulation fulfillment, an also for nuclear liability.

   - Also establishes the funding resources to National Authority

   This law is implemented through:

   - Supreme Decree Nº 039-2008-EM (also known as Regulation of Law Nº 28028) addressing the details of scope, exemptions, exclusions, notifications, registration, authorizations and licensing of ionizing sources and nuclear facilities, individual authorizations, inspections and enforcement including sanctions and;

   - Supreme Decree Nº 009-97-EM "Radiological Safety Regulation" which is broadly based on the International Basic Safety Standards for Protection Against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series 115 (BSS 115).

b) Law No. 27757, *Law of Prohibition for Importing Used Goods, Machines and Equipment Using Radiation Sources*. This law provides general conditions to import second hand radiation sources. It also establishes that importation will be allowed to users having a license. The Law requires that IPEN prepares a listing of goods that will be under control of IPEN (in the Custom List).

This Law is implemented by Supreme Decree Nº 001-2004-EM “Regulation of Law No. 27757” which establishes the import control mechanism for used ionizing radiation sources.

SECTION F. OTHER GENERAL SAFETY PROVISIONS

To carry out these functions, IPEN has developed the following aspects:

a. Regulatory infrastructure for occupational radiation protection

As established in the Regulation of Law 28028 (Supreme Decree 039-2008-EM) the registrants, licensees and employers are responsible for fulfilling all of radiation safety requirements which includes the worker protection.

Also, the Radiological Safety Regulation (approved by Supreme Decree Nº 009-97-EM) specifically establishes that registrants, licensees and employers are responsible for protection of workers and fulfilling regulation and rules of national regulatory body. However responsibilities of workers are not established in regulations and it is expected being considered in the revision of Radiation Safety Regulation.

In despite of main regulation does not specifically establishes to implement a Radiation Protection Program, the articles 19 to 33 of Radiation Safety Regulation provide requisites of a radiation protection program including conditions for workers exposure, requisites for working areas, radiological surveillance, individual monitoring and medical surveillance amongst others. Also, the specific technical standards for radiation safety on tele therapy, nuclear medicine, industrial radiography and X-ray diagnostic have established provisions for implementing radiation protection programs in these activities.

Providers of technical services on individual monitoring, calibration services, maintenance, among others, are required to be authorized by the national regulatory body. There is a specific rule for personnel dosimetry services approved since 2011 as "Technical and Administrative Requisites for External Dosimetry Services" where requisites related to facilities, equipment and personnel of the individual dosimetry services are established. However these requisites are not yet established for workplace monitoring services.

Also other specific rules for radiation safety on tele therapy, nuclear medicine, X ray medicine diagnostic uses, industrial radiography and gamma irradiators provide requisites to be fulfilled on occupational exposure.

The quality management systems are not yet established however some elements are being implemented.

b. Regulatory Infrastructure for Radiological Protection in Medicine

The Law 28028, Law of Regulation on Use of Ionizing Radiation Sources, which was approved in July 2003, establishes that all the activities involving radiation exposures shall be authorized by the national regulatory body. Authorization is granted after the applicant demonstrates that fulfills regulations on radiation protection of individuals and on safety of sources. The law scopes all practices, including medical uses of radiation sources. IPEN is designated as National Authority to control and enforce the law and for issuing regulations on radiation and nuclear safety, security and safeguards.

The *Regulation of Law 28028*, approved by Supreme Decree 039-2008-EM, has established the regime for authorizations and enforcement. General requisites have been established for applying an authorization. The installations and activities have been categorized considering the Code of Conduct.

The Technical Standard N° IR.003.2013 "Requirements for Radiation Protection in Medical Diagnostic using X-Rays", approved in June 2013, establishes requirements for radiation protection in X-ray diagnostic and it is applicable to entities carrying out X-rays diagnostic in the country.

The Technical Standard N° IR.002.2012 "Requirements for Radiation Safety and Protection in Nuclear Medicine", approved in February 2012, establishes requirements for radiation protection and safety applied in nuclear medicine and it is applicable to nuclear medicine activities carried out in the country.

The Technical Standard N° IR.001.2002 "Requirements for Radiation Safety in Tele therapy", approved in 2001, establishes specific requirements for radiological safety for the practices of tele therapy and it is applicable to users carrying out tele therapy activities in the country

c. Regulatory Framework for the Control of Public exposure Non-associated with Radioactive Waste Management or Decommissioning Activities;

The ionizing radiation sources have been used in Peru for more than 80 years. The main radiation sources are X-ray machines which are applied in medicine. Other radiation sources include mostly sealed radioactive sources being used in industrial and medicine application. Radiotherapy, industrial radiography and gamma irradiation facilities are the most relevant, besides the research reactors RP-0 (critical assembly), RP-10 Research reactor (10 MW) and the PPR (Radioisotope Production Plant) operated by the Peruvian Institute of Nuclear Energy (IPEN). Other radioactive facilities as nuclear medicine and well logging and nuclear gauges are also considered involved in the public exposures.

Doses to public are considered very low because the public protection are duly implemented (mainly shielding). The doses due to discharges are also negligible. Concentrations of liquid effluents from nuclear reactor are low as the background level.

The responsibility for public protection due to regulated activities is charged to the licensee and the national regulatory body is responsible for assuring the fulfilment of protection requirements.

As mentioned, the legal framework contains the following laws and regulations:

Law Nº 28028, Law of Regulation on the Use of Ionizing Radiation Source, approved in July 2003. This law establishes the scope and purpose as for protecting the people and environment and property against the harmful effects from ionizing radiation, in all the country. Accordingly, IPEN is designated as national regulatory body on radiation and nuclear safety, security and safeguards, authorization obligations, and empowering it to enforce and issuing penalties due to infractions.

The Regulation *of Law N° 28028* was approved by Supreme Decree Nº 039-2008-EM and addresses the details of scope, exemptions, and exclusions and establishes the regime for notification and authorizations for practices involving radioactive and nuclear facilities, operation personnel and also the regime for inspections and enforcement including sanctions.

Law N° 27757, *Law of Prohibition for Importing Used Goods, Machines and Equipment Using Radiation Sources*. This law provides general conditions to import used radiation sources. It also establishes that importation of radiation sources will be authorized by IPEN if the applicants are licensee (Paragraph 23 and 24 of Code of Conduct).

The Regulation *of Law 27757* was approved by Supreme Decree Nº 001-2004-EM and establishing the mechanism and requisites to import radiation sources which are included in an approved custom listing.

The *Regulation on Physical Protection of Nuclear Materials and Facilities* approved by Supreme Decree Nº 014-2002-EM, establishes the requirements and requisites for security of nuclear materials and facilities.

The *Radiological Safety Regulation,* approved by Supreme Decree Nº 009-97-EM establishes the technical conditions and requirements on radiation safety which is broadly based on the IAEA Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series 115. This regulation includes requirements for:

- Occupational exposure
- Public exposure
- Medical exposure
- Chronic exposure
- Safety of radiation sources, including the security provision
- Interventions and emergencies
- Radioactive wastes
- Transport of radioactive material (IAEA regulation adopted)
- Conditions for exclusion and exemption

The public and environmental protection is regulated by general established in the Radiological Safety Regulation. Also include general provisions for radioactive waste management and transport of radioactive material.

These requirements for public exposure control are also established in specific technical standards on industrial radiography, nuclear medicine, tele therapy, diagnostic radiology among others.

The fulfilment of public exposure control is controlled by the national regulatory body through authorizations, inspections and enforcement and including the regime of sanctions.

d. Legal and Regulatory Framework for Safe Transport of Radioactive Material

The Regulations for Safe and Secure Transport of Radioactive Materials (TRAM) that are in force in the country are:

The regulation of the Law 28028, article 70° establish that the transport of radioactive and nuclear material and the design and validation of packages and packaging must be approved by the national regulatory body (IPEN).

The Radiological Safety Regulation, article 102 establish that the requirements for transport of radioactive material shall be those established on the Regulation for the safe transport of radioactive materials from the International Atomic Energy Agency, as well as other specific rules as established or considered necessary to apply by national regulatory body. Currently the regulatory body applies the IAEA Specific Safety Requirements No. SSR-6, Safe Transport of Radioactive Material.

Law No. 28256, Peruvian Law Regulating Land Transport of Dangerous Waste Materials, regulates the activities, processes and land transport operations with hazardous materials and waste, subject to the principles of prevention and protection of people, the environment and property. This law includes IPEN as support agency.

The Regulation of the Law No. 28256 (D.S. No.021-2008-MTC), denominated "National Regulation for Land Transport of Hazardous Materials and Waste", Article 12 states that the Peruvian Nuclear Energy Institute – IPEN performs the functions of authorizing, controlling and monitoring the operation of land transport of sources of ionizing radiation on radiological and nuclear safety, physical protection and safeguards of nuclear materials at the national level in accordance with the provisions of existing national rules and regulations on the subject.

The organizations that are appointed as competent authorities (CA) in charge of safety of TRAM and their responsibilities are:

Based on the Law 28028, IPEN is the competent authority for authorizing, controlling and monitoring the operation of transport of radioactive material as well as its radiological and nuclear safety, physical protection and safeguards of nuclear materials.

According the Law No. 28256, the Ministry of Transport and Communications is responsible for the authorization and control of vehicles used in the transportation of hazardous materials

and wastes, and authorization of drivers of such vehicles.

Also based on the Law No. 29380, the Superintendence of Transport of persons, cargo and goods (SUTRAN), oversees ground transportation services of persons, cargo and freight at national level, compliance with traffic rules and national regulation of vehicles and the activity of the entities that provide complementary services related to transportation and land transportation as vehicle technical inspection centers, driving schools, etc.

Laws that support them are:

IPEN is designated as National Authority according the Law 28028. According the article 74° of Rule of Law 28028 (Supreme Decree n.° 039-2008-EM), the compliance assurance with the regulations is verified by IPEN through inspections, which can be performed during transport.

The Ministry of Transport and Communications is competent authority as established on its organic law, Law 29370.

SUTRAN is based on the Law No. 29380.

There is not in place any revision process for Regulations on TRAM. All of provisions are adopted from IAEA Specific Safety Requirements for Transport of Radioactive Material.

There were problems for the repatriation of sources due to the denial of transporting by sea, so they were transported by air despite the higher costs.

Nationally, initially airlines de-prioritized transport of radiopharmaceuticals, but currently they are transported with due priority.

There is a system in place for dealing denials of radioactive transport. The denial matters were dealt by information provision and chats with transport companies. Currently IPEN issues letters for assuring that packages fulfill the transport regulation. Letters are prepared by request of transport user or source owner.

e) Technical standards for national practices. IPEN has approved the following standards:

- Technical Standard IR.003.2013 "Requirements for Radiological Protection in Medical Diagnosis with X-Ray" (R.P. 123-13-IPEN / PRES)

- Technical Standard IR.002.2012 "Requirements for Radiological Protection and Safety in Nuclear Medicine" (R.P. 048-12-IPEN / PRES)

- Technical Standard SF.001.2011 "Physical Security Requirements in Radioactive Sources" (R.P. 131-11-IPEN / PRES)

- Technical Standard PR.002.2011 "Technical and Administrative Requirements for Personal Radiation Dosimetry Services" (R.P. 132-11-IPEN / PRES)

- Modification of Technical Standard PR.002.2011 (R.P. 240-12-IPEN / PRES)

- Technical Standard IR.001.2009 "Radiological Safety Requirements in Industrial Radiography" (R.P. 147-09-IPEN / PRES)Modification of Technical Standard IR.001.2009 (R.P. 234-10-IPEN-PRES)

- Technical Standard IR.001.01 "Radiological Safety Requirements for Teletherapy" (R.P. 007-01- IPEN / AUNA)

- Technical Standard IR.013.98 "Technical Safety Requirements for the Use of Category Self-shielding Gamma Radiators" (R.P. 009-98-IPEN / AN)

- Technical Standard IR.012.98 "Technical Safety Requirements for the Use of Class II and IV Panoramic Gamma Radiators" (R.P. 008-98-IPEN / AN)

SECTION G. SAFETY OF SPENT FUEL MANAGEMENT

General Safety Requirements

The temporary Storage for Spent Fuel is located in the Auxiliary Pool of the RP10 Research Reactor at the RACSO Nuclear Center It is designed to ensure to avoid the criticality and also removal residual heat is adequately addressed. For the temporary storage it is required the authorization of the national regulatory body, for this purpose the operator needs to prepare and submit a safety analysis report that includes description of the facility, study of the nuclear fuel management, accident analysis and operational radiological monitoring.

In the country there is no a permanent spent fuel storage facility, there is no processing capacity or plans to carry out in the future. The spent fuel will be repatriated to the country origin. Peru does not have any spent fuel management facility.

SECTION H. SAFETY OF RADIOACTIVE WASTE MANAGEMENT

The licensee that have disused radioactive sources, for which no further use is expected, should be re-exported to the country of origin or managed at the IPEN radioactive waste management plant within a period not exceeding ninety (90) days, after declaring them in disuse (Art. 73 of Regulation of Law 28028).

The operating license for waste storage must be requested attaching information, on the characteristics of the facilities, description of the sources of radiation to be stored, test results, calibrations and quality control of equipment and supplies as well as the quality assurance program, safety measures and systems and radiological protection, means and measures of security, organization, procedures and emergency plan, previsions for the decommission of the installation, as well as the list of personal with individual license.

The decommission of the waste treatment facilities must be requested attaching the decommission plan where management of radioactive sources as well as those produced radioactive waste, and the procedures to be applied for this task considering restoration of the area or facility, as well as the final staff dose report.

At present there is only one facility that operates as a centralized warehouse for radioactive waste in Peru named Radioactive Waste Management Plant and it has a license. There are no plans to install another.

During the operation of the Reactor some wastes are generated associated to activating products as: aluminum, iron, cobalt, and impurities of these materials. This waste is conditioned in cylinders, prior identification of the radioactive elements contained.
The cylinders will store residual materials, properly conditioned, until it reaches its capacity, and then be evacuated, according to their condition, as conventional or radioactive waste. In case of radioactive waste it will be transferred to the Radioactive Waste Management Plant located.

The photos show the cylinders and the identification of radionuclides

SECTION I. TRANSBOUNDARY MOVEMENT

As it has been already mentioned in 2017, 28 spent fuel element were repatriated to United States of America according a bilateral arrangement under an US Department of Energy Program of Repatriation of Fuel Elements of US origin.

In 2010 disused radioactive sources stored in the waste management plant were re-exported to United States of America.

SECTION J. DISUSED SEALED SOURCES

According with Article 73 of the Regulation of Law Nº 28028 the reuse of radioactive sources or the radioactive waste disposal can be done only with the authorization of the national regulatory body.

The before indicated authorization must be requested presenting information about characteristics of the materials to be reused or eliminated, quantities, volume and concentration, form of reuse or elimination, estimated environmental impact, justification and safety and security measures and operative procedures to carry out the planned activities.

As already indicated the Licensee that have disused radioactive sources, for which no further use is expected, should be re-exported to the country of origin or managed at the IPEN R adioactive Waste Management ¨Plant within a period not exceeding ninety (90) days, after declaring them in disuse.

Currently in the country there are not radiation sealed sources factories, consequently there are not arrangement for retrieval of sealed sources of national origin from a foreign state.

SECTION K. GENERAL EFFORT TO IMPROVE SAFETY

In order to improve the safe management of radioactive waste and spent fuel the National Policy and Strategies will be prepared in order to deal with radioactive waste and spent fuel in Peru. Usually in Peru the policies is established in the laws or regulations. For this purpose, the current laws and regulations should be reviewed and updated in the next years.

ANNEX 1

NUCLEAR MATERIAL IN FUEL ELEMENTS OF RP10 AND RP0 REACTORS

	RP 10 (10 MW RESEARCH REACTOR)	RP0 (CRITICAL FACILITY REACTOR)
USix and UOx number of fuel elements	**55**	
UOx number of fuel elements		**13**
Utotal (kg) ^{235}U enriched less than 20%	**98**	**18.5**

LIST OF DISUSED SEALED SOURCES

Code	Radioisitope	Activity (GBq)	Equipment		
			Trade	Model	Serial
CS 010117	Cs-137	0.00999	RONAN	RRRL1	EX 203481
GE 010317	Ge-68	0.07537			
GE 020317	Ge-68	0.07444			
GAGE 010317	Ge-68	0.07837			
GAGE 020317	Ge-68	0.08260			
CS 010417	Cs-137	0.29600			
AMBE 010417	Am-241	1.48000			38195
CS 020417	Cs-137	0.29600			
AMBE 020417	Am-241	1.48000	TROXLER	3440	38031
CS 030417	Cs-137	0.29600			
AMBE 030417	Am-241	1.48000			38058
CS 040417	Cs-137				
AMBE 040417	Am-241	1.48000			38030
CS 010517	Cs-137	3.70000	RONAN	SA1-C10	EE-811
CS 010617	Cs-137	10.4480	BERTHOLD	LB7440D	1798-6-92
CS 020617	Cs-137	10.4480	BERTHOLD	LB7440D	1800-6-92
CS 030617	Cs-137	7.01E+00	OHMART	ELG-08	63748
CS 040617	Cs-137	7.01E+00	OHMART	ELG-08	63749
CS 050617	Cs-137	2.10E+00	OHMART	ED-12	63746
CS 060617	Cs-137	5.17E-01	OHMART	SR-A	9419-GK
31RA 010617	Ra-226				
CS 010717	Cs-137	0.3	TROXLER	3440	36286
AMBE 010717	Am-241	1.48			
CS 020717	Cs-137	0.3	TROXLER	3440	37692
AMBE 020717	Am-241	1.48			
CO 010917	Co-60	1.85	ENDRESS+HAUSER	AG 100	162433
CO 020917	Co-60	1.85	ENDRESS+HAUSER	AG 100	162437
CO 030917	Co-60	1.85	ENDRESS+HAUSER	AG 100	162438
CO 040917	Co-60	1.85	ENDRESS+HAUSER	AG 100	162439
CS 010917	Cs-137	3.7	KAY RAY	7062	9598
CS 020917	Cs-137	3.7	KAY RAY	7062	10877
IR 010116	Ir-192	0.238	SPEC	G-1F	VI 1811
CS 010116	Cs-137	1.829	RGI	ABS 80	7-7-1571/3
AM 010216	Am-241	0.07	THOR	T-100	809
CO 010316	Co-60	631.1	SENTINEL	680B	B394

CS 010316	Cs-137	0.02	RONAN	RLL1	204286A
AM 010816	Am-241	0.02	THOR	T-25	181
CS 020816	Cs-137	3.7	Thermo Fisher	5192	B-7375
CS 010816	Cs-137	3.7	Texas Nuclear Products	5192	B-6044
RA 010816	Ra-226				
RA 020816	Ra-226				
RA 030816	Ra-226				
RA 040816	Ra-226				
RA 050816	Ra-226				
33 AM011016	Am-241		THOR	T-100	
26 AM021016	Am-241		THOR	T-60	
15 AM031016	Am-241		THOR	T-25	
25 RA011016	Ra-226				
RA 011016	Ra-226	0.246			
RA 021016	Ra-226	0.246			
RA 031016	Ra-226	0.246			
RA 041016	Ra-226	0.493			
RA 051016	Ra-226	0.493			
CD 011116	Cd-109	2.64E-02	TGM	AM282	Cd-109.3.10
CD 021116	Cd-109	2.64E-02	TGM	AM282	Cd-109.4.10
CD 031116	Cd-109	2.64E-02	TGM	AM282	Cd-109.5.10
CD 041116	Cd-109	2.64E-02	TGM	AM282	Cd-109.6.10
CD 051116	Cd-109	2.64E-02	TGM	AM282	Cd-109.7.10
CD 061116	Cd-109	2.64E-02	TGM	AM282	Cd-109.8.10
CD 071116	Cd-109	2.64E-02	TGM	AM282	Cd-109.9.10
CD 081116	Cd-109	2.64E-02	TGM	AM282	Cd-109.10.10
CD 091116	Cd-109	2.64E-02	TGM	AM282	Cd-109.11.10
CD 101116	Cd-109	2.64E-02	TGM	AM282	Cd-109.12.10
CD 111116	Cd-109	2.64E-02	TGM	AM282	Cd-109.13.10
CD 121116	Cd-109	2.64E-02	TGM	AM282	Cd-109.14.10
CD 131116	Cd-109	2.64E-02	TGM	AM282	Cd-109.15.10
CD 141116	Cd-109	2.64E-02	TGM	AM282	Cd-109.16.10
CD 151116	Cd-109	2.64E-02	TGM	AM282	Cd-109.17.10
CD 161116	Cd-109	2.64E-02	TGM	AM282	Cd-109.18.10
CD 171116	Cd-109	2.64E-02	TGM	AM282	Cd-109.19.10
CD 181116	Cd-109	2.64E-02	TGM	AM282	Cd-109.20.10
CD 191116	Cd-109	2.64E-02	TGM	AM282	Cd-109.21.10
CD 201116	Cd-109	2.64E-02	TGM	AM282	Cd-109.22.10
CD 211116	Cd-109	2.64E-02	TGM	AM282	Cd-109.23.10
CD 221116	Cd-109	2.64E-02	TGM	AM282	G9-091
CO 011216	Co-60	---	---	---	---
13 CS 011216	Cs-137	---	---	---	---
155 RA 011216	Ra-226	---	---	---	---
UR010115			SPEC	2-T	218
UR020115			SPEC	2-T	221
IR010115	Ir-192	0.001	QSA GLOBAL		TB1618
IR020115	Ir-192	0.001	QSA GLOBAL		TB1619
UR020115			IRIDRITON	520	389
UR060115			SPEC	2-T	214
UR060115			SPEC	2-T	1068
AM010215	Am-241	0.05	THOR	T-100	357
AM020215	Am-241	0.07	THOR	T-100	358

AM030215	Am-241	0.07	THOR	T-100	470
AM040215	Am-241	0.07	THOR	T-100	480
AM050215	Am-241	0.07	THOR	T-100	504
AM060215	Am-241	0.07	THOR	T-100	505
AM070215	Am-241	0.07	THOR	T-100	506
AM080215	Am-241	0.07	THOR	T-100	526
AM090215	Am-241	0.07	THOR	T-60	154
AM100215	Am-241	36.918	IGCI	410	H-511T
AM110215	Am-241	36.918	IGCI	410	H-512T
AM120215	Am-241	36.918	MEASUREX	SD	978888-2
AM130215	Am-241	36.918	MEASUREX	SD	978888-1
CS010215	Cs-137	1075.033	DMC HONOYWELL		97889
CS020215	Cs-137	0	RONAN	EX6070A	
CS030215	Cs-137	0	RONAN	EX6086A	
CS040215	Cs-137	0	RONAN	EX6084A	
CS050215	Cs-137	0	RONAN	EX7171A	
CS060215	Cs-137	0	RONAN		
CO010215	Co-60	21878.997	AECL	Theratron 60	151
CO010315	Co-60	0.017			
CO020315	Co-60	0.017			
CO030315	Co-60	0.017			
CO040315	Co-60	0.017			
CO050315	Co-60	0.017			
IR010315	Ir-192	2.808	SPEC	T-5	VC1719
IR020315	Ir-192	1.139	SPEC	C-1	VC1715
IR030315	Ir-192	1.139	SPEC	C-1	VC1716
CS010415	Cs-137	0.287			
AMBE010415	Am-241	1.477	TROXLER	3440	22060
CS020415	Cs-137	0.287			
AMBE020415	Am-241	1.477	TROXLER	3440	28157
CS030415	Cs-137	0.287			
AMBE030415	Am-241	1.477	TROXLER	3440	29277
CS040415	Cs-137	0			
AMBE040415	Am-241	1.477	TROXLER	3440	34626
IR010515	Ir-192	0	QSA GLOBAL	A424-9	59716B
CS010515	Cs-137	0.36	HUMBOLDT SCIENTIFIC INC	881160	101899
AMBE010515	Am-241	1.477	HUMBOLDT SCIENTIFIC INC	883506	62999
BA010515	Ba-133	0.343	RITVERC		Gba3.061.451.11
RA010515	Ra-226	0			
RA020515	Ra-226	0			
RA030515	Ra-226	0			
RA040515	Ra-226	0			
RA050515	Ra-226	0			
RA060515	Ra-226	0			
RA070515	Ra-226	0			
RA080515	Ra-226	0			
RA090515	Ra-226	0			
RA100515	Ra-226	0			
RA110515	Ra-226	0			
RA120515	Ra-226	0			
RA130515	Ra-226	0			

RA140515	Ra-226	0			
RA150515	Ra-226	0			
RA160515	Ra-226	0			
RA170515	Ra-226	0			
RA180515	Ra-226	0			
RA190515	Ra-226	0			
RA200515	Ra-226	0			
RA210515	Ra-226	0			
RA220515	Ra-226	0			
RA230515	Ra-226	0			
RA240515	Ra-226	0			
RA250515	Ra-226	0			
RA260515	Ra-226	0			
RA270515	Ra-226	0			
RA280515	Ra-226	0			
RA290515	Ra-226	0			
RA300515	Ra-226	0			
RA310515	Ra-226	0			
AM010615	Am-241	1.662	CONTO CONTROL	FILL SCAN	5766 LA
AM020615	Am-241	3.694	CONTO CONTROL	FILTEC FT-50	5983
CO010915	Co-60	0.033			
CS 010915	Cs-137	0.363	ENDRESS + HAUSER	QG 20	4513
CS 020915	Cs-137	0.363	ENDRESS + HAUSER	QG 20	4514
IR010915	Ir-192	0.067	SPEC		TB2004
UR010915			SPEC	2-T	618
UR020915			SPEC	2-T	695
IR010915	Ir-192		SPEC	2-T	1311
CS011015	Cs-137	0.291	TROXLER		77-7883
AMBE011015	Am-241	1.478	TROXLER		78-4880
CS021015	Cs-137	0.142	OHMART /VEGA	SR-A	6127CM
CS031015	Cs-137	0.285	OHMART /VEGA	SR-A	9019CM
CS041015	Cs-137	0.524	OHMART /VEGA	SR-A	1017CG
CS051015	Cs-137	0.525	OHMART /VEGA	SR-A	1018CG
CS061015	Cs-137	0.525	OHMART /VEGA	SR-A	1020CG
CS071015	Cs-137	1.311	OHMART /VEGA	SR-A	1025CG
CS081015	Cs-137	0.525	OHMART /VEGA	SR-A	1029CG
CS091015	Cs-137	0.525	OHMART /VEGA	SR-A	1032CG
CS101015	Cs-137	0.278	CPN INTERNATIONAL	MC-3 PORTAPROBE	M340907575
AMBE021015	Am-241	18.143	CPN INTERNATIONAL	MC-3 PORTAPROBE	M340907575
CS111015	Cs-137	0.243	CPN INTERNATIONAL	MC-3 PORTAPROBE	M390805248
AMBE031015	Am-241	17.998	CPN INTERNATIONAL	MC-3 PORTAPROBE	M390805248
CM011015	Cm-244	2.22	METOREX	HEPS2171	3508LM
AM 011215	Am-241	1.575			5759 LA
CS011215	Cs-137	0	----	----	----
CS021215	Cs-137	0	----	----	----
AM010614	Am-241	0.149	THOR	T-25	267
AM020614	Am-241	0.498	THOR	T-100	401
AM030614	Am-241	0.498	THOR	T-100	402
AM040614	Am-241	0.498	THOR	T-100	403
AM050614	Am-241	0.498	THOR	T-100	404

AM010714	Am-241	0.15	THOR	T-25	183
CS141014	Cs-137	0.288	TROXLER	3440	37951
AMBE011014	Am-241	1.496	TROXLER	3440	37951
CS080413	Cs-137	0.687	AMDEL	AM426-02	1197
CS090413	Cs-137	0.687	AMDEL	AM427-02	1196
CS010813	Cs-137	138.454	TN TECHNOLOGIES	5204	B4444
CS020813	Cs-137	138.454	TN TECHNOLOGIES	5204	B4445
CS030813	Cs-137	138.454	TN TECHNOLOGIES	5204	B4446
CS040813	Cs-137	0.692	TN TECHNOLOGIES	5201	B3347
CS010412	Cs-137	0.237	BOAR LONGYEAR	MC-1DR	MD 60103010
AMBE010412	Am-241	1.794	BOAR LONGYEAR	MC-1DR	MD 60103010
CS 010112	Cs-137		HUMBOLDT	5001	5771
AMBE 010112	Am-241		HUMBOLDT	5001	5771
IR 010312	Ir-192		QSA GLOBAL		
IR 020312	Ir-192		QSA GLOBAL		
IR 030312	Ir-192		QSA GLOBAL		
IR 011012	Ir-192				
IR 021012	Ir-192				
IR 031012	Ir-192				
IR 041012	Ir-192				
IR 051012	Ir-192				
IR 061012	Ir-192				
CO 011112	Co-60	3.19E+04	AECL	Theratron 60	90
AM 021111	Am-241		INDUSTRIES DINAMICS	FILTEC FT-50	3337
AM 011111	Am-241		CONTO NIVEAU	FILL SCAN	5754 LA
AM 010511	Am-241		CONTO NIVEAU	FILL SCAN	5763 LA
CS 011011	Cs-137		**CPN INTERNATIONAL**		M380904522
AMBE 011011	Am-241		**CPN INTERNATIONAL**		M380904522
CS 031211	Cs-137		TN technologies	5202	B2299
CO 011211	Co-60		Texas Nuclear Products	5184	B1046
CO 010911	**Co-60**		QSA GLOBAL	A424/18	1827OB
AM 010910	Am-241	0.071	THOR	T-100	309
AM 030910	Am-241	0.071	THOR	T-100	359
AM 040910	Am-241	0.071	THOR	T-100	410
AM 050910	Am-241	0.071	THOR	T-100	508
AM 070910	Am-241	0.071	THOR	T-100	408
AM 080910	Am-241	0.071	THOR	T-100	409
AM 090910	Am-241	0.071	THOR	T-100	407
AM 100910	Am-241	0.071	THOR	T-100	704
AM 120910	Am-241	0.071	THOR	T-100	767
AM 130910	Am-241	0.071	THOR	T-100	411
AM 140910	Am-241	0.071	THOR	T-100	705
AM 150910	Am-241	0.071	THOR	T-100	766
AM 160910	Am-241	2.11E-02	THOR	T-25	13527
AM 170910	Am-241	4.25E-02	THOR	T-60	13527C
AM 180910	Am-241	2.11E-02	THOR	T-25	127
RA 010910	Am-241	8.80E-02	AMERION	R-100	7497
RA 030910	Am-241	8.80E-02	AMERION	R-100	7757
AM 010207	Am-241				6166B
CO 011106	Co-60	3.19E+04	AECL	Theratron 60	90
CO 011206	Co-60	1.60E+05	PHILLIPS		1398205

CS 011204	Cs-137		TROXLER		75 6151
AMBE 011204	Am-241		TROXLER	3430	24140
AM 010204	Am-241				1359
CS 010502	CS-137				M351002913
AMBE 010502	Am-241				M351002913
CS 010700	Cs-137		**RONAN**	**SA8-C10**	**74739**
CO 010800	Co-60	3.13E+03	PICKER	V4M/60	5900
AM 031099	Am-241		ID FILTEC	NC	**1834**
CO 010295	Co-60	185000	SIEMENS	Gammatron I	**1544**
CS 010595	Cs-137	723350	LEYBOLD-HERAUS	KCSM	8172